FINAL REPORT

Limerick Landfill

2023 Annual Development, Operations and Monitoring Report

Submitted to:

Ministry of the Environment, Conservation and Parks (MECP)

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1.0 INTRODUCTION

The Limerick Landfill, also historically referred as Limerick Road Landfill or Township of Mosa Landfill (the Site), is located at 724 Limerick Road, Bothwell, Ontario (Figure 1). The legal property description is Lot 23, Concession 3, Township of Mosa, Southwest Middlesex, Ontario.

The Site consists of a property with a triangular shape and area of 6.27 hectares (Ha). The Amended Environmental Compliance Approval (ECA) No. A041902 for the Site issued on June 8, 2020 (Appendix A) revoked the original Provisional Certificate of Approval issued on August 28, 1980. The Site was approved to accept domestic and non-hazardous industrial waste.

The Site accepted domestic and non-hazardous industrial waste from 1971 to 2018. The Site has not accepted waste since 2018 following an inspection completed by the Ministry of Environment, Conservation and Parks (MECP) requiring the Municipality of Southwest Middlesex (Municipality) to implement operational improvements and submit a Closure Plan in case a decision was made to close the landfill. The Municipality made the decision to close the landfill and subsequently retained Golder Associates Ltd. (Golder) to complete a subsurface investigation and a Closure Plan as required by the MECP Inspection Report. The Closure Plan (Golder, 2019) was submitted to the MECP on December 16, 2019 and approved with the issuance of the June 8, 2020 ECA. The Closure Plan documents the field investigations and monitoring activities completed by Golder in 2018 and 2019 and the requirements for site closure, inspection, maintenance, monitoring, and contingencies.

This report describes the development, operations and monitoring for the Limerick Landfill site for the year 2023 required by Conditions 7(5) and 7(6) of the ECA.

1.1 Surrounding Land Use

The Site is located in a predominantly rural area approximately 6 kilometres northeast of the community of Bothwell and approximately 30 m south of Fansher Creek located north of the Site. The Site is bounded to the west by Limerick Road and to the southeast by Coltsfoot Drive.

The immediate adjacent land use is a forested land to the south and farm fields to the west and east. There are no residences within a 500 m radius from the Site. The closest residence is located approximately 700 m northeast of the Site. This closest residence has a water well (MECP ID No. 3405215, see Figure 1) that was installed in 1977 based on the MECP well records database.

2.0 LANDFILL SITE DEVELOPMENT/CLOSURE ACTIVITIES

The property boundary, inferred waste limit, and existing ground conditions are shown on Figure 2. The inferred depth of waste is shown on Figures 3 and 4.

Condition 1(5)(a) of the ECA requires the completion of the closure activities proposed in the Closure Plan within five years of issuance of the ECA, i.e., by June 8, 2025. The closure activities include regrading of the waste fill area, construction of stormwater management improvements and final capping. A plan showing the proposed Site appearance after completion of closure activities including regrading and stormwater management improvements is provided in Figure 5. No development or closure activities were completed in the 2023 calendar year.

3.0 PHYSICAL SITE SETTING

3.1 Topography and Drainage

The 2018 site topographic survey shown on Figure 2 reflects the current condition at the site as no further landfilling nor soil movement has occurred since that time. The Site is relatively flat with a waste fill mound height of approximately 1.5 metre (m) above original ground and three isolated waste piles up to 2.5 m in height within the inferred limit of waste fill. A slight depression in ground surface elevation is present in the central portion of the Site. The ground elevation within the inferred waste limit varies between 208.5 metres above mean sea level (masl) along the periphery to as much as approximately 211.5 masl at the top of the waste piles. Minimum ground surface elevations at the Site are generally located along the west property boundary and to the north towards Fansher Creek. Two cross-sections of the Site (from south to north and from west to east) showing the existing ground are provided on Figures 3 and 4. Regionally, the ground surface generally slopes to the west towards the Sydenham River located approximately 14 km from the Site (Figure 1, Key Map).

The closest surface water feature is Fansher Creek, located about 30 m north of the Site. Surface water in the creek flows west towards the Sydenham River, which ultimately flows southwest and drains to Lake St. Clair.

Stormwater runoff in the eastern portion of the Site flows towards the existing depression in the central portion of the Site based on existing topography.

Stormwater runoff in the western portion of the Site flows to a ditch located along the western property boundary adjacent to Limerick Road. The roadside ditch south of the Site entrance has a catch basin at a low point that connects to an existing 150 mm diameter culvert. This 150 mm diameter culvert is approximately 37 m long and outlets to the Bean Drain catchment area, which ultimately discharges to Fansher Creek. The roadside ditch north of the Site entrance flows to the north and outlets to Fansher Creek (Figure 2).

3.1.1 Geology

The Site is located within the Bothwell Sand Plain physiographic region (Chapman, 1984). The surficial materials of the Bothwell Sand Plain physiographic region are comprised of coarse-textured glaciolacustrine deposits of sand and gravel with minor amounts of silt and clay, associated with a delta of the Thames River in glacial Lake Warren. The coarse-textured glaciolacustrine deposits are typically less than 2 m in thickness at regional scale and overly a predominantly clay soil. Poor drainage of the Bothwell Sand Plains also results in the presence of wet-mesic forests and swamps.

The Site is situated between clay physiographic regions to the northeast (Ekfrid Clay Plains) and northwest (St. Clair Clay Plains). Sand dunes are mapped to the west-southwest of the Site towards the Town of Bothwell and to the northeast towards the Town of Newbury.

The 2018 borehole investigation at the Site is presented in the Closure Plan (Golder, 2019). The borehole locations are shown in Figure 2. Borehole records are included in Appendix C. The stratigraphy encountered at the boreholes is shown in the cross sections in Figures 3 and 4. The subsurface conditions encountered are generally consistent with the geological mapping referenced above and the previous preliminary hydrogeological assessment completed at the Site in 1981 (MOE, 1981). In general, the native overburden deposits encountered at the Site during the 2018 borehole investigation consist of a native brown silty sand to a depth of approximately 1.5 to 3.7 metres below ground surface (mbgs) underlain by a silty clay layer to a depth ranging from 22.0 to 28.8 mbgs.

Based on available mapping, the Site is underlain by Middle Devonian bedrock of the Hamilton Group of Formations consisting of grey calcareous shale and minor limestone. Based on a review of the MECP water well database for wells located within 2 km of the Site (Figure 1), the bedrock was reported at depths ranging from about 17.1 to 27.1 mbgs, which is consistent with the findings of this borehole investigation (i.e., bedrock depths ranging from 22.0 to 28.8 mbgs).

3.1.2 Hydrogeology

The hydrostratigraphy in the area of the Site consists of a shallow unconfined silty sand aquifer which is approximately 1.5 m to 4.0 m thick. The thickness of the unconfined aquifer generally decreases from the southern to the northern portion of the Site. Underlying the shallow flow system below the Site is a 19.5 to 24.5 m thick silty clay layer followed by bedrock.

Nine groundwater monitoring wells and one leachate monitoring well were installed in December 2018 at the locations shown in Figure 2. Table 1 provides a list of the monitoring wells, the hydrostratigraphic unit they are screened within and the screen interval depths below ground surface. The wells are protected from traffic and vandalism by a lockable protective casing and have been maintained in accordance with Ontario Regulation (O. Reg.) 903.

Six of the nine groundwater monitoring wells were installed in the shallow unconfined silty sand aquifer layer to assess the potential lateral movement of leachate impacted groundwater. The other three groundwater monitoring wells are deep groundwater wells screened just above the bedrock contact to obtain deep groundwater levels required to assess the rate of groundwater flow and potential contaminant migration downwards to the bedrock.

3.1.2.1 Leachate and Groundwater Levels and Flows

Leachate and groundwater levels encountered at the monitoring wells are provided in Table 2. In 2023, leachate and groundwater levels were measured during the Spring (May 8 to11) and Fall (October 4 to 10) as required by Schedule “B” of the ECA. In addition, as part of the landfill gas monitoring, groundwater levels were also measured at monitoring wells MW-101, MW-103 and MW-104 in the winter (January 27). Groundwater and leachate elevation contours for the October 2023 monitoring event are shown on Figures 7 (shallow groundwater) and 8 (deep groundwater).

Consistent with previous years’ monitoring, slight leachate mounding within the waste fill area was present at leachate well LW-101 with a measured leachate elevation of 207.29 masl in October 2023 (up to about 0.9 m above the shallow groundwater elevations measured at the perimeter shallow monitoring wells). This minor amount of leachate mounding is expected considering that the height of the landfill surface above original ground is only about 1.5 m (excluding the existing waste piles). It is recognized that the leachate levels along the waste fill area has variable height due to the heterogeneous nature of the waste; however, since the height of the landfill surface above original ground is only about 1.5 m (excluding the existing waste piles), the 0.9 m high leachate mounding is considered representative of site conditions. The waste pile near leachate well LW-101 (Waste Fill Pile 1) consists of concrete rubble placed above the existing soil cover. This concrete rubble pile does not affect the leachate mounding height because it does not retain infiltration; i.e., water flows freely through the high void spaces in the concrete rubble. The other two waste piles on Site (Waste Piles 2 and 3) may have limited influence on the leachate mound height as they are relatively small in area and up to 2.5 m high. All three waste piles will be removed as the material is regraded prior to final cover construction, as part of the approved closure activities.

The shallow groundwater elevations measured in 2023 indicate a predominantly northerly shallow groundwater flow direction towards Fansher Creek (Figure 7). Also evident from Figure 7 are slight easterly shallow groundwater flow components emanating from the central portion of the landfill, driven by the slight leachate mounding in the landfill as measured at LW-101.

The deep groundwater monitoring wells (screened in the lower portion of the silty clay at the top of bedrock) indicate a southerly groundwater flow direction based on the groundwater elevations measured in October 2023 as depicted in Figure 8. The May 2023 elevations are comparable to the October 2023 elevations and confirm the southwesterly groundwater flow direction for the deep groundwater (Figure 8). This deep groundwater flow direction is consistent with the southerly dip in bedrock surface elevation at the Site. The southwesterly groundwater flow direction determined in 2023 is consistent with the previous years (i.e., 2020, 2021 and 2022), which was considered a refinement of the inferred southeasterly groundwater flow direction interpreted from the 2018/2019 groundwater levels as presented in the Closure Plan (Golder, 2019). The deep groundwater levels measured since 2020 are considered more representative of actual conditions and show relatively stable elevations between spring and fall. Also, the flow direction determined since 2020 is consistent with the regional groundwater flow direction.

Groundwater elevations measured in the paired (shallow and deep) monitoring wells indicate a slightly downward groundwater flow gradient through the silty clay layer ranging between approximately 0.08 and 0.15 m/m in May 2023, and between 0.03 and 0.12 m/m in October 2023.

4.0 ENVIRONMENTAL MONITORING

4.1 Groundwater and Leachate Monitoring Program

The groundwater and leachate monitoring program was originally proposed in the Closure Plan (Golder, 2019) and slightly modified and approved as Schedule “B” of the ECA. The approved monitoring program is included in Appendix B.

The groundwater quality monitoring program involves sampling of the six shallow groundwater monitoring wells (MW-101S, MW-102, MW103S, MW104S, MW-105 and MW-106), and one deep groundwater monitoring well (MW-103D). The leachate monitoring program involves sampling of the leachate monitoring well (LW-101).

Shallow monitoring wells MW-103S and MW-104S located at the southeast and southwest corners of the Site, respectively, are considered background monitoring locations as they are upgradient of the waste fill area with respect to shallow groundwater flow (Figure 7). Shallow monitoring wells MW-101S, MW-102, MW-105 and MW-106 are located downgradient of the waste fill area.

Leachate quality is obtained from leachate monitoring well LW-101, which is located in the central portion of the waste footprint and is screened in the lower portion of the waste fill (4.3 m waste fill thickness) down to the contact with the underlying silty clay unit.

The deep monitoring well MW-103D is located at the southeast corner of the site and is screened within the lower portion of the silty clay layer at the inferred bedrock surface. Groundwater elevations measured at the deep monitoring wells in 2019 as part of the Closure Plan preparation (Golder, 2019) indicated a southeasterly groundwater flow direction for the deep groundwater. For this reason, MW-103D was included in the groundwater monitoring program to monitor deep groundwater quality downgradient of the waste footprint. The other deep monitoring wells MW-101D and MW-104D (inferred to be located upgradient of the waste) were not included in the groundwater monitoring program for deep groundwater quality. Instead, these deep monitoring wells were

included for monitoring of groundwater elevations only. However, based on the 2020 to 2023 deep groundwater levels, it appears that the southeasterly groundwater flow direction reported in the Closure Plan is incorrect due to un-stabilized groundwater levels. For future monitoring, it was recommended that sampling of downgradient bedrock groundwater quality be undertaken at Well MW-104D instead of MW-103D. This change to the monitoring program was to be implemented following ECA amendment approval as required by Conditions No. 3 (7) and 3 (8) of the ECA. A letter notifying the groundwater flow direction change interpretation was submitted to the MECP on March 29, 2022. This letter was reviewed and the proposed modifications to the monitoring program was not accepted by the MECP's District Office as per email received on March 22, 2023.

The list of parameters for the groundwater and leachate monitoring is provided in Appendix B. The parameters include field temperature, pH and conductivity, general chemistry, metals and nutrients. Volatile organic compounds (VOCs) are included in the monitoring program once every three years starting in 2021, i.e., VOCs were not included in the 2023 monitoring program. Amongst the analyzed parameters, the following leachate indicator parameters (LIPs) were identified in the Closure Plan:

- General chemistry: alkalinity, chemical oxygen demand (COD), conductivity, total dissolved solids (TDS) and dissolved organic carbon (DOC);
- Major ions: chloride, calcium, magnesium and sodium;
- Metals: barium, boron and iron; and
- Nutrients: ammonia.

The selection of LIPs was further supported by the 2020 to 2023 analytical results.

The ECA requires that the groundwater and leachate quality monitoring be carried out twice annually (Spring and Fall).

4.1.1 Groundwater and Leachate Monitoring Carried Out in 2023

The 2023 groundwater monitoring was carried out by WSP in May and October in accordance with the ECA requirements.

Groundwater and leachate samples and field measurements were obtained from the monitoring locations using industry standard protocols. Groundwater and leachate monitoring wells were developed by purging three well volumes, or by purging the well dry prior to sample collection. Purged groundwater from the wells was distributed on the ground surface. Purged leachate from the wells was distributed on the ground surface at a low area near the leachate wells and allowed to infiltrate. At completion of purging, samples were collected for field measurement of pH, electrical conductivity and temperature. Samples were then collected for laboratory analyses. For metals analyses, the groundwater and leachate samples were field filtered using dedicated, in-line 0.45 µm filters. The groundwater and leachate samples were stored on ice in a cooler until delivered, under a chain-of-custody document, to an accredited laboratory (Bureau Veritas Laboratories of London, Ontario; "BV Labs").

The groundwater and leachate quality results, including field-measured parameters, for the 2023 monitoring program are summarized along with the previous (2019 to 2022) data in Tables 3 to 5. Laboratory Certificates of Analysis are provided in Appendix D.

The MECP's District Office email received on March 22, 2023 confirmed that since the Site does not extend to Fansher Creek, the groundwater analytical results should only be compared for compliance with the Reasonable

Use Criteria, while the leachate and surface water analytical results should be compared for compliance with the Provincial Water Quality Objectives. Also, the LIPs are reviewed for additional context in this report. In summary, the groundwater, leachate and surface water data was reviewed and compared with the criteria indicated in the able below, based on comments received from the MECP on March 22, 2023.

Sample Media	PWQO	ODWS/RUC	LIP
Groundwater	No	Yes	Yes
Leachate	Yes	No	Yes
Surface Water	Yes	No	Yes

4.1.2 Leachate Quality Results

Concentrations of analysed parameters in the leachate samples collected from LW-101 (Tables 3 and 4) are below the Provincial Water Quality Objectives (PWQO) (MOEE 1994a) for all parameters except for unionized ammonia (0.063 and 0.088 mg/L in May and October 2023, respectively, versus 0.02 mg/L), phenols (0.0035 and 0.0032 in May and October 2023, respectively, versus 0.001 mg/L), phosphorus (0.19 and 0.16 mg/L in May and October 2023, respectively, versus 0.03 mg/L), boron (420 and 1,500 µg/L in May and October 2023, respectively, versus interim PWQO 200 µg/L), and iron (14,000 and 27,000 µg/L in May and October 2023, respectively, versus 300 µg/L). These recent results are consistent with the results since 2020.

On the Piper Diagram (Figure 9), the leachate quality plots as predominantly a mixed magnesium, calcium and sodium bicarbonate type water.

4.1.3 Groundwater Quality Results

As shown in Figure 7, shallow groundwater elevations measured during the October 2023 sampling event indicate shallow groundwater flow is predominantly to the north and towards Fansher Creek, which is located about 30 m north of the Site. Although Fansher Creek is considered the primary receptor of any leachate impacts from the landfill, the Site boundary is not adjacent to the creek. For this reason, the groundwater quality results are reviewed in the Section below based on the Piper Diagram (Figure 9) for upgradient and downgradient monitoring wells and LIPs for downgradient monitoring wells. An assessment is carried out for compliance with the MECP (formerly the Ministry of the Environment and Energy) Guideline B-7 (MOEE, 1994b) under Section 4.1.4.

4.1.3.1 Upgradient (Background) Shallow Wells

MW-103S

Shallow monitoring well MW-103S is located adjacent to the southeast corner of the Site and upgradient of the waste footprint. This shallow well was installed to a depth of about 4.3 mbgs and is screened in the lower part of the shallow unconfined silty sand aquifer. Groundwater quality at this well is considered representative of background conditions un-impacted by the presence of the Limerick Landfill.

On the Piper Diagram (Figure 9), the water quality plots as a mixed calcium and sodium bicarbonate/chloride type water.

MW-104S

Shallow monitoring well MW-104S is located adjacent to the southwest corner of the Site and upgradient of the waste footprint. This shallow well was installed to a depth of about 4.0 mbgs and is screened within the silty sand

layer. Groundwater quality at this well is considered representative of background conditions un-impacted by the presence of the Limerick Landfill.

On the Piper Diagram (Figure 9), the water quality plots as a mixed calcium and sodium chloride/bicarbonate type water which is generally consistent with the groundwater from the other shallow background well MW-103S with the exception of the higher sodium and chloride concentrations possibly reflecting impacts from salting along Limerick Road.

4.1.3.2 Downgradient Shallow Wells

MW-101S

Shallow monitoring well MW-101S is located adjacent to the north property boundary, north of the waste footprint and is inferred to be downgradient with respect to the groundwater flow direction. The well was installed to a depth of about 4.4 mbgs and is screened across the interface between the silty sand and silty clay layers.

In 2023, concentrations of the LIPs were above the range of concentrations detected in the upgradient (background) shallow monitoring wells with the exception of iron (October 2023 sample) and magnesium (October 2023 sample), indicating potential influence from the Limerick Landfill at this monitoring well location.

On the Piper Diagram (Figure 9), the water quality plots as a mixed magnesium, calcium and sodium bicarbonate/chloride/sulphate type water. The position on the Piper Diagram falls closer to that of the leachate well sample than the background groundwater samples. This is consistent with the interpretation that this well is impacted by leachate.

MW-102

Shallow monitoring well MW-102 is located adjacent to the waste footprint in the eastern portion of the Site and is inferred to be downgradient with respect to the groundwater flow direction. MW-102 was installed to a depth of about 4.4 mbgs and is screened mostly in the upper part of the silty clay layer but straddles the interface between the clay and overlying silty sand layer.

In 2023, concentrations of the LIPs were above the range of concentrations detected in the background wells with the exception of chloride (October 2023 sample), indicating potential influence from the Limerick Landfill at this monitoring location.

MW-105

Shallow monitoring well MW-105 is located adjacent to the waste footprint in the western portion of the Site and is inferred to be downgradient with respect to the groundwater flow direction. MW-105 was installed to a depth of about 4.4 mbgs. It is screened mostly in the silty sand layer but crosses the interface between the silty sand and underlying silty clay.

In 2023, concentrations of the LIPs were above the range of concentrations detected in the background wells, indicating potential influence from the Limerick Landfill at this monitoring location.

MW-106

Shallow monitoring well MW-106 is located adjacent to the waste footprint in the northwest portion of the Site and is inferred to be downgradient with respect to the groundwater flow direction. MW-106 was installed to a depth of

about 4.4 mbgs and is screened mostly in the silty sand layer but crosses the interface with the underlying silty clay.

In 2023, concentrations of the LIPs were above the range of concentrations obtained for the background wells with the exception of TDS (October 2023 sample), chloride (October 2023 sample) and sodium (October 2023 sample), indicating potential influence from the Limerick Landfill at this monitoring location.

4.1.3.3 Deep Upgradient (Background) Well

MW-101D

Deep monitoring well MW-101D is located adjacent to the north property boundary, north of the waste footprint, and is screened in the lower portion of the clay unit at the bedrock contact. It is upgradient of the landfill with respect to the deep groundwater flow direction (Figure 8). This monitoring well was not sampled in 2023 because it is currently excluded from the sampling program. Concentrations obtained at this well in 2019 are provided in Table 4.

4.1.3.4 Deep Downgradient Wells

MW-103D and MW-104D

As noted in Section 4.1, deep monitoring well MW-103D at the southeast corner of the landfill property was interpreted in the Closure Plan to be downgradient of the waste fill area. Based on the 2020 to 2023 groundwater level monitoring, this interpretation is found to be incorrect and reflective of unstabilized groundwater levels in the newly constructed well. Instead, MW-104D located at the southwest corner of the landfill property better represents the downgradient bedrock well. Monitoring well MW-104D was not sampled in 2020 to 2023 because it is currently excluded from the sampling program. A letter notifying the groundwater flow direction and downgradient monitoring well (MW-104D) was submitted to the MECP on March 29, 2022. This letter was reviewed by the MECP, and the flow direction interpretation based on the latest groundwater elevations has not been accepted by the MECP as per email received on March 22, 2023. Therefore, the approved monitoring program has been followed, i.e., well MW-103D was sampled in 2023.

Monitoring data from deep wells is not critical for landfill compliance assessment because the landfill is not expected to significantly impact the deep aquifer.

4.1.4 Groundwater Compliance with MECP Guideline B.7 - Shallow Wells

Operational landfills are required to comply with the Reasonable Use Criteria (RUC), as outlined in MECP Guideline B-7 (MOEE, 1994b) at the downgradient site boundary. The Guideline addresses the levels of off-Site leachate impact on groundwater considered acceptable by the MECP and defines the level of impact on groundwater beyond which some form of mitigation measure(s) would be warranted.

The Reasonable Use Guideline B-7 (MOEE, 1994b) establishes a quantitative benchmark for protecting off-Site groundwater quality for drinking water purposes. The Reasonable Use Guideline makes the following statement regarding groundwater impact at the landfill property boundary:

> *"In the case of drinking water, the quality must not be degraded by an amount in excess of 50% of the difference between background and the Ontario Drinking Water Objectives for non-health related parameters and in excess of 25% of the difference between background and the Ontario Drinking Water Objectives for health-related parameters. Background is considered to be the quality of the groundwater prior to any man-made contamination."*

The methodology for the calculation of the RUC for the shallow groundwater at the Site is summarized as follows.

- The maximum allowable concentration (C_m) at the downgradient property boundary was calculated for the LIP that have Ontario Drinking Water Quality Standards (ODWQS) according to the following formula:

$$C_m = C_b + x(C_c - C_b)$$

where:

C_b = average background concentration obtained from monitoring wells MW-103S and MW-104S, based on groundwater samples collected in 2019 to 2021;

Cc = maximum concentration allowed by ODWQS; and

x = a "safety factor" of 0.25 for health-related criteria or 0.5 for non-health related criteria.

The maximum allowable concentration was determined based on either the health related or non health related criteria that exists for each parameter. The resultant RUC is considered by the MECP to be a concentration that would have only a negligible effect on the off-site use of the groundwater as a drinking water resource.

The RUC values for the leachate indicator parameters which have an ODWQS value are provided in Table 5. The RUC values were calculated based on an average of the analytical results for samples collected in 2019 to 2021 from the background shallow groundwater monitoring wells MW-103S and MW-104S.

As shown in Table 5, LIPs for which concentrations above the RUC were measured in 2023 at downgradient shallow (i.e., silty sand layer) monitoring wells located near the property boundary are as follows:

- MW-101S
  - Laboratory and calculated TDS (May and October), DOC (May and October), alkalinity (May and October) and iron (May and October).
- MW-102
  - Laboratory and calculated TDS (May and October), DOC (May and October), alkalinity (May and October) and iron (May and October).
- MW-105
  - Laboratory and calculated TDS (May and October), DOC (May and October), alkalinity (May and October), chloride (October), barium (October), boron (October) iron (October) and sodium (May and October).
- MW-106
  - Calculated TDS (May and October), DOC (May and October), alkalinity (May and October) and iron (May and October).

4.1.5 Groundwater Compliance Summary

It should be noted that the RUC exceedances in the shallow groundwater are unlikely to affect offsite water supply wells as the primary receptor of the groundwater is considered to be Fansher Creek, which is located about 30 m north of the Site's north property boundary. The extent of offsite contaminant migration to the east and west of the landfill property boundary is inferred to be very minor based on the shallow groundwater piezometric surface

shown in Figure 7. The piezometric surface shows very little leachate mounding in the landfill (up to about 0.5 m above groundwater elevations measured in the perimeter monitoring wells in 2023) reflecting the very small height of the landfill above perimeter grade (typically about 1.5 m height). For this condition, lateral hydraulic gradients are not enough to direct groundwater flow to a significant distance beyond the east and west property boundaries. On this basis and considering that the proposed closure/capping of the landfill (Figure 5) will reduce leachate generation and improve downgradient shallow groundwater quality over time, mitigative measures to address the RUC exceedances in the shallow groundwater are not recommended at this time. However, continued groundwater monitoring will be used to confirm site conditions and the overall improvement in groundwater quality following closure.

4.1.6 Estimated Site Contaminating Lifespan

ECA Condition 7(6)(l) requires the annual report to include an assessment of the contaminating life span of the Site based on the monitoring program to date. Since the Site monitoring program started in 2019, there is not enough historical data to provide a confident basis to estimate the contaminating life span. This assessment will be completed in future annual reports as more historical information becomes available and trends can be established.

4.2 Surface Water Monitoring Program

The surface water monitoring program was originally proposed in the Closure Plan (Golder, 2019) and slightly modified and approved as Schedule “B” of the ECA. The approved monitoring program is included in Appendix B. The surface water monitoring locations designated LIM-1 and LIM-2 are shown on Figure 6. Both locations are located within Fansher Creek. Location LIM-1 is located upstream of the confluence with the proposed ditch extension from the north end of the landfill to represent background surface water quality, and LIM-2 is located downgradient of the confluence. The monitoring locations were chosen based on the surface water characterization study (RWDI, 2017). GPS coordinates of the surface water monitoring locations are as follows:

- LIM-1: 431703 m E, 4724414 m N (Zone 17T)
- LIM-2: 431526 m E, 4724374 m N (Zone 17T)

The parameters for the surface water monitoring program are provided in Appendix B. The surface water samples are collected from the centre of the watercourse and not filtered, except for the samples submitted for analysis of aluminum which are filtered using dedicated, in-line 0.45 µm filters. Temperature, pH and conductivity are measured in the field at the time of sampling. Wetted width, water depth, and surface water flow at the sampling location are also recorded.

As per Appendix B, surface water monitoring events for Fansher Creek are carried out annually during the Spring and Fall (similar to the groundwater sampling).

4.2.1 Surface Water Monitoring Carried Out in 2023

4.2.1.1 Surface Water Flow Direction and Rate

Surface water in the Fansher Creek flows west towards the Sydenham River, which ultimately flows southwest and drains to Lake St. Clair.

The Fansher Creek flow was visually assessed during the May and October 2023 sampling events at the two monitoring locations LIM-1 and LIM-2 (Figure 6) as required by the ECA. The flow visual observations are summarised in the table below.

Monitoring Location	Monitoring Date	Visual Flow Observations
LIM-1 (upstream)	May 9, 2023	The water velocity was noted as fast; the water appeared slightly silty to clear.
	October 10, 2023	The water velocity was noted as minimal; the water appeared slightly silty to clear.
LIM-2 (downstream)	May 9, 2023	The water velocity was noted as fast; the water appeared slightly silty to clear.
	October 10, 2023	The water velocity was noted as minimal; the water appeared slightly silty to clear.

Notes:
1. Refer to Figure 6 for surface water monitoring locations relative to the Site.

4.2.1.2 Surface Water Quality

As discussed above, the closest surface water feature is Fansher Creek which is located about 30 m north of the Site. Based on its close proximity to the Site, and the north-easterly groundwater flow direction observed for shallow groundwater at the Site, Fansher Creek is considered the primary receptor to potential leachate impacts.

Surface water monitoring locations LIM-1 and LIM-2 correspond to the upstream and downstream locations within Fansher Creek, respectively.

Prior to 2020, surface water samples were collected at the LIM-1 and LIM-2 monitoring locations by RWDI in July 2017. Concentrations of analysed parameters in the surface water samples in July 2017 were below PWQO values except for phosphorous (0.08 mg/L at upstream location and 0.04 mg/L at downstream location versus PWQO of 0.03 mg/L) and iron (0.75 mg/L at upstream location and 0.33 mg/L at downstream location versus PWQO of 0.3 mg/L). Higher concentrations for phosphorous and iron were obtained in the samples collected upstream of the landfill compared to the downstream samples, indicating that the Limerick Landfill was not having a measurable impact on Fansher Creek water quality in 2017.

Surface water samples were collected from LIM-1 and LIM-2 monitoring locations in May and October 2023 and submitted for laboratory analysis for the parameters included in the monitoring program (Appendix B).

The results of the 2020 to 2023 surface water monitoring program are presented in Table 6. Laboratory Certificates of Analysis are provided in Appendix D.

Concentrations of analysed parameters in the surface water samples in 2023 were below PWQO values except for the following:

- LIM-1 (upstream location): unionized ammonia (0.0230 mg/L in May 2023 versus PWQO 0.02 mg/L), phenols (0.0027 mg/L in October 2023 versus PWQO of 0.001 mg/L). Phosphorous, cadmium, copper and selenium had reportable detection limits (RDL) values above the PWQO (<0.1, <0.005, <0.02 and <0.2 mg/L in May and October 2023 versus a PWQO of 0.03, 0.0002, 0.005 and 0.1 mg/L).
- LIM-2 (downstream location): unionized ammonia (0.0346 mg/L in May 2023 versus PWQO 0.02 mg/L). Phosphorous, cadmium, copper and selenium had RDL values above the PWQO (<0.1, <0.005, <0.02 and <0.2 mg/L in May and October 2023 versus a PWQO of 0.03, 0.0002, 0.005 and 0.1 mg/L).

The PWQO exceedance for phenols at the upstream sampling location was obtained during the October 2023 sampling event i.e., when there was minimal measurable water flow. No exceedances were measured in the May 2023 surface water samples., i.e., when the water flow was noted as fast. As unionized ammonia was detected in May 2023 at similar concentrations at the upstream and downstream locations, the cause is likely attributed to an off-site source possibly from local agricultural uses.

It is noted on Table 6 that the concentrations of phosphorous, cadmium, copper and selenium at LIM-1 and LIM-2 were below the reportable detection limit (RPD) which was greater than the respective PWQO criteria. The RDL for these parameters excluding phosphorous in 2020 were above the respective PWQO criteria (similar to 2023); however, in 2021 and 2022 the RDL values were set below PWQO to appropriately determine if an exceedance has occurred or not. No PWQO exceedances were reported for these parameters with the exception of phosphorous in 2021 or 2022. The RDL for these parameters should be reset below the respective PWQO criteria in 2024.

4.2.1.3 Surface Water Compliance Summary

Based on the physical and hydrogeological setting of the Site, Fansher Creek likely represents the ultimate discharge point for potentially leachate-impacted groundwater via shallow groundwater flow system within the silty sand layer. Fansher Creek is located about 30 m north of the Site's north property boundary. Groundwater at the shallow monitoring wells screened in the silty sand layer downgradient of the Site (MW-101S, MW-102, MW-105 and MW-106) is inferred to be impacted by landfill leachate and is migrating towards Fansher Creek. In addition, potential drainage tiles installed in the adjacent farm field to the east may represent preferential pathways for leachate-impacted groundwater to reach Fansher Creek.

The PWQO exceedance for phenols is minor and considered anomalous. Monitoring of this parameter will continue to confirm the 2023 anomaly. As unionized ammonia was detected in May 2023 at similar concentrations slightly above the PWQO value at the upstream and downstream locations, the cause is likely attributed to an off-site source possibly from local agricultural uses.

Unlike 2022, iron did not exceed the PWQO limit in 2023 samples. In 2023, iron concentrations ranged from 0.03 to 0.06 mg/L at LIM-1 and LIM-2, and were below the PWQO limit of 0.3 mg/L.

The results available to date for surface water indicate that the Limerick Landfill is not having a measurable impact on Fansher Creek water quality.

4.3 Landfill Gas

4.3.1 Landfill Gas Monitoring Program

Annual landfill gas monitoring is required as part of the ECA. Starting in 2021, combustible gas concentrations readings are required to be collected once annually during the winter (January or February) under frozen ground conditions at the gas monitoring probes GP-101, GP-103 and GP-104. These probes coincide with the shallow groundwater wells MW-101S, MW-103S and MW-104S which have screen sections that straddle the shallow groundwater table. Winter is generally a period of lower groundwater levels, which is important to ensure that the upper portion of the gas monitor screens extend above the groundwater table. Furthermore, the frozen ground reduces atmospheric venting of landfill gas, which in turn increases the potential for lateral migration of landfill gas.

To collect gas measurements, the j-plug was removed to measure water levels at the gas probes to determine the air volume to be purged out of the well. After measuring the water level, the j-plug was tightened to establish a seal, followed by connecting the gas analyser to purge one well volume while recording the gas measurement results.

The need for routine landfill gas monitoring for the post-closure monitoring program will be reassessed in the future based on the monitoring results. Due to the high groundwater levels at the site (i.e., minimal thickness of

unsaturated zone) and the age/quantity of the waste fill, lateral migration of LFG from the landfill is expected to be insignificant.

4.3.2 Landfill Gas Monitoring Results

Landfill gas (LFG) consists largely of methane (CH_4) and carbon dioxide (CO_2), and minor components of VOC and other compounds. Methane is potentially explosive at concentrations of 5% to 15% (by volume). The lower explosive limit (LEL) of methane is commonly used as a reference for concentrations indicative of a potential health and safety concern.

LFG monitoring was conducted in January 2023 and the concentrations recorded are provided in the following table. All methane measurements collected in 2023 were below the LEL of 5%.

Location ID	Date	CH4 (% by Volume)	CO2 (%)	O2 (%)
GP-101	January 27, 2023	0.0	0.7	20.2
GP-103	January 27, 2023	0.1	0.1	20.3
GP-104	January 27, 2023	0.1	0.6	20.1

Notes:
1. CH4 – Methane
2. CO_2 – Carbon Dioxide
3. O_2 – Oxygen
4. LEL – Lower Explosive Limit of methane is 5%.
5. Bolded indicates an LFG concentration greater than 5% LEL.
6. Refer to Figure 6 for gas probe monitoring locations on-Site.

4.4 QA/QC Program

The objective of the Quality Assurance/Quality Control (QA/QC) assessment was to evaluate the quality and appropriateness of the analytical data, particularly at concentrations that may be at or near decision-making criteria for the water monitoring program. The QA/QC assessment addresses the precision of the reported results for the parameters tested for the downgradient monitoring wells. This assessment does not include a review of laboratory duplicate samples that are part of the laboratory's internal QA/QC standard program.

Based on the number of monitoring locations, the QA/QC program consisted of one trip blank and one field duplicate sample during each monitoring event. Duplicate groundwater samples were collected during each of the May and October monitoring events, as follows:

- May 2023: one duplicate sample designated DWS-5, and collected at MW-105; and
- October 2023: one duplicate sample, designated DWS-5, and collected at MW-105.

The relative percent difference (RPD) between the sample and the duplicate was calculated for each parameter where the average of the concentration measured in the sample and the duplicate was a minimum of five times the method detection limit (MOE, 2011). The RPD were within acceptable limits for all parameters.

Trip blank samples, provided by BV Labs, were used in the field during both May and October 2023 sampling events. The analytical results of the trip blank samples for all parameters are below the method detection limits (MDLs) as per attached Certificates of Analysis (Appendix D).

On the basis of the QA/QC assessment, the 2023 results are considered acceptable.

The groundwater sampling protocols followed during the 2023 monitoring program should be adhered to during subsequent groundwater monitoring sessions. Field blank samples should be prepared with distilled water, using

the same protocol as the regular groundwater samples (i.e., filtration and preservation). All laboratory analyses on groundwater samples should be performed by a private analytical laboratory and the method detection limits (MDLs) for the specific analyses should be commensurate with the standards established in the Ontario Drinking Water Quality Standards, Objectives and Guidelines (MOE, 2003) or the Provincial Water Quality Objectives (MOEE, 1994a), whichever is lower.

5.0 SUMMARY OF COMPLAINTS, INSPECTION AND MAINTENANCE

There were no complaints received from the public (i.e., nearby residents) in 2023.

The Site is inspected and maintained as per ECA Conditions 7.1 to 7.3, which reference the approved Inspection and Maintenance Program prepared by Golder, i.e., Table 7 of the Closure Plan. The Municipality's staff completed regular inspections in 2023.

There was minimal maintenance (i.e., grass cutting) and no repairs were required in 2023. There were no notable deficiencies of the monitoring wells observed in 2023.

6.0 CONCLUSIONS

Based on the historical investigations and monitoring results, and the 2023 annual monitoring program results, the following conclusions are provided:

- The Site has native overburden deposits that consist of a native brown silty sand to a depth of approximately 1.5 to 4 mbgs underlain by a silty clay layer to a depth ranging from 22.0 to 28.8 mbgs, which is in contact with the underlying calcareous shale bedrock aquifer. The inferred limit of waste fill at the Site (Figure 2) covers an area of 3.16 Ha (or about 50% of the overall 6.27 Ha property area).
- The shallow groundwater flow direction in the silty sand deposit (surficial aquifer) is in a northerly direction (Figure 7), with slight easterly and westerly shallow groundwater flow components emanating from the northern half of the landfill, driven by the slight leachate mounding measured at leachate well LW-101.
- Deep groundwater monitoring wells at the contact between the silty clay layer and bedrock indicate a southwesterly groundwater flow direction (Figure 8). The deep groundwater southwesterly flow direction determined since 2020 is considered a refinement to the southeasterly flow direction determined in 2019.
- Leachate monitoring well LW-101, installed with a screen section in the lower portion of the waste fill (4.3 m waste fill thickness), is considered representative of leachate quality at this location.
- As part of the 2023 monitoring program, groundwater samples were collected from eight monitoring wells on-Site, namely MW-103S and MW-104S (located upgradient of the waste footprint with respect to shallow groundwater flow); LW-101 (leachate well located within the waste footprint); MW-101S, MW-102, MW-105, and MW-106 (located downgradient of the waste footprint with respect to shallow groundwater flow); and MW-103D (deep well located downgradient of the waste footprint). In addition, groundwater levels were measured in deep wells MW-101D and MW-104D in 2023.
- Based on the results of the 2023 monitoring program, it appears that leachate impacted groundwater extends to the areas downgradient of the waste fill area. At all shallow downgradient wells, concentrations of one or more LIPs were measured above the respective RUC values. The LIPs exceeding their respective RUC values were TDS, DOC, alkalinity, iron, boron, sodium and chloride.

- The proposed permanent closure activities are expected to improve shallow groundwater quality in the long term.
- The surface water quality results available to date indicate that Fansher Creek, located 30 m north of the Site, is not adversely impacted by the Site.
- In 2023, the Limerick Landfill was monitored in compliance with the monitoring and inspection requirements outlined in the ECA.

7.0 RECOMMENDATIONS

The following recommendations are provided relative to the results of the 2023 environmental compliance monitoring program at the Limerick Landfill:

- The monitoring program summarized in Appendix B should be implemented in 2024.
- The laboratory should be reminded to achieve a minimum detection limit at or below the PWQO value for phosphorus and the metal parameters.
- No contingency plans and/or additional mitigation measures are recommended at this time.
- An annual monitoring report should be prepared and submitted to the MECP yearly by March 31st.
- At this point, no consideration is given to reducing the sampling or reporting frequency.
- No inspections, maintenance and operating changes are recommended at this time.
- The Municipality should inspect and maintain the Site as per ECA conditions 7.1 to 7.3, which includes the approved Inspection and Maintenance Program prepared by Golder, i.e., Table 7 of the Closure Plan.
- The Municipality should complete the permanent closure activities included in the Closure Report by June 8, 2025 as required by ECA Condition 1(5)(a).

8.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Municipality of Southwest Middlesex (Municipality) in accordance with the scope and conditions agreed upon between these parties, acknowledging that this report is intended for submission to applicable regulatory agencies for their review.

The report, which specifically includes all tables, figures and appendices, is based on data and information collected by WSP and is based solely on the conditions of the properties at the time of the work, supplemented by historical information and data obtained by WSP as described in this report. Each of these reports must be read and understood collectively and can only be relied upon in their totality.

WSP has relied in good faith on all information provided and does not accept responsibility for any deficiency, misstatements, or inaccuracies contained in the reports as a result of omissions, misinterpretation, or fraudulent acts of the persons contacted or errors or omissions in the reviewed documentation.

The assessment of environmental conditions at this Site has been made using the results of physical measurements and chemical analyses of liquids from a number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at borehole locations. Subsurface conditions may vary from these sampled locations.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, WSP should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

Signature Page

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https://golderassociates.sharepoint.com/sites/32886g/Deliverables/2023 Annual Reports/2023 Limerick/18108934 (7800) Limerick 2023 Annual Report_28March2024-1.docx

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TABLES

Table 1
Monitoring Well Details
Limerick Landfill
2023 Annual Monitoring Report

Well ID	Date Installed	Easting	Northing	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Well Diameter (mm)	Screen Length (m)	Screen Interval (mbgs)	Borehole Depth (mbgs)	Lithology at Screen
LW-101	07-Dec-18	431648	4724156	209.17	210.10	51	4.6	3.1 - 6.1	7.6	WASTE
MW-101S	04-Dec-18	431576	4724318	208.47	209.28	51	3.1	0.9 - 4.0	4.4	SILTY SAND and SILTY CLAY
MW-101D	04-Dec-18	431577	4724319	208.41	209.19	51	1.9	21.2 - 22.7	22.9	SILTY CLAY and GRAVEL
MW-102	12-Dec-18	431691	4724216	208.63	209.39	51	2.4	2.0 - 4.1	4.4	SILTY SAND and SILTY CLAY
MW-103S	11-Dec-18	431806	4724087	209.27	210.13	51	3.1	1.2 - 4.3	4.4	SILTY SAND and SILTY CLAY
MW-103D	11-Dec-18	431805	4724086	209.13	209.93	51	2.0	25 - 26.5	26.5	SILTY CLAY
MW-104S	10-Dec-18	431585	4723902	208.79	209.72	51	3.1	0.9 - 4.0	4.4	SILTY SAND, SAND and GRAVEL
MW-104D	10-Dec-18	431584	4723901	208.74	209.42	51	2.0	27.3 - 28.8	29.0	SILTY CLAY and sandy SILTY CLAY
MW-105	03-Dec-18	431577	4724044	209.03	209.80	51	3.1	0.9 - 4.0	4.4	SILTY SAND and SILTY CLAY
MW-106	03-Dec-18	431584	4724196	208.94	209.66	51	3.1	0.9 - 4.0	4.4	SILTY SAND and SILTY CLAY

Notes:

m	Metre.
mm	Millimetre.
mbgs	Metres below ground surface.
masl	Metres above sea level.
	Table to be read in conjunction with accompanying report.

Table 2
Groundwater Elevations
Limerick Landfill
2023 Annual Monitoring Report

Well ID	Date Installed	Easting	Northing	Ground Surface Elevation (masl)	Top of Pipe Elevation (masl)	Groundwater Elevation (masl)	Groundwater Elevation (masl)								
						Encountered at Completion of Well Installation	05-May-20	06-Oct-20	17-Feb-21	26-May-21	29-Oct-21 and 02-Nov-21	03-May-22	11-Oct -22 to 14-Oct-22	08-May-23 to 11-May-23	04-Oct -23 to 10-Oct-23
LW-101	07-Dec-18	431648	4724156	209.17	210.10	207.04	208.39	207.14	--	207.95	208.08	208.60	206.87	208.43	207.29
MW-101S	04-Dec-18	431576	4724318	208.47	209.28	206.61	207.27	206.15	206.65	206.78	207.16	207.55	205.92	207.37	206.36
MW-101D	04-Dec-18	431577	4724319	208.41	209.19	--	205.72	205.79	--	205.76	205.85	205.82	205.82	205.71	205.78
MW-102	12-Dec-18	431691	4724216	208.63	209.39	206.77	207.50	206.50	--	207.03	207.38	207.83	206.20	207.65	206.59
MW-103S	11-Dec-18	431806	4724087	209.27	210.13	207.20	208.24	207.21	207.82	207.89	208.50	208.47	206.99	208.35	207.49
MW-103D	11-Dec-18	431805	4724086	209.13	209.93	--	205.35	205.18	--	205.18	205.34	205.30	205.27	205.36	205.28
MW-104S	10-Dec-18	431585	4723902	208.79	209.72	208.03	208.29	207.08	207.79	207.67	208.36	208.26	206.90	208.16	207.39
MW-104D	10-Dec-18	431584	4723901	208.74	209.42	--	204.28	204.30	--	204.34	204.44	204.36	204.37	204.34	204.36
MW-105	03-Dec-18	431577	4724044	209.03	209.80	207.05	207.88	206.77	--	207.39	208.09	208.10	206.45	207.96	206.96
MW-106	03-Dec-18	431584	4724196	208.94	209.66	206.96	207.74	206.44	--	207.05	207.34	207.91	206.15	207.80	206.66

Notes:
m Metre.
mbgs Metres below ground surface.
masl Metres above sea level.
-- Not measured.
Table to be read in conjunction with accompanying report.

Table 3
Comparison of Leachate Quality to PWQO
Limerick Landfill
2023 Annual Monitoring Report

		Well ID	LW-101	LW-101	LW-101	LW-101	LW-101	LW-101	LW-101	LW-101	LW-101
		Well Location	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint	Waste Footprint
		Sample Date	2019-01-08	2020-05-05	2020-10-06	2021-05-26	2021-11-02	2022-05-03	2022-10-14	2023-05-11	2023-10-10
Parameter	**PWQO[1]**	**Unit**									
Calculated Parameters											
Hardness, Calcium Carbonate		mg/L	-	790	770	890	740	750	720	310	710
Ion Balance		%	-	3.97	2.43	3.85	0.890	4.17	2.86	28.3	4.82
Total dissolved solids, calculated[2]		mg/L	1800	-	-	1900	1800	1400	1400	1100	1400
Unionized Ammonia, Calculated	0.02	mg/L	**0.180**	**0.075**	**0.117**	**75.280**	**0.130**	**0.077**	**0.043**	**0.063**	**0.088**
Field Measurements											
Conductivity, field measured[2]		uS/cm	3231	2969	2562	3309	3204	2480	2671	1173	2581
Temperature, field measured		°C	10.3	11	14.7	11.1	13.6	9.0	12.7	11.4	12.8
pH, field measured	6.5 - 8.5	pH units	6.8	6.57	6.6	**9.92**	6.66	6.77	**6.35**	6.73	6.62
Inorganics											
Total Ammonia-N[2]		mg/L	150	100	110	120	120	76	83	57	92
Biochemical Oxygen Demand, 5 Day		mg/L	40	3	3	4	< 6	12	14	4	< 2
Chemical Oxygen Demand[2]		mg/L	130	84	87	90	100	77	80	80	80
Conductivity[2]		umhos/cm	3400	3000	3100	-	-	-	-	-	-
Total Dissolved Solids[2]		mg/L	1390	1290	1300	1220	1320	985	1070	1150	1160
Nitrogen, Kjeldahl (TKN)		mg/L	130	98	100	110	130	73	81	76	81
Dissolved Organic Carbon[2]		mg/L	45	25	28	27	30	21	23	24	23
pH	6.5 - 8.5	pH units	7.29	7.20	7.40	7.35	7.55	7.54	7.53	7.70	7.50
Phenolics, Total Recoverable	0.001	mg/L	**0.0070**	**0.0032**	**0.0036**	**0.0038**	**0.0065**	**0.0023**	**0.0025**	**0.0035**	**0.0032**
Phosphorus	0.03[4]	mg/L	**0.11**	**0.15**	**0.16**	**0.20**	**0.21**	**0.19**	**0.16**	**0.19**	**0.16**
Sulfate		mg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	4.2	1.1
Alkalinity, Total as CaCO3[2]	--[5]	mg/L	1300	1100	1200	1300	1300	1000	1100	980	1100
Chloride[2]		mg/L	320	280	320	360	310	220	210	190	190
Nitrate as N		mg/L	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nitrite as N		mg/L	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Nitrogen, Nitrate-Nitrite		mg/L	< `0.10	-	-	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Metals[3]											
Aluminum		ug/L	-	17	19	15	14	16	15	21	11
Arsenic	100	ug/L	2.5	1.3	< 1.0	1.5	2.6	3.4	1.7	6.3	1.4
Barium[2]		ug/L	250	640	510	480	380	670	670	210	780
Boron[2]	200	ug/L	**1400**	**1600**	**1700**	**1600**	**1600**	**1400**	**1600**	**420**	**1500**
Cadmium	0.2	ug/L	< 0.10	< 0.10	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090
Calcium[2]		ug/L	160000	180000	180000	200000	160000	180000	170000	95000	170000
Chromium		ug/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Copper	5[6]	ug/L	< 1.0	< 1.0	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90
Iron[2]	300	ug/L	**43000**	**41000**	**38000**	**43000**	**33000**	**38000**	**32000**	**14000**	**27000**
Lead	25[7]	ug/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Magnesium[2]		ug/L	78000	82000	78000	96000	81000	71000	71000	18000	69000
Manganese		ug/L	450	180	180	190	160	190	150	110	120
Potassium		ug/L	89000	73000	84000	84000	91000	58000	56000	31000	57000
Selenium	100	ug/L	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium[2]		ug/L	180000	160000	160000	200000	180000	140000	140000	55000	140000
Strontium		ug/L	-	1600	1200	1200	950	1700	1700	460	1800
Zinc	30	ug/L	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Mercury	0.0002	mg/L	< 0.00010	-	-	-	-	-	-	-	-

Legend:
Exceeds PWQO
< Indicates parameter was below laboratory equipment detection limit.
> Indicates parameter detected above equipment analytical range.
- Chemical not analyzed or criteria not defined.
- DWS denotes Duplicate Water Sample.

Table 4
Comparison of Leachate VOCs to PWQO
Limerick Landfill
2023 Annual Monitoring Report

		Well ID	LW-101	LW-101
		Well Location	Waste Footprint	Waste Footprint
		Sample Date	2019-01-08	2021-05-26
Parameter	**PWQO[1]**	**Unit**		
Volatile Organic Compounds				
Acetone		ug/L	-	< 10
Benzene	100	ug/L	3.7	4.1
Bromodichloromethane	200	ug/L	-	< 0.50
Bromoform	60	ug/L	-	< 1.0
Bromomethane	0.9	ug/L	-	< 0.50
Carbon Tetrachloride		ug/L	-	< 0.19
Chlorobenzene	15	ug/L	-	8.4
Chloroethane		ug/L	-	-
Chloroform		ug/L	-	< 0.20
Chloromethane	700	ug/L	-	-
Dibromochloromethane	40	ug/L	-	< 0.50
Dichlorodifluoromethane		ug/L	-	3.0
1,2-Dibromoethane	5	ug/L	-	< 0.19
1,2-Dichlorobenzene	2.5	ug/L	-	< 0.40
1,3-Dichlorobenzene	2.5	ug/L	-	< 0.40
1,4-Dichlorobenzene	4	ug/L	< 1.0	0.99
1,1-Dichloroethane	200	ug/L	-	< 0.20
1,2-Dichloroethane	100	ug/L	-	< 0.49
1,1-Dichloroethene	40	ug/L	-	< 0.20
cis-1,2-Dichloroethene	200	ug/L	-	< 0.50
trans-1,2-Dichloroethene	200	ug/L	-	< 0.50
1,2-Dichloropropane	0.7	ug/L	-	< 0.20
cis-1,3-Dichloropropene		ug/L	-	< 0.30
trans-1,3-Dichloropropene	7	ug/L	-	< 0.40
Ethylbenzene	8	ug/L	-	1.9
n-Hexane		ug/L	-	< 1.0
Methyl Ethyl Keton (2-Butanone)	400	ug/L	-	< 10
Methyl Butyl Ketone (2-hexanone)		ug/L	-	-
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)		ug/L	-	< 5.0
Methyl tert-Butyl Ether	200	ug/L	-	< 0.50
Methylene Chloride	100	ug/L	< 2.5	< 2.0
Styrene	4	ug/L	-	< 0.40
1,1,1,2-Tetrachloroethane	20	ug/L	-	< 0.50
1,1,2,2-Tetrachloroethane	70	ug/L	-	< 0.40
Tetrachloroethene	50	ug/L	-	< 0.20
Toluene	0.8	ug/L	**< 1.0**	< 0.20
1,1,1-Trichloroethane	10	ug/L	-	< 0.20
1,1,2-Trichloroethane	800	ug/L	-	< 0.40
Trichloroethene	20	ug/L	-	< 0.20
Trichlorofluoromethane		ug/L	-	< 0.50
1,3,5-Trimethylbenzene		ug/L	-	-
Vinyl Chloride	600	ug/L	< 1.0	< 0.20
m,p-Xylenes		ug/L	-	1.2
o-Xylene	40	ug/L	-	0.23
Xylenes, Total		ug/L	-	1.4

Legend:
Exceeds PWQO
< Indicates parameter was below laboratory equipment detection limit.
> Indicates parameter detected above equipment analytical range.
- Chemical not analyzed or criteria not defined.

Notes:
1. PWQO Guidelines Provincial Water Quality Objectives, Ministry of The Environment (MOE), July, 1994, rev. 1998.
2. Leachate Indicator Parameter
3. Criteria are for total metals whereas results are presented for dissolved metals.
4. Interim PWQO to prevent excessive plant grown in rivers and streams.
5. Should not be decreased by >25% of natural concentration
6. When hardness>20, PWQO is 5 ug/L
7. When alkalinity>80, the PWQO is 25 ug/L

Table 5
Groundwater RUC Comparison - Shallow Wells
Limerick Landfill
2023 Annual Monitoring Report

						Well ID	MW-103S	MW-103S	MW-103S	MW-103S	MW-103S	MW-103S	MW-103S	MW-103S	MW-103S	MW-104S	MW-104S	MW-104S	MW-104S	MW-104S	MW-104S	MW-104S	MW-104S
						Well Location	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southeast)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)	Upgradient (southwest)
						Sample Date	2019-01-08	2020-05-05	2020-10-06	2021-05-25	2021-10-29	2022-05-03	2022-10-17	2023-05-09	2023-10-05	2019-01-08	2020-05-05	2020-10-06	2021-05-26	2021-10-29	2022-05-03	2022-10-12	2023-05-09	2023-10-05
		ODWS[1]		RUC Parameters[4]																		
Parameter	Unit	MAC&IMAC[2]	AO&OG[3]	Cc	x																	
Calculated Parameters																						
Hardness, Calcium Carbonate	mg/L						-	190	*400*	310	270	280	*410*	*320*	*480*	-	*510*	*670*	*410*	*600*	*370*	*620*	*540*	*560*
Ion Balance	%						-	0.280	3.28	*18.2*	0.0800	0.0400	1.22	0.290	*7.70*	-	2.09	0.250	1.42	0.370	2.95	0.310	1.31	4.30
Total dissolved solids, calculated	mg/L		500	500	0.25		380	-	-	**670**	320	410	600	430	**670**	**900**	-	-	**650**	**980**	490	**980**	**800**	**850**
Field Measurements																						
Conductivity, field measured	uS/cm						556	919	570.1	779	660	702	855	639	1017	*1538*	*1544*	*1674*	1117	*2010*	860	*1894*	*1481*	*1593*
Field Measured Temperature	°C						7.3	8	*13.1*	*13.7*	*13.5*	7.8	*12.1*	9	*15.8*	8.2	7.1	*13.3*	*11.6*	*12.9*	7.9	*13.2*	9.1	*14.4*
pH, field measured	pH units						*8.77*	*7.56*	*7.27*	*7.3*	*7.06*	*7.11*	*7.21*	*7.55*	*7.03*	*7.27*	*6.97*	*7.01*	*7.26*	*7.02*	*7.33*	*6.7*	*7.25*	*7.13*
Inorganics																						
Total Ammonia-N[5]	mg/L						0.44	< 0.050	0.082	0.75	< 0.050	< 0.050	0.12	< 0.050	< 0.050	0.48	0.081	0.11	0.071	0.087	0.17	0.069	0.091	0.073
Chemical Oxygen Demand	mg/L									5.6	11	22	< 4.0	12	9.6				6.3	9.1	< 4.0	8.2	4.6	5.7
Conductivity[5]	umhos/cm						630	990	1200	-	-	-	-	-	-	1700	1600	2000	-	-	-	-	-	-
Total Dissolved Solids[5]	mg/L		500	500	0.25		**1770**	635	**1120**	**860**	340	440	640	385	750	**1010**	**855**	**1260**	760	**1120**	515	**1170**	760	**955**
Nitrogen, Kjeldahl (TKN)	mg/L						-	0.22	< 1.0	2.5	0.18	0.35	0.13	0.23	0.17	-	0.19	0.29	0.31	0.29	0.21	0.16	0.17	0.35
Dissolved Organic Carbon[5]	mg/L		5	5	0.5		**8.7**	**6.4**	2.4	2.4	4.7	**7.2**	2.4	**5.4**	3.0	**20**	1.6	1.3	1.5	2	2.1	1.4	1.5	1.7
pH	pH units		6.5 - 8.5	6.5	0.5		*8.65*	*7.92*	*7.86*	*8.01*	7.44	*7.94*	*7.90*	*7.81*	*7.85*	*7.79*	*7.70*	*7.68*	*7.94*	7.20	*7.90*	*7.73*	*7.76*	*7.85*
Phenolics, Total Recoverable	mg/L						-	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	-	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Phosphorus	mg/L						-	0.027	*2.1*	0.18	0.023	0.08	*0.25*	0.06	0.009	-	0.14	0.11	0.14	0.17	0.14	0.080	0.17	*0.23*
Sulfate	mg/L		500	500	0.5		*33*	*200*	*54*	*43*	*16*	*39*	*22*	*91*	*15*	*29*	*31*	*22*	*20*	*45*	*18*	*21*	*16*	*21*
Alkalinity, Total as CaCO3[5]	mg/L		30 - 500	500	0.5		260	280	270	280	290	320	290	270	280	290	310	370	280	310	250	340	300	290
Chloride[5]	mg/L		250	250	0.5		41	19	*200*	**250**	5.3	22	170	14	**260**	**350**	**290**	**440**	*200*	**380**	130	**380**	**300**	**310**
Nitrate as N	mg/L	10		10	0.25		< 0.10	1.83	< 0.50	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.12	< 0.10	< 0.10	< 0.10
Nitrite as N	mg/L	1		1	0.25		-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	-	0.01	0.013	< 0.010	0.019	< 0.010	< 0.010	< 0.010	< 0.010
Nitrate+Nitrite as N	mg/L	10		10	0.25		-	1.83	-	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10	-	0.010	0.013	-	< 0.10	0.12	< 0.10	< 0.10	< 0.10
Metals[6]																						
Aluminum	ug/L						-	*600*	*78*	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	-	< 5.0	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9
Arsenic	ug/L	25		25			-	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Barium[5]	ug/L	1000		1000	0.5		17	61	150	84	91	120	120	83	190	210	*220*	*330*	160	*270*	120	*230*	190	200
Boron[5]	ug/L	5000		5000	0.25		83	80	61	42	13	20	49	21	35	49	34	54	33	44	41	61	39	48
Cadmium	ug/L	5		5	0.25		-	< 0.10	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	-	< 0.10	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090
Calcium[5]	ug/L						11000	61000	*120000*	*99000*	91000	91000	*130000*	*100000*	*150000*	*180000*	*160000*	*210000*	*130000*	*190000*	*120000*	*200000*	*170000*	*180000*
Chromium	ug/L	50		50	0.25		-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Copper	ug/L		1000	1000	0.5		-	5.4	2.5	7.4	3.3	9.3	2.7	3.1	2.3	-	2.5	< 0.90	< 0.90	2.0	1.1	< 0.90	3.2	0.96
Iron[5]	ug/L		300	300	0.5		150	230	100	< 100	< 100	< 100	< 100	< 100	< 100	120	**2000**	**3400**	**1800**	**2800**	**1700**	< 100	**2300**	**2000**
Lead	ug/L	10		10	0.25		-	0.76	0.59	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Magnesium[5]	ug/L						1400	9800	*24000*	15000	11000	13000	*22000*	13000	*25000*	*31000*	*29000*	*35000*	*21000*	*32000*	18000	*31000*	*27000*	*29000*
Manganese	ug/L		50	50	0.25		-	7.0	*150*	< 2.0	*360*	12	*190*	< 2.0	14	-	*280*	*350*	*190*	*270*	*190*	*300*	*270*	*230*
Potassium	ug/L						860	2400	2700	2400	13000	6400	3300	7800	4400	2100	1100	1600	940	1300	690	1200	930	1200
Selenium	ug/L						-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium[5]	ug/L		200000	200000	0.5		*120000*	*150000*	*81000*	*73000*	9200	46000	*66000*	29000	37000	*130000*	*120000*	*150000*	*90000*	*130000*	48000	*130000*	*94000*	*120000*
Strontium	ug/L						-	410	*970*	*550*	320	440	*710*	310	*830*	-	*680*	*960*	*560*	*920*	*690*	*1100*	*930*	*910*
Zinc	ug/L		5000	5000	0.5		-	5.5	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Legend:
Exceeds RUC Cm
Above ODWS and RUC Cm if applicable
Above 75% RUC but below RUC
Concentration above concentration detected in the leachate well LW-01.
< Indicates parameter was below laboratory equipment detection limit.
> Indicates parameter detected above equipment analytical range.
- Chemical not analyzed or criteria not defined.

Notes:
1. ODWS is Ontario Drinking Water Standard (MOE, 2002)
2. MAC & IMAC - (Interim) Maximum Acceptable Concentration
3. AO & OQ - Aesthetic Objective and Operational Guideline
4. RUC - Reasonable Use Criteria
5. Leachate Indicator Parameter
6. Criteria are for total metals whereas results are presented for dissolved metals.

Table 5
Groundwater RUC Comparison - Shallow Wells
Limerick Landfill
2023 Annual Monitoring Report

						Well ID		MW-101S	MW-101S	MW-101S	MW-101S	MW-101S	MW-101S	MW-101S	MW-101S	MW-101S	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102	MW-102
						Well Location		Downgradient (north)	Downgradient (north)	Downgradient (north)	Downgradient (north)	Downgradient (north)	Downgradient (north)	Downgradient (north)	MW-101S	MW-101S	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)	Downgradient (east)
						Sample Date		2019-01-10	2020-05-05	2020-10-06	2021-05-26	2021-10-29	2022-05-03	2022-10-17	2023-05-09	2023-10-05	2019-01-08	2020-05-05	2020-10-06	2021-05-25	2021-10-29	2022-05-03	2022-10-12	2023-05-09	2023-10-05
		ODWS[1]		RUC Parameters[4]																				
Parameter	Unit	MAC&IMAC[2]	AO&OG[3]	Cc	x	Cm	75% Cm																	
Calculated Parameters																								
Hardness, Calcium Carbonate	mg/L					NV	NV	-	*880*	*850*	*890*	*660*	*1000*	*790*	*750*	*760*	-	*720*	*860*	*850*	*800*	*880*	*740*	*810*	*890*
Ion Balance	%					NV	NV	-	*1.87*	*0.90*	0.0900	*1.5*	1.70	0.540	1.24	*5.37*	-	*4.04*	*1.26*	*1.08*	0.830	1.30	0.240	2.88	3.65
Total dissolved solids, calculated	mg/L		500	500	0.25	612.5	459.4	**990**	-	-	**1400**	**1100**	**1400**	**1100**	**1100**	**1100**	**1100**	-	-	**1200**	**1200**	**1200**	**1000**	**1100**	**1200**
Field Measurements																								
Conductivity, field measured	uS/cm					NV	NV	*1675*	*2030*	*1719*	*2170*	*2420*	*2190*	*2016*	1.82	1.868	*1664*	*1639*	*1581*	*1880*	*2120*	*1910*	*1819*	*1779*	*1937*
Field Measured Temperature	°C					NV	NV	4	8.4	*14.2*	*11.3*	6	7.1	*13.4*	9.2	*14.8*	9.2	8.2	*12.7*	*11.9*	*12.6*	7.7	*13.7*	8.9	*14.7*
pH, field measured	pH units					NV	NV	*8.12*	*7.17*	*7.04*	*10.99*	*7.02*	*7.15*	*6.88*	*7.13*	*7*	*6.92*	*6.97*	*6.93*	*6.82*	*6.77*	*6.92*	6.62	*7.25*	*6.82*
Inorganics																								
Total Ammonia-N[5]	mg/L					NV	NV	0.17	1.6	14	13	8.9	5.4	11	7.1	9.8	34	23	24	26	24	27	27	24	25
Chemical Oxygen Demand	mg/L					NV	NV				51	27	54	44	25	29		42	55	49	48	48	52	49	57
Conductivity[5]	umhos/cm					NV	NV	1900	2100	2000	-	-	-	-	-	-	1900	1600	1900	-	-	-	-	-	-
Total Dissolved Solids[5]	mg/L		500	500	0.25	854.8	641.1	**1000**	**1250**	**1210**	**1380**	**1050**	**1360**	**990**	**1040**	**1100**	**1010**	**820**	**1020**	**1060**	**1140**	**1020**	**1100**	**890**	**1050**
Nitrogen, Kjeldahl (TKN)	mg/L					NV	NV	-	2.2	15	14	9.1	7.0	12	7.6	9.8	-	25	25	27	26	30	32	25	25
Dissolved Organic Carbon[5]	mg/L		5	5	0.5	5.1	3.8	4.3	**16**	**17**	**16**	**9.0**	**19**	**17**	**9.1**	**9.4**	**19**	**15**	**18**	**16**	**16**	**15**	**17**	**16**	**19**
pH	pH units		6.5 - 8.5	6.5	0.5	NV	NV	*8.04*	*7.77*	*7.81*	*7.87*	*7.25*	*7.98*	*7.77*	*7.78*	*7.81*	*7.45*	*7.58*	*7.56*	*7.73*	7.01	*7.74*	*7.69*	*7.56*	*7.64*
Phenolics, Total Recoverable	mg/L					NV	NV	-	< 0.0010	0.0012	< 0.0010	0.0010	< 0.0010	< 0.0010	0.0011	< 0.0010	-	0.0011	0.0012	0.0011	0.0015	0.0011	< 0.0010	0.0013	0.0016
Phosphorus	mg/L					NV	NV	-	< 0.020	0.047	0.031	0.019	0.017	0.071	0.012	0.013	-	0.033	0.049	0.053	0.032	0.078	0.086	0.056	0.054
Sulfate	mg/L		500	500	0.5	274.7	206.0	*56*	**310**	*230*	**280**	*210*	*130*	*93*	*240*	*230*	*44*	*38*	*87*	*49*	*180*	*110*	< 1.0	*96*	*66*
Alkalinity, Total as $CaCO_3$[5]	mg/L		30 - 500	500	0.5	397.0	297.8	290	**580**	**700**	**700**	**550**	**980**	**780**	**490**	**540**	**910**	**790**	**910**	**970**	**790**	**920**	**940**	**870**	**950**
Chloride[5]	mg/L		250	250	0.5	233.8	175.3	**380**	170	150	180	170	160	150	190	150	82	49	74	83	81	68	54	54	65
Nitrate as N	mg/L	10		10	0.25	2.54	1.9	< 0.10	**5.36**	< 0.10	< 0.10	*0.21*	0.28	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	*0.2*	< 0.10	< 0.10	0.10	< 0.10	< 0.10	< 0.10
Nitrite as N	mg/L	1		1	0.25	0.25	0.19	-	*0.019*	*0.019*	*0.013*	*0.060*	0.010	0.020	< 0.010	0.021	-	< 0.010	*0.014*	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.012
Nitrate+Nitrite as N	mg/L	10		10	0.25	2.72	2.04	-	**5.38**	*0.019*	*0.013*	*0.27*	0.29	< 0.10	< 0.10	< 0.10	-	-	*0.214*	-	< 0.10	0.10	< 0.10	< 0.10	< 0.10
Metals[6]																								
Aluminum	ug/L					NV	NV	-	< 5.0	< 4.9	< 4.9	< 4.9	< 4.9	*16*	< 4.9	< 4.9	-	< 5.0	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9	< 4.9
Arsenic	ug/L	25		25		NV	NV	-	< 1.0	< 1.0	*2.7*	*2.2*	< 1.0	1.3	*1.5*	*5.5*	-	*1.3*	*2.4*	*1.7*	*2.1*	< 1.0	< 1.0	*1.7*	*2.6*
Barium[5]	ug/L	1000		1000	0.5	579.7	434.7	82	140	190	200	140	100	190	170	120	*260*	*350*	*370*	*360*	*270*	*260*	*360*	*450*	*380*
Boron[5]	ug/L	5000		5000	0.25	1287.8	965.8	*1200*	*1000*	*980*	*930*	*940*	*1100*	*850*	*660*	*830*	*1200*	*900*	*1100*	*940*	*750*	*860*	*1100*	*850*	*1000*
Cadmium	ug/L	5		5	0.25	NV	NV	-	< 0.10	< 0.090	< 0.090	< 0.090	0.30	< 0.090	< 0.090	< 0.090	-	< 0.10	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090
Calcium[5]	ug/L					NV	NV	59000	*170000*	*160000*	*170000*	*130000*	*190000*	*140000*	*150000*	*150000*	*200000*	*190000*	*240000*	*230000*	*230000*	*240000*	*190000*	*220000*	*240000*
Chromium	ug/L	50		50	0.25	NV	NV	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Copper	ug/L		1000	1000	0.5	NV	NV	-	*2.6*	< 0.90	< 0.90	*1.6*	3.9	0.97	< 0.90	< 0.90	-	< 1.0	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90
Iron[5]	ug/L		300	300	0.5	300.0	225.0	< 100	*260*	**2100**	**4600**	**3600**	*260*	**1800**	**2200**	**3600**	**3000**	**13000**	**16000**	**19000**	**16000**	< 100	< 100	**16000**	**17000**
Lead	ug/L	10		10	0.25	NV	NV	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Magnesium[5]	ug/L					NV	NV	*47000*	*110000*	*110000*	*120000*	*84000*	*140000*	*92000*	*92000*	*93000*	*59000*	*56000*	*63000*	*65000*	*55000*	*67000*	*63000*	*63000*	*68000*
Manganese	ug/L		50	50	0.25	NV	NV	-	60	*170*	*340*	*390*	*160*	*130*	*540*	*290*	-	*200*	*230*	*210*	*160*	*210*	*170*	*170*	*200*
Potassium	ug/L					NV	NV	*41000*	*63000*	*59000*	*73000*	*59000*	*68000*	*49000*	*53000*	*64000*	*45000*	*38000*	*40000*	*43000*	*43000*	*42000*	*42000*	*38000*	*44000*
Selenium	ug/L					NV	NV	-	*3.9*	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium[5]	ug/L		200000	200000	0.5	152660	114495	**220000**	*110000*	*88000*	*98000*	*91000*	*110000*	*85000*	*87000*	*100000*	*69000*	48000	51000	*61000*	*66000*	*58000*	53000	*58000*	*59000*
Strontium	ug/L					NV	NV	-	*830*	*1200*	*930*	*850*	*980*	*1300*	*850*	*850*	-	*1400*	*1400*	*1400*	*1300*	*1500*	*1400*	*1400*	*1500*
Zinc	ug/L		5000	5000	0.5	NV	NV	-	< 5.0	< 5.0	< 5.0	< 5.0	6.3	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Legend:
Exceeds RUC Cm
Above ODWS and RUC Cm if applicable
Above 75% RUC but below RUC
Concentration above concentration detected in the leachate well LW-01.
< Indicates parameter was below laboratory equipment detection limit.
> Indicates parameter detected above equipment analytical range.
- Chemical not analyzed or criteria not defined.

Notes:
1. ODWS is Ontario Drinking Water Standard (MOE, 2002)
2. MAC & IMAC - (Interim) Maximum Acceptable Concentration
3. AO & OQ - Aesthetic Objective and Operational Guideline
4. RUC - Reasonable Use Criteria
5. Leachate Indicator Parameter
6. Criteria are for total metals whereas results are presented for dissolved metals.

Table 5
Groundwater RUC Comparison - Shallow Wells
Limerick Landfill
2023 Annual Monitoring Report

						Well ID	MW-105	MW-105	MW-105	MW-105	DWS - 5 (MW-105)	MW-105	DWS-5 (MW-105)	MW-105	MW-105	DWS-5	MW-105	DWS-5	MW-105	DWS-5	MW-106	MW-106	DWS-106 (MW-106)	MW-106	DWS-6 (MW-106)	MW-106	MW-106	MW-106
						Well Location	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (west)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)
						Sample Date	2019-01-08	2020-05-05	2020-10-06	2021-05-26	2021-05-26	2021-10-29	2021-10-29	2022-05-03	2022-10-12	2022-10-12	2023-05-09	2023-05-09	2023-10-05	2023-10-05	2019-01-08	2020-05-05	2020-05-05	2020-10-06	2020-10-06	2021-05-26	2021-10-29	2022-05-03
		ODWS[1]		RUC Parameters[4]																								
Parameter	Unit	MAC&IMAC[2]	AO&OG[3]	Cc	x																							
Calculated Parameters																												
Hardness, Calcium Carbonate	mg/L						-	*910*	*690*	*830*	*850*	*990*	*970*	*890*	*800*	*800*	*1100*	*1000*	*750*	*740*	-	*630*	*610*	*510*	*510*	*790*	*690*	*610*
Ion Balance	%						-	*1.39*	0.13	*1.9*	*2.75*	*1.16*	0.570	*6.42*	1.03	0.770	*6.02*	*5.97*	4.35	3.87	-	*2.91*	*2.01*	*3.11*	*3.49*	*2.42*	*2.57*	1.85
Total dissolved solids, calculated	mg/L		500	500	0.25	**1500**	-	-	**1600**	**1600**	**1800**	**1800**	**1400**	**2300**	**2300**	**1700**	**1700**	**2300**	**2300**	**840**	-	-	-	-	-	**990**	**960**	**750**
Field Measurements																												
Conductivity, field measured	uS/cm						*2267*	*2442*	*1719*	*2493*	*2493*	*4170*	*4170*	*2420*	*4178*	-	*2542*	-	*4001*	-	*1382*	*1220*	*1220*	*1424*	*1424*	*1705*	*2280*	*1230*
Field Measured Temperature	°C						8	8.7	*15.4*	*12.7*	*12.7*	5.9	5.9	8.3	*15.2*	*15.2*	10.6	-	*15.2*	-	8.63	8.9	8.9	*13.5*	*13.5*	*13.1*	6.1	8
pH, field measured	pH units						*6.83*	6.43	*7.04*	6.57	6.57	*6.62*	6.62	*6.8*	6.44	6.44	*6.82*	-	*6.63*	-	*6.58*	6.34	6.34	*6.59*	*6.59*	*8.74*	*6.59*	*6.76*
Inorganics																												
Total Ammonia-N[5]	mg/L						7.7	12	*140*	*71*	*71*	13	*13*	*20*	*170*	*170*	*6.8*	*9.0*	*190*	*200*	7.5	6.5	6.5	*98*	*97*	17	32	7.5
Chemical Oxygen Demand	mg/L						48	37	*100*	58	57	62	*64*	*66*	*130*	*130*	*35*	*26*	*120*	*120*	20	34	35	39	43	32	53	41
Conductivity[5]	umhos/cm						2400	2500	*3300*	-	-	-	-	-	-	-	-	-	-	-	1200	1300	1300	1800	1800	-	-	-
Total Dissolved Solids[5]	mg/L		500	500	0.25	**1560**	**1530**	**1360**	**1300**	**1220**	**1750**	**1720**	**1230**	**1670**	**1670**	**1640**	**1580**	**1550**	**1540**	755	715	**775**	**590**	**590**	**965**	775	720
Nitrogen, Kjeldahl (TKN)	mg/L						-	13	*140*	70	70	15	*15*	*21*	*160*	*160*	*6.7*	*7.6*	*170*	*170*	-	7.2	6.7	*100*	*89*	18	32	9.6
Dissolved Organic Carbon[5]	mg/L		5	5	0.5	**20**	**14**	**27**	**18**	**18**	**20**	**20**	**21**	**44**	**44**	**13**	**13**	**40**	**39**	**8.8**	**11**	**11**	**14**	**14**	**8.9**	**15**	**11**
pH	pH units		6.5 - 8.5	6.5	0.5	*7.54*	*7.23*	*7.4*	*7.56*	*7.57*	6.86	6.86	*7.65*	7.48	7.44	*7.55*	*7.54*	7.49	*7.53*	*7.48*	7.18	7.13	*7.39*	*7.34*	*7.57*	6.80	*7.70*
Phenolics, Total Recoverable	mg/L					-	< 0.0010	< 0.0010	< 0.0010	0.0010	0.003	0.0030	*0.0094*	0.0015	0.0017	< 0.0010	< 0.0010	0.0020	0.0015	-	< 0.0010	< 0.0010	0.0016	0.0014	< 0.0010	0.0028	< 0.0010
Phosphorus	mg/L					-	0.021	0.041	< 0.020	< 0.10	0.046	0.044	0.035	0.091	0.082	0.021	0.021	0.084	0.074	-	< 0.020	< 0.020	0.1	0.087	0.023	0.09	0.073
Sulfate	mg/L		500	500	0.5	*71*	*180*	< 1.0	*34*	*36*	*110*	*110*	*2.0*	*< 1.0*	*< 1.0*	**370**	**360**	*< 1.0*	*1.7*	*49*	*39*	*38*	*3.8*	< 1.0	*48*	*18*	*23*
Alkalinity, Total as CaCO3[5]	mg/L		30 - 500	500	0.5	**1100**	**650**	**1400**	**1200**	**1200**	**1100**	**1100**	**1100**	**1600**	**1600**	**790**	**790**	**1600**	**1600**	**610**	**600**	**600**	**870**	**870**	**740**	**840**	**670**
Chloride[5]	mg/L		250	250	0.5	*210*	*210*	**260**	*210*	*210*	**310**	**300**	130	**390**	**420**	91	90	**350**	**370**	40	32	32	46	45	45	43	19
Nitrate as N	mg/L	10		10	0.25	< 0.10	**54.4**	*0.11*	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	**24.3**	**23.5**	< 0.10	< 0.10	**18**	**2.73**	2.51	< 0.10	< 0.10	**17.0**	< 0.10	< 0.10
Nitrite as N	mg/L	1		1	0.25	-	**1.74**	< 0.010	*0.020*	*0.022*	*0.038*	0.039	< 0.010	< 0.010	< 0.010	**0.994**	**0.985**	< 0.010	< 0.010	-	*0.02*	0.022	< 0.010	< 0.010	*0.186*	*0.033*	0.027
Nitrate+Nitrite as N	mg/L	10		10	0.25	-	**56.14**	*0.11*	*0.020*	-	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	**25.3**	**24.5**	< 0.10	< 0.10	**18**	**2.75**	2.53	-	-	**17.186**	< 0.10	< 0.10
Metals[6]																												
Aluminum	ug/L					-	6.2	5.8	5.9	5.7	*21*	*22*	*21*	6.8	5.3	< 4.9	< 4.9	< 4.9	< 4.9	-	7.5	6.8	< 4.9	< 4.9	< 4.9	5.1	*21*
Arsenic	ug/L	25		25		-	< 1.0	*5.6*	*1.7*	*1.9*	*7.5*	*7.6*	*2.6*	*1.6*	*1.6*	< 1.0	< 1.0	*8.5*	*8.7*	-	< 1.0	< 1.0	*2.1*	*2.3*	< 1.0	*6.4*	*6.7*
Barium[5]	ug/L	1000		1000	0.5	*410*	*310*	**1300**	**710**	**740**	**740**	**730**	*480*	**1400**	**1500**	85	84	**1900**	**1900**	150	110	110	*550*	*550*	190	170	120
Boron[5]	ug/L	5000		5000	0.25	260	*460*	*1200*	*630*	*660*	*560*	*550*	290	**1400**	**1400**	*450*	*430*	**1700**	**1600**	360	270	290	*450*	*440*	420	*470*	130
Cadmium	ug/L	5		5	0.25	-	0.23	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	-	0.12	0.12	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090	< 0.090
Calcium[5]	ug/L					*260000*	*280000*	*140000*	*220000*	*220000*	*290000*	*280000*	*260000*	*150000*	*150000*	*320000*	*310000*	*140000*	*140000*	*210000*	*210000*	*200000*	*150000*	*150000*	*250000*	*210000*	*200000*
Chromium	ug/L	50		50	0.25	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Copper	ug/L		1000	1000	0.5	-	*6.4*	< 0.90	< 0.90	1.1	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	3.9	3.7	< 0.90	< 0.90	-	2.6	2.1	< 0.90	< 0.90	1.8	< 0.90	< 0.90
Iron[5]	ug/L		300	300	0.5	**370**	< 100	**22000**	**6800**	**6900**	**20000**	**19000**	**23000**	100	**110**	< 100	< 100	**24000**	**24000**	< 100	210	200	**19000**	**19000**	170	**33000**	**19000**
Lead	ug/L	10		10	0.25	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Magnesium[5]	ug/L					*51000*	*54000*	*83000*	*72000*	*72000*	*67000*	*65000*	*61000*	*100000*	*100000*	*65000*	*63000*	*96000*	*96000*	*28000*	*27000*	*27000*	*32000*	*32000*	*41000*	*42000*	*25000*
Manganese	ug/L		50	50	0.25	-	*900*	*200*	*520*	*530*	*1600*	*1600*	*910*	85	84	*690*	*680*	72	74	-	*530*	*520*	*430*	*420*	*750*	*1700*	*1500*
Potassium	ug/L					*53000*	*64000*	*98000*	*78000*	*81000*	*80000*	*79000*	*76000*	*120000*	*120000*	*79000*	*79000*	*130000*	*130000*	13000	15000	15000	25000	25000	16000	18000	9100
Selenium	ug/L					-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium[5]	ug/L		200000	200000	0.5	**230000**	*150000*	**180000**	**170000**	**170000**	**240000**	**240000**	**160000**	**290000**	**290000**	**180000**	**180000**	**290000**	**290000**	*30000*	*32000*	31000	*35000*	*35000*	*41000*	*37000*	31000
Strontium	ug/L					-	*1000*	*1100*	*1200*	*1200*	*1300*	*1200*	*900*	*2300*	*2300*	*860*	*860*	*1900*	*1900*	-	*680*	*670*	*920*	*920*	*860*	*910*	*690*
Zinc	ug/L		5000	5000	0.5	-	< 5.0	< 5.0	*5.6*	5.6	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0	7	< 5.0	< 5.0	< 5.0	< 5.0

Legend:
Exceeds RUC Cm
Above ODWS and RUC Cm if applicable
Above 75% RUC but below RUC
Concentration above concentration detected in the leachate well LW-01.
< Indicates parameter was below laboratory equipment detection limit.
> Indicates parameter detected above equipment analytical range.
- Chemical not analyzed or criteria not defined.

Notes:
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3. AO & OQ - Aesthetic Objective and Operational Guideline
4. RUC - Reasonable Use Criteria
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Table 5
Groundwater RUC Comparison - Shallow Wells
Limerick Landfill
2023 Annual Monitoring Report

						Well ID	DWS 6	MW-106	MW-106	MW-106
						Well Location	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)	Downgradient (northwest)
						Sample Date	2022-05-03	2022-10-12	2023-05-09	2023-10-05
		ODWS[1]		**RUC Parameters[4]**						
Parameter	**Unit**	**MAC&IMAC[2]**	**AO&OG[3]**	**Cc**	**x**					
Calculated Parameters										
Hardness, Calcium Carbonate	mg/L						*630*	*470*	*680*	*530*
Ion Balance	%						3.26	1.92	0.190	*7.01*
Total dissolved solids, calculated	mg/L		500	500	0.25		**760**	**910**	**840**	**990**
Field Measurements										
Conductivity, field measured	uS/cm						-	*1794*	*1274*	*1786*
Field Measured Temperature	°C						-	*14*	10.6	*15.7*
pH, field measured	pH units						-	6.44	*6.66*	6.54
Inorganics										
Total Ammonia-N[5]	mg/L						7.7	*100*	4.2	*100*
Chemical Oxygen Demand	mg/L						37	51	34	51
Conductivity[5]	umhos/cm						-	-	-	-
Total Dissolved Solids[5]	mg/L		500	500	0.25		640	785	750	595
Nitrogen, Kjeldahl (TKN)	mg/L						9.7	*84*	4.7	*88*
Dissolved Organic Carbon[5]	mg/L		5	5	0.5		**11**	**14**	**12**	**14**
pH	pH units		6.5 - 8.5	6.5	0.5		*7.70*	7.43	7.29	7.44
Phenolics, Total Recoverable	mg/L						< 0.0010	0.0016	0.0010	0.0023
Phosphorus	mg/L						0.072	*0.38*	0.031	*0.31*
Sulfate	mg/L		500	500	0.5		*22*	< 1.0	*110*	*11*
Alkalinity, Total as $CaCO_3$[5]	mg/L		30 - 500	500	0.5		**670**	**830**	**600**	**840**
Chloride[5]	mg/L		250	250	0.5		19	42	34	44
Nitrate as N	mg/L	10		10	0.25		< 0.10	< 0.10	**4.52**	< 0.10
Nitrite as N	mg/L	1		1	0.25		0.014	0.012	0.017	< 0.010
Nitrate+Nitrite as N	mg/L	10		10	0.25		< 0.10	< 0.10	**4.54**	< 0.10
Metals[6]										
Aluminum	ug/L						*28*	< 4.9	4.9	< 4.9
Arsenic	ug/L	25		25			*6.6*	< 1.0	< 1.0	*4.8*
Barium[5]	ug/L	1000		1000	0.5		120	*250*	100	*460*
Boron[5]	ug/L	5000		5000	0.25		140	*460*	310	*490*
Cadmium	ug/L	5		5	0.25		< 0.090	< 0.090	< 0.090	< 0.090
Calcium[5]	ug/L						*210000*	*130000*	*230000*	*150000*
Chromium	ug/L	50		50	0.25		< 5.0	< 5.0	< 5.0	< 5.0
Copper	ug/L		1000	1000	0.5		< 0.90	< 0.90	1.9	< 0.90
Iron[5]	ug/L		300	300	0.5		**19000**	< 100	**740**	**33000**
Lead	ug/L	10		10	0.25		< 0.50	< 0.50	< 0.50	< 0.50
Magnesium[5]	ug/L						*25000*	*33000*	*28000*	*37000*
Manganese	ug/L		50	50	0.25		*1400*	*160*	*550*	*200*
Potassium	ug/L						9000	24000	12000	27000
Selenium	ug/L						< 2.0	< 2.0	< 2.0	< 2.0
Sodium[5]	ug/L		200000	200000	0.5		31000	35000	33000	35000
Strontium	ug/L						*680*	*920*	*720*	*950*
Zinc	ug/L		5000	5000	0.5		< 5.0	< 5.0	< 5.0	< 5.0

Legend:
Exceeds RUC Cm
Above ODWS and RUC Cm if applicable
Above 75% RUC but below RUC
Concentration above concentration detected in the leachate well LW-01.
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Table 6
Comparison of PWQO to Surface Water Analytical Results
Limerick Landfill
2023 Annual Monitoring Report

		Sample Name	LIM-1	LIM-1	LIM-1	LIM-1	LIM-1	LIM-1	LIM-1	LIM-1	LIM-2	LIM-2	LIM-2	LIM-2	LIM-2	LIM-2	LIM-2	LIM-2
		Sample Location	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (upstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)	Fansher Creek (downstream)
		Sample Date	2020-05-05	2020-10-06	2021-05-26	2021-11-02	2022-05-06	2022-10-14	2023-05-09	2023-10-10	2020-05-05	2020-10-06	2021-05-26	2021-11-02	2022-05-06	2022-10-14	2023-05-09	2023-10-10
Parameter	**PWQO[1]**	**Unit**																
Calculated Parameters																		
Hardness, Calcium Carbonate		mg/L	270	370	320	340	320	350	290	390	280	380	320	340	320	380	290	390
Ion Balance		%	0.410	2.38	1.53	0.390	1.44	0.500	1.14	5.17	2.67	0.100	2.01	1.10	2.45	0.390	0.700	5.66
Unionized Ammonia, Calculated	0.02	mg/L	< 0.0047	< 0.0012	**0.1072**	<0.0006	0.0015	0.0021	**0.0230**	0.0102	< 0.0047	< 0.0012	**0.1597**	0.0063	0.0016	0.0013	**0.0346**	0.0026
Field Measurements																		
Conductivity, field measured[2]		uS/cm	568	548	735	645.7	584	774	574	714	571.8	548	751	649.7	591	844	581	732
Field Measured Temperature		°C	12.8	17.2	21.6	9.7	9.2	9.4	16.9	10.5	13.1	17.2	20.9	9.4	9.1	9.0	16.4	9.9
pH, field measured	6.5 - 8.5	pH units	**8.65**	7.88	**9.17**	7.83	8.02	7.31	8.42	8.23	**8.64**	7.88	**9.73**	7.88	7.92	7.56	8.38	8.12
Dissolved Oxygen, field measured		mg/L	12.59	8.18	0.0	8.46	5.89	4.71	10.67	4.79	13.54	8.18	0.0	8.19	6.13	5.82	10.89	4.73
Inorganics																		
Total Ammonia-N [2]		mg/L	< 0.050	< 0.050	0.27	< 0.050	0.084	0.57	0.30	0.32	< 0.050	< 0.050	0.23	0.47	0.11	0.21	0.51	0.11
Biochemical Oxygen Demand, 5 Day		mg/L	< 2	< 2	< 2	< 2	< 2	3	< 2	< 2	< 2	< 2	< 2	< 2	< 2	4	< 2	< 2
Chemical Oxygen Demand[2]		mg/L	22	19	26	28	26	34	21	19	19	15	26	26	26	37	22	23
Conductivity[2]		umhos/cm	580	860	-	-	-	-	-	-	580	850	-	-	-	-	-	-
Total Dissolved Solids[2]		mg/L	345	520	400	390	345	455	320	490	360	450	420	350	350	415	310	505
Nitrogen, Kjeldahl (TKN)		mg/L	0.56	0.85	0.30	< 0.50	0.26	1.2	1.1	0.87	0.80	1.2	< 0.20	< 0.50	0.44	0.87	1.8	0.47
Dissolved Organic Carbon[2]		mg/L	9.5	6.2	7.1	10	10	11	9.1	7.4	9.8	6.0	7.3	10	9.9	12	8.9	7.4
pH	6.5 - 8.5	pH units	8.49	8.00	8.30	8.07	8.12	8.09	8.33	8.39	8.50	8.21	8.32	8.04	8.13	8.19	8.28	8.32
Phenolics, Total Recoverable	0.001	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	**0.0027**	0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Phosphorus	0.03[4]	mg/L	0.015	**0.032**	**0.047**	0.017	0.014	**0.16**	< 0.1	< 0.1	0.021	0.030	**0.045**	0.017	0.015	**0.15**	< 0.1	< 0.1
Sulfate		mg/L	40	59	51	39	29	14	42	39	38	59	52	35	28	12	43	40
Alkalinity, Total as CaCO3[2]	--[5]	mg/L	190	280	230	260	240	330	210	280	190	280	230	260	250	350	210	280
Chloride[2]		mg/L	34	72	42	29	28	44	31	41	34	72	41	29	29	61	32	44
Nitrate as N		mg/L	4.58	4.02	5.44	6.46	4.77	< 0.10	5.25	2.16	4.62	3.64	5.29	6.44	4.77	< 0.10	5.18	2.13
Nitrite as N		mg/L	0.011	0.014	0.081	< 0.010	0.017	0.020	0.020	< 0.010	0.011	0.012	0.083	< 0.010	0.012	0.038	0.020	< 0.010
Total Organic Carbon		mg/L	9.9	7.1	8.0	10	10	12	9.8	8.0	11	7.1	8.1	10	10	14	9.8	7.8
Color		TCU	35	20	25	50	30	32	33	25	38	19	24	48	30	37	34	25
Metals[3]																		
Aluminum (total)		mg/L	< 0.1	< 0.1	0.081	0.021	0.023	0.082	0.023	0.028	< 0.1	< 0.1	0.12	0.022	0.024	0.091	0.019	0.068
Aluminum (dissolved)		ug/L	-	< 4.9	< 5	6	< 5	< 5	< 5	< 5	-	5.0	< 5	7	< 5	< 5	< 5	< 5
Arsenic	0.1	mg/L	*< 0.2*	*< 0.2*	< 0.0010	< 0.0010	< 0.0010	0.0019	*< 0.2*	*< 0.2*	*< 0.2*	*< 0.2*	< 0.0010	< 0.0010	< 0.0010	0.0021	*< 0.2*	*< 0.2*
Barium[2]		mg/L	0.044	0.091	0.069	0.059	0.047	0.075	0.048	0.067	0.042	0.090	0.074	0.063	0.052	0.072	0.049	0.071
Boron[2]	0.2	mg/L	< 0.02	0.03	0.02	0.02	0.017	0.024	< 0.02	0.02	< 0.02	0.03	0.022	0.021	0.026	0.032	< 0.02	0.03
Cadmium	0.0002	mg/L	< 0.005	< 0.005	< 0.00009	< 0.00009	< 0.000090	< 0.000090	< 0.005	< 0.005	< 0.005	< 0.005	< 0.00009	< 0.00009	< 0.000090	< 0.000090	< 0.005	< 0.005
Calcium[2]		mg/L	84	130	100	110	96	110	93	120	85	130	110	120	98	110	94	130
Chromium		mg/L	< 0.01	< 0.01	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.01	< 0.01
Copper	0.005[6]	mg/L	< 0.02	< 0.02	0.0014	0.0029	0.0033	< 0.00090	< 0.02	< 0.02	< 0.02	< 0.02	0.0017	0.0028	0.0021	0.0013	< 0.02	< 0.02
Hexavalent Chromium	1	ug/L	**1.9**	< 0.50	< 0.50	0.68	< 0.50	< 0.50	< 0.50	< 0.50	**1.4**	< 0.50	< 0.50	0.79	< 0.50	< 0.50	< 0.50	< 0.50
Iron[2]	0.3	mg/L	0.19	**0.32**	**0.35**	0.16	0.11	**2**	0.04	0.03	0.08	0.16	**0.43**	0.16	0.11	**1.3**	0.06	0.03
Lead	0.025[7]	mg/L	*< 0.05*	< 0.00050	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*	*< 0.05*
Magnesium[2]		mg/L	14	18	17	17	15	17	15	19	14	18	17	17	15	18	15	19
Manganese		mg/L	0.07	-	0.19	0.032	0.045	1.5	0.03	0.04	0.07	-	0.2	0.032	0.048	1.6	0.04	0.06
Potassium		mg/L	4	9	5.5	5.6	4.2	11	5	9	4	9	5.7	5.8	4.4	17	5	9
Selenium	0.1	mg/L	< 0.2	< 0.0020	< 0.0020	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Sodium[2]		mg/L	13	30	12	8.9	9.4	16	11	14	13	30	12	9.2	9.3	17	11	15
Strontium		mg/L	0.25	0.36	0.29	0.27	0.24	0.3	0.25	0.34	0.25	0.36	0.29	0.28	0.25	0.34	0.26	0.35
Zinc	0.03	mg/L	< 0.01	< 0.01	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.01	< 0.01	< 0.01	< 0.01	< 0.0050	< 0.0050	< 0.0050	0.0057	< 0.01	< 0.01

Legend:

Exceeds PWQO

Reportable detection limit exceeds the PWQO

< Indicates parameter was below laboratory equipment detection limit.

> Indicates parameter detected above equipment analytical range.

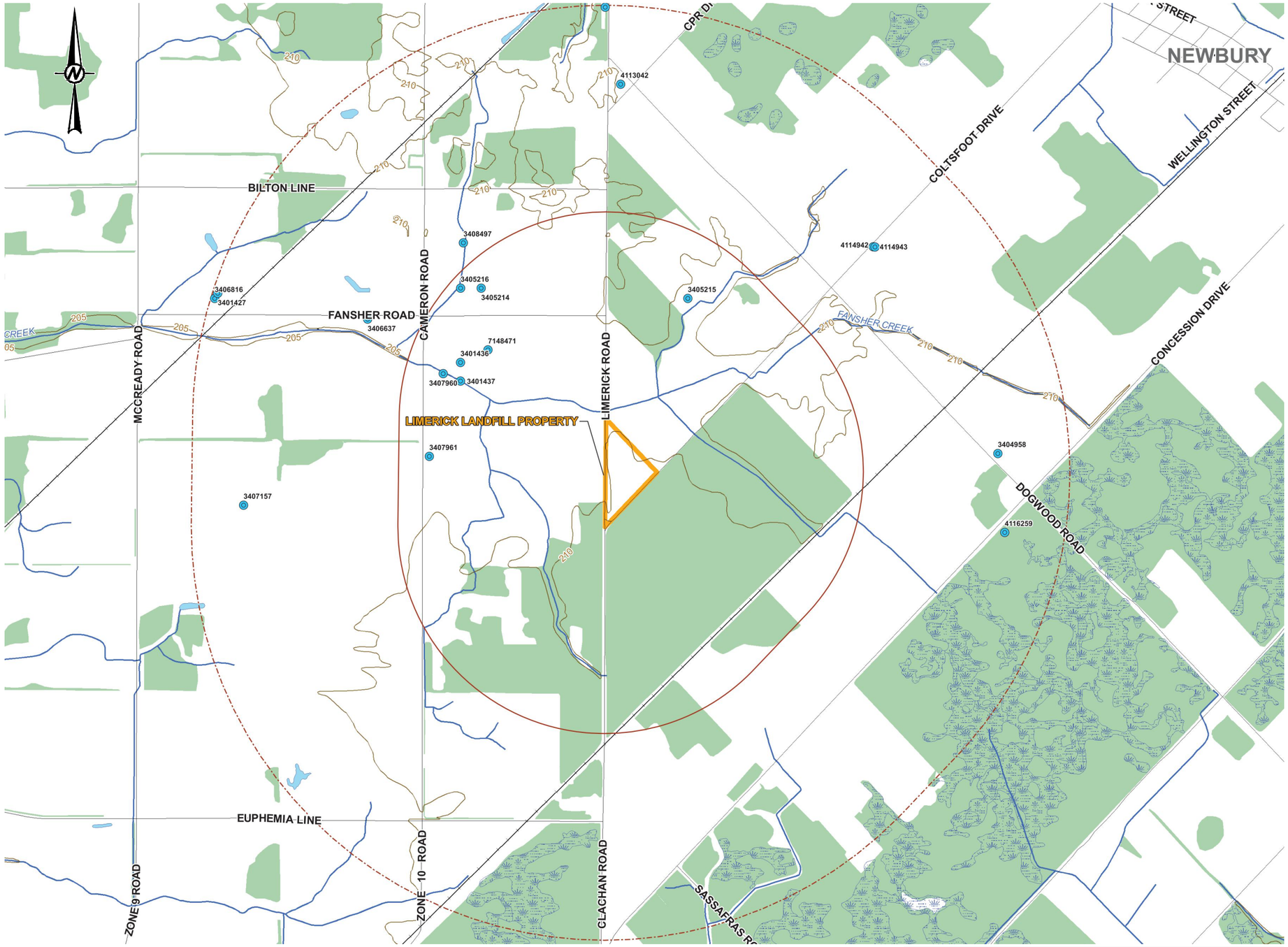
- Chemical not analyzed or criteria not defined.

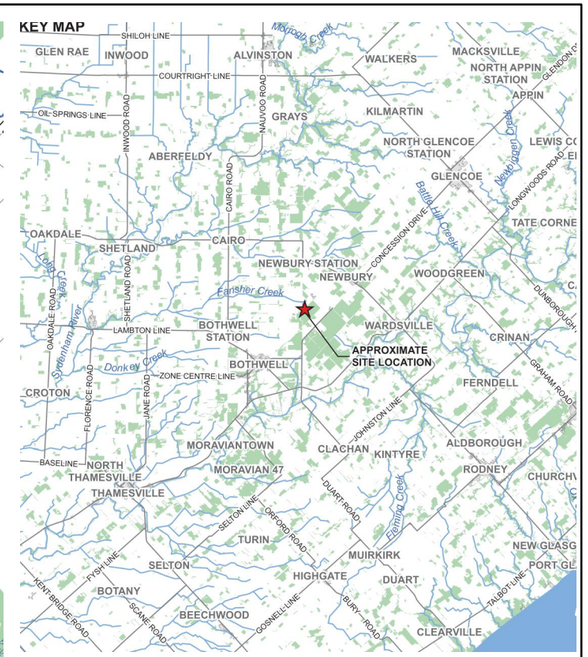
Notes:

1. PWQO Guidelines Provincial Water Quality Objectives, Ministry of The Environment (MOE), July, 1994, rev. 1998.
2. Leachate Indicator Parameter
3. Criteria are for total metals whereas results are presented for dissolved metals.
4. Interim PWQO to prevent excessive plant grown in rivers and streams.
5. Should not be decreased by >25% of natural concentration
6. When hardness>20, PWQO is 5 ug/L
7. When alkalinity>80, the PWQO is 25 ug/L

Prepared by: LL
Checked by: JER/FSB

FIGURES





LEGEND

- MECP WATER WELL LOCATION
- ROAD
- RAILWAY
- WATERCOURSE
- CONTOUR - 5 M INTERVAL
- WETLAND
- WATERBODY
- WOODED AREA
- PROPERTY BOUNDARY (6.27 Ha)
- 1KM RADIUS FROM PROPERTY LINE
- 2KM RADIUS FROM PROPERTY LINE

NOTES(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

1. BASE DATA: MNR LIO, OBTAINED 2018 PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2019
2. MECP WATER WELLS - MOECC, OBTAINED 2018-10-17
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

NOT FOR CONSTRUCTION

FINAL

0 500 1,000
1:20,000 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT
wsp

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

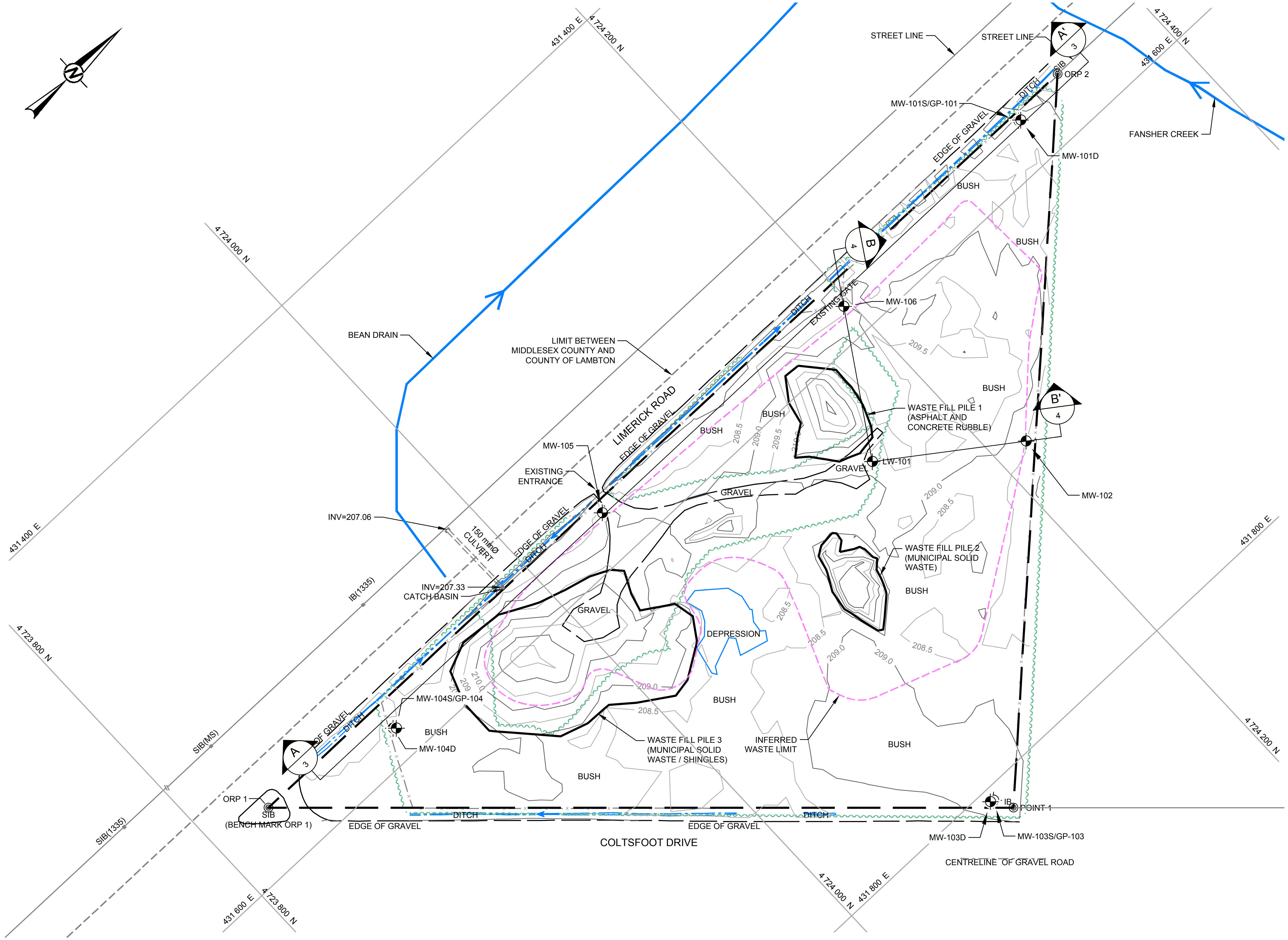
PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
SITE LOCATION PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm



LEGEND

— —	PROPERTY BOUNDARY (6.27 ha)
—x—x—	EXISTING FENCE
·–·–←	EXISTING DITCH
~~	EXISTING TREE LINE
209.0	EXISTING MAJOR CONTOUR (INTERVAL 1 m)
208.5	EXISTING MINOR CONTOUR (INTERVAL 0.5 m)
LW-101	ACTIVE LEACHATE MONITORING WELL
MW-106	ACTIVE GROUNDWATER MONITORING WELL
- - -	INFERRED WASTE LIMIT (3.16 ha)
ORP 2	OBSERVATION REFERENCE POINT

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
2. BENCHMARK: ELEVATIONS ARE GEODETIC CGVD28(HTV2.0) AND ARE DERIVED FROM LEICA G.P.S. SMART-NET REFERRED TO POINT NO. 1, BEING A SIB AS NOTED ON THE PLAN. ELEVATION = 208.82m.

OBSERVATION REFERENCE POINT TABLE

POINT ID	NORTHING (m)	EASTING (m)
ORP 1	4723831.10	431571.35
ORP 2	4724347.17	431572.77
POINT 1	4724091.91	431815.08

REFERENCE(S)

1. TOPOGRAPHIC BASE PLAN, DATED DEC. 05, 2018 BY ARCHIBALD, GRAY & McKAY LTD.

NOT FOR CONSTRUCTION

FINAL

0 50 100

1:2,000 METRES

CLIENT

THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT

wsp

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

PROJECT

2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

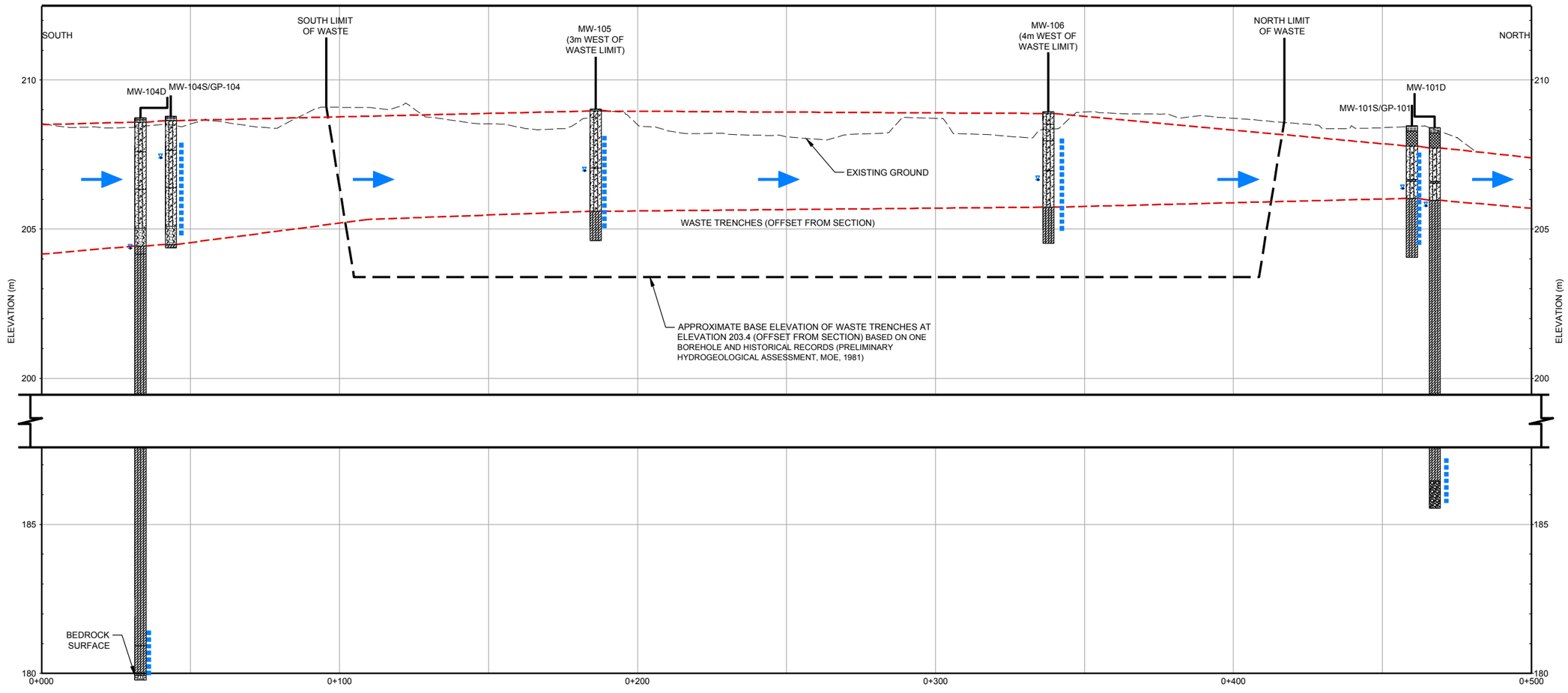
TITLE

SITE PLAN SHOWING EXISTING CONDITIONS

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	2

25 mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D



SCALE 1:1500 (A2)
VERT. SCALE 1:150 m

CROSS SECTION A-A'

LEGEND

- FILL/OVERBURDEN
- WASTE
- SILTY CLAY
- ORGANICS/TOPSOIL
- SILTY SAND
- GRAVEL
- SAND AND GRAVEL
- BEDROCK
- CLAY
- INFERRED STRATIGRAPHIC CONTACT
- INFERRED WASTE FILL LIMIT (OFFSET FROM SECTION)
- INFERRED SHALLOW GROUNDWATER FLOW DIRECTION

MW-104D — MW ID
MW LOCATION
GROUNDWATER ELEVATION -ON OCT. 4 AND 5, 2023
WELL SCREEN INTERVAL

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
2. BENCHMARK: ELEVATIONS ARE GEODETIC CGVD28(HTV2.0) AND ARE DERIVED FROM LEICA G.P.S. SMART-NET REFERRED TO POINT NO. 1, BEING A SIB AS NOTED ON THE PLAN. ELEVATION = 208.82 m.

REFERENCE(S)

1. TOPOGRAPHIC BASE PLAN, DATED DEC. 05, 2018 BY ARCHIBALD, GRAY & McKAY LTD.

NOT FOR CONSTRUCTION

FINAL

0 25 50
1:1,500 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT
wsp

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

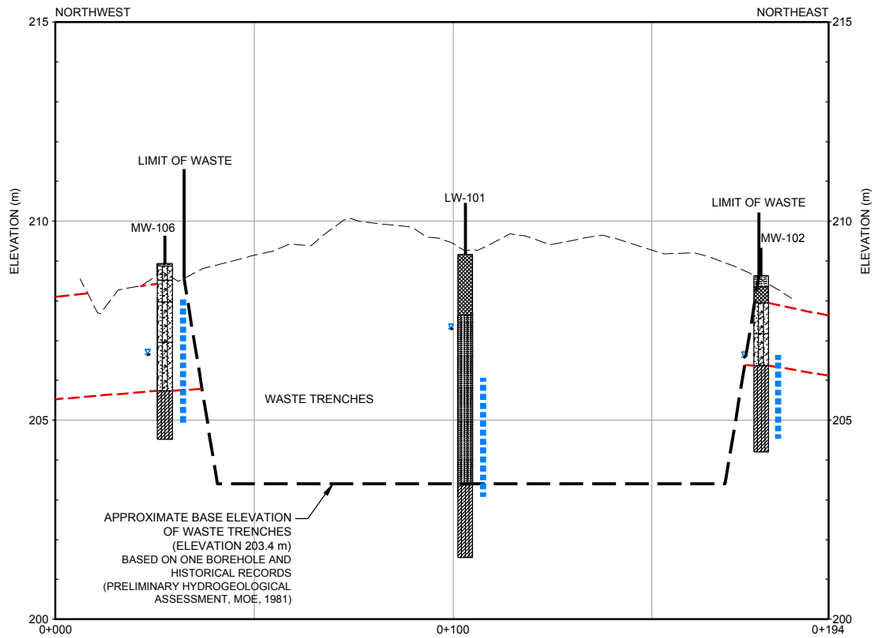
TITLE
CROSS SECTION A-A'

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

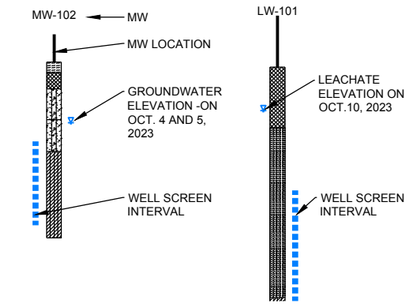
Path: \\golder.gds\complexdata\office\Ontario\SIM\Clients\Municipality_of_Southwest_Middlesex\Limerick_Landfill\99_PRO\18108934_Landfill_Services\40_PROD\0007_Annual_Report_2023\ | File Name: 18108934-0007-CW-0003.dwg | Last Edited By: axzhang Date: 2024-02-06 Time:12:12:21 PM | Printed By: AXZhang Date: 2024-03-27 Time:1:52:56 PM



SCALE 1:1500 / VERT. SCALE 1:150 m — B 2 — CROSS SECTION B-B'

LEGEND

- FILL/OVERBURDEN
- WASTE
- SILTY CLAY
- ORGANICS/TOPSOIL
- SILTY SAND
- CLAY
- INFERRED STRATIGRAPHIC CONTACT
- INFERRED WASTE FILL LIMIT (OFFSET FROM SECTION)



NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
2. BENCHMARK: ELEVATIONS ARE GEODETIC CGVD28(HTV2.0) AND ARE DERIVED FROM LEICA G.P.S. SMART-NET REFERRED TO POINT NO. 1, BEING A SIB AS NOTED ON THE PLAN. ELEVATION = 208.82 m.

REFERENCE(S)

1. TOPOGRAPHIC BASE PLAN, DATED DEC. 05, 2018 BY ARCHIBALD, GRAY & McKAY LTD.

NOT FOR CONSTRUCTION

FINAL

0 25 50
1:1,500 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT
wsp

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

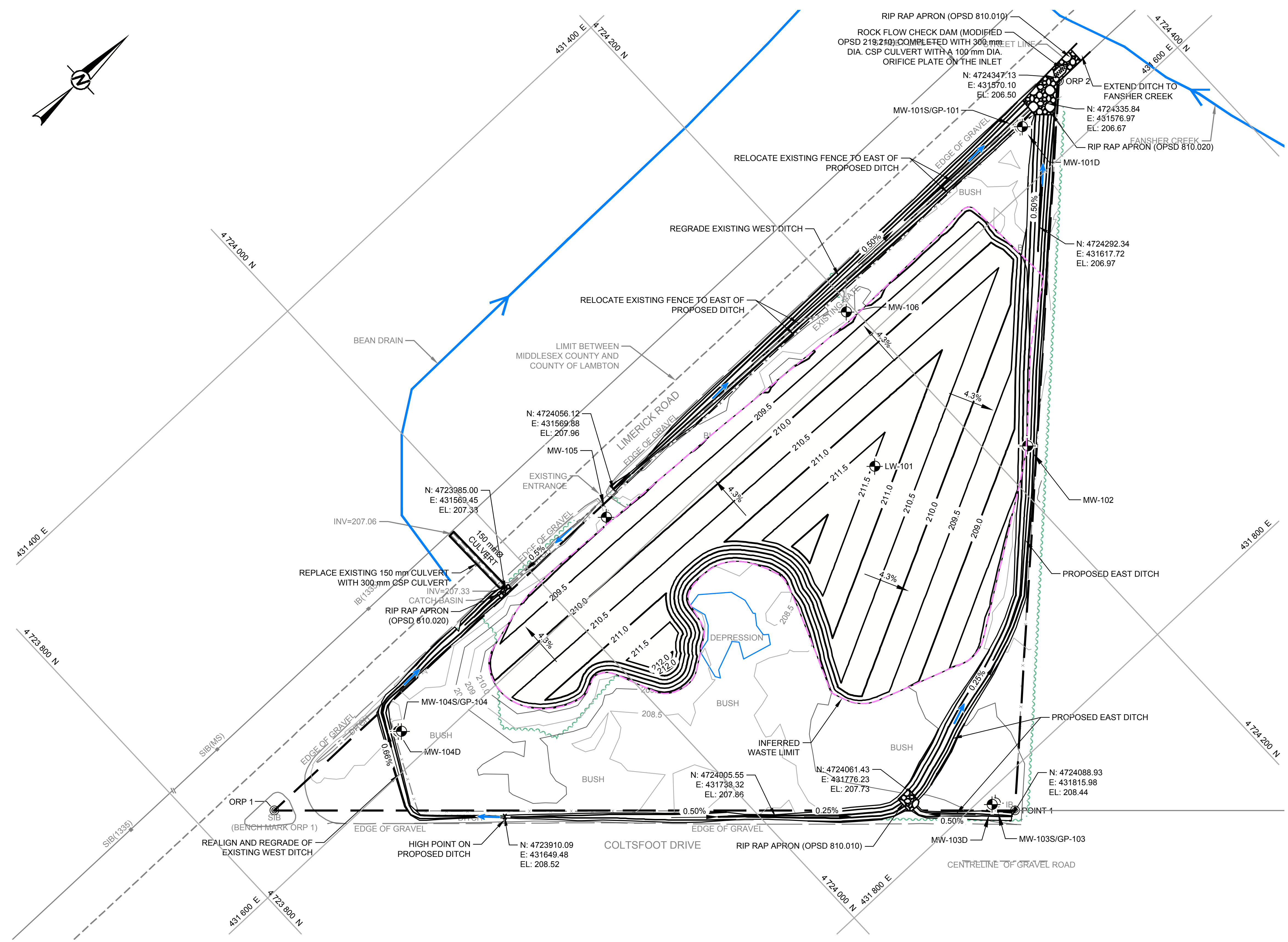
PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
CROSS SECTION B-B'

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm



LEGEND

— — —	PROPERTY BOUNDARY (6.27 ha)
—x—x—	EXISTING FENCE
←—	EXISTING DITCH
∿∿∿	EXISTING TREE LINE
209.0	EXISTING MAJOR CONTOUR (INTERVAL 1 m)
208.5	EXISTING MINOR CONTOUR (INTERVAL 0.5 m)
211.0	PROPOSED MAJOR CONTOUR (TOP OF FINAL COVER)
210.5	PROPOSED MINOR CONTOUR (TOP OF FINAL COVER)
══	PROPOSED DITCH
- - -	INFERRED WASTE LIMIT (3.16 ha)
LW-101	ACTIVE LEACHATE MONITORING WELL
MW-106	ACTIVE GROUNDWATER MONITORING WELL
N: 4724088.93 E: 431815.98 EL: 208.44	PROPOSED DITCH BOTTOM ELEVATION AND COORDINATE
ORP 2	OBSERVATION REFERENCE POINT

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
2. BENCHMARK: ELEVATIONS ARE GEODETIC CGVD28(HTV2.0) AND ARE DERIVED FROM LEICA G.P.S. SMART-NET REFERRED TO POINT NO. 1, BEING A SIB AS NOTED ON THE PLAN. ELEVATION = 208.82m.
3. FINAL COVER TOPSOIL (AVAILABLE ON SITE) VOLUME = 4,745 m³
   CLAYEY SOIL (IMPORTED) VOLUME = 18,978 m³
   TOTAL VOLUME = 23,723 m³

OBSERVATION REFERENCE POINT TABLE		
POINT ID	NORTHING (m)	EASTING (m)
ORP 1	4723831.10	431571.35
ORP 2	4724347.17	431572.77
POINT 1	4724091.91	431815.08

REFERENCE(S)

1. TOPOGRAPHIC BASE PLAN, DATED DEC. 05, 2018 BY ARCHIBALD, GRAY & McKAY LTD.

NOT FOR CONSTRUCTION

FINAL

0 50 100
1:2,000 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
PROPOSED SITE REGRADING PLAN (AFTER FINAL COVER CONSTRUCTION)

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

LEGEND

- PROPERTY BOUNDARY (6.27 ha)
- EXISTING FENCE
- EXISTING DITCH
- EXISTING TREE LINE
- EXISTING MAJOR CONTOUR (INTERVAL 1 m)
- EXISTING MINOR CONTOUR (INTERVAL 0.5 m)
- LW-101 — ACTIVE LEACHATE MONITORING WELL
- MW-106 — ACTIVE GROUNDWATER MONITORING WELL
- MW-101S /GP101 — ACTIVE COMBINED GROUNDWATER MONITORING WELL AND GAS PROBE
- LIM 1 — SURFACE WATER MONITORING LOCATION
- INFERRED WASTE LIMIT (3.16 ha)
- ORP 2 — OBSERVATION REFERENCE POINT

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
2. BENCHMARK: ELEVATIONS ARE GEODETIC CGVD28(HTV2.0) AND ARE DERIVED FROM LEICA G.P.S. SMART-NET REFERRED TO POINT NO. 1, BEING A SIB AS NOTED ON THE PLAN. ELEVATION = 208.82m.

OBSERVATION REFERENCE POINT TABLE		
POINT ID	NORTHING (m)	EASTING (m)
ORP 1	4723831.10	431571.35
ORP 2	4724347.17	431572.77
POINT 1	4724091.91	431815.08

REFERENCE(S)

1. TOPOGRAPHIC BASE PLAN, DATED DEC. 05, 2018 BY ARCHIBALD, GRAY & McKAY LTD.

NOT FOR CONSTRUCTION

FINAL

0 50 100
1:2,000 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT
wsp

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

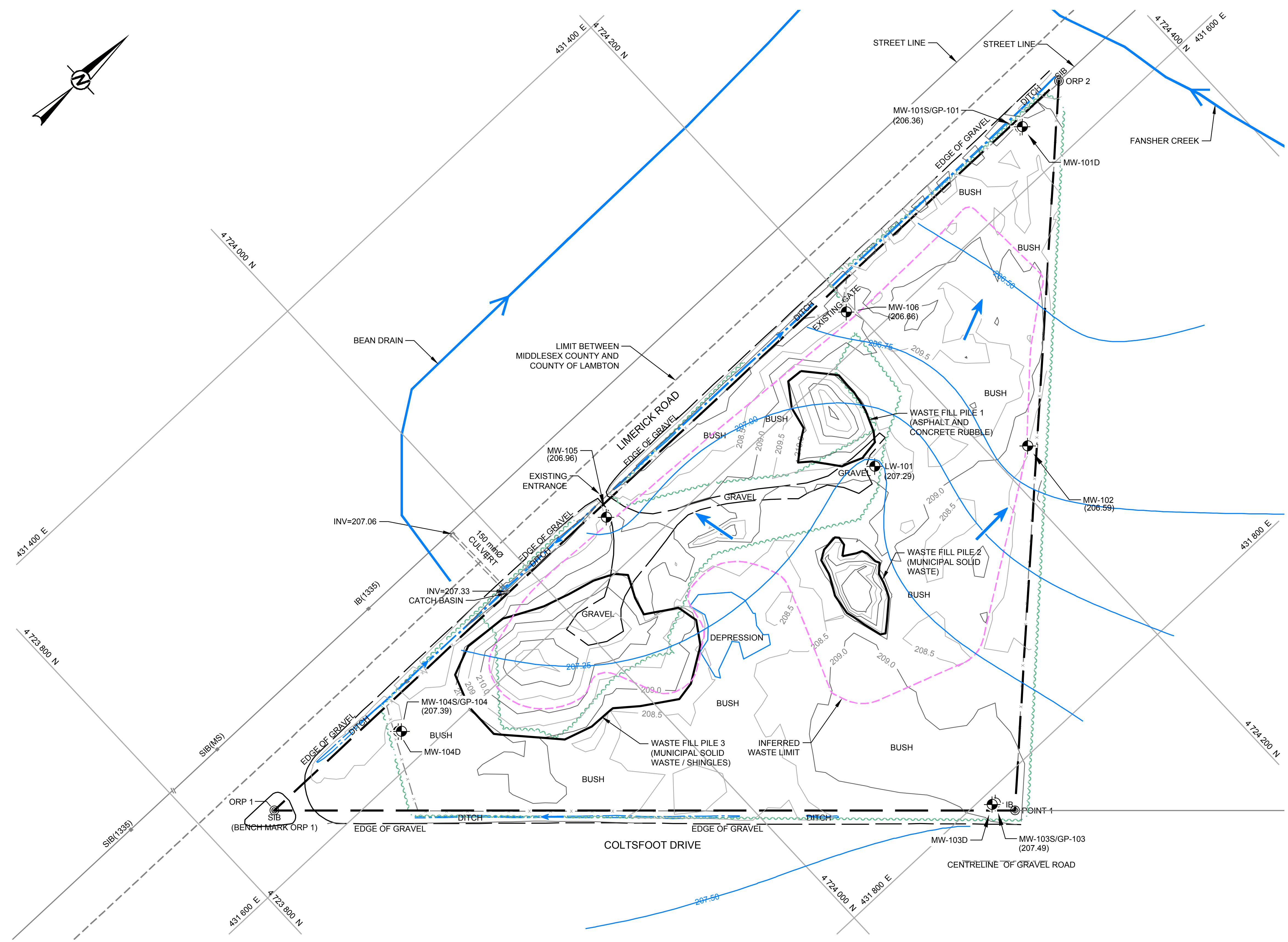
PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
LOCATION OF MONITORING WELLS, SURFACE WATER STATIONS AND LANDFILL GAS PROBES

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm



LEGEND

(line symbol)	PROPERTY BOUNDARY (6.27 ha)
(line symbol)	EXISTING FENCE
(line symbol)	EXISTING DITCH
(line symbol)	EXISTING TREE LINE
209.0	EXISTING MAJOR CONTOUR (INTERVAL 1 m)
208.5	EXISTING MINOR CONTOUR (INTERVAL 0.5 m)
LW-101	ACTIVE LEACHATE MONITORING WELL
MW-106	ACTIVE GROUNDWATER MONITORING WELL
(line symbol)	INFERRED WASTE LIMIT (3.16 ha)
(206.36)	GROUNDWATER ELEVATIONS (MASL), OCTOBER 4, 2023 LEACHATE ELEVATION (MASL), OCTOBER 10, 2023
206.75	GROUNDWATER SHALLOW WELL ELEVATIONS CONTOUR
ORP 2	OBSERVATION REFERENCE POINT

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
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ORP 2	4724347.17	431572.77
POINT 1	4724091.91	431815.08

REFERENCE(S)

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NOT FOR CONSTRUCTION

FINAL

0 50 100
1:2,000 METRES

CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT
WSP

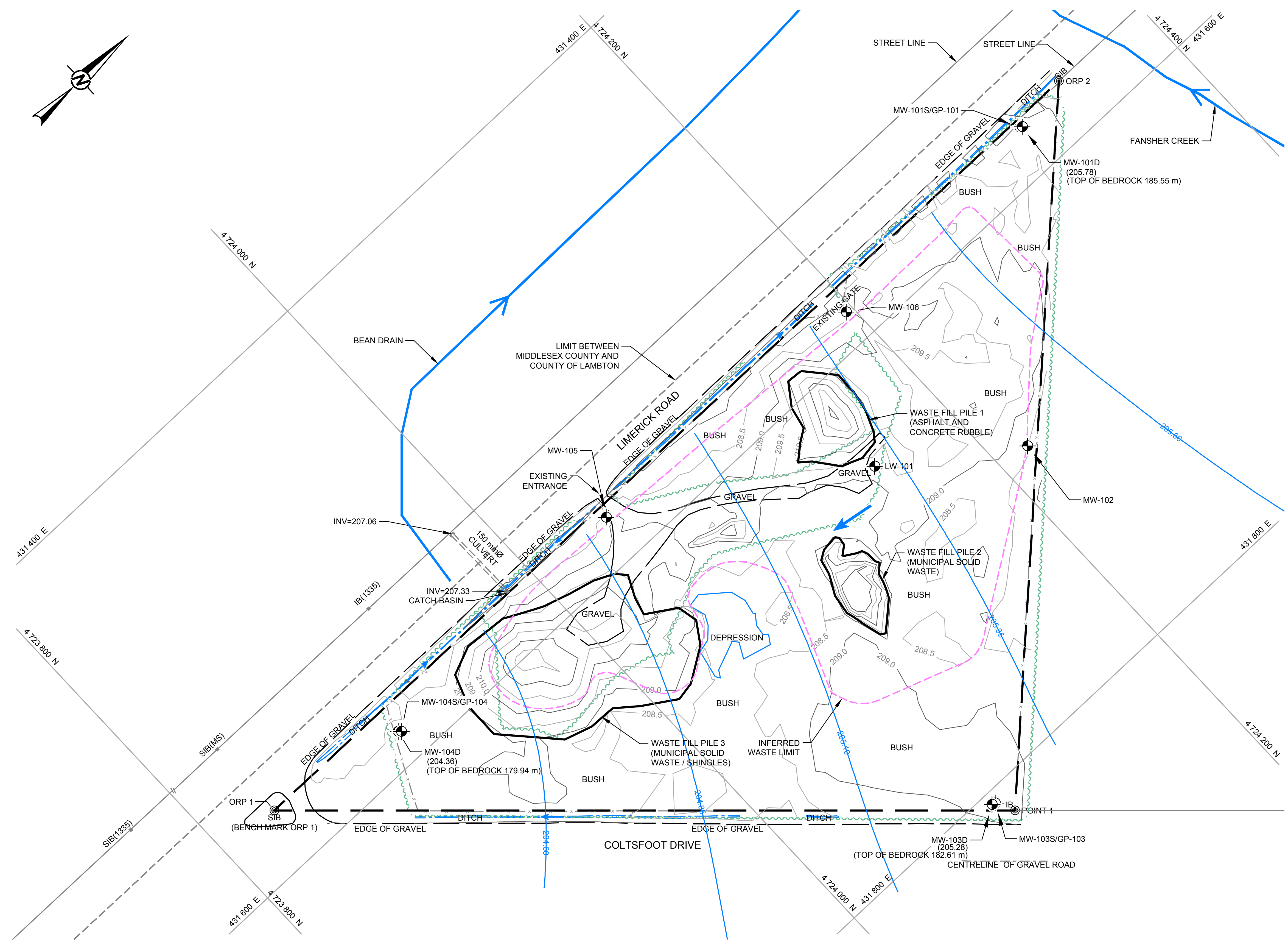
YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
GROUNDWATER ELEVATIONS – SHALLOW WELLS (OCTOBER 2023)

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D
25 mm



LEGEND

(line)	PROPERTY BOUNDARY (6.27 ha)
(line)	EXISTING FENCE
(line)	EXISTING DITCH
(line)	EXISTING TREE LINE
209.0	EXISTING MAJOR CONTOUR (INTERVAL 1 m)
208.5	EXISTING MINOR CONTOUR (INTERVAL 0.5 m)
LW-101	ACTIVE LEACHATE MONITORING WELL
MW-106	ACTIVE GROUNDWATER MONITORING WELL
(line)	INFERRED WASTE LIMIT (3.16 ha)
(205.78)	GROUNDWATER ELEVATIONS (MASL), OCTOBER 4 AND 5, 2023
205.60	GROUNDWATER DEEP WELL ELEVATIONS CONTOUR
ORP 2	OBSERVATION REFERENCE POINT

NOTES(S)

1. BEARINGS ARE U.T.M. GRID, IN NAD83 (ORIGINAL) DERIVED FROM G.P.S. OBSERVATIONS AND THE LEICA SMART-NET AND ARE REFERRED TO THE CENTRAL MERIDIAN 81°00' WEST LONGITUDE, ZONE 17.
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FINAL

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CLIENT
THE MUNICIPALITY OF SOUTHWEST MIDDLESEX

CONSULTANT

YYYY-MM-DD	2024-02-06
DESIGNED	FRG
PREPARED	AZ
REVIEWED	FRG
APPROVED	FSB

PROJECT
2023 ANNUAL REPORT
LIMERICK LANDFILL
SOUTHWEST MIDDLESEX, ONTARIO

TITLE
GROUNDWATER ELEVATIONS – DEEP WELLS (OCTOBER 2023)

PROJECT NO.	CONTROL	REV.	FIGURE
18108934	0007	A	8

APPENDIX A

Amended Environmental Compliance Approval

AMENDED ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A041902
Issue Date: June 8, 2020

The Corporation of the Municipality of Southwest Middlesex
153 McKellar St
Post Office Box, No. 218
Glencoe, Ontario
N0L 1M0

Site Location: 724 Limerick Rd, Bothwell
Southwest Middlesex Municipality, County of Middlesex
N0P 1C0

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

for a closed 6.27 hectare waste disposal site (landfill).

For the purpose of this environmental compliance approval, the following definitions apply:

"Approval" or "ECA" means this entire Environmental Compliance Approval document, issued in accordance with section 20.3 of the EPA, and includes any schedules to it, the application and the supporting documentation listed in schedule "A;

"CAZ" means contaminant attenuation zone;

"Director" means any Ministry employee appointed in writing by the Minister pursuant to section 5 of the EPA as a Director for the purposes of Part V of the EPA;

"District Manager" means the District Manager of the local district office of the Ministry in which the Site is geographically located;

"EPA" or "Act" means Environmental Protection Act, R.S.O. 1990, c. E. 19, as amended;

"Ministry" means the Ontario Ministry of the Environment, Conservation and Parks;

"Operator" has the same meaning as "operator" as defined in s.25 of the EPA;

“Owner” means the Corporation of the Municipality of Southwest Middlesex and its successors and assigns;

“PA” means the Pesticides Act, R.S.O. 1990, c. P-11, as amended;

"Provincial Officer" means any person designated in writing by the Minister as a provincial officer pursuant to section 5 of the OWRA or section 5 of the EPA or section 17 of PA.

"Regional Director" means the Regional Director of the local Regional Office of the Ministry in which the Site is located.

"Regulation 232" or "Reg. 232" means Ontario Regulation 232/98, Landfilling Sites, made under the EPA, as amended;

"Regulation 347" or "Reg. 347" means Regulation 347, R.R.O. 1990, General Waste Management, made under the EPA, as amended;

"Site" means the entire Limerick Road waste disposal site, including the buffer lands, and contaminant attenuation zone (where applicable) located at 724 Limerick Rd, Bothwell, Municipality of Southwest Middlesex, County of Middlesex, approved by this Approval; and

“Trained Personnel” means personnel knowledgeable in the following through instruction and/or practice:
a. relevant waste management legislation, regulations and guidelines;
b. major environmental concerns pertaining to the waste to be handled;
c. occupational health and safety concerns pertaining to the processes and wastes to be handled;
d. management procedures including the use and operation of equipment for the processes and wastes to be handled;
e. emergency response procedures;
f. specific written procedures for the control of nuisance conditions;
g. specific written procedures for refusal of unacceptable waste loads;
h. the requirements of this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL

Compliance

(1) This Approval revokes all previous Approvals and Notices of Amendment issued under Part V of the Environmental Protection Act for this Site. The approval given herein, including the terms and conditions set out, replaces all previously issued Approvals and related terms and conditions under Part V of the Act for this Site.

(2) The Owner and Operator shall ensure compliance with all the conditions of this Approval and shall ensure that any person authorized to carry out work on or operate any aspect of the Site is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

(3) Any person authorized to carry out work on or operate any aspect of the Site shall comply with the conditions of this Approval.

In Accordance

(4) Except as otherwise provided by this Approval, the Site shall be designed, developed, built, operated and maintained in accordance with the documentation listed in the attached Schedule "A".

(5) (a) Construction and installation of aspects described in Schedule "A" must be completed within 5 years of the later of:

1. the date this Approval is issued; or
2. if there is a hearing or other litigation in respect of the issuance of this Approval, the date that this hearing or litigation is disposed of, including all appeals.

(b) This Approval ceases to apply in respect of the aspects of the Site noted above that have not been constructed or installed before the later of the dates identified in Condition 1(5)(a).

Interpretation

(6) Where there is a conflict between a provision of any document listed in Schedule "A" in this Approval, and the conditions of this Approval, the conditions in this Approval shall take precedence.

(7) Where there is a conflict between the application and a provision in any document listed in Schedule "A", the application shall take precedence, unless it is clear that the purpose of the document was to amend the application and the Ministry approved the amendment.

(8) Where there is a conflict between any two documents listed in Schedule "A", the document bearing the most recent date shall take precedence.

(9) The conditions of this Approval are severable. If any condition of this Approval, or the application of any condition of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.

Other Legal Obligations

(10) The issuance of, and compliance with, this Approval does not:
   (a) relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement; and
   (b) limit in any way the authority of the Ministry to require certain steps be taken or to require the Owner and Operator to furnish any further information related to compliance with this Approval.
   (c) The Owner shall ensure that:
      (i) all equipment discharging to atmosphere are approved under Section 9 of the ECA where applicable; and
      (ii) all effluent is discharged in accordance with the OWRA where applicable.

Adverse Effect

(11) The Owner and Operator shall take steps to minimize and ameliorate any adverse effect on the natural environment or impairment of water quality resulting from the present, past and historical operations at the Site. Such steps may include accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

(12) Despite an Owner, Operator, or any other person fulfilling any obligations imposed by this Approval, the person remains responsible for any contravention of any other condition of this Approval or any applicable statute, regulation, or other legal requirement resulting from any act or omission that caused the adverse effect to the natural environment or impairment of water quality.

(13) At no time shall the Owner or Operator allow the discharge of a contaminant that causes or is likely to cause an adverse effect be permitted.

Change of Ownership

(14) The Owner shall notify the Director, in writing, and forward a copy of the notification to the District Manager, within 30 days of the occurrence of any changes in the following information:
   (a) the ownership of the Site;
   (b) the Operator of the Site;
   (c) the address of the Owner or Operator; and
   (d) the partners, where the Owner or Operator is or at any time becomes a partnership and a copy of the most recent declaration filed under the Business Names Act, R. S. O. 1990, c. B.17, shall be included in the notification.

(15) No portion of this Site shall be transferred or encumbered prior to or after closing of the Site unless the Director is notified in advance and sufficient financial assurance is deposited with the Ministry to ensure that these conditions will be carried out.

(16) In the event of any change in ownership of the Site, other than change to a successor municipality, the Owner shall notify the successor of and provide the successor with a copy of this Approval, and the Owner shall provide a copy of the notification to the District Manager and the Director.

Registration on Title Requirement

(17) Prior to dealing with the property in any way, the Owner shall provide a copy of this Approval and any amendments, to any person who acquires an interest in the property as a result of the dealing.

(18) (a) If not already completed, within ninety (90) calendar days from the date of issuance of this Approval, the Owner shall submit to the Director a completed Certificate of Requirement which shall include:

(i) a plan of survey prepared, signed and sealed by an Ontario Land Surveyor, which shows the area of the Site where waste has been and is to be deposited at the Site;
(ii) proof of ownership of the Site;
(iii) a letter signed by a member of the Law Society of Upper Canada or other qualified legal practitioner acceptable to the Director, verifying the legal description provided in the Certificate of Requirement;
(iv) the legal abstract of the property; and
(v) any supporting documents including a registerable description of the Site.

(b) If not already completed, within fifteen (15) calendar days of receiving a Certificate of Requirement authorized by the Director, the Owner shall:

(i) register the Certificate of Requirement in the appropriate Land Registry Office on the title to the property; and
(ii) submit to the Director and the District Manager, written verification that the Certificate of Requirement has been registered on title.

Registration on Title Requirement - Contaminant Attenuation Zone (CAZ)

(19) Within thirty (30) calendar days from the date of establishing a contaminant attenuation zone (CAZ) (overburden and/or bedrock aquifers) in either fee simple or by way of a groundwater easement, the Owner shall submit to the Director a completed Certificate of Requirement which shall include:

(a) If rights are obtained in fee simple, the Owner shall provide:

(i) documentation evidencing ownership of the CAZ obtained in compliance with Regulation 232, as amended;
(ii) a completed Certificate of Requirement and supporting documents containing a registerable description of the CAZ; and
(iii) a letter signed by a member of the Law Society of Upper Canada; or other qualified legal practitioner acceptable to the Director, verifying the legal description of the CAZ.

(b) within fifteen (15) calendar days of receiving a Certificate of Requirement signed or authorized by the Director,the Owner shall:

(i) register the Certificate of Requirement in the appropriate Land Registry Office on the title to the property; and
(ii) submit to the Director and the District Manager, a written verification that the Certificate of Requirement has been registered on title.

(c) If rights are obtained by way of a groundwater easement, the Applicant shall:

(i) provide a copy of the agreement for the easement;
(ii) provide a plan of survey signed and sealed by an Ontario Land Surveyor for the CAZ; and
(iii) submit proof of registration on title of the groundwater easement to the Director and District Manager;

(d) The Owner shall not amend, or remove, or consent to the removal of the easement or CAZ from title without the prior written consent of the Director.

Inspections by the Ministry

(20) No person shall hinder or obstruct a Provincial Officer from carrying out any and all inspections authorized by the OWRA, the EPA, the PA, the SDWA or the NMA, of any place to which this Approval relates, and without limiting the foregoing:
(a) to enter upon the premises where the approved works are located, or the location where the records required by the conditions of this Approval are kept;
(b) to have access to, inspect, and copy any records required to be kept by the conditions of this Approval;
(c) to inspect the Site, related equipment and appurtenances;
(d) to inspect the practices, procedures, or operations required by the conditions of this Approval; and
(e) to sample and monitor for the purposes of assessing compliance with the terms and conditions of this Approval or the EPA, the OWRA, the PA, the SDWA or the NMA.

Information and Record Retention

(21) (a) Except as authorized in writing by the Director, all records required by this Approval shall be retained at the Site for a minimum of two (2) years from their date of creation.
(b) The Owner shall retain all documentation listed in Schedule "A" for as long as this Approval is valid.
(c) All information and logs required in Condition 7(1) shall be kept at the Site until they are included in the Annual Report.
(d) The Owner shall retain employee training records as long as the employee is working at the Site.
(e) The Owner shall make all of the above documents available for inspection upon request of Ministry staff.

(22) The receipt of any information by the Ministry or the failure of the Ministry to prosecute any person or to require any person to take any action under this Approval or under any statute, regulation or other legal requirement, in relation to the information, shall not be construed as:
(a) an approval, waiver, or justification by the Ministry of any act or omission of any person that contravenes any term or condition of this Approval or any statute, regulation or other legal requirement; and
(b) acceptance by the Ministry of the information's completeness or accuracy.

(23) The Owner shall ensure that a copy of this Approval, in its entirety and including all its Notices of Amendment, and documentation listed in Item #1 of Schedule "A", are retained at the Site or the Owner's office at all times.

(24) Any information related to this Approval and contained in Ministry files may be made available to the public in accordance with the provisions of the Freedom of Information and Protection of Privacy Act, RSO 1990, CF-31.

2. SITE OPERATIONS AND DESIGN

General

(1) The Site is closed and shall not receive any additional waste.

Signage and Security

(2) A sign shall be installed and maintained at the main entrance/exit to the Site which legibly displays the following information:
(a) the name of the Site and Owner;
(b) the number of the Approval;
(c) the telephone number to which complaints may be directed;
(d) a warning against unauthorized access;
(e) a twenty-four (24) hour emergency telephone number (if different from above); and
(f) a warning against dumping outside the Site.

(3) The Owner shall ensure that:
a. access to the Site is restricted by fencing; and
b. fencing and lockable gate are kept in good repair.

Nuisance Control

(4) If at any time problems such as odours, dust, litter, noise, vectors, vermin, rodents, bears or other nuisances are found at the Site, the Owner shall take appropriate, immediate remedial action to eliminate the problem.

3. GROUNDWATER AND SURFACE WATER MONITORING

Compliance

(1) The Site shall be operated in such a way as to ensure compliance with the following:

(a) Reasonable Use Guideline B-7 for the protection of the groundwater at the Site; and
(b) Provincial Water Quality Objectives included in the July 1994 publication entitled Water Management Policies, Guidelines, Provincial Water Quality Objectives, as amended from time to time, or limits set by the Regional Director, or the Canadian Water Quality Guidelines published by the Canadian Council of Ministers of the Environment, 1999 for the protection of the surface water at and off the Site.

Surface Water and Groundwater

(2) The Owner shall monitor surface water and groundwater in accordance with the environmental monitoring program outlined in Schedule "B".

(3) A certified Professional Geoscientist or Professional Engineer possessing appropriate hydrogeologic and hydrologic training and experience shall execute or directly supervise the execution of the environmental monitoring and reporting program.

Groundwater Wells and Monitors

(4) The Owner shall ensure that all groundwater monitoring wells which form part of the monitoring program are properly capped, locked and protected from damage and maintained in accordance with Regulation 903.

(5) Any groundwater monitoring well included in the on-going monitoring program that is damaged shall be assessed, repaired, replaced or decommissioned by the Owner, as required.

(a) The Owner shall repair or replace any monitoring well which is destroyed or in any way made to be inoperable for sampling such that no more than one regular sampling event is missed.

(b) All monitoring wells which are no longer required as part of the groundwater monitoring program, and have been approved by the Director or the District Manager for abandonment, shall be decommissioned by the Owner, as required, in accordance with Regulation 903, to prevent contamination through the abandoned well. A report on the decommissioning of the well shall be included in the Annual Report for the period during which the well was decommissioned.

Trigger Mechanisms and Contingency Plans

(6) The Owner shall comply with the site-specific trigger mechanism program and contingency measures outlined in Item #1 of Schedule "A".

Changes to the Monitoring Plan, Trigger Mechanism and Contingency Plan

(7) The Owner may request to make changes to the environmental monitoring program, Trigger Mechanism and Contingency Plan to the District Manager in accordance with the recommendations of the annual report. The Owner shall make clear reference to the proposed changes in a separate letter that shall accompany the annual report.

(8) Within fourteen (14) days of receiving the written correspondence from the District Manager confirming that the District Manager is in agreement with the proposed changes to the environmental monitoring program, the Owner shall forward a letter identifying the proposed changes and a copy of the correspondences from the District Manager and all other correspondences and responses related to the changes to the monitoring program, to the Director requesting the Approval be amended to approve the

proposed changes to the environmental monitoring plan prior to implementation.

(9) In the event any other changes to the environmental monitoring program are proposed outside of the recommendation of the annual report, the Owner shall follow current Ministry procedures for seeking approval for amending the Approval.

4. EMPLOYEE TRAINING

(1) A training plan for all employees that operate any aspect of the Site shall be developed and implemented by the Owner or the Operator. Only Trained Personnel shall operate any aspect of the Site or carry out any activity required under this Approval.

(2) The Owner shall ensure that all site operations employees have been adequately trained and received on-going training with respect to the following, but not limited to:

(a) terms, conditions and operating requirements of this Approval for the Site;
(b) the operation, inspection, and maintenance of the Site with respect to the approved design and operations documents;
(c) relevant waste management legislation and regulations;
(d) environmental concerns related to waste management at the Site;
(e) occupational Health and Safety concerns related to waste management at the Site;
(f) emergency procedures and contingency plans in case of fire, spills, off-site impacts and any other emergency situations;
(g) terms, conditions and operating requirements of this Approval;
(h) operation and management of the landfill and the other waste storage areas as described in the documents in Schedule "A" attached to this Approval unless otherwise required by the conditions of this Approval;
(i) outline of the responsibilities of the operators of the Site;
(j) any environmental concerns pertaining to wastes being handled at the Site;
(k) occupational health and safety concerns pertaining to the wastes to be handled at the Site;
(l) relevant environmental legislation and regulations, including but not limited to the EPA and Reg. 347;
(m) specific written procedures for the control of nuisance conditions; and
(n) operation of equipment and procedures to be followed in the event of an emergency situation as described in the Emergency Response Manual required by this Approval.

5. COMPLAINTS RESPONSE PROCEDURE

(1) If at any time the Owner receives complaints regarding the operation of the Site, the Owner shall respond to these complaints according to the following procedure:

(a) The Owner shall record and number each complaint, either electronically or in a log book, and shall include the following information: the nature of the complaint, the name, address and the telephone number of the complainant if the complainant will provide this information and the time and date of the complaint;

(b) The Owner, upon notification of the complaint, shall initiate appropriate steps to determine possible causes of the complaint, proceed to take the necessary actions to eliminate the cause of the complaint and forward a written reply to the complainant; and

(c) The Owner shall complete and retain on-site a report written within one (1) week of the complaint date, listing the actions taken to resolve the complaint and recommendations, if any, for remedial measures, and managerial or operational changes to reasonably avoid the recurrence of similar incidents.

(2) The Owner shall designate a person to receive any complaints and to respond with a written notice of action as soon as possible. The Owner shall post site complaints procedure at site entrance. All complaints and the Owner's actions taken to remedy the complaints must be summarized in the Annual Report.

6. EMERGENCY AND SPILL RESPONSE

(1) All Spills as defined in the EPA occurring at or from the Site shall be immediately reported to the Ministry's Spills Action Centre at 1-800-268-6060 and shall be recorded in the log book. The Owner/Operator shall record for each Spill event the contaminant(s) spilled, the quantity or volume of contaminants spilled, the spatial distribution of the area impacted by the Spill, a root cause analysis of the events leading up to the Spill and a list of actions designed to prevent similar Spill events.

(2) In addition, the Owner shall submit to the District Manager a written report within three (3) business days of the Spill event, outlining the nature of the incident, remedial measures taken, handling of waste generated as a result of the emergency situation and the measures taken to prevent future occurrences at the Site.

(3) All wastes resulting from a Spill event shall be managed and disposed of in accordance with the EPA and Regulation 347.

(4) All equipment and materials required to handle the Spill event shall be:
(a) kept on hand at all times that waste landfilling and/or handling is undertaken at the Site; and
(b) adequately maintained and kept in good repair.

(5) The Owner shall ensure that the emergency response personnel are familiar with the use of such equipment and its location(s).

7. INSPECTIONS, RECORD KEEPING AND REPORTING

Inspections and Inspection Log

(1) The Owner shall ensure that Site inspections and maintenance program outlined in Table 7, Item #1 of Schedule "A" are undertaken by Trained Personnel and the areas to be inspected shall include, but not be limited to the following, to ensure that:

(a) the Site is secure;

(b) the operation of the Site is not causing any nuisances;
(c) the operation of the Site is not causing any adverse effects on the environment or impairing water quality;
(d) the Site is being operated in compliance with this Approval.
(e) condition of the surface water drainage works;
(f) presence of any ponded water at the Site;
(g) condition of the on-site roads for evidence of excessive erosion and fugitive dust emissions;
(h) presence of litter at the Site's perimeter and litter fences;
(i) condition of the final cover;
(j) presence of vector, vermin and animals;
(k) condition of the on-site facilities, the gate and its lock and the signs required by this Approval;
(l) presence of leachate seeps.

(2) Any deficiencies discovered as a result of the inspections shall be remedied immediately**.**

(3) An electronic or written record of the inspections shall be maintained and shall include the following:
(a) the name and signature of person that conducted the inspection;
(b) the date and time of the inspection;
(c) the list of all deficiencies discovered during the inspections, including but not limited to:
(i) the presence of any leachate seeps;
(ii) poor drainage conditions and ponding of surface water; and
(iii) the presence of waste outside of the approved fill area;
(d) the recommendations for remedial action to address the identified deficiencies; and
(e) the date, time and description of the remedial actions taken.

Other Information

(4) Any information requested, by the Director, the District Manager or a Provincial Officer, concerning the Site and its operation under this Approval, including but not limited to any records required to be kept by this Approval shall be provided to the Ministry, upon request.

Annual Report

(5) A written report on the development, operation and monitoring of the Site, shall be completed annually (the "Annual Report"). The Annual Report shall be submitted to the District Manager, by March 31st of the year following the period being reported upon.

(6) The Annual Report shall include, but not be limited to, the following information:

(a) any operating problems encountered and corrective actions taken;
(b) details on the monitoring program undertaken, outlining monitor locations, analytical parameters sampled, and frequency of sampling;
(c) an analysis and interpretation of the surface water and groundwater monitoring data, a review of the adequacy of the monitoring program, conclusions of the monitoring data, and recommendations

for any changes that may be necessary;

(d) summary of inspections undertaken at the Site;
(e) summary of any public complaints received and the responses made;
(f) a statement as to compliance with all conditions of this Approval and the other relevant Ministry's groundwater and surface water requirements;
(g) recommendations respecting any proposed changes in the operation of the Site;
(h) a report on the status of all monitoring wells and a statement as to compliance with Ontario Regulation 903; and
(i) any other information that the Regional Director or the District Manager may require.
(j) a plan showing Site appearance after closure;
(k) an assessment of the adequacy of and need to implement the contingency plans; and
(l) an estimate of the contaminating life span of the Site, based on the results of the monitoring programs to-date.

8. CLOSURE PLAN

(1) The Site shall be closed in accordance with the submitted closure plan identified by Item #1 of Schedule "A".

Schedule "A"

This Schedule "A" forms part of Environmental Compliance Approval No. A041902.

1. Final Report, Limerick Landfill Closure Plan, 724 Limerick Road, Bothwell, Municipality of Southwest Middlesex. Reference No. 18108934-3000. Prepared by Golder Associates Ltd., December, 2019.

Schedule "B"

Groundwater, Surface Water, and Landfill Gas Monitoring

Sample Regime	Sample Location	Sample Frequency	Parameters
Groundwater	Background: MW-103S, and MW-104S Leachate: LW-101 Downgradient: MW-101S, MW-102, MW-103D, MW-105, and MW-106 QA/QC: one field blank, and one field duplicate	Two times per year to be completed in the Spring and Fall	Alkalinity, Aluminum, Ammonia, Arsenic, Barium, Boron, Calcium, Cadmium, Chloride, Chromium, Conductivity (field), Copper, Chemical Oxygen Demand (COD), Dissolved Organic Carbon (DOC), Hardness, Ion Balance, Iron, Lead, Magnesium, Manganese, Nitrate, Nitrite, pH (field and lab), Phenols, Potassium, Selenium, Sodium, Strontium, Sulphate, Temperature (field), Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN), Total Phosphorus, Water level (field), Zinc
	MW-101D and MW-104D	Two times per year to be completed in the Spring and Fall	Water level
	LW-101	Two times per year to be completed in the Spring and Fall	Biochemical Oxygen Demand (5-day) (BOD)
	Background: MW-103S, and MW-104S Leachate: LW-101 Downgradient: MW-101S, MW-102, MW-103D, MW-105, and MW-106	Once every three years in the Spring beginning in 2021.	Acetone, Benzene, Bromodichloromethane, Bromoform, Bromomethane, Carbon Tetrachloride, Chlorobenzene, Chloroethane, Chloroform, Chloromethane, Dibromochloromethane, Dichlorodifluoromethane, Ethylene dibromide (dibromoethane, 1,2-), 1,2-Dichlorobenzene, 1,3-, Dichlorobenzene, 1,4-Dichlorobenzene, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,1-Dichloroethylene, cis-1,2-Dichloroethylene, trans-1,2-Dichloroethylene, 1,2-Dichloroethylene, total, 1,2-Dichloropropane, cis-1,3-Dichloropropylene, trans-1,3-Dichloropropylene,

			1,3-Dichloropropene, total, Ethylbenzene, Hexane, Methyl Ethyl Ketone (2-Butanone), Methyl Butyl Ketone (2-Hexanone), Methyl Isobutyl Ketone, Methyl tert-butyl ether, Methylene Chloride, Styrene, 1,1,1,2-Tetrachloroethane, 1,1,2,2-Tetrachloroethane, Tetrachloroethylene, Toluene 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene, Trichlorofluoromethane 1,3,5-Trimethylbenzene, Vinyl Chloride, m/p-Xylene, o-Xylene, Xylenes, total
Surface Water	Lim-1 and Lim-2	Two times per year to be completed in the Spring and Fall	Alkalinity, Aluminum, Total Ammonia, Un-ionized Ammonia (calculated), Arsenic, Barium, Boron, BOD (5-day), Cadmium, Calcium, Chloride, Chromium VI, Conductivity (field), COD, Colour, Copper, Dissolved oxygen (field), DOC, Flow (visual observation), Hardness, Ion Balance, Iron, Lead, Magnesium, Manganese, pH (field and lab), Nitrate, Nitrite, Phenols, Potassium, Selenium, Sodium, Strontium, Sulphate, Temperature (field), TDS, TKN, Total Organic Carbon (TOC), Total Phosphorus, TSS, Zinc
Landfill Gas	GP-101, GP-103, and GP-104	One time per year in January or February	percent lower explosive limit methane concentration of combustible gas, carbon dioxide, oxygen and water level

The reasons for the imposition of these terms and conditions are as follows:

Conditions 1(1), 1(2), 1(3), 1(6), 1(7), 1(8), 1(9), 1(10), 1(11), 1(12), 1(13), 1(21), 1(22), and 1(23) are to clarify the legal rights and responsibilities of the Owner and Operator under this Approval.

Conditions 1(4) and 1(5) are to ensure that the Site is designed, operated, monitored and maintained in accordance with the application and supporting documentation submitted by the Owner, and not in a manner which the Director has not been asked to consider.

Condition 1(12) is to ensure that the Site is operated under the corporate name which appears on the application form submitted for this approval and to ensure that the Director is informed of any changes.

Condition 1(14) is to restrict potential transfer or encumbrance of the Site without the approval of the Director and to ensure that any transfer of encumbrance can be made only on the basis that it will not endanger compliance with this Approval.

Conditions 1(15) and 1(16) are to ensure that the successor is aware of its legal responsibilities.

Conditions 1(17), 1(18) and 1(19) clarify that the Part II.1 Director is an individual with authority pursuant to Section 197 of the Environmental Protection Act to require registration on title and provide any person with an interest in property before dealing with the property in any way to give a copy of the Approval to any person who will acquire an interest in the property as a result of the dealing.

Condition 1(20) is to ensure that appropriate Ministry staff has ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this Approval. This Condition is supplementary to the powers of entry afforded a Provincial Officer pursuant to the Act, the OWRA, the PA, the NMA and the SDWA.

Condition 1(24) clarifies what information may be subject to the Freedom of Information Act.

Condition 2(1) is to clarify that the site is closed and waste is no longer permitted to be received at the site.

Conditions 2(2) and 2(3) are to specify pertinent Site and contact information and ro ensure the Site is maintained in a secure manner.

Conditions 2(4) is to ensure that the Site is operated in a manner which does not result in a nuisance or a hazard to the health and safety of the environment or people

Condition 3(1) is to provide the groundwater and surface water limits to prevent water pollution at the Site

Conditions 3(2) and 3(3) are included to require the Owner to demonstrate that the Site is performing as designed and the impacts on the natural environment are acceptable. Regular monitoring allows for the analysis of trends over time and ensures that there is an early warning of potential problems so that any necessary remedial/contingency action can be taken.

Conditions 3(4) and 3(5) are included to ensure the integrity of the groundwater monitoring network so that accurate monitoring results are achieved and the natural environment is protected.

Condition 3(6) is added to ensure the Owner has a plan with an organized set of procedures for identifying and responding to potential issues relating to groundwater and surface water contamination at the Site's compliance point.

Conditions 3(7), 3(8), and 3(9) are included to streamline the approval of the changes to the monitoring plan.

Conditions 4(1) and 4(2) are to ensure that the Site is operated by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person.

Conditions 5(1) and 5(2) are added to ensure that any complaints regarding landfill operations at this Site are responded to in a timely and efficient manner.

Condition 6(1) is to ensure the Owner immediately responds to a spill.

Conditions 6(2), 6(3), 6(4), and 6(5) are to ensure that the Owner notifies the Ministry forthwith of any spills so that an appropriate response can be determined.

Conditions 7(1), 7(2), and 7(3) are to ensure that detailed records of Site inspections are recorded and maintained for inspection and information purposes.

Condition 7(4) is added to ensure that accurate waste records are maintained to ensure compliance with the conditions in this Approval, record keeping, annual reporting, the EPA and its regulations.

Conditions 7(5), and 7(6) are added to ensure that regular review of site development, operations and monitoring data is documented and any possible improvements to site design, operations or monitoring programs are identified. An annual report is an important tool used in reviewing site activities and for determining the effectiveness of site design.

Condition 8(1) is added to ensure that final closure of the Site is completed in an aesthetically pleasing manner, in accordance with Ministry standards, and to ensure the long-term protection of the health and safety of the public and the environment.

Upon issuance of the environmental compliance approval, I hereby revoke Approval No(s). A041902 issued on May 25, 2020

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

a. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
b. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

Pursuant to subsection 139(3) of the Environmental Protection Act, a hearing may not be required with respect to any terms and conditions in this environmental compliance approval, if the terms and conditions are substantially the same as those contained in an approval that is amended or revoked by this environmental compliance approval.

The Notice should also include:

1. The name of the appellant;
2. The address of the appellant;
3. The environmental compliance approval number;
4. The date of the environmental compliance approval;
5. The name of the Director, and;
6. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, Ontario
M4V 1P5

*** Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 326-5370 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 8th day of June, 2020

Mohsen Keyvani, P.Eng.
Director
appointed for the purposes of Part II.1 of the
Environmental Protection Act

CF/

c: District Manager, MECP London - District
Fabiano Gondim, Golder Associates Ltd

APPENDIX B

Monitoring Program (Limerick Landfill)

APPENDIX B: MONITORING PROGRAM (LIMERICK LANDFILL)

1.0 MONITORING FREQUENCY

- Groundwater, leachate and surface water monitoring should occur twice per year (i.e., Spring and Fall) for the first three years of post-closure monitoring and may be revised upon review of the analytical results against trigger mechanisms.
- Organic parameters, inorganic parameters and metals are to be included in every leachate, groundwater and surface water monitoring event (i.e., Spring and Fall).
- Volatile organic compounds (VOCs) are to be included in the Spring only leachate and groundwater samples every three years starting in 2021 (i.e., 2021, 2024, 2027, 2030, etc.).
- Landfill gas monitoring during the winter (January or February) under frozen ground conditions.

2.0 GROUNDWATER SAMPLING LOCATIONS

- Background (Upgradient) Groundwater Quality Monitoring Locations:
  - MW-103S and MW-104S.
- Leachate Monitoring Locations:
  - LW-101.
- Downgradient Groundwater Quality Monitoring Locations:
  - MW-101S, MW-102, MW-103D, MW-105 and MW-106.

Note: Monitoring wells MW-101D and MW-104D will not be monitored for groundwater quality; these wells will only be monitored for groundwater levels. See Figure 6 for location of monitoring wells.

2.1 GROUNDWATER QA/QC

- Approximately one field blank and one field duplicate per groundwater sampling event.

3.0 SURFACE WATER SAMPLING LOCATIONS

- LIM-1 and LIM-2 as shown on Figure 6.

4.0 LANDFILL GAS SAMPLING LOCATIONS

- GP-101, GP-103 and GP-104 as shown on Figure 6.

5.0 FIELD MEASURED PARAMETERS

- Groundwater levels in all functional groundwater monitoring wells, including MW-101D and MW-104D;
- Groundwater temperature, conductivity and pH in all functional groundwater monitoring wells, except for MW-101D and MW-104D;

- Surface water temperature, conductivity, dissolved oxygen and pH;
- Surface water visual assessment of flow; and
- Landfill gas methane, carbon dioxide and oxygen.

6.0 LABORATORY MEASURED PARAMETERS

The inorganic parameters, metals and VOCs indicated in the Table B-1 below are included in the monitoring program.

Table B-1: Annual Monitoring Program

Sample Regime	Group of Parameters	List of Parameters
Groundwater	Organics, Inorganics and Metals	Alkalinity, Aluminum, Ammonia, Arsenic, Barium, Boron, Calcium, Cadmium, Chloride, Chromium, Copper, Chemical Oxygen Demand (COD), Dissolved Organic Carbon (DOC), Hardness, Ion Balance, Iron, Lead, Magnesium, Manganese, Nitrate, Nitrite, pH, Phenols, Potassium, Selenium, Sodium, Strontium, Sulphate, Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN), Total Phosphorus, Zinc
	VOCs	Acetone, Benzene, Bromodichloromethane, Bromoform, Bromomethane, Carbon Tetrachloride, Chlorobenzene, Chloroethane, Chloroform, Chloromethane, Dibromochloromethane, Dichlorodifluoromethane, Ethylene dibromide (dibromoethane, 1,2-), 1,2-Dichlorobenzene, 1,3-, Dichlorobenzene, 1,4-Dichlorobenzene, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,1-Dichloroethylene, cis-1,2-Dichloroethylene, trans-1,2-Dichloroethylene, 1,2-Dichloroethylene (total), 1,2-Dichloropropane, cis-1,3-Dichloropropylene, trans-1,3-Dichloropropylene, 1,3-Dichloropropene (total), Ethylbenzene, Hexane, Methyl Ethyl Ketone (2-Butanone),Methyl Butyl Ketone (2-Hexanone), MethylIsobutyl Ketone, Methyl tert-butyl ether, Methylene Chloride, Styrene, 1,1,1,2-Tetrachloroethane,1,1,2,2-Tetrachloroethane, Tetrachloroethylene, Toluene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene,Trichlorofluoromethane, 1,3,5-Trimethylbenzene, Vinyl Chloride,m/p-Xylene, o-Xylene, Xylenes (total)
Leachate	Organics, Inorganics and Metals	Biochemical Oxygen Demand (5-day) (BOD) Alkalinity, Aluminum, Ammonia, Arsenic, Barium, Boron, Calcium, Cadmium, Chloride, Chromium, Copper, Chemical Oxygen Demand (COD), Dissolved Organic Carbon (DOC), Hardness, Ion Balance, Iron, Lead, Magnesium, Manganese, Nitrate, Nitrite, pH, Phenols, Potassium, Selenium, Sodium, Strontium, Sulphate, Total Dissolved Solids (TDS), Total Kjeldahl Nitrogen (TKN), Total Phosphorus, Zinc
	VOCs	Acetone, Benzene, Bromodichloromethane, Bromoform, Bromomethane, Carbon Tetrachloride, Chlorobenzene, Chloroethane, Chloroform, Chloromethane, Dibromochloromethane, Dichlorodifluoromethane, Ethylene dibromide (dibromoethane, 1,2-), 1,2-Dichlorobenzene, 1,3-, Dichlorobenzene, 1,4-Dichlorobenzene, 1,1-Dichloroethane, 1,2-Dichloroethane, 1,1-Dichloroethylene, cis-1,2-Dichloroethylene, trans-1,2-Dichloroethylene, 1,2-Dichloroethylene (total), 1,2-Dichloropropane, cis-1,3-Dichloropropylene, trans-1,3-Dichloropropylene, 1,3-Dichloropropene (total), Ethylbenzene, Hexane, Methyl Ethyl Ketone (2-Butanone),Methyl Butyl Ketone (2-Hexanone), MethylIsobutyl Ketone, Methyl tert-butyl ether, Methylene Chloride, Styrene, 1,1,1,2-Tetrachloroethane,1,1,2,2-Tetrachloroethane, Tetrachloroethylene, Toluene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene,Trichlorofluoromethane, 1,3,5-Trimethylbenzene, Vinyl Chloride,m/p-Xylene, o-Xylene, Xylenes (total)

Sample Regime	Group of Parameters	List of Parameters
Surface Water	Organics, Inorganics and Metals	Alkalinity, Aluminum, Total Ammonia, Un-ionized Ammonia (calculated), Arsenic, Barium, Boron, BOD (5-day), Cadmium, Calcium, Chloride, Chromium VI, COD, Colour, Copper, DOC, Hardness, Ion Balance, Iron, Lead, Magnesium, Manganese, pH, Nitrate, Nitrite, Phenols, Potassium, Selenium, Sodium, Strontium, Sulphate, TDS, TKN, Total Organic Carbon (TOC), Total Phosphorus, TSS, Zinc

6.1 Special Note for Parameters with Established Provincial Water Quality Criteria

All laboratory analyses of groundwater samples should be performed by a private analytical laboratory and the method detection limits (MDLs) for the specific analyses would be commensurate with the standards established in the Ontario Drinking Water Quality Standards, Objectives and Guidelines (MOE, 2003) or the Provincial Water Quality Objectives (MOEE, 1994a) whichever is lower.

APPENDIX C

Borehole Logs

METHOD OF SOIL CLASSIFICATION

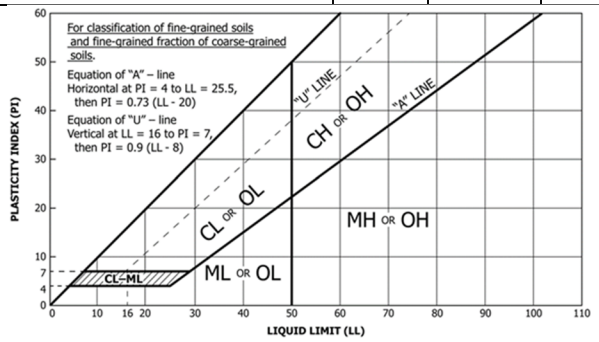
The WSP Canada Soil Classification[1] System is based on the Unified Soil Classification System (USCS) (after ASTM D2487)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content [6,9]	USCS Group Symbol[3,5,7]	Primary Group Name[2]
INORGANIC (Organic Content <30% by mass)	**COARSE-GRAINED SOILS** (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Clean Gravels with <5% fines [3] (by mass)	Well Graded	≥4 (and)	≥1 to ≤3	≤30%	GW	Well-graded GRAVEL [4,6]
				Poorly Graded	<4 (and/or)	<1 or >3		GP	Poorly graded GRAVEL [4,6]
			Gravels with >12% fines [3] (by mass)	Below A Line	n/a			GM	SILTY GRAVEL [4,6]
				Above A Line	n/a			GC	CLAYEY GRAVEL [4,5,6]
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Clean Sands with <5% fines [7] (by mass)	Well Graded	≥6 (and)	≥1 to ≤3		SW	Well-graded SAND [6,8]
				Poorly Graded	<6 (and/or)	<1 or >3		SP	Poorly graded SAND [6,8]
			Sands with >12% fines [7] (by mass)	Below A Line	n/a			SM	SILTY SAND [6,8]
				Above A Line	n/a			SC	CLAYEY SAND [5,6,8]

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators: Dilatancy	Dry Strength	Shine Test	Thread Diameter (mm)	Toughness (of 3 mm thread)	Organic Content [B,H]	USCS Group Symbol [A]	Primary Group Name [A]
INORGANIC (Organic Content <30% by mass)	**FINE-GRAINED SOILS** (≥50% by mass is smaller than 0.075 mm)	SILTS (Nonplastic or PI and LL plot **below A-Line** on Plasticity Chart below) [C]	Liquid Limit <50 [D]	Rapid	None to Low	Dull to None	3 to >6	Low/can't roll 3 mm	<15%	ML	SILT [H]
				None to Slow	Low to Medium	Dull to Slight	3 to 6	Low	15% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50 [D]	None to V.Slow	Low to Medium	Slight	3 to 6	Low to Medium	<15%	MH	ELASTIC SILT[H]
				None	Medium to High	Dull to Slight	1 to 3	Low to Medium	15% to <30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot **above A-Line** on Plasticity Chart below) [A]	Liquid Limit <50 [D]	None to Medium Slow	Medium to High	Slight to Shiny	1 to 3	Medium	<15%	CL	LEAN CLAY [A,E,F,G,H]
				None to V.Slow	Medium to High	Slight to Shiny	1 to 3	Medium	15% to <30%	OL	ORGANIC CLAY [E,F,G]
			Liquid Limit ≥50 [D]	None	High to V.High	Shiny	<1	High	<15%	CH	FAT CLAY [E,F,G,H]
				None	High	Shiny	<1 to 1	High	15% to <30%	OH	ORGANIC CLAY [E,F,G]
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures	Relatively lightweight, possibly spongy. Some water may squeeze from sample. Some shrinkage may occur on air drying. Sand fraction may be visible. Low to high dilatancy. Thread weak near plastic limit. Low to medium dry strength.						30% to <75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat	Lightweight, spongy. Much water squeezes from sample. Shrinks considerably on air drying (i.e., very high water content). Plant structure identiable to altered.						75% to 100%		PEAT

Coarse-Grained Soil Note(s):

1. Based on the material passing the 75 mm sieve.
2. If field sample contains or drilling observations indicate cobbles or boulders or both, add, "with cobbles" or "with cobbles and boulders". Include notes on the depth(s) encountered, and sizes if possible.
3. Gravels with 5% to 12% fines require dual symbols:
   (GW-GM) Well-graded GRAVEL with silt,
   (GW-GC) Well-graded GRAVEL with clay,
   (GP-GM) Poorly graded GRAVEL with silt,
   (GP-GC) Poorly graded GRAVEL with clay.
4. If soil contains ≥15% sand, add "with sand" to Group Name.
5. If fines classify as CL-ML, use dual symbol (GC-GM) or (SC-SM) for Group Symbol.
6. If the soil has an organic content (OC) 15%≤OC<30% the prefix "Organic" should be added before the Group Name. If the soil has an organic content 3%≤OC<15% add "with organic fines" to Group Name. If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added.
7. Sands with 5% to 12% fines require dual symbols:
   (SW-SM) Well-graded SAND with silt,
   (SW-SC) Well-graded SAND with clay,
   (SP-SM) Poorly graded SAND with silt,
   (SP-SC) Poorly graded SAND with clay.
8. If soil contains ≥15% gravel, add "with gravel" to Group Name.



Fine-Grained Soil Note(s):

- **A.** If Atterberg limits plot above the A-line but in the 'hatched' area on the plasticity chart, soil is a (CL-ML) SILTY CLAY.
- **B.** If the soil contains >0% to ≤3% organics, the descriptor "trace organics" may be added.
- **C.** If fine-grained materials are nonplastic (i.e., a plastic limit (PL) cannot be measured), soil is a (ML) SILT.
- **D.** If soil has a liquid limit (LL) >30% to <50%, the term 'medium plasticity' may be included in the description, but the Group Name/Symbol is not changed.
- **E.** If soil contains 15% to <30% +No.200, add "with sand" or "with gravel".
- **F.** If soil contains ≥30% +No.200 mainly sand, add "Sandy" to Group Name.
- **G.** If soil contains ≥30% +No.200 mainly gravel, add "Gravelly" to Group Name.
- **H.** If the soil has an organic content (OC) 3%≤OC<15% add "with organic fines" to Group Name.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

GRADATIONAL COMPONENT TERMS

% (by mass)	Term
≤ 5	Use “trace”
> 5 to ≤ 12	Use “few”
> 12 to <30	Use “little”
≥ 30 to <50	Use “some”
≥ 50	Use “mostly”

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); Nd:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven, pushed tube sampler, or geoprobe macro-core – note size
DS	Denison type sample
FS	Foil Sample
GS	Grab Sample
MC	Modified California Samples – note sample diameter and hammer weight
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split-spoon sampler (50 mm OD); larger sizes use MC
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT ‘N’ (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT ‘N’ in general accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT ‘N’ ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT ‘N’ value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT ‘N’ value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT ‘N’[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT ‘N’ in general accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT ‘N’ values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	nonplastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 18108934

LOCATION: N 4724155.65; E 431647.83

RECORD OF BOREHOLE: LW-101

BORING DATE: December 7, 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖ W I WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		209.17							
0		FILL - SILTY SAND; brown with garbage plastic bag material; moist		0.00	1A	AS					Concrete
1					1B						Bentonite
				207.65							
		WASTE mixed with Silty clay; black; wet - Dirty diaper - Rags - Clothes - Plastic lid - Garbage bag - Plastic bag		1.52							
2					2	AS					December 7, 2018
3					3	AS					Sand
4											
5					4A						Screen
				203.39							
6		SILTY CLAY, some sand, trace gravel; grey, wet		5.78	4B	AS					
7					5	AS					Bentonite
				201.55							
		END OF BOREHOLE		7.62							
8		NOTE: 1. Water level in open borehole at a depth of 2.13 m below ground surface (Elev. 207.04 m).									
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724319.27; E 431576.83

RECORD OF BOREHOLE: MW-101D

BORING DATE: December 4, 2018

SHEET 1 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖ W I WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.41							
0	D50 50 mm Split Spoon / Hollow Stem Augers	TOPSOIL (180 mm)		0.00 / 208.23	1A						
		FILL -SILTY SAND, trace gravel; brown, odourless; loose with trace bits of plastic, moist		0.18 / 207.73	1B	SS	6				Concrete
1		SILTY SAND, some roots; brown/orange, odourless, oxidized; loose to compact, moist		0.68	2	SS	7				
		- Brown at a depth of 1.45 m to 1.8 m		206.61	3A						Bentonite
2		SILTY CLAY, some sand, trace gravel; brown, odourless; stiff, moist to wet		1.86	3B	SS	16				
		SILTY SAND; light brown, odourless; compact to stiff, wet - Grey and garbage odour at a depth of 2.21 m to 2.44 m		205.97	3C						
3		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet - Garbage odour at a depth of 2.44 m to 2.97 m		2.44	4A	SS	12				
					4B						
					5	SS	18				
4					6	SS	13				
5					7	SS	12				
					8	SS	15				
6											December 4, 2018
					9	SS	15				Grout
7											
8					10	SS	15				
9											
					11	SS	13				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724319.27; E 431576.83

RECORD OF BOREHOLE: MW-101D

BORING DATE: December 4, 2018

SHEET 2 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ○ W I Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet									
11					12	SS	13				
12											
13					13	SS	11				
14					14	SS	15				
15											Grout
16					15	SS	13				
17					16	SS	13				
18											
19					17	SS	15				
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724319.27; E 431576.83

RECORD OF BOREHOLE: MW-101D

BORING DATE: December 4, 2018

SHEET 3 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet									Grout / Bentonite
21					18	SS	16				Sand
22				186.46							Screen
		GRAVEL with gas pocket, wet		21.95							
23		END OF BOREHOLE		185.55 22.86							
24		NOTE: 1. Water level in open borehole at a depth of 6.1 m below ground surface (Elev. 206.55 m). 2. Borehole terminated on inferred top of bedrock.									
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724318.34; E 431576.40

RECORD OF BOREHOLE: MW-101S

BORING DATE: December 4, 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		208.47							
	D50 50 mm Split Spoon / Hollow Stem Augers	TOPSOIL (180 mm)		0.00 / 208.29	1A						Concrete
		FILL -SILTY SAND, trace gravel; brown, odourless; loose with trace bits of plastic, moist		0.18	1B	SS	6				Bentonite
				207.79							
1		SILTY SAND, some roots; brown/orange, odourless, oxidized; loose to compact, moist		0.68	2	SS	7				Sand
		- Brown at a depth of 1.45 m to 1.8 m			3A						
				206.67	3B	SS	16				
2		SILTY CLAY, some sand, trace gravel; brown, odourless; stiff, moist to wet		1.86	3C						December 4, 2018
		SILTY SAND; light brown, odourless; compact to stiff, wet - Grey and garbage odour at a depth of 2.21 m to 2.44 m		206.03	4A	SS	12				Screen
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet - Garbage odour at a depth of 2.44 m to 2.97 m		2.44	4B						
3					5	SS	18				
4					6	SS	13				
				204.05							
		END OF BOREHOLE		4.42							
5		NOTE: 1. Water level in open borehole at a depth of 1.86 m below ground surface (Elev. 206.61 m)									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724216.23; E 431690.99

RECORD OF BOREHOLE: MW-102

BORING DATE: December 12, 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.63							
0	D50 50 mm Split Spoon / Hollow Stem Augers	TOPSOIL (270 mm)		0.00 / 208.36	1	SS	4				Concrete
		FILL - SILTY SAND; brown, rottlets; brown, odourless; very loose with plastic and glass pieces, moist		0.27 / 207.95	2	SS	9				
1		SILTY SAND; brown/orange, slightly oxidized, odourless; loose, moist		0.68 / 207.18							Bentonite
		SILTY SAND; grey, odourless; loose to compact, wet		1.45 / 206.38	3	SS	25				December 12, 2018 / Sand
2		SILTY CLAY, some sand, trace gravel; grey, odourless; firm to very stiff, wet		2.25	4A / 4B	SS	8				
3					5	SS	19				Screen
4				204.21	6	SS	15				
		END OF BOREHOLE		4.42							
5		NOTE: 1. Water level in open borehole at a depth of 1.86 m below ground surface (Elev. 206.61 m).									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724085.87; E 431805.49

RECORD OF BOREHOLE: MW-103D

BORING DATE: December 11, 2018

SHEET 1 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa — nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT Wp — W — Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		209.13									
0	D50 50 mm Split Spoon / Hollow Stem Augers	TOPSOIL (70 mm)		0.00	1A	SS	8						Concrete
		SILTY SAND; brown/orange, oxidized, odourless; loose, moist		0.09	1B								
1					2	SS	8						
		SILTY SAND; brown, odourless; compact, moist		207.73 1.40									
2					3	SS	24						December 11, 2018
					4A	SS	23						
		SILTY SAND; grey, odourless; compact, wet		206.43 2.70	4B								
3					5A	SS	16						
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff, wet		205.58 3.55	5B								
4					6	SS	10						
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet		204.56 4.57	7	SS	15						Bentonite
5													
6					8	SS	15						
7													
8					9	SS	15						
9													
10					10	SS	15						
		CONTINUED NEXT PAGE											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724085.87; E 431805.49

RECORD OF BOREHOLE: MW-103D

BORING DATE: December 11, 2018

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ○W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet									
11					11	SS	16				
12					12	SS	16				
13											
14					13	SS	14				
15											Bentonite
16					14	SS	19				
17					15	SS	13				
18											
19					16	SS	19				
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

PROJECT: 18108934

LOCATION: N 4724085.87; E 431805.49

RECORD OF BOREHOLE: MW-103D

BORING DATE: December 11, 2018

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet									
21											
22					17	SS	26				Bentonite
23		Hard at 22.86 m			18	SS	50				
24											
25		Some gravel at 24.38 m			19	SS					Sand
26					20	SS					Screen
				182.61							
27		END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 2.03 m below ground surface (Elev. 207.10 m). 2. Borehole terminated on inferred top of bedrock.		26.52							
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

PROJECT: 18108934

LOCATION: N 4724087.46; E 431806.00

RECORD OF BOREHOLE: MW-103S

BORING DATE: December 7, 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		209.27							
0	D50 50 mm Split Spoon, Hollow Stem Augers	TOPSOIL (70 mm)		0.00	1A	SS	8				Concrete
		SILTY SAND; brown/orange, oxidized, odourless; loose, moist		0.09	1B						
1					2	SS	8				Bentonite
				207.82							Sand
		SILTY SAND; brown, odourless; compact, moist		1.45	3	SS	24				
2					4A						December 7, 2018
				206.60		SS	23				
		SILTY SAND; grey, odourless; compact, wet		2.67	4B						Screen
3					5A						
				205.92		SS	16				
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff, wet		3.35	5B						
4					6	SS	10				
				204.85							
		END OF BOREHOLE		4.42							
5		NOTE:									
		1. Water level in open borehole at a depth of 2.07 m below ground surface (Elev. 207.20 m).									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4723900.71; E 431584.36

RECORD OF BOREHOLE: MW-104D

BORING DATE: December 10, 2018

SHEET 1 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.74							
0	D50 50 mm Split Spoon / Hollow Stem Augers	Organics, leaves, sticks, moist		0.00	1A						Concrete
		TOPSOIL		0.08	1B						
		SILTY SAND, some roots; brown/orange, oxidized, odourless; loose, moist to wet		0.15	1C	SS	6				Bentonite
1				207.60	2	SS	10				December 10, 2018
		SILTY SAND, some clay; grey, odourless; loose to compact, wet		1.14							
2					3	SS	15				
				206.34	4A						
		SILTY SAND; grey, odourless; loose to compact, wet		2.40	4B	SS	9				
3						SS	12				
				205.04							
		SAND and GRAVEL, some silt; grey, odourless; compact, wet		3.70	5A	SS	15				
4				204.44							
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff, wet		4.30	5B						
				204.17							
		SILTY CLAY, trace to some sand, trace gravel; grey, odourless; stiff to very stiff, wet		4.57	7	SS	16				
5											Grout
					8	SS	15				
6					9	SS	18				
7					10	SS	18				
8					11	SS	20				
					12	SS	18				
9					13	SS	18				
10					14	SS	17				

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

PROJECT: 18108934

LOCATION: N 4723900.71; E 431584.36

RECORD OF BOREHOLE: MW-104D

BORING DATE: December 10, 2018

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, trace to some sand, trace gravel; grey, odourless; stiff to very stiff, wet			14	SS	17				
11					15	SS	15				
12					16	SS	17				
13					17	SS	16				
14					18	SS	15				
15											Grout
16					19	SS	16				
17					20	SS	20				
18											
19					21	SS	18				
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

PROJECT: 18108934

LOCATION: N 4723900.71; E 431584.36

RECORD OF BOREHOLE: MW-104D

BORING DATE: December 10, 2018

SHEET 3 OF 3

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	D50 50 mm Split Spoon / Hollow Stem Augers	SILTY CLAY, trace to some sand, trace gravel; grey, odourless; stiff to very stiff, wet									
21											
22					22	SS	14				
23											Grout
24					23	SS	14				
25											
26											Bentonite
27		Hard at 27.43 m			24A						Sand
				180.94							
		Sandy SILTY CLAY, some gravel; grey, odourless; hard, wet		27.80	24B	SS					
28											Screen
				179.94							
		BEDROCK		28.80							
29		END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 0.76 m below ground surface (Elev. 207.98 m).		28.96							
30											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4723901.88; E 431585.44

RECORD OF BOREHOLE: MW-104S

BORING DATE: December 7, 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.79									
0	D50 50 mm Split Spoon / Hollow Stem Augers	Organics, leaves, sticks, moist		0.00	1A								Concrete
		TOPSOIL		0.08	1B								
		SILTY SAND, some roots; brown/orange, oxidized, odourless; loose, moist to wet		0.15	1C	SS	6						Bentonite
1				207.65	2	SS	10						December 7, 2018 / Sand
		SILTY SAND, some clay; grey, odourless; loose to compact, wet		1.14									
2					3	SS	15						
				206.39	4A								
		SILTY SAND; grey, odourless; loose to compact, wet		2.40	4B	SS	9						Screen
3						SS	12						
				205.09									
		SAND and GRAVEL, some silt; grey, odourless; compact, wet		3.70									
4					5A	SS	15						
				204.49									
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff, wet		4.30	5B								
				4.42									
		END OF BOREHOLE											
		NOTE:											
		1. Water level in open borehole at a depth of 0.76 m below ground surface (Elev. 208.03 m).											
5													
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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PROJECT: 18108934

LOCATION: N 4724044.41; E 431577.36

RECORD OF BOREHOLE: MW-105

BORING DATE: December 3 , 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		209.03									
0	D50 50 mm Split Spoon / Hollow Stem Augers	TOPSOIL (76 mm)		0.00									
		SILTY SAND; brown, odourless; loose to compact, moist		0.07	1	SS	8						Concrete
													Bentonite
1					2	SS	15						Sand
					3A	SS	6						
				207.05									
2		SILTY SAND; brown, odourless; loose to compact, wet		1.98	3B								December 3, 2018
					4	SS	24						Screen
3					5A	SS	13						
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff to very stiff, wet		205.60 3.43	5B								
4					6	SS	13						
				204.61									
		END OF BOREHOLE		4.42									
5		NOTE:											
		1. Water level in open borehole at a depth of 1.98 m below ground surface (Elev. 207.05 m).											
6													
7													
8													
9													
10													

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

PROJECT: 18108934

LOCATION: N 4724196.36; E 431584.18

RECORD OF BOREHOLE: MW-106

BORING DATE: December 3 , 2018

SHEET 1 OF 1

DATUM:

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊖ W I WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		208.94							
0	D50 50 mm Split Spoon / Hollow Stem Augers	ORGANICS		0.00							
		SILTY SAND, some rootlets; brown, odourless; loose to compact, moist		0.06 / 208.52	1A	SS	7				Concrete
		SILTY SAND, trace gravel; brown, odourless; loose, moist		0.42	1B						Bentonite
				207.97	2A	SS	8				Sand
1		SILTY SAND, trace clay, trace gravel; brown/orange, oxidized, odourless; compact, wet		0.97	2B						
					3A	SS	8				
2		SILTY SAND, trace gravel; grey, some garbage/organic odour; loose to compact, wet		206.96 / 1.98	3B						December 3, 2018
					4	SS	27				Screen
3				205.74	5A						
		SILTY CLAY, some sand, trace gravel; grey, odourless; stiff, wet		3.20	5B	SS	12				
4					6	SS	10				
				204.52							
		END OF BOREHOLE		4.42							
5		NOTE: 1. Water level in open borehole at a depth of 1.98 m below ground surface (Elev. 206.96 m).									
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: MC

CHECKED: FRG

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APPENDIX D

Laboratory Certificate of Analysis

Your Project #: 18108934
Site#: LIMERICK
Site Location: LIMERICK LANDFILL BOTHWELL
Your C.O.C. #: 928607-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/17
Report #: R7633076
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D1815
Received: 2023/05/09, 14:23

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	8	N/A	2023/05/12	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	1	N/A	2023/05/10	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	7	N/A	2023/05/11	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	7	N/A	2023/05/11	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2023/05/12	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	7	N/A	2023/05/10	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/05/11	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	8	N/A	2023/05/15	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	8	N/A	2023/05/12	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	8	N/A	2023/05/15		
Total Ammonia-N	7	N/A	2023/05/11	CAM SOP-00441	USGS I-2522-90 m
Total Ammonia-N	1	N/A	2023/05/17	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	8	N/A	2023/05/10	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	8	2023/05/10	2023/05/12	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	3	N/A	2023/05/12	CAM SOP-00444	OMOE E3179 m
Phenols (4AAP)	5	N/A	2023/05/15	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/05/10	CAM SOP-00464	SM 23 4500-SO42- E m
Sulphate by Automated Turbidimetry	7	N/A	2023/05/11	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	8	N/A	2023/05/15		Auto Calc
Total Dissolved Solids	8	2023/05/12	2023/05/15	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	2	2023/05/10	2023/05/12	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	5	2023/05/10	2023/05/15	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2023/05/10	2023/05/16	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	8	2023/05/10	2023/05/11	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Your Project #: 18108934
Site#: LIMERICK
Site Location: LIMERICK LANDFILL BOTHWELL
Your C.O.C. #: 928607-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/17
Report #: R7633076
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D1815

Received: 2023/05/09, 14:23

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		VTN679			VTN680			VTN681		
Sampling Date		2023/05/09 07:47			2023/05/09 09:16			2023/05/09 11:38		
COC Number		928607-01-01			928607-01-01			928607-01-01		
	UNITS	MW-103S	RDL	QC Batch	MW-104S	RDL	QC Batch	MW-101S	RDL	QC Batch
Calculated Parameters										
Calculated TDS	mg/L	430	1.0	8654176	800	1.0	8654176	1100	1.0	8654176
Hardness (CaCO3)	mg/L	320	1.0	8654944	540	1.0	8654944	750	1.0	8654944
Ion Balance (% Difference)	%	0.290	N/A	8655511	1.31	N/A	8655511	1.24	N/A	8655511
Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	8657472	0.091	0.050	8657472	7.1	0.050	8657472
Total Chemical Oxygen Demand (COD)	mg/L	12	4.0	8657721	4.6	4.0	8657721	25	4.0	8657721
Total Dissolved Solids	mg/L	385	10	8660431	760	10	8660431	1040	10	8660431
Total Kjeldahl Nitrogen (TKN)	mg/L	0.23	0.10	8657718	0.17	0.10	8657718	7.6	0.20	8657718
Dissolved Organic Carbon	mg/L	5.4	0.40	8654528	1.5	0.40	8656379	9.1	0.40	8654528
pH	pH	7.81		8656595	7.76		8656595	7.78		8656595
Phenols-4AAP	mg/L	<0.0010	0.0010	8663039	<0.0010	0.0010	8663039	0.0011	0.0010	8663039
Total Phosphorus	mg/L	0.006	0.004	8656876	0.17	0.004	8656876	0.012	0.004	8656876
Dissolved Sulphate (SO4)	mg/L	91	1.0	8656189	16	1.0	8656189	240	1.0	8656568
Alkalinity (Total as CaCO3)	mg/L	270	1.0	8656588	300	1.0	8656588	490	1.0	8656588
Dissolved Chloride (Cl-)	mg/L	14	1.0	8656166	300	2.0	8656166	190	1.0	8656566
Nitrite (N)	mg/L	<0.010	0.010	8656441	<0.010	0.010	8656441	<0.010	0.010	8656441
Nitrate (N)	mg/L	<0.10	0.10	8656441	<0.10	0.10	8656441	<0.10	0.10	8656441
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8656441	<0.10	0.10	8656441	<0.10	0.10	8656441

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		VTN682			VTN683			VTN684		
Sampling Date		2023/05/09 08:28			2023/05/09 10:04			2023/05/09 10:45		
COC Number		928607-01-01			928607-01-01			928607-01-01		
	UNITS	MW-102	RDL	QC Batch	MW-105	RDL	QC Batch	MW-106	RDL	QC Batch
Calculated Parameters										
Calculated TDS	mg/L	1100	1.0	8654176	1700	1.0	8654176	840	1.0	8654176
Hardness (CaCO3)	mg/L	810	1.0	8654944	1100	1.0	8654944	680	1.0	8654944
Ion Balance (% Difference)	%	2.88	N/A	8655511	6.02	N/A	8655511	0.190	N/A	8655511
Inorganics										
Total Ammonia-N	mg/L	24	0.050	8657472	6.8 (1)	0.050	8668426	4.2	0.050	8657472
Total Chemical Oxygen Demand (COD)	mg/L	49	4.0	8657721	35	4.0	8657721	34	4.0	8657721
Total Dissolved Solids	mg/L	890	10	8660431	1640	10	8660431	750	10	8660431
Total Kjeldahl Nitrogen (TKN)	mg/L	25	1.0	8657718	6.7	1.0	8657718	4.7	0.50	8657718
Dissolved Organic Carbon	mg/L	16	0.40	8654528	13	0.40	8654528	12	0.40	8654528
pH	pH	7.56		8656595	7.55		8656595	7.29		8656595
Phenols-4AAP	mg/L	0.0013	0.0010	8663039	<0.0010	0.0010	8663039	0.0010	0.0010	8663039
Total Phosphorus	mg/L	0.056	0.004	8656876	0.021	0.004	8656876	0.031	0.004	8656876
Dissolved Sulphate (SO4)	mg/L	96	1.0	8656189	370	1.0	8656189	110	1.0	8656189
Alkalinity (Total as CaCO3)	mg/L	870	1.0	8656588	790	1.0	8656588	600	1.0	8656588
Dissolved Chloride (Cl-)	mg/L	54	1.0	8656166	91	1.0	8656166	34	1.0	8656166
Nitrite (N)	mg/L	<0.010	0.010	8656441	0.994	0.010	8656441	0.017	0.010	8656441
Nitrate (N)	mg/L	<0.10	0.10	8656441	24.3	0.50	8656441	4.52	0.10	8656441
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8656441	25.3	0.50	8656441	4.54	0.10	8656441

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Result is reported from TKN bottle. KPJ2023/05/17

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Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		VTN685			VTN686		
Sampling Date		2023/05/09 11:48			2023/05/09 10:30		
COC Number		928607-01-01			928607-01-01		
	UNITS	FIELD BLANK-101	RDL	QC Batch	DWS-5	RDL	QC Batch
Calculated Parameters							
Calculated TDS	mg/L	<1.0	1.0	8654176	1700	1.0	8654176
Hardness (CaCO3)	mg/L	<1.0	1.0	8654944	1000	1.0	8654944
Ion Balance (% Difference)	%	NC	N/A	8655511	5.97	N/A	8655511
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	8657472	9.0	0.050	8657472
Total Chemical Oxygen Demand (COD)	mg/L	4.1	4.0	8657721	26	4.0	8657721
Total Dissolved Solids	mg/L	<10	10	8660431	1580	10	8660431
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	8656889	7.6	1.0	8656889
Dissolved Organic Carbon	mg/L	<0.40	0.40	8654528	13	0.40	8654528
pH	pH	5.87		8656595	7.54		8656595
Phenols-4AAP	mg/L	<0.0010	0.0010	8663039	<0.0010	0.0010	8665356
Total Phosphorus	mg/L	<0.004	0.004	8656876	0.021	0.004	8657675
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	8656189	360	1.0	8656189
Alkalinity (Total as CaCO3)	mg/L	<1.0	1.0	8656588	790	1.0	8656588
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	8656166	90	1.0	8656166
Nitrite (N)	mg/L	<0.010	0.010	8656441	0.985	0.010	8656441
Nitrate (N)	mg/L	<0.10	0.10	8656441	23.5	0.50	8656441
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8656441	24.5	0.50	8656441

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		VTN679	VTN680	VTN681	VTN682	VTN683	VTN684		
Sampling Date		2023/05/09 07:47	2023/05/09 09:16	2023/05/09 11:38	2023/05/09 08:28	2023/05/09 10:04	2023/05/09 10:45		
COC Number		928607-01-01	928607-01-01	928607-01-01	928607-01-01	928607-01-01	928607-01-01		
	UNITS	MW-103S	MW-104S	MW-101S	MW-102	MW-105	MW-106	RDL	QC Batch
Metals									
Dissolved Aluminum (Al)	ug/L	<4.9	<4.9	<4.9	<4.9	<4.9	4.9	4.9	8656313
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	1.5	1.7	<1.0	<1.0	1.0	8656313
Dissolved Barium (Ba)	ug/L	83	190	170	450	85	100	2.0	8656313
Dissolved Boron (B)	ug/L	21	39	660	850	450	310	10	8656313
Dissolved Cadmium (Cd)	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	0.090	8656313
Dissolved Calcium (Ca)	ug/L	100000	170000	150000	220000	320000	230000	200	8656313
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	8656313
Dissolved Copper (Cu)	ug/L	3.1	3.2	<0.90	<0.90	3.9	1.9	0.90	8656313
Dissolved Iron (Fe)	ug/L	<100	2300	2200	16000	<100	740	100	8656313
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	8656313
Dissolved Magnesium (Mg)	ug/L	13000	27000	92000	63000	65000	28000	50	8656313
Dissolved Manganese (Mn)	ug/L	<2.0	270	540	170	690	550	2.0	8656313
Dissolved Potassium (K)	ug/L	7800	930	53000	38000	79000	12000	200	8656313
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	8656313
Dissolved Sodium (Na)	ug/L	29000	94000	87000	58000	180000	33000	100	8656313
Dissolved Strontium (Sr)	ug/L	310	930	850	1400	860	720	1.0	8656313
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	8656313

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		VTN685	VTN686		
Sampling Date		2023/05/09 11:48	2023/05/09 10:30		
COC Number		928607-01-01	928607-01-01		
	UNITS	FIELD BLANK-101	DWS-5	RDL	QC Batch
Metals					
Dissolved Aluminum (Al)	ug/L	<4.9	<4.9	4.9	8656313
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	1.0	8656313
Dissolved Barium (Ba)	ug/L	<2.0	84	2.0	8656313
Dissolved Boron (B)	ug/L	<10	430	10	8656313
Dissolved Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	8656313
Dissolved Calcium (Ca)	ug/L	<200	310000	200	8656313
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5.0	8656313
Dissolved Copper (Cu)	ug/L	<0.90	3.7	0.90	8656313
Dissolved Iron (Fe)	ug/L	<100	<100	100	8656313
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	0.50	8656313
Dissolved Magnesium (Mg)	ug/L	<50	63000	50	8656313
Dissolved Manganese (Mn)	ug/L	<2.0	680	2.0	8656313
Dissolved Potassium (K)	ug/L	<200	79000	200	8656313
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	2.0	8656313
Dissolved Sodium (Na)	ug/L	<100	180000	100	8656313
Dissolved Strontium (Sr)	ug/L	<1.0	860	1.0	8656313
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.0	8656313

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Sample VTN683 [MW-105] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample VTN686 [DWS-5] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8654528	GID	Matrix Spike	Dissolved Organic Carbon	2023/05/10		92	%	80 - 120
8654528	GID	Spiked Blank	Dissolved Organic Carbon	2023/05/10		96	%	80 - 120
8654528	GID	Method Blank	Dissolved Organic Carbon	2023/05/10	<0.40		mg/L	
8654528	GID	RPD	Dissolved Organic Carbon	2023/05/10	4.1		%	20
8656166	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2023/05/11		90	%	80 - 120
8656166	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2023/05/11		96	%	80 - 120
8656166	ADB	Method Blank	Dissolved Chloride (Cl-)	2023/05/11	<1.0		mg/L	
8656166	ADB	RPD	Dissolved Chloride (Cl-)	2023/05/11	2.9		%	20
8656189	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2023/05/11		94	%	75 - 125
8656189	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/05/11		101	%	80 - 120
8656189	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/05/11	<1.0		mg/L	
8656189	ADB	RPD	Dissolved Sulphate (SO4)	2023/05/11	2.0		%	20
8656313	TLG	Matrix Spike	Dissolved Aluminum (Al)	2023/05/12		102	%	80 - 120
			Dissolved Arsenic (As)	2023/05/12		105	%	80 - 120
			Dissolved Barium (Ba)	2023/05/12		NC	%	80 - 120
			Dissolved Boron (B)	2023/05/12		NC	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/12		102	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/12		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/12		98	%	80 - 120
			Dissolved Copper (Cu)	2023/05/12		102	%	80 - 120
			Dissolved Iron (Fe)	2023/05/12		102	%	80 - 120
			Dissolved Lead (Pb)	2023/05/12		100	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/12		NC	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/12		98	%	80 - 120
			Dissolved Potassium (K)	2023/05/12		108	%	80 - 120
			Dissolved Selenium (Se)	2023/05/12		107	%	80 - 120
			Dissolved Sodium (Na)	2023/05/12		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/12		NC	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/12		100	%	80 - 120
8656313	TLG	Spiked Blank	Dissolved Aluminum (Al)	2023/05/12		91	%	80 - 120
			Dissolved Arsenic (As)	2023/05/12		100	%	80 - 120
			Dissolved Barium (Ba)	2023/05/12		97	%	80 - 120
			Dissolved Boron (B)	2023/05/12		100	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/12		97	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/12		95	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/12		91	%	80 - 120
			Dissolved Copper (Cu)	2023/05/12		98	%	80 - 120
			Dissolved Iron (Fe)	2023/05/12		98	%	80 - 120
			Dissolved Lead (Pb)	2023/05/12		96	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/12		95	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/12		94	%	80 - 120
			Dissolved Potassium (K)	2023/05/12		98	%	80 - 120
			Dissolved Selenium (Se)	2023/05/12		100	%	80 - 120
			Dissolved Sodium (Na)	2023/05/12		95	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/12		95	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/12		98	%	80 - 120
8656313	TLG	Method Blank	Dissolved Aluminum (Al)	2023/05/12	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/05/12	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/05/12	<2.0		ug/L	
			Dissolved Boron (B)	2023/05/12	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/05/12	<0.090		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Calcium (Ca)	2023/05/12	<200		ug/L	
			Dissolved Chromium (Cr)	2023/05/12	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/05/12	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/05/12	<100		ug/L	
			Dissolved Lead (Pb)	2023/05/12	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/05/12	<50		ug/L	
			Dissolved Manganese (Mn)	2023/05/12	<2.0		ug/L	
			Dissolved Potassium (K)	2023/05/12	<200		ug/L	
			Dissolved Selenium (Se)	2023/05/12	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/05/12	110, RDL=100		ug/L	
			Dissolved Strontium (Sr)	2023/05/12	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/05/12	<5.0		ug/L	
8656313	TLG	RPD	Dissolved Boron (B)	2023/05/12	1.2		%	20
			Dissolved Calcium (Ca)	2023/05/12	0.24		%	20
			Dissolved Chromium (Cr)	2023/05/12	NC		%	20
			Dissolved Iron (Fe)	2023/05/12	0.15		%	20
			Dissolved Magnesium (Mg)	2023/05/12	0.94		%	20
			Dissolved Manganese (Mn)	2023/05/12	0.50		%	20
			Dissolved Potassium (K)	2023/05/12	1.2		%	20
			Dissolved Sodium (Na)	2023/05/12	0.23		%	20
			Dissolved Zinc (Zn)	2023/05/12	NC		%	20
8656379	GID	Matrix Spike	Dissolved Organic Carbon	2023/05/11		92	%	80 - 120
8656379	GID	Spiked Blank	Dissolved Organic Carbon	2023/05/11		94	%	80 - 120
8656379	GID	Method Blank	Dissolved Organic Carbon	2023/05/11	<0.40		mg/L	
8656379	GID	RPD	Dissolved Organic Carbon	2023/05/11	0.42		%	20
8656441	C_N	Matrix Spike [VTN680-01]	Nitrite (N)	2023/05/10		102	%	80 - 120
			Nitrate (N)	2023/05/10		99	%	80 - 120
8656441	C_N	Spiked Blank	Nitrite (N)	2023/05/10		102	%	80 - 120
			Nitrate (N)	2023/05/10		103	%	80 - 120
8656441	C_N	Method Blank	Nitrite (N)	2023/05/10	<0.010		mg/L	
			Nitrate (N)	2023/05/10	<0.10		mg/L	
8656441	C_N	RPD [VTN680-01]	Nitrite (N)	2023/05/10	NC		%	20
			Nitrate (N)	2023/05/10	NC		%	20
8656566	MJ1	Matrix Spike	Dissolved Chloride (Cl-)	2023/05/10		88	%	80 - 120
8656566	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/05/10		92	%	80 - 120
8656566	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/05/10	<1.0		mg/L	
8656566	MJ1	RPD	Dissolved Chloride (Cl-)	2023/05/10	0.10		%	20
8656568	MJ1	Matrix Spike	Dissolved Sulphate (SO4)	2023/05/10		NC	%	75 - 125
8656568	MJ1	Spiked Blank	Dissolved Sulphate (SO4)	2023/05/10		95	%	80 - 120
8656568	MJ1	Method Blank	Dissolved Sulphate (SO4)	2023/05/10	<1.0		mg/L	
8656568	MJ1	RPD	Dissolved Sulphate (SO4)	2023/05/10	2.1		%	20
8656588	KIT	Spiked Blank	Alkalinity (Total as CaCO3)	2023/05/12		98	%	85 - 115
8656588	KIT	Method Blank	Alkalinity (Total as CaCO3)	2023/05/12	<1.0		mg/L	
8656588	KIT	RPD	Alkalinity (Total as CaCO3)	2023/05/12	0.56		%	20
8656595	KIT	Spiked Blank	pH	2023/05/11		102	%	98 - 103
8656595	KIT	RPD	pH	2023/05/12	0.15		%	N/A
8656876	SPC	Matrix Spike	Total Phosphorus	2023/05/11		105	%	80 - 120
8656876	SPC	QC Standard	Total Phosphorus	2023/05/11		105	%	80 - 120
8656876	SPC	Spiked Blank	Total Phosphorus	2023/05/11		103	%	80 - 120
8656876	SPC	Method Blank	Total Phosphorus	2023/05/11	<0.004		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8656876	SPC	RPD	Total Phosphorus	2023/05/11	2.1		%	20
8656889	JJH	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/05/12		96	%	80 - 120
8656889	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/05/12		102	%	80 - 120
8656889	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12		101	%	80 - 120
8656889	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12	<0.10		mg/L	
8656889	JJH	RPD	Total Kjeldahl Nitrogen (TKN)	2023/05/12	4.8		%	20
8657472	KPJ	Matrix Spike [VTN683-07]	Total Ammonia-N	2023/05/11		85	%	75 - 125
8657472	KPJ	Spiked Blank	Total Ammonia-N	2023/05/11		99	%	80 - 120
8657472	KPJ	Method Blank	Total Ammonia-N	2023/05/11	<0.050		mg/L	
8657675	SPC	Matrix Spike	Total Phosphorus	2023/05/11		100	%	80 - 120
8657675	SPC	QC Standard	Total Phosphorus	2023/05/11		110	%	80 - 120
8657675	SPC	Spiked Blank	Total Phosphorus	2023/05/11		102	%	80 - 120
8657675	SPC	Method Blank	Total Phosphorus	2023/05/11	<0.004		mg/L	
8657675	SPC	RPD	Total Phosphorus	2023/05/11	NC		%	20
8657718	JJH	Matrix Spike [VTN683-04]	Total Kjeldahl Nitrogen (TKN)	2023/05/15		NC	%	80 - 120
8657718	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/05/12		105	%	80 - 120
8657718	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12		106	%	80 - 120
8657718	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12	<0.10		mg/L	
8657718	JJH	RPD [VTN683-04]	Total Kjeldahl Nitrogen (TKN)	2023/05/15	5.2		%	20
8657721	NS3	Matrix Spike [VTN684-04]	Total Chemical Oxygen Demand (COD)	2023/05/11		89	%	80 - 120
8657721	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/05/11		94	%	80 - 120
8657721	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/05/11	<4.0		mg/L	
8657721	NS3	RPD [VTN684-04]	Total Chemical Oxygen Demand (COD)	2023/05/11	4.1		%	20
8660431	SHD	QC Standard	Total Dissolved Solids	2023/05/15		100	%	90 - 110
8660431	SHD	Method Blank	Total Dissolved Solids	2023/05/15	<10		mg/L	
8660431	SHD	RPD	Total Dissolved Solids	2023/05/15	2.4		%	20
8663039	MKX	Matrix Spike	Phenols-4AAP	2023/05/12		103	%	80 - 120
8663039	MKX	Spiked Blank	Phenols-4AAP	2023/05/12		100	%	80 - 120
8663039	MKX	Method Blank	Phenols-4AAP	2023/05/12	<0.0010		mg/L	
8663039	MKX	RPD	Phenols-4AAP	2023/05/12	NC		%	20
8665356	MKX	Matrix Spike	Phenols-4AAP	2023/05/15		105	%	80 - 120
8665356	MKX	Spiked Blank	Phenols-4AAP	2023/05/15		103	%	80 - 120
8665356	MKX	Method Blank	Phenols-4AAP	2023/05/15	<0.0010		mg/L	
8665356	MKX	RPD	Phenols-4AAP	2023/05/15	NC		%	20
8668426	KPJ	Matrix Spike	Total Ammonia-N	2023/05/17		86	%	75 - 125
8668426	KPJ	Spiked Blank	Total Ammonia-N	2023/05/17		101	%	80 - 120
8668426	KPJ	Method Blank	Total Ammonia-N	2023/05/17	<0.050		mg/L	
8668426	KPJ	RPD	Total Ammonia-N	2023/05/17	0.10		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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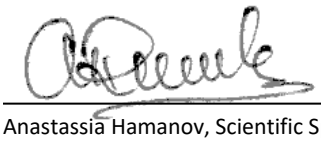
Bureau Veritas Job #: C3D1815
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LANDFILL BOTHWELL
Sampler Initials: K.B

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: LIMERICK LANDFILL
Site Location: BOTHWELL LANDFILL
Your C.O.C. #: 928607-02-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/24
Report #: R7641279
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D6652
Received: 2023/05/12, 11:15

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2023/05/18	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	1	N/A	2023/05/16	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	1	N/A	2023/05/16	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/05/16	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2023/05/19	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	1	N/A	2023/05/18	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2023/05/19		
Total Ammonia-N	1	N/A	2023/05/16	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	1	N/A	2023/05/16	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2023/05/15	2023/05/18	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2023/05/16	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/05/16	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	1	N/A	2023/05/19		Auto Calc
Total Dissolved Solids	1	2023/05/17	2023/05/18	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	1	2023/05/16	2023/05/18	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	1	2023/05/15	2023/05/17	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the

Your Project #: 18108934
Site#: LIMERICK LANDFILL
Site Location: BOTHWELL LANDFILL
Your C.O.C. #: 928607-02-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/24
Report #: R7641279
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D6652
Received: 2023/05/12, 11:15
customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444
==========
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Bureau Veritas Job #: C3D6652
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: BOTHWELL LANDFILL
Sampler Initials: KG

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		VUN379		
Sampling Date		2023/05/12 09:50		
COC Number		928607-02-01		
	UNITS	MW-103D	RDL	QC Batch
Calculated Parameters				
Calculated TDS	mg/L	490	1.0	8661104
Hardness (CaCO3)	mg/L	89	1.0	8662957
Ion Balance (% Difference)	%	0.170	N/A	8661112
Inorganics				
Total Ammonia-N	mg/L	0.092	0.050	8666080
Total Chemical Oxygen Demand (COD)	mg/L	41	4.0	8666070
Total Dissolved Solids	mg/L	470	10	8669213
Total Kjeldahl Nitrogen (TKN)	mg/L	0.25	0.10	8666884
Dissolved Organic Carbon	mg/L	13	0.40	8665210
pH	pH	8.19		8664942
Phenols-4AAP	mg/L	<0.0010	0.0010	8668663
Total Phosphorus	mg/L	0.018	0.004	8666060
Dissolved Sulphate (SO4)	mg/L	71	1.0	8665817
Alkalinity (Total as CaCO3)	mg/L	170	1.0	8664949
Dissolved Chloride (Cl-)	mg/L	130	1.0	8665811
Nitrite (N)	mg/L	<0.010	0.010	8664584
Nitrate (N)	mg/L	<0.10	0.10	8664584
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8664584

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3D6652
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: BOTHWELL LANDFILL
Sampler Initials: KG

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		VUN379		
Sampling Date		2023/05/12 09:50		
COC Number		928607-02-01		
	UNITS	MW-103D	RDL	QC Batch
Metals				
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	8664903
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8664903
Dissolved Barium (Ba)	ug/L	60	2.0	8664903
Dissolved Boron (B)	ug/L	970	10	8664903
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8664903
Dissolved Calcium (Ca)	ug/L	22000	200	8664903
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8664903
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8664903
Dissolved Iron (Fe)	ug/L	<100	100	8664903
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8664903
Dissolved Magnesium (Mg)	ug/L	8500	50	8664903
Dissolved Manganese (Mn)	ug/L	78	2.0	8664903
Dissolved Potassium (K)	ug/L	2600	200	8664903
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8664903
Dissolved Sodium (Na)	ug/L	150000	100	8664903
Dissolved Strontium (Sr)	ug/L	790	1.0	8664903
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	8664903

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Results relate only to the items tested.

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Bureau Veritas Job #: C3D6652
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: BOTHWELL LANDFILL
Sampler Initials: KG

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8664584	C_N	Matrix Spike	Nitrite (N)	2023/05/16		101	%	80 - 120
			Nitrate (N)	2023/05/16		96	%	80 - 120
8664584	C_N	Spiked Blank	Nitrite (N)	2023/05/16		103	%	80 - 120
			Nitrate (N)	2023/05/16		100	%	80 - 120
8664584	C_N	Method Blank	Nitrite (N)	2023/05/16	<0.010		mg/L	
			Nitrate (N)	2023/05/16	<0.10		mg/L	
8664584	C_N	RPD	Nitrite (N)	2023/05/16	NC		%	20
			Nitrate (N)	2023/05/16	NC		%	20
8664903	PBA	Matrix Spike	Dissolved Aluminum (Al)	2023/05/18		100	%	80 - 120
			Dissolved Arsenic (As)	2023/05/18		103	%	80 - 120
			Dissolved Barium (Ba)	2023/05/18		96	%	80 - 120
			Dissolved Boron (B)	2023/05/18		95	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/18		99	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/18		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/18		98	%	80 - 120
			Dissolved Copper (Cu)	2023/05/18		96	%	80 - 120
			Dissolved Iron (Fe)	2023/05/18		103	%	80 - 120
			Dissolved Lead (Pb)	2023/05/18		98	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/18		97	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/18		97	%	80 - 120
			Dissolved Potassium (K)	2023/05/18		101	%	80 - 120
			Dissolved Selenium (Se)	2023/05/18		102	%	80 - 120
			Dissolved Sodium (Na)	2023/05/18		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/18		99	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/18		99	%	80 - 120
8664903	PBA	Spiked Blank	Dissolved Aluminum (Al)	2023/05/18		97	%	80 - 120
			Dissolved Arsenic (As)	2023/05/18		99	%	80 - 120
			Dissolved Barium (Ba)	2023/05/18		95	%	80 - 120
			Dissolved Boron (B)	2023/05/18		95	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/18		96	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/18		100	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/18		95	%	80 - 120
			Dissolved Copper (Cu)	2023/05/18		94	%	80 - 120
			Dissolved Iron (Fe)	2023/05/18		101	%	80 - 120
			Dissolved Lead (Pb)	2023/05/18		95	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/18		98	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/18		96	%	80 - 120
			Dissolved Potassium (K)	2023/05/18		98	%	80 - 120
			Dissolved Selenium (Se)	2023/05/18		99	%	80 - 120
			Dissolved Sodium (Na)	2023/05/18		99	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/18		98	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/18		97	%	80 - 120
8664903	PBA	Method Blank	Dissolved Aluminum (Al)	2023/05/18	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/05/18	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/05/18	<2.0		ug/L	
			Dissolved Boron (B)	2023/05/18	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/05/18	<0.090		ug/L	
			Dissolved Calcium (Ca)	2023/05/18	<200		ug/L	
			Dissolved Chromium (Cr)	2023/05/18	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/05/18	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/05/18	<100		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lead (Pb)	2023/05/18	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/05/18	<50		ug/L	
			Dissolved Manganese (Mn)	2023/05/18	<2.0		ug/L	
			Dissolved Potassium (K)	2023/05/18	<200		ug/L	
			Dissolved Selenium (Se)	2023/05/18	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/05/18	200, RDL=100		ug/L	
			Dissolved Strontium (Sr)	2023/05/18	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/05/18	<5.0		ug/L	
8664903	PBA	RPD	Dissolved Aluminum (Al)	2023/05/18	2.8		%	20
			Dissolved Arsenic (As)	2023/05/18	NC		%	20
			Dissolved Barium (Ba)	2023/05/18	2.2		%	20
			Dissolved Boron (B)	2023/05/18	0.93		%	20
			Dissolved Cadmium (Cd)	2023/05/18	NC		%	20
			Dissolved Calcium (Ca)	2023/05/18	4.6		%	20
			Dissolved Chromium (Cr)	2023/05/18	NC		%	20
			Dissolved Copper (Cu)	2023/05/18	2.2		%	20
			Dissolved Iron (Fe)	2023/05/18	NC		%	20
			Dissolved Lead (Pb)	2023/05/18	NC		%	20
			Dissolved Magnesium (Mg)	2023/05/18	0.072		%	20
			Dissolved Manganese (Mn)	2023/05/18	3.6		%	20
			Dissolved Potassium (K)	2023/05/18	0.36		%	20
			Dissolved Selenium (Se)	2023/05/18	NC		%	20
			Dissolved Sodium (Na)	2023/05/18	0.35		%	20
			Dissolved Strontium (Sr)	2023/05/18	0.61		%	20
			Dissolved Zinc (Zn)	2023/05/18	NC		%	20
8664942	KIT	Spiked Blank	pH	2023/05/18		102	%	98 - 103
8664942	KIT	RPD	pH	2023/05/18	0.11		%	N/A
8664949	KIT	Spiked Blank	Alkalinity (Total as CaCO3)	2023/05/18		100	%	85 - 115
8664949	KIT	Method Blank	Alkalinity (Total as CaCO3)	2023/05/18	<1.0		mg/L	
8664949	KIT	RPD	Alkalinity (Total as CaCO3)	2023/05/18	1.6		%	20
8665210	GID	Matrix Spike	Dissolved Organic Carbon	2023/05/16		94	%	80 - 120
8665210	GID	Spiked Blank	Dissolved Organic Carbon	2023/05/16		96	%	80 - 120
8665210	GID	Method Blank	Dissolved Organic Carbon	2023/05/16	<0.40		mg/L	
8665210	GID	RPD	Dissolved Organic Carbon	2023/05/16	0.69		%	20
8665811	MJ1	Matrix Spike	Dissolved Chloride (Cl-)	2023/05/16		NC	%	80 - 120
8665811	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/05/16		108	%	80 - 120
8665811	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/05/16	<1.0		mg/L	
8665811	MJ1	RPD	Dissolved Chloride (Cl-)	2023/05/16	1.6		%	20
8665817	MJ1	Matrix Spike	Dissolved Sulphate (SO4)	2023/05/16		97	%	75 - 125
8665817	MJ1	Spiked Blank	Dissolved Sulphate (SO4)	2023/05/16		104	%	80 - 120
8665817	MJ1	Method Blank	Dissolved Sulphate (SO4)	2023/05/16	<1.0		mg/L	
8665817	MJ1	RPD	Dissolved Sulphate (SO4)	2023/05/16	NC		%	20
8666060	GYA	Matrix Spike	Total Phosphorus	2023/05/17		98	%	80 - 120
8666060	GYA	QC Standard	Total Phosphorus	2023/05/17		105	%	80 - 120
8666060	GYA	Spiked Blank	Total Phosphorus	2023/05/17		110	%	80 - 120
8666060	GYA	Method Blank	Total Phosphorus	2023/05/17	<0.004		mg/L	
8666060	GYA	RPD	Total Phosphorus	2023/05/17	0.73		%	20
8666070	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/05/16		94	%	80 - 120
8666070	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/05/16		99	%	80 - 120
8666070	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/05/16	<4.0		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8666070	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/05/16	2.0		%	20
8666080	KPJ	Matrix Spike	Total Ammonia-N	2023/05/16		100	%	75 - 125
8666080	KPJ	Spiked Blank	Total Ammonia-N	2023/05/16		100	%	80 - 120
8666080	KPJ	Method Blank	Total Ammonia-N	2023/05/16	<0.050		mg/L	
8666080	KPJ	RPD	Total Ammonia-N	2023/05/16	1.4		%	20
8666884	RTY	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/05/18		107	%	80 - 120
8666884	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/05/18		100	%	80 - 120
8666884	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/18		98	%	80 - 120
8666884	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/18	<0.10		mg/L	
8666884	RTY	RPD	Total Kjeldahl Nitrogen (TKN)	2023/05/18	8.7		%	20
8668663	MKX	Matrix Spike	Phenols-4AAP	2023/05/16		104	%	80 - 120
8668663	MKX	Spiked Blank	Phenols-4AAP	2023/05/16		103	%	80 - 120
8668663	MKX	Method Blank	Phenols-4AAP	2023/05/16	<0.0010		mg/L	
8668663	MKX	RPD	Phenols-4AAP	2023/05/16	NC		%	20
8669213	SHD	QC Standard	Total Dissolved Solids	2023/05/18		100	%	90 - 110
8669213	SHD	Method Blank	Total Dissolved Solids	2023/05/18	<10		mg/L	
8669213	SHD	RPD	Total Dissolved Solids	2023/05/18	1.1		%	20

N/A = Not Applicable

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

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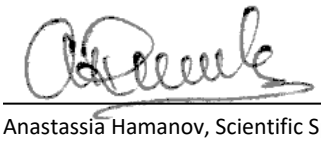
Bureau Veritas Job #: C3D6652
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: BOTHWELL LANDFILL
Sampler Initials: KG

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: LIMERICK
Site Location: LIMERICK SURFACE WATER LANDFILL
BOTHWELL
Your C.O.C. #: 928610-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/17
Report #: R7633209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D1795
Received: 2023/05/09, 14:23

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Dissolved Aluminum (0.2 u, clay free)	2	N/A	2023/05/16	CAM SOP-00447	EPA 6020B m
Alkalinity	2	N/A	2023/05/12	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	2	2023/05/10	2023/05/15	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	2	N/A	2023/05/11	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	2	N/A	2023/05/11	CAM SOP-00416	SM 23 5220 D m
Colour	2	N/A	2023/05/10	CAM SOP-00412	SM 23 2120C m
Chromium (VI) in Water	2	N/A	2023/05/10	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2023/05/10	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	2	N/A	2023/05/11	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	2	2023/05/10	2023/05/15	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	1	2023/05/12	2023/05/12	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	2023/05/12	2023/05/15	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2023/05/15		
Total Ammonia-N	2	N/A	2023/05/11	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2023/05/10	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2023/05/10	2023/05/12	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	2	N/A	2023/05/12	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	2	N/A	2023/05/11	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	2	N/A	2023/05/15		Auto Calc
Total Dissolved Solids	2	2023/05/12	2023/05/15	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	2	2023/05/10	2023/05/15	CAM SOP-00938	OMOE E3516 m
Total Organic Carbon (TOC) (3)	2	N/A	2023/05/10	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	2	2023/05/10	2023/05/11	CAM SOP-00407	SM 23 4500-P I
Low Level Total Suspended Solids	2	2023/05/11	2023/05/12	CAM SOP-00428	SM 23 2540D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

Your Project #: 18108934
Site#: LIMERICK
Site Location: LIMERICK SURFACE WATER LANDFILL
BOTHWELL
Your C.O.C. #: 928610-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
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CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D1795

Received: 2023/05/09, 14:23

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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Bureau Veritas Job #: C3D1795
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK SURFACE WATER LANDFILL BOTHWELL
Sampler Initials: K.B

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		VTN603	VTN604		
Sampling Date		2023/05/09 13:09	2023/05/09 12:31		
COC Number		928610-01-01	928610-01-01		
	UNITS	LIM-1	LIM-2	RDL	QC Batch
Calculated Parameters					
Calculated TDS	mg/L	350	350	1.0	8654176
Hardness (CaCO3)	mg/L	290	290	1.0	8654944
Ion Balance (% Difference)	%	1.14	0.700	N/A	8655511
Inorganics					
Total Ammonia-N	mg/L	0.30	0.51	0.050	8657472
Total BOD	mg/L	<2	<2	2	8655900
Total Chemical Oxygen Demand (COD)	mg/L	21	22	4.0	8656879
Colour	TCU	33	34	2	8656485
Total Dissolved Solids	mg/L	320	310	10	8660431
Total Kjeldahl Nitrogen (TKN)	mg/L	1.1	1.8	0.20	8656889
Dissolved Organic Carbon	mg/L	9.1	8.9	0.40	8654528
Total Organic Carbon (TOC)	mg/L	9.8	9.8	0.40	8656901
pH	pH	8.33	8.28		8656595
Phenols-4AAP	mg/L	<0.0010	<0.0010	0.0010	8663039
Total Phosphorus	mg/L	0.008	0.009	0.004	8656876
Total Suspended Solids	mg/L	1	2	1	8660030
Dissolved Sulphate (SO4)	mg/L	42	43	1.0	8656189
Alkalinity (Total as CaCO3)	mg/L	210	210	1.0	8656588
Dissolved Chloride (Cl-)	mg/L	31	32	1.0	8656166
Nitrite (N)	mg/L	0.020	0.020	0.010	8656113
Nitrate (N)	mg/L	5.25	5.18	0.10	8656113
Nitrate + Nitrite (N)	mg/L	5.27	5.20	0.10	8656113

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		VTN603	VTN604		
Sampling Date		2023/05/09 13:09	2023/05/09 12:31		
COC Number		928610-01-01	928610-01-01		
	UNITS	LIM-1	LIM-2	RDL	QC Batch
Metals					
Dissolved Aluminum (Al)	mg/L	<0.1	<0.1	0.1	8656575
Dissolved (0.2u) Aluminum (Al)	ug/L	<5	<5	5	8656545
Dissolved Antimony (Sb)	mg/L	<0.2	<0.2	0.2	8656575
Dissolved Arsenic (As)	mg/L	<0.2	<0.2	0.2	8656575
Dissolved Barium (Ba)	mg/L	0.048	0.049	0.005	8656575
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	0.001	8656575
Dissolved Boron (B)	mg/L	<0.02	<0.02	0.02	8656575
Dissolved Cadmium (Cd)	mg/L	<0.005	<0.005	0.005	8656575
Dissolved Calcium (Ca)	mg/L	93	94	0.05	8656575
Dissolved Chromium (Cr)	mg/L	<0.01	<0.01	0.01	8656575
Chromium (VI)	ug/L	<0.50	<0.50	0.50	8656005
Dissolved Cobalt (Co)	mg/L	<0.02	<0.02	0.02	8656575
Dissolved Copper (Cu)	mg/L	<0.02	<0.02	0.02	8656575
Dissolved Iron (Fe)	mg/L	0.04	0.06	0.02	8656575
Dissolved Lead (Pb)	mg/L	<0.05	<0.05	0.05	8656575
Dissolved Magnesium (Mg)	mg/L	15	15	0.05	8656575
Dissolved Manganese (Mn)	mg/L	0.03	0.04	0.01	8656575
Dissolved Molybdenum (Mo)	mg/L	<0.02	<0.02	0.02	8656575
Dissolved Nickel (Ni)	mg/L	<0.05	<0.05	0.05	8656575
Dissolved Phosphorus (P)	mg/L	<0.1	<0.1	0.1	8656575
Dissolved Potassium (K)	mg/L	5	5	1	8656575
Dissolved Selenium (Se)	mg/L	<0.2	<0.2	0.2	8656575
Dissolved Silicon (Si)	mg/L	1.9	2.0	0.2	8656575
Dissolved Silver (Ag)	mg/L	<0.01	<0.01	0.01	8656575
Dissolved Sodium (Na)	mg/L	11	11	0.5	8656575
Dissolved Strontium (Sr)	mg/L	0.25	0.26	0.005	8656575
Dissolved Sulphur (S)	mg/L	15	15	0.5	8656575
Dissolved Tin (Sn)	mg/L	<0.2	<0.2	0.2	8656575
Dissolved Titanium (Ti)	mg/L	<0.01	<0.01	0.01	8656575
Dissolved Vanadium (V)	mg/L	<0.01	<0.01	0.01	8656575
Dissolved Zinc (Zn)	mg/L	<0.01	<0.01	0.01	8656575
Total Aluminum (Al)	ug/L	23	19	4.9	8661158
Total Antimony (Sb)	ug/L	<0.50	<0.50	0.50	8661158

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C3D1795
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK SURFACE WATER LANDFILL BOTHWELL
Sampler Initials: K.B

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		VTN603	VTN604		
Sampling Date		2023/05/09 13:09	2023/05/09 12:31		
COC Number		928610-01-01	928610-01-01		
	UNITS	LIM-1	LIM-2	RDL	QC Batch
Total Arsenic (As)	ug/L	<1.0	<1.0	1.0	8661158
Total Barium (Ba)	ug/L	47	51	2.0	8661158
Total Beryllium (Be)	ug/L	<0.40	<0.40	0.40	8661158
Total Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	8661158
Total Boron (B)	ug/L	17	17	10	8661158
Total Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	8661158
Total Calcium (Ca)	ug/L	89000	97000	200	8661158
Total Chromium (Cr)	ug/L	<5.0	<5.0	5.0	8661158
Total Cobalt (Co)	ug/L	<0.50	<0.50	0.50	8661158
Total Copper (Cu)	ug/L	2.4	2.3	0.90	8661158
Total Iron (Fe)	ug/L	110	120	100	8661158
Total Lead (Pb)	ug/L	<0.50	<0.50	0.50	8661158
Total Lithium (Li)	ug/L	<5.0	<5.0	5.0	8661158
Total Magnesium (Mg)	ug/L	15000	15000	50	8661158
Total Manganese (Mn)	ug/L	32	37	2.0	8661158
Total Molybdenum (Mo)	ug/L	2.9	2.9	0.50	8661158
Total Nickel (Ni)	ug/L	1.3	1.9	1.0	8661158
Total Potassium (K)	ug/L	4400	4700	200	8661158
Total Selenium (Se)	ug/L	<2.0	<2.0	2.0	8661158
Total Silicon (Si)	ug/L	1800	1800	50	8661158
Total Silver (Ag)	ug/L	<0.090	<0.090	0.090	8661158
Total Sodium (Na)	ug/L	10000	11000	100	8661158
Total Strontium (Sr)	ug/L	240	260	1.0	8661158
Total Tellurium (Te)	ug/L	<1.0	<1.0	1.0	8661158
Total Thallium (Tl)	ug/L	<0.050	<0.050	0.050	8661158
Total Tin (Sn)	ug/L	<1.0	<1.0	1.0	8661158
Total Titanium (Ti)	ug/L	<5.0	<5.0	5.0	8661158
Total Tungsten (W)	ug/L	<1.0	<1.0	1.0	8661158
Total Uranium (U)	ug/L	2.9	3.0	0.10	8661158
Total Vanadium (V)	ug/L	0.86	0.61	0.50	8661158
Total Zinc (Zn)	ug/L	<5.0	<5.0	5.0	8661158
Total Zirconium (Zr)	ug/L	<1.0	<1.0	1.0	8661158

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8654528	GID	Matrix Spike	Dissolved Organic Carbon	2023/05/10		92	%	80 - 120
8654528	GID	Spiked Blank	Dissolved Organic Carbon	2023/05/10		96	%	80 - 120
8654528	GID	Method Blank	Dissolved Organic Carbon	2023/05/10	<0.40		mg/L	
8654528	GID	RPD	Dissolved Organic Carbon	2023/05/10	4.1		%	20
8655900	GUJ	QC Standard	Total BOD	2023/05/15		90	%	80 - 120
8655900	GUJ	Method Blank	Total BOD	2023/05/15	<2		mg/L	
8655900	GUJ	RPD	Total BOD	2023/05/15	6.4		%	30
8656005	TL2	Matrix Spike	Chromium (VI)	2023/05/10		100	%	80 - 120
8656005	TL2	Spiked Blank	Chromium (VI)	2023/05/10		105	%	80 - 120
8656005	TL2	Method Blank	Chromium (VI)	2023/05/10	<0.50		ug/L	
8656005	TL2	RPD	Chromium (VI)	2023/05/10	5.7		%	20
8656113	C_N	Matrix Spike	Nitrite (N)	2023/05/10		86	%	80 - 120
			Nitrate (N)	2023/05/10		101	%	80 - 120
8656113	C_N	Spiked Blank	Nitrite (N)	2023/05/10		104	%	80 - 120
			Nitrate (N)	2023/05/10		102	%	80 - 120
8656113	C_N	Method Blank	Nitrite (N)	2023/05/10	<0.010		mg/L	
			Nitrate (N)	2023/05/10	<0.10		mg/L	
8656113	C_N	RPD	Nitrite (N)	2023/05/10	NC		%	20
			Nitrate (N)	2023/05/10	3.3		%	20
8656166	ADB	Matrix Spike	Dissolved Chloride (Cl-)	2023/05/11		90	%	80 - 120
8656166	ADB	Spiked Blank	Dissolved Chloride (Cl-)	2023/05/11		96	%	80 - 120
8656166	ADB	Method Blank	Dissolved Chloride (Cl-)	2023/05/11	<1.0		mg/L	
8656166	ADB	RPD	Dissolved Chloride (Cl-)	2023/05/11	2.9		%	20
8656189	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2023/05/11		94	%	75 - 125
8656189	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/05/11		101	%	80 - 120
8656189	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/05/11	<1.0		mg/L	
8656189	ADB	RPD	Dissolved Sulphate (SO4)	2023/05/11	2.0		%	20
8656485	GID	Spiked Blank	Colour	2023/05/10		100	%	80 - 120
8656485	GID	Method Blank	Colour	2023/05/10	<2		TCU	
8656485	GID	RPD [VTN604-02]	Colour	2023/05/10	0		%	25
8656545	TLG	Matrix Spike [VTN604-02]	Dissolved (0.2u) Aluminum (Al)	2023/05/16		99	%	80 - 120
8656545	TLG	Spiked Blank	Dissolved (0.2u) Aluminum (Al)	2023/05/16		100	%	80 - 120
8656545	TLG	Method Blank	Dissolved (0.2u) Aluminum (Al)	2023/05/16	<5		ug/L	
8656545	TLG	RPD [VTN604-02]	Dissolved (0.2u) Aluminum (Al)	2023/05/16	NC		%	20
8656575	SUK	Matrix Spike [VTN603-03]	Dissolved Aluminum (Al)	2023/05/15		101	%	80 - 120
			Dissolved Antimony (Sb)	2023/05/15		69 (1)	%	80 - 120
			Dissolved Arsenic (As)	2023/05/15		99	%	80 - 120
			Dissolved Barium (Ba)	2023/05/15		100	%	80 - 120
			Dissolved Beryllium (Be)	2023/05/15		98	%	80 - 120
			Dissolved Boron (B)	2023/05/15		100	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/15		97	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/15		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/15		103	%	80 - 120
			Dissolved Cobalt (Co)	2023/05/15		97	%	80 - 120
			Dissolved Copper (Cu)	2023/05/15		101	%	80 - 120
			Dissolved Iron (Fe)	2023/05/15		103	%	80 - 120
			Dissolved Lead (Pb)	2023/05/15		99	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/15		NC	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/15		102	%	80 - 120
			Dissolved Molybdenum (Mo)	2023/05/15		100	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Nickel (Ni)	2023/05/15		98	%	80 - 120
			Dissolved Phosphorus (P)	2023/05/15		98	%	80 - 120
			Dissolved Potassium (K)	2023/05/15		101	%	80 - 120
			Dissolved Selenium (Se)	2023/05/15		102	%	80 - 120
			Dissolved Silicon (Si)	2023/05/15		NC	%	80 - 120
			Dissolved Silver (Ag)	2023/05/15		69 (1)	%	80 - 120
			Dissolved Sodium (Na)	2023/05/15		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/15		103	%	80 - 120
			Dissolved Sulphur (S)	2023/05/15		NC	%	80 - 120
			Dissolved Tin (Sn)	2023/05/15		96	%	80 - 120
			Dissolved Titanium (Ti)	2023/05/15		99	%	80 - 120
			Dissolved Vanadium (V)	2023/05/15		100	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/15		96	%	80 - 120
8656575	SUK	Spiked Blank	Dissolved Aluminum (Al)	2023/05/15		96	%	80 - 120
			Dissolved Antimony (Sb)	2023/05/15		116	%	80 - 120
			Dissolved Arsenic (As)	2023/05/15		93	%	80 - 120
			Dissolved Barium (Ba)	2023/05/15		95	%	80 - 120
			Dissolved Beryllium (Be)	2023/05/15		92	%	80 - 120
			Dissolved Boron (B)	2023/05/15		95	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/15		93	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/15		95	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/15		98	%	80 - 120
			Dissolved Cobalt (Co)	2023/05/15		93	%	80 - 120
			Dissolved Copper (Cu)	2023/05/15		96	%	80 - 120
			Dissolved Iron (Fe)	2023/05/15		97	%	80 - 120
			Dissolved Lead (Pb)	2023/05/15		95	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/15		93	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/15		97	%	80 - 120
			Dissolved Molybdenum (Mo)	2023/05/15		94	%	80 - 120
			Dissolved Nickel (Ni)	2023/05/15		94	%	80 - 120
			Dissolved Phosphorus (P)	2023/05/15		91	%	80 - 120
			Dissolved Potassium (K)	2023/05/15		95	%	80 - 120
			Dissolved Selenium (Se)	2023/05/15		96	%	80 - 120
			Dissolved Silicon (Si)	2023/05/15		96	%	80 - 120
			Dissolved Silver (Ag)	2023/05/15		102	%	80 - 120
			Dissolved Sodium (Na)	2023/05/15		96	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/15		95	%	80 - 120
			Dissolved Sulphur (S)	2023/05/15		94	%	80 - 120
			Dissolved Tin (Sn)	2023/05/15		92	%	80 - 120
			Dissolved Titanium (Ti)	2023/05/15		93	%	80 - 120
			Dissolved Vanadium (V)	2023/05/15		94	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/15		93	%	80 - 120
8656575	SUK	Method Blank	Dissolved Aluminum (Al)	2023/05/15	<0.1		mg/L	
			Dissolved Antimony (Sb)	2023/05/15	<0.2		mg/L	
			Dissolved Arsenic (As)	2023/05/15	<0.2		mg/L	
			Dissolved Barium (Ba)	2023/05/15	<0.005		mg/L	
			Dissolved Beryllium (Be)	2023/05/15	<0.001		mg/L	
			Dissolved Boron (B)	2023/05/15	<0.02		mg/L	
			Dissolved Cadmium (Cd)	2023/05/15	<0.005		mg/L	
			Dissolved Calcium (Ca)	2023/05/15	<0.05		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Chromium (Cr)	2023/05/15	<0.01		mg/L	
			Dissolved Cobalt (Co)	2023/05/15	<0.02		mg/L	
			Dissolved Copper (Cu)	2023/05/15	<0.02		mg/L	
			Dissolved Iron (Fe)	2023/05/15	<0.02		mg/L	
			Dissolved Lead (Pb)	2023/05/15	<0.05		mg/L	
			Dissolved Magnesium (Mg)	2023/05/15	<0.05		mg/L	
			Dissolved Manganese (Mn)	2023/05/15	<0.01		mg/L	
			Dissolved Molybdenum (Mo)	2023/05/15	<0.02		mg/L	
			Dissolved Nickel (Ni)	2023/05/15	<0.05		mg/L	
			Dissolved Phosphorus (P)	2023/05/15	<0.1		mg/L	
			Dissolved Potassium (K)	2023/05/15	<1		mg/L	
			Dissolved Selenium (Se)	2023/05/15	<0.2		mg/L	
			Dissolved Silicon (Si)	2023/05/15	<0.2		mg/L	
			Dissolved Silver (Ag)	2023/05/15	<0.01		mg/L	
			Dissolved Sodium (Na)	2023/05/15	<0.5		mg/L	
			Dissolved Strontium (Sr)	2023/05/15	<0.005		mg/L	
			Dissolved Sulphur (S)	2023/05/15	<0.5		mg/L	
			Dissolved Tin (Sn)	2023/05/15	<0.2		mg/L	
			Dissolved Titanium (Ti)	2023/05/15	<0.01		mg/L	
			Dissolved Vanadium (V)	2023/05/15	<0.01		mg/L	
			Dissolved Zinc (Zn)	2023/05/15	<0.01		mg/L	
8656575	SUK	RPD [VTN603-03]	Dissolved Aluminum (Al)	2023/05/15	NC		%	25
			Dissolved Antimony (Sb)	2023/05/15	NC		%	25
			Dissolved Arsenic (As)	2023/05/15	NC		%	25
			Dissolved Barium (Ba)	2023/05/15	1.4		%	25
			Dissolved Beryllium (Be)	2023/05/15	NC		%	25
			Dissolved Boron (B)	2023/05/15	NC		%	25
			Dissolved Cadmium (Cd)	2023/05/15	NC		%	25
			Dissolved Calcium (Ca)	2023/05/15	0.71		%	25
			Dissolved Chromium (Cr)	2023/05/15	NC		%	25
			Dissolved Cobalt (Co)	2023/05/15	NC		%	25
			Dissolved Copper (Cu)	2023/05/15	NC		%	25
			Dissolved Iron (Fe)	2023/05/15	11		%	25
			Dissolved Lead (Pb)	2023/05/15	NC		%	25
			Dissolved Magnesium (Mg)	2023/05/15	0.069		%	25
			Dissolved Manganese (Mn)	2023/05/15	0		%	25
			Dissolved Molybdenum (Mo)	2023/05/15	NC		%	25
			Dissolved Nickel (Ni)	2023/05/15	NC		%	25
			Dissolved Phosphorus (P)	2023/05/15	NC		%	25
			Dissolved Potassium (K)	2023/05/15	0.067		%	25
			Dissolved Selenium (Se)	2023/05/15	NC		%	25
			Dissolved Silicon (Si)	2023/05/15	0.052		%	25
			Dissolved Silver (Ag)	2023/05/15	NC		%	25
			Dissolved Sodium (Na)	2023/05/15	0.57		%	25
			Dissolved Strontium (Sr)	2023/05/15	0.56		%	25
			Dissolved Sulphur (S)	2023/05/15	0.21		%	25
			Dissolved Tin (Sn)	2023/05/15	NC		%	25
			Dissolved Titanium (Ti)	2023/05/15	NC		%	25
			Dissolved Vanadium (V)	2023/05/15	NC		%	25
			Dissolved Zinc (Zn)	2023/05/15	NC		%	25

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8656588	KIT	Spiked Blank	Alkalinity (Total as CaCO3)	2023/05/12		98	%	85 - 115
8656588	KIT	Method Blank	Alkalinity (Total as CaCO3)	2023/05/12	<1.0		mg/L	
8656588	KIT	RPD	Alkalinity (Total as CaCO3)	2023/05/12	0.56		%	20
8656595	KIT	Spiked Blank	pH	2023/05/11		102	%	98 - 103
8656595	KIT	RPD	pH	2023/05/12	0.15		%	N/A
8656876	SPC	Matrix Spike	Total Phosphorus	2023/05/11		105	%	80 - 120
8656876	SPC	QC Standard	Total Phosphorus	2023/05/11		105	%	80 - 120
8656876	SPC	Spiked Blank	Total Phosphorus	2023/05/11		103	%	80 - 120
8656876	SPC	Method Blank	Total Phosphorus	2023/05/11	<0.004		mg/L	
8656876	SPC	RPD	Total Phosphorus	2023/05/11	2.1		%	20
8656879	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/05/11		NC	%	80 - 120
8656879	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/05/11		95	%	80 - 120
8656879	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/05/11	<4.0		mg/L	
8656879	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/05/11	7.0		%	20
8656889	JJH	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/05/12		96	%	80 - 120
8656889	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/05/12		102	%	80 - 120
8656889	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12		101	%	80 - 120
8656889	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/12	<0.10		mg/L	
8656889	JJH	RPD	Total Kjeldahl Nitrogen (TKN)	2023/05/12	4.8		%	20
8656901	GID	Matrix Spike	Total Organic Carbon (TOC)	2023/05/10		99	%	80 - 120
8656901	GID	Spiked Blank	Total Organic Carbon (TOC)	2023/05/10		99	%	80 - 120
8656901	GID	Method Blank	Total Organic Carbon (TOC)	2023/05/10	<0.40		mg/L	
8656901	GID	RPD	Total Organic Carbon (TOC)	2023/05/10	0.057		%	20
8657472	KPJ	Matrix Spike	Total Ammonia-N	2023/05/11		85	%	75 - 125
8657472	KPJ	Spiked Blank	Total Ammonia-N	2023/05/11		99	%	80 - 120
8657472	KPJ	Method Blank	Total Ammonia-N	2023/05/11	<0.050		mg/L	
8660030	SHD	QC Standard	Total Suspended Solids	2023/05/12		95	%	85 - 115
8660030	SHD	Method Blank	Total Suspended Solids	2023/05/12	<1		mg/L	
8660030	SHD	RPD	Total Suspended Solids	2023/05/12	11		%	20
8660431	SHD	QC Standard	Total Dissolved Solids	2023/05/15		100	%	90 - 110
8660431	SHD	Method Blank	Total Dissolved Solids	2023/05/15	<10		mg/L	
8660431	SHD	RPD	Total Dissolved Solids	2023/05/15	2.4		%	20
8661158	PBA	Matrix Spike	Total Aluminum (Al)	2023/05/12		99	%	80 - 120
			Total Antimony (Sb)	2023/05/12		109	%	80 - 120
			Total Arsenic (As)	2023/05/12		102	%	80 - 120
			Total Barium (Ba)	2023/05/12		96	%	80 - 120
			Total Beryllium (Be)	2023/05/12		96	%	80 - 120
			Total Bismuth (Bi)	2023/05/12		92	%	80 - 120
			Total Boron (B)	2023/05/12		95	%	80 - 120
			Total Cadmium (Cd)	2023/05/12		98	%	80 - 120
			Total Calcium (Ca)	2023/05/12		NC	%	80 - 120
			Total Chromium (Cr)	2023/05/12		97	%	80 - 120
			Total Cobalt (Co)	2023/05/12		96	%	80 - 120
			Total Copper (Cu)	2023/05/12		101	%	80 - 120
			Total Iron (Fe)	2023/05/12		97	%	80 - 120
			Total Lead (Pb)	2023/05/12		95	%	80 - 120
			Total Lithium (Li)	2023/05/12		99	%	80 - 120
			Total Magnesium (Mg)	2023/05/12		99	%	80 - 120
			Total Manganese (Mn)	2023/05/12		97	%	80 - 120
			Total Molybdenum (Mo)	2023/05/12		108	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Nickel (Ni)	2023/05/12		95	%	80 - 120
			Total Potassium (K)	2023/05/12		98	%	80 - 120
			Total Selenium (Se)	2023/05/12		102	%	80 - 120
			Total Silicon (Si)	2023/05/12		98	%	80 - 120
			Total Silver (Ag)	2023/05/12		99	%	80 - 120
			Total Sodium (Na)	2023/05/12		NC	%	80 - 120
			Total Strontium (Sr)	2023/05/12		NC	%	80 - 120
			Total Tellurium (Te)	2023/05/12		100	%	80 - 120
			Total Thallium (Tl)	2023/05/12		95	%	80 - 120
			Total Tin (Sn)	2023/05/12		101	%	80 - 120
			Total Titanium (Ti)	2023/05/12		98	%	80 - 120
			Total Tungsten (W)	2023/05/12		102	%	80 - 120
			Total Uranium (U)	2023/05/12		96	%	80 - 120
			Total Vanadium (V)	2023/05/12		100	%	80 - 120
			Total Zinc (Zn)	2023/05/12		97	%	80 - 120
			Total Zirconium (Zr)	2023/05/12		97	%	80 - 120
8661158	PBA	Spiked Blank	Total Aluminum (Al)	2023/05/12		98	%	80 - 120
			Total Antimony (Sb)	2023/05/12		108	%	80 - 120
			Total Arsenic (As)	2023/05/12		101	%	80 - 120
			Total Barium (Ba)	2023/05/12		97	%	80 - 120
			Total Beryllium (Be)	2023/05/12		97	%	80 - 120
			Total Bismuth (Bi)	2023/05/12		94	%	80 - 120
			Total Boron (B)	2023/05/12		95	%	80 - 120
			Total Cadmium (Cd)	2023/05/12		98	%	80 - 120
			Total Calcium (Ca)	2023/05/12		99	%	80 - 120
			Total Chromium (Cr)	2023/05/12		97	%	80 - 120
			Total Cobalt (Co)	2023/05/12		97	%	80 - 120
			Total Copper (Cu)	2023/05/12		98	%	80 - 120
			Total Iron (Fe)	2023/05/12		99	%	80 - 120
			Total Lead (Pb)	2023/05/12		96	%	80 - 120
			Total Lithium (Li)	2023/05/12		99	%	80 - 120
			Total Magnesium (Mg)	2023/05/12		98	%	80 - 120
			Total Manganese (Mn)	2023/05/12		97	%	80 - 120
			Total Molybdenum (Mo)	2023/05/12		103	%	80 - 120
			Total Nickel (Ni)	2023/05/12		96	%	80 - 120
			Total Potassium (K)	2023/05/12		99	%	80 - 120
			Total Selenium (Se)	2023/05/12		104	%	80 - 120
			Total Silicon (Si)	2023/05/12		99	%	80 - 120
			Total Silver (Ag)	2023/05/12		98	%	80 - 120
			Total Sodium (Na)	2023/05/12		99	%	80 - 120
			Total Strontium (Sr)	2023/05/12		98	%	80 - 120
			Total Tellurium (Te)	2023/05/12		102	%	80 - 120
			Total Thallium (Tl)	2023/05/12		98	%	80 - 120
			Total Tin (Sn)	2023/05/12		100	%	80 - 120
			Total Titanium (Ti)	2023/05/12		99	%	80 - 120
			Total Tungsten (W)	2023/05/12		102	%	80 - 120
			Total Uranium (U)	2023/05/12		97	%	80 - 120
			Total Vanadium (V)	2023/05/12		99	%	80 - 120
			Total Zinc (Zn)	2023/05/12		99	%	80 - 120
			Total Zirconium (Zr)	2023/05/12		102	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8661158	PBA	Method Blank	Total Aluminum (Al)	2023/05/15	<4.9		ug/L	
			Total Antimony (Sb)	2023/05/15	<0.50		ug/L	
			Total Arsenic (As)	2023/05/15	<1.0		ug/L	
			Total Barium (Ba)	2023/05/15	<2.0		ug/L	
			Total Beryllium (Be)	2023/05/15	<0.40		ug/L	
			Total Bismuth (Bi)	2023/05/15	<1.0		ug/L	
			Total Boron (B)	2023/05/15	<10		ug/L	
			Total Cadmium (Cd)	2023/05/15	<0.090		ug/L	
			Total Calcium (Ca)	2023/05/15	<200		ug/L	
			Total Chromium (Cr)	2023/05/15	<5.0		ug/L	
			Total Cobalt (Co)	2023/05/15	<0.50		ug/L	
			Total Copper (Cu)	2023/05/15	<0.90		ug/L	
			Total Iron (Fe)	2023/05/15	<100		ug/L	
			Total Lead (Pb)	2023/05/15	<0.50		ug/L	
			Total Lithium (Li)	2023/05/15	<5.0		ug/L	
			Total Magnesium (Mg)	2023/05/15	<50		ug/L	
			Total Manganese (Mn)	2023/05/15	<2.0		ug/L	
			Total Molybdenum (Mo)	2023/05/15	<0.50		ug/L	
			Total Nickel (Ni)	2023/05/15	<1.0		ug/L	
			Total Potassium (K)	2023/05/15	<200		ug/L	
			Total Selenium (Se)	2023/05/15	<2.0		ug/L	
			Total Silicon (Si)	2023/05/15	<50		ug/L	
			Total Silver (Ag)	2023/05/15	<0.090		ug/L	
			Total Sodium (Na)	2023/05/15	<100		ug/L	
			Total Strontium (Sr)	2023/05/15	<1.0		ug/L	
			Total Tellurium (Te)	2023/05/15	<1.0		ug/L	
			Total Thallium (Tl)	2023/05/15	<0.050		ug/L	
			Total Tin (Sn)	2023/05/15	<1.0		ug/L	
			Total Titanium (Ti)	2023/05/15	<5.0		ug/L	
			Total Tungsten (W)	2023/05/15	<1.0		ug/L	
			Total Uranium (U)	2023/05/15	<0.10		ug/L	
			Total Vanadium (V)	2023/05/15	<0.50		ug/L	
			Total Zinc (Zn)	2023/05/15	<5.0		ug/L	
			Total Zirconium (Zr)	2023/05/15	<1.0		ug/L	
8661158	PBA	RPD	Total Aluminum (Al)	2023/05/12	5.7		%	20
			Total Antimony (Sb)	2023/05/12	3.2		%	20
			Total Arsenic (As)	2023/05/12	NC		%	20
			Total Barium (Ba)	2023/05/12	2.1		%	20
			Total Beryllium (Be)	2023/05/12	NC		%	20
			Total Bismuth (Bi)	2023/05/12	NC		%	20
			Total Boron (B)	2023/05/12	0.059		%	20
			Total Cadmium (Cd)	2023/05/12	NC		%	20
			Total Calcium (Ca)	2023/05/12	2.4		%	20
			Total Chromium (Cr)	2023/05/12	NC		%	20
			Total Cobalt (Co)	2023/05/12	NC		%	20
			Total Copper (Cu)	2023/05/12	5.5		%	20
			Total Iron (Fe)	2023/05/12	12		%	20
			Total Lead (Pb)	2023/05/12	NC		%	20
			Total Magnesium (Mg)	2023/05/12	1.1		%	20
			Total Manganese (Mn)	2023/05/12	2.7		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Molybdenum (Mo)	2023/05/12	4.6		%	20
			Total Nickel (Ni)	2023/05/12	5.3		%	20
			Total Potassium (K)	2023/05/12	1.7		%	20
			Total Selenium (Se)	2023/05/12	NC		%	20
			Total Silicon (Si)	2023/05/12	1.6		%	20
			Total Silver (Ag)	2023/05/12	NC		%	20
			Total Sodium (Na)	2023/05/12	2.0		%	20
			Total Strontium (Sr)	2023/05/12	1.8		%	20
			Total Thallium (Tl)	2023/05/12	NC		%	20
			Total Tin (Sn)	2023/05/12	5.8		%	20
			Total Titanium (Ti)	2023/05/12	NC		%	20
			Total Vanadium (V)	2023/05/12	NC		%	20
			Total Zinc (Zn)	2023/05/12	1.0		%	20
			Total Zirconium (Zr)	2023/05/12	NC		%	20
8663039	MKX	Matrix Spike [VTN603-10]	Phenols-4AAP	2023/05/12		103	%	80 - 120
8663039	MKX	Spiked Blank	Phenols-4AAP	2023/05/12		100	%	80 - 120
8663039	MKX	Method Blank	Phenols-4AAP	2023/05/12	<0.0010		mg/L	
8663039	MKX	RPD [VTN603-10]	Phenols-4AAP	2023/05/12	NC		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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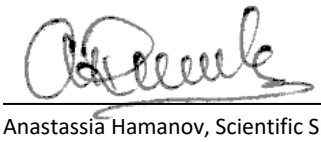
Bureau Veritas Job #: C3D1795
Report Date: 2023/05/17

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK SURFACE WATER LANDFILL BOTHWELL
Sampler Initials: K.B

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: LIMERICK
Site Location: LIMERICK LEACHATE LANDFILL BOTHWELL
Your C.O.C. #: 928609-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/24
Report #: R7641337
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D5174
Received: 2023/05/11, 12:56

Sample Matrix: Leachate
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2023/05/19	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	1	2023/05/13	2023/05/18	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	1	N/A	2023/05/19	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	1	N/A	2023/05/15	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/05/13	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2023/05/18	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	1	N/A	2023/05/19	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2023/05/18		
Total Ammonia-N	1	N/A	2023/05/16	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	1	N/A	2023/05/12	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2023/05/12	2023/05/17	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2023/05/16	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/05/19	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	1	N/A	2023/05/18		Auto Calc
Total Dissolved Solids	1	2023/05/16	2023/05/17	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	1	2023/05/12	2023/05/17	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	1	2023/05/12	2023/05/16	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.

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Site Location: LIMERICK LEACHATE LANDFILL BOTHWELL
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Report Date: 2023/05/24
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CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D5174

Received: 2023/05/11, 12:56

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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Bureau Veritas Job #: C3D5174
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LEACHATE LANDFILL BOTHWELL
Sampler Initials: KB

RESULTS OF ANALYSES OF LEACHATE

Bureau Veritas ID		VUF538		
Sampling Date		2023/05/11 10:21		
COC Number		928609-01-01		
	UNITS	**LW-101**	**RDL**	**QC Batch**
Calculated Parameters				
Calculated TDS	mg/L	1100	1.0	8661104
Hardness (CaCO3)	mg/L	310	1.0	8661103
Ion Balance (% Difference)	%	28.3	N/A	8661112
Inorganics				
Total Ammonia-N	mg/L	57	1.0	8664910
Total BOD	mg/L	4	2	8663345
Total Chemical Oxygen Demand (COD)	mg/L	80	4.0	8664666
Total Dissolved Solids	mg/L	1150	10	8666696
Total Kjeldahl Nitrogen (TKN)	mg/L	76	5.0	8663021
Dissolved Organic Carbon	mg/L	24	0.40	8662117
pH	pH	7.70		8662539
Phenols-4AAP	mg/L	0.0035	0.0010	8667786
Total Phosphorus	mg/L	0.19	0.020	8663003
Dissolved Sulphate (SO4)	mg/L	4.2	1.0	8674551
Alkalinity (Total as CaCO3)	mg/L	980	1.0	8674772
Dissolved Chloride (Cl-)	mg/L	190	1.0	8674550
Nitrite (N)	mg/L	<0.010	0.010	8662226
Nitrate (N)	mg/L	<0.10	0.10	8662226
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8662226

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3D5174
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LEACHATE LANDFILL BOTHWELL
Sampler Initials: KB

ELEMENTS BY ATOMIC SPECTROSCOPY (LEACHATE)

Bureau Veritas ID		VUF538		
Sampling Date		2023/05/11 10:21		
COC Number		928609-01-01		
	UNITS	LW-101	RDL	QC Batch
Metals				
Dissolved Aluminum (Al)	ug/L	21	4.9	8674801
Dissolved Arsenic (As)	ug/L	6.3	1.0	8674801
Dissolved Barium (Ba)	ug/L	210	2.0	8674801
Dissolved Boron (B)	ug/L	420	10	8674801
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8674801
Dissolved Calcium (Ca)	ug/L	95000	200	8674801
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8674801
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8674801
Dissolved Iron (Fe)	ug/L	14000	100	8674801
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8674801
Dissolved Magnesium (Mg)	ug/L	18000	50	8674801
Dissolved Manganese (Mn)	ug/L	110	2.0	8674801
Dissolved Potassium (K)	ug/L	31000	200	8674801
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8674801
Dissolved Sodium (Na)	ug/L	55000	100	8674801
Dissolved Strontium (Sr)	ug/L	460	1.0	8674801
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	8674801

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Sample VUF538 [LW-101] : Elevated ion balance result was confirmed by reanalysis.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8662117	GID	Matrix Spike	Dissolved Organic Carbon	2023/05/12		93	%	80 - 120
8662117	GID	Spiked Blank	Dissolved Organic Carbon	2023/05/12		97	%	80 - 120
8662117	GID	Method Blank	Dissolved Organic Carbon	2023/05/12	<0.40		mg/L	
8662117	GID	RPD	Dissolved Organic Carbon	2023/05/12	NC		%	20
8662226	C_N	Matrix Spike	Nitrite (N)	2023/05/12		105	%	80 - 120
			Nitrate (N)	2023/05/12		93	%	80 - 120
8662226	C_N	Spiked Blank	Nitrite (N)	2023/05/12		105	%	80 - 120
			Nitrate (N)	2023/05/12		97	%	80 - 120
8662226	C_N	Method Blank	Nitrite (N)	2023/05/12	<0.010		mg/L	
			Nitrate (N)	2023/05/12	<0.10		mg/L	
8662226	C_N	RPD	Nitrite (N)	2023/05/12	NC		%	20
			Nitrate (N)	2023/05/12	NC		%	20
8662539	KIT	Spiked Blank	pH	2023/05/17		101	%	98 - 103
8662539	KIT	RPD	pH	2023/05/17	1.2		%	N/A
8663003	GYA	Matrix Spike	Total Phosphorus	2023/05/16		100	%	80 - 120
8663003	GYA	QC Standard	Total Phosphorus	2023/05/15		104	%	80 - 120
8663003	GYA	Spiked Blank	Total Phosphorus	2023/05/15		99	%	80 - 120
8663003	GYA	Method Blank	Total Phosphorus	2023/05/15	<0.020		mg/L	
8663003	GYA	RPD	Total Phosphorus	2023/05/16	13		%	20
8663021	JJH	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/05/16		106	%	80 - 120
8663021	JJH	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/05/16		99	%	80 - 120
8663021	JJH	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/16		104	%	80 - 120
8663021	JJH	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/05/16	<0.10		mg/L	
8663021	JJH	RPD	Total Kjeldahl Nitrogen (TKN)	2023/05/16	14		%	20
8663345	GUJ	QC Standard	Total BOD	2023/05/18		93	%	80 - 120
8663345	GUJ	Method Blank	Total BOD	2023/05/18	<2		mg/L	
8663345	GUJ	RPD	Total BOD	2023/05/18	16		%	30
8664666	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/05/15		103	%	80 - 120
8664666	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/05/15		93	%	80 - 120
8664666	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/05/15	<4.0		mg/L	
8664666	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/05/15	NC		%	20
8664910	KPJ	Matrix Spike	Total Ammonia-N	2023/05/16		100	%	75 - 125
8664910	KPJ	Spiked Blank	Total Ammonia-N	2023/05/16		100	%	80 - 120
8664910	KPJ	Method Blank	Total Ammonia-N	2023/05/16	<0.050		mg/L	
8664910	KPJ	RPD	Total Ammonia-N	2023/05/16	NC		%	20
8666696	SHD	QC Standard	Total Dissolved Solids	2023/05/17		95	%	90 - 110
8666696	SHD	Method Blank	Total Dissolved Solids	2023/05/17	<10		mg/L	
8666696	SHD	RPD	Total Dissolved Solids	2023/05/17	3.4		%	20
8667786	MKX	Matrix Spike	Phenols-4AAP	2023/05/16		105	%	80 - 120
8667786	MKX	Spiked Blank	Phenols-4AAP	2023/05/16		103	%	80 - 120
8667786	MKX	Method Blank	Phenols-4AAP	2023/05/16	<0.0010		mg/L	
8667786	MKX	RPD	Phenols-4AAP	2023/05/16	NC		%	20
8674550	YPA	Matrix Spike	Dissolved Chloride (Cl-)	2023/05/19		NC	%	80 - 120
8674550	YPA	Spiked Blank	Dissolved Chloride (Cl-)	2023/05/19		96	%	80 - 120
8674550	YPA	Method Blank	Dissolved Chloride (Cl-)	2023/05/19	<1.0		mg/L	
8674550	YPA	RPD	Dissolved Chloride (Cl-)	2023/05/19	5.0		%	20
8674551	YPA	Matrix Spike	Dissolved Sulphate (SO4)	2023/05/19		NC	%	75 - 125
8674551	YPA	Spiked Blank	Dissolved Sulphate (SO4)	2023/05/19		99	%	80 - 120
8674551	YPA	Method Blank	Dissolved Sulphate (SO4)	2023/05/19	<1.0		mg/L	
8674551	YPA	RPD	Dissolved Sulphate (SO4)	2023/05/19	0		%	20
8674772	KIT	Spiked Blank	Alkalinity (Total as CaCO3)	2023/05/19		97	%	85 - 115

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8674772	KIT	Method Blank	Alkalinity (Total as CaCO3)	2023/05/19	<1.0		mg/L	
8674772	KIT	RPD	Alkalinity (Total as CaCO3)	2023/05/19	0.60		%	20
8674801	TLG	Matrix Spike [VUF538-03]	Dissolved Aluminum (Al)	2023/05/19		NC	%	80 - 120
			Dissolved Arsenic (As)	2023/05/19		103	%	80 - 120
			Dissolved Barium (Ba)	2023/05/19		101	%	80 - 120
			Dissolved Boron (B)	2023/05/19		96	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/19		104	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/19		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/19		101	%	80 - 120
			Dissolved Copper (Cu)	2023/05/19		103	%	80 - 120
			Dissolved Iron (Fe)	2023/05/19		98	%	80 - 120
			Dissolved Lead (Pb)	2023/05/19		101	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/19		95	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/19		96	%	80 - 120
			Dissolved Potassium (K)	2023/05/19		NC	%	80 - 120
			Dissolved Selenium (Se)	2023/05/19		103	%	80 - 120
			Dissolved Sodium (Na)	2023/05/19		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/19		105	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/19		103	%	80 - 120
8674801	TLG	Spiked Blank	Dissolved Aluminum (Al)	2023/05/19		98	%	80 - 120
			Dissolved Arsenic (As)	2023/05/19		99	%	80 - 120
			Dissolved Barium (Ba)	2023/05/19		100	%	80 - 120
			Dissolved Boron (B)	2023/05/19		93	%	80 - 120
			Dissolved Cadmium (Cd)	2023/05/19		101	%	80 - 120
			Dissolved Calcium (Ca)	2023/05/19		100	%	80 - 120
			Dissolved Chromium (Cr)	2023/05/19		99	%	80 - 120
			Dissolved Copper (Cu)	2023/05/19		100	%	80 - 120
			Dissolved Iron (Fe)	2023/05/19		99	%	80 - 120
			Dissolved Lead (Pb)	2023/05/19		101	%	80 - 120
			Dissolved Magnesium (Mg)	2023/05/19		95	%	80 - 120
			Dissolved Manganese (Mn)	2023/05/19		96	%	80 - 120
			Dissolved Potassium (K)	2023/05/19		99	%	80 - 120
			Dissolved Selenium (Se)	2023/05/19		103	%	80 - 120
			Dissolved Sodium (Na)	2023/05/19		96	%	80 - 120
			Dissolved Strontium (Sr)	2023/05/19		96	%	80 - 120
			Dissolved Zinc (Zn)	2023/05/19		101	%	80 - 120
8674801	TLG	Method Blank	Dissolved Aluminum (Al)	2023/05/20	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/05/20	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/05/20	<2.0		ug/L	
			Dissolved Boron (B)	2023/05/20	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/05/20	<0.090		ug/L	
			Dissolved Calcium (Ca)	2023/05/20	<200		ug/L	
			Dissolved Chromium (Cr)	2023/05/20	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/05/20	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/05/20	<100		ug/L	
			Dissolved Lead (Pb)	2023/05/20	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/05/20	<50		ug/L	
			Dissolved Manganese (Mn)	2023/05/20	<2.0		ug/L	
			Dissolved Potassium (K)	2023/05/20	<200		ug/L	
			Dissolved Selenium (Se)	2023/05/20	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/05/20	<100		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Strontium (Sr)	2023/05/20	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/05/20	<5.0		ug/L	
8674801	TLG	RPD [VUF538-03]	Dissolved Aluminum (Al)	2023/05/19	7.5		%	20
			Dissolved Arsenic (As)	2023/05/19	1.5		%	20
			Dissolved Barium (Ba)	2023/05/19	2.2		%	20
			Dissolved Boron (B)	2023/05/19	0.68		%	20
			Dissolved Cadmium (Cd)	2023/05/19	NC		%	20
			Dissolved Calcium (Ca)	2023/05/19	0.47		%	20
			Dissolved Chromium (Cr)	2023/05/19	NC		%	20
			Dissolved Copper (Cu)	2023/05/19	NC		%	20
			Dissolved Iron (Fe)	2023/05/19	2.3		%	20
			Dissolved Lead (Pb)	2023/05/19	NC		%	20
			Dissolved Magnesium (Mg)	2023/05/19	0.34		%	20
			Dissolved Manganese (Mn)	2023/05/19	0.41		%	20
			Dissolved Potassium (K)	2023/05/19	0.70		%	20
			Dissolved Selenium (Se)	2023/05/19	NC		%	20
			Dissolved Sodium (Na)	2023/05/19	1.8		%	20
			Dissolved Strontium (Sr)	2023/05/19	0.92		%	20
			Dissolved Zinc (Zn)	2023/05/19	NC		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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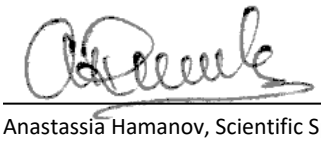
Bureau Veritas Job #: C3D5174
Report Date: 2023/05/24

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK LEACHATE LANDFILL BOTHWELL
Sampler Initials: KB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: BOTHWELL ONT
Site Location: LIMERICK GROUND WATER
Your C.O.C. #: 957068-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/16
Report #: R7862597
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V1574
Received: 2023/10/05, 15:57

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	8	N/A	2023/10/13	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	8	N/A	2023/10/13	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	8	N/A	2023/10/12	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	7	N/A	2023/10/11	CAM SOP-00446	SM 23 5310 B m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/10/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	8	N/A	2023/10/13	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	7	N/A	2023/10/11	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2023/10/13	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	8	N/A	2023/10/13		
Total Ammonia-N	8	N/A	2023/10/13	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	8	N/A	2023/10/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	8	2023/10/10	2023/10/13	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	8	N/A	2023/10/10	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	8	N/A	2023/10/13	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	8	N/A	2023/10/13		Auto Calc
Total Dissolved Solids	8	2023/10/11	2023/10/12	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	3	2023/10/11	2023/10/12	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	5	2023/10/11	2023/10/13	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	7	2023/10/12	2023/10/12	CAM SOP-00407	SM 23 4500-P I
Total Phosphorus (Colourimetric)	1	2023/10/12	2023/10/14	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Your Project #: 18108934
Site#: BOTHWELL ONT
Site Location: LIMERICK GROUND WATER
Your C.O.C. #: 957068-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/16
Report #: R7862597
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V1574
Received: 2023/10/05, 15:57

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XFJ277		XFJ278		XFJ279		
Sampling Date		2023/10/05 10:32		2023/10/05 09:44		2023/10/05 13:55		
COC Number		957068-01-01		957068-01-01		957068-01-01		
	UNITS	MW-103S	QC Batch	MW-104S	RDL	MW-101S	RDL	QC Batch
Calculated Parameters								
Calculated TDS	mg/L	670	8967984	850	1.0	1100	1.0	8967984
Hardness (CaCO3)	mg/L	480	8967982	560	1.0	760	1.0	8967982
Ion Balance (% Difference)	%	7.70	8967983	4.30	N/A	5.37	N/A	8967983
Inorganics								
Total Ammonia-N	mg/L	<0.050	8973562	0.073	0.050	9.8	0.050	8973562
Total Chemical Oxygen Demand (COD)	mg/L	9.6	8973103	5.7	4.0	29	4.0	8973856
Total Dissolved Solids	mg/L	750	8972100	955	10	1100	10	8972100
Total Kjeldahl Nitrogen (TKN)	mg/L	0.17	8973958	0.35	0.10	9.8	0.50	8973958
Dissolved Organic Carbon	mg/L	3.0	8970659	1.7	0.40	9.4	0.40	8970311
pH	pH	7.85	8970064	7.85		7.81		8970064
Phenols-4AAP	mg/L	<0.0010	8970763	<0.0010	0.0010	<0.0010	0.0010	8970763
Total Phosphorus	mg/L	0.009	8974503	0.23	0.004	0.013	0.004	8974503
Dissolved Sulphate (SO4)	mg/L	15	8970210	21	1.0	230	1.0	8970210
Alkalinity (Total as CaCO3)	mg/L	280	8970048	290	1.0	540	1.0	8970048
Dissolved Chloride (Cl-)	mg/L	260	8970193	310	2.0	150	1.0	8970193
Nitrite (N)	mg/L	<0.010	8970076	<0.010	0.010	0.021	0.010	8970076
Nitrate (N)	mg/L	<0.10	8970076	<0.10	0.10	<0.10	0.10	8970076
Nitrate + Nitrite (N)	mg/L	<0.10	8970076	<0.10	0.10	<0.10	0.10	8970076

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XFJ280		XFJ281			XFJ282		
Sampling Date		2023/10/05 11:35		2023/10/05 09:08			2023/10/05 13:03		
COC Number		957068-01-01		957068-01-01			957068-01-01		
	UNITS	MW-102	RDL	MW-105	RDL	QC Batch	MW-106	RDL	QC Batch
Calculated Parameters									
Calculated TDS	mg/L	1200	1.0	2300	1.0	8967984	990	1.0	8967984
Hardness (CaCO3)	mg/L	890	1.0	750	1.0	8967982	530	1.0	8967982
Ion Balance (% Difference)	%	3.65	N/A	4.35	N/A	8967983	7.01	N/A	8967983
Inorganics									
Total Ammonia-N	mg/L	25	0.050	190	2.5	8973562	100	1.0	8973582
Total Chemical Oxygen Demand (COD)	mg/L	57	4.0	120	4.0	8973856	51	4.0	8973856
Total Dissolved Solids	mg/L	1050	10	1550	10	8972100	595	10	8972100
Total Kjeldahl Nitrogen (TKN)	mg/L	25	1.0	170	50	8973958	88	2.5	8973958
Dissolved Organic Carbon	mg/L	19	0.40	40	0.40	8970311	14	0.40	8970659
pH	pH	7.64		7.49		8970064	7.44		8970064
Phenols-4AAP	mg/L	0.0016	0.0010	0.0020	0.0010	8970763	0.0023	0.0010	8970763
Total Phosphorus	mg/L	0.054	0.004	0.084	0.004	8974503	0.31	0.004	8974503
Dissolved Sulphate (SO4)	mg/L	66	1.0	<1.0	1.0	8970210	11	1.0	8970210
Alkalinity (Total as CaCO3)	mg/L	950	1.0	1600	1.0	8970048	840	1.0	8970048
Dissolved Chloride (Cl-)	mg/L	65	1.0	350	5.0	8970193	44	1.0	8970193
Nitrite (N)	mg/L	0.012	0.010	<0.010	0.010	8970076	<0.010	0.010	8970076
Nitrate (N)	mg/L	<0.10	0.10	<0.10	0.10	8970076	<0.10	0.10	8970076
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	<0.10	0.10	8970076	<0.10	0.10	8970076

RDL = Reportable Detection Limit
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Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XFJ283			XFJ284		
Sampling Date		2023/10/05 14:00			2023/10/05 08:45		
COC Number		957068-01-01			957068-01-01		
	UNITS	FB-101	RDL	QC Batch	DWS-5	RDL	QC Batch
Calculated Parameters							
Calculated TDS	mg/L	1.0	1.0	8967984	2300	1.0	8967984
Hardness (CaCO3)	mg/L	<1.0	1.0	8967982	740	1.0	8967982
Ion Balance (% Difference)	%	NC	N/A	8967983	3.87	N/A	8967983
Inorganics							
Total Ammonia-N	mg/L	<0.050	0.050	8973562	200	2.5	8973562
Total Chemical Oxygen Demand (COD)	mg/L	<4.0	4.0	8973856	120	4.0	8973856
Total Dissolved Solids	mg/L	<10	10	8972100	1540	10	8972100
Total Kjeldahl Nitrogen (TKN)	mg/L	<0.10	0.10	8973958	170	50	8973958
Dissolved Organic Carbon	mg/L	<0.40	0.40	8970311	39	0.40	8969608
pH	pH	6.39		8970064	7.53		8970064
Phenols-4AAP	mg/L	<0.0010	0.0010	8970763	0.0015	0.0010	8970763
Total Phosphorus	mg/L	<0.004	0.004	8974503	0.074	0.004	8976310
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	8970210	1.7	1.0	8970210
Alkalinity (Total as CaCO3)	mg/L	1.3	1.0	8970048	1600	1.0	8970048
Dissolved Chloride (Cl-)	mg/L	<1.0	1.0	8970193	370	5.0	8970193
Nitrite (N)	mg/L	<0.010	0.010	8970076	<0.010	0.010	8970076
Nitrate (N)	mg/L	<0.10	0.10	8970076	<0.10	0.10	8970076
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8970076	<0.10	0.10	8970076

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QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XFJ277	XFJ278	XFJ279	XFJ280	XFJ281	XFJ282		
Sampling Date		2023/10/05 10:32	2023/10/05 09:44	2023/10/05 13:55	2023/10/05 11:35	2023/10/05 09:08	2023/10/05 13:03		
COC Number		957068-01-01	957068-01-01	957068-01-01	957068-01-01	957068-01-01	957068-01-01		
	UNITS	MW-103S	MW-104S	MW-101S	MW-102	MW-105	MW-106	RDL	QC Batch
Metals									
Dissolved Aluminum (Al)	ug/L	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	4.9	8971168
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	5.5	2.6	8.5	4.8	1.0	8971168
Dissolved Barium (Ba)	ug/L	190	200	120	380	1900	460	2.0	8971168
Dissolved Boron (B)	ug/L	35	48	830	1000	1700	490	10	8971168
Dissolved Cadmium (Cd)	ug/L	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	0.090	8971168
Dissolved Calcium (Ca)	ug/L	150000	180000	150000	240000	140000	150000	200	8971168
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	8971168
Dissolved Copper (Cu)	ug/L	2.3	0.96	<0.90	<0.90	<0.90	<0.90	0.90	8971168
Dissolved Iron (Fe)	ug/L	<100	2000	3600	17000	24000	33000	100	8971168
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	8971168
Dissolved Magnesium (Mg)	ug/L	25000	29000	93000	68000	96000	37000	50	8971168
Dissolved Manganese (Mn)	ug/L	14	230	290	200	72	200	2.0	8971168
Dissolved Potassium (K)	ug/L	4400	1200	64000	44000	130000	27000	200	8971168
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	8971168
Dissolved Sodium (Na)	ug/L	37000	120000	100000	59000	290000	35000	100	8971168
Dissolved Strontium (Sr)	ug/L	830	910	850	1500	1900	950	1.0	8971168
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	8971168

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XFJ283	XFJ284		
Sampling Date		2023/10/05 14:00	2023/10/05 08:45		
COC Number		957068-01-01	957068-01-01		
	UNITS	FB-101	DWS-5	RDL	QC Batch
Metals					
Dissolved Aluminum (Al)	ug/L	<4.9	<4.9	4.9	8971168
Dissolved Arsenic (As)	ug/L	<1.0	8.7	1.0	8971168
Dissolved Barium (Ba)	ug/L	<2.0	1900	2.0	8971168
Dissolved Boron (B)	ug/L	<10	1600	10	8971168
Dissolved Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	8971168
Dissolved Calcium (Ca)	ug/L	<200	140000	200	8971168
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	5.0	8971168
Dissolved Copper (Cu)	ug/L	<0.90	<0.90	0.90	8971168
Dissolved Iron (Fe)	ug/L	<100	24000	100	8971168
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	0.50	8971168
Dissolved Magnesium (Mg)	ug/L	<50	96000	50	8971168
Dissolved Manganese (Mn)	ug/L	<2.0	74	2.0	8971168
Dissolved Potassium (K)	ug/L	<200	130000	200	8971168
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	2.0	8971168
Dissolved Sodium (Na)	ug/L	<100	290000	100	8971168
Dissolved Strontium (Sr)	ug/L	<1.0	1900	1.0	8971168
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.0	8971168

RDL = Reportable Detection Limit
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GENERAL COMMENTS

Sample XFJ281 [MW-105] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample XFJ282 [MW-106] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Sample XFJ284 [DWS-5] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8969608	GID	Matrix Spike	Dissolved Organic Carbon	2023/10/11		93	%	80 - 120
8969608	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/11		95	%	80 - 120
8969608	GID	Method Blank	Dissolved Organic Carbon	2023/10/11	<0.40		mg/L	
8969608	GID	RPD	Dissolved Organic Carbon	2023/10/11	0.63		%	20
8970048	NGI	Spiked Blank	Alkalinity (Total as CaCO3)	2023/10/13		96	%	85 - 115
8970048	NGI	Method Blank	Alkalinity (Total as CaCO3)	2023/10/13	<1.0		mg/L	
8970048	NGI	RPD [XFJ281-01]	Alkalinity (Total as CaCO3)	2023/10/13	0.40		%	20
8970064	NGI	Spiked Blank	pH	2023/10/13		103	%	98 - 103
8970064	NGI	RPD [XFJ281-01]	pH	2023/10/13	0.0013		%	N/A
8970076	C_N	Matrix Spike [XFJ279-01]	Nitrite (N)	2023/10/14		105	%	80 - 120
			Nitrate (N)	2023/10/14		99	%	80 - 120
8970076	C_N	Spiked Blank	Nitrite (N)	2023/10/14		105	%	80 - 120
			Nitrate (N)	2023/10/14		87	%	80 - 120
8970076	C_N	Method Blank	Nitrite (N)	2023/10/14	<0.010		mg/L	
			Nitrate (N)	2023/10/14	<0.10		mg/L	
8970076	C_N	RPD [XFJ279-01]	Nitrite (N)	2023/10/14	2.8		%	20
			Nitrate (N)	2023/10/14	NC		%	20
8970193	MJ1	Matrix Spike [XFJ277-01]	Dissolved Chloride (Cl-)	2023/10/13		NC	%	80 - 120
8970193	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/10/13		98	%	80 - 120
8970193	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/10/13	<1.0		mg/L	
8970193	MJ1	RPD [XFJ277-01]	Dissolved Chloride (Cl-)	2023/10/13	3.4		%	20
8970210	ADB	Matrix Spike [XFJ277-01]	Dissolved Sulphate (SO4)	2023/10/13		95	%	75 - 125
8970210	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/10/13		100	%	80 - 120
8970210	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/10/13	<1.0		mg/L	
8970210	ADB	RPD [XFJ277-01]	Dissolved Sulphate (SO4)	2023/10/13	2.2		%	20
8970311	GID	Matrix Spike	Dissolved Organic Carbon	2023/10/11		94	%	80 - 120
8970311	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/11		97	%	80 - 120
8970311	GID	Method Blank	Dissolved Organic Carbon	2023/10/11	<0.40		mg/L	
8970311	GID	RPD	Dissolved Organic Carbon	2023/10/11	8.7		%	20
8970659	GID	Matrix Spike [XFJ277-03]	Dissolved Organic Carbon	2023/10/11		94	%	80 - 120
8970659	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/11		95	%	80 - 120
8970659	GID	Method Blank	Dissolved Organic Carbon	2023/10/11	<0.40		mg/L	
8970659	GID	RPD [XFJ277-03]	Dissolved Organic Carbon	2023/10/11	0.96		%	20
8970763	CPO	Matrix Spike	Phenols-4AAP	2023/10/10		100	%	80 - 120
8970763	CPO	Spiked Blank	Phenols-4AAP	2023/10/10		99	%	80 - 120
8970763	CPO	Method Blank	Phenols-4AAP	2023/10/10	<0.0010		mg/L	
8970763	CPO	RPD	Phenols-4AAP	2023/10/10	1.6		%	20
8971168	AFZ	Matrix Spike [XFJ281-05]	Dissolved Aluminum (Al)	2023/10/11		109	%	80 - 120
			Dissolved Arsenic (As)	2023/10/11		102	%	80 - 120
			Dissolved Barium (Ba)	2023/10/11		NC	%	80 - 120
			Dissolved Boron (B)	2023/10/11		NC	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/11		100	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/11		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/11		102	%	80 - 120
			Dissolved Copper (Cu)	2023/10/11		106	%	80 - 120
			Dissolved Iron (Fe)	2023/10/11		100	%	80 - 120
			Dissolved Lead (Pb)	2023/10/11		99	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/11		NC	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/11		102	%	80 - 120
			Dissolved Potassium (K)	2023/10/11		NC	%	80 - 120
			Dissolved Selenium (Se)	2023/10/11		97	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2023/10/11		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/11		NC	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/11		98	%	80 - 120
8971168	AFZ	Spiked Blank	Dissolved Aluminum (Al)	2023/10/11		101	%	80 - 120
			Dissolved Arsenic (As)	2023/10/11		98	%	80 - 120
			Dissolved Barium (Ba)	2023/10/11		101	%	80 - 120
			Dissolved Boron (B)	2023/10/11		100	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/11		99	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/11		102	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/11		99	%	80 - 120
			Dissolved Copper (Cu)	2023/10/11		100	%	80 - 120
			Dissolved Iron (Fe)	2023/10/11		101	%	80 - 120
			Dissolved Lead (Pb)	2023/10/11		100	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/11		101	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/11		99	%	80 - 120
			Dissolved Potassium (K)	2023/10/11		106	%	80 - 120
			Dissolved Selenium (Se)	2023/10/11		96	%	80 - 120
			Dissolved Sodium (Na)	2023/10/11		101	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/11		98	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/11		97	%	80 - 120
8971168	AFZ	Method Blank	Dissolved Aluminum (Al)	2023/10/11	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/10/11	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/10/11	<2.0		ug/L	
			Dissolved Boron (B)	2023/10/11	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/10/11	<0.090		ug/L	
			Dissolved Calcium (Ca)	2023/10/11	<200		ug/L	
			Dissolved Chromium (Cr)	2023/10/11	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/10/11	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/10/11	<100		ug/L	
			Dissolved Lead (Pb)	2023/10/11	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/10/11	<50		ug/L	
			Dissolved Manganese (Mn)	2023/10/11	<2.0		ug/L	
			Dissolved Potassium (K)	2023/10/11	<200		ug/L	
			Dissolved Selenium (Se)	2023/10/11	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/10/11	<100		ug/L	
			Dissolved Strontium (Sr)	2023/10/11	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/10/11	<5.0		ug/L	
8971168	AFZ	RPD [XFJ281-05]	Dissolved Aluminum (Al)	2023/10/11	NC		%	20
			Dissolved Arsenic (As)	2023/10/11	4.5		%	20
			Dissolved Barium (Ba)	2023/10/11	0.66		%	20
			Dissolved Boron (B)	2023/10/11	7.8		%	20
			Dissolved Cadmium (Cd)	2023/10/11	NC		%	20
			Dissolved Calcium (Ca)	2023/10/11	1.8		%	20
			Dissolved Chromium (Cr)	2023/10/11	NC		%	20
			Dissolved Copper (Cu)	2023/10/11	NC		%	20
			Dissolved Iron (Fe)	2023/10/11	1.3		%	20
			Dissolved Lead (Pb)	2023/10/11	NC		%	20
			Dissolved Magnesium (Mg)	2023/10/11	0.18		%	20
			Dissolved Manganese (Mn)	2023/10/11	1.3		%	20
			Dissolved Potassium (K)	2023/10/11	1.5		%	20
			Dissolved Selenium (Se)	2023/10/11	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Sodium (Na)	2023/10/11	0.16		%	20
			Dissolved Strontium (Sr)	2023/10/11	1.6		%	20
			Dissolved Zinc (Zn)	2023/10/11	NC		%	20
8972100	SHD	Spiked Blank	Total Dissolved Solids	2023/10/12		95	%	90 - 110
8972100	SHD	Method Blank	Total Dissolved Solids	2023/10/12	<10		mg/L	
8972100	SHD	RPD [XFJ277-02]	Total Dissolved Solids	2023/10/12	0.66		%	20
8973103	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/10/12		90	%	80 - 120
8973103	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/10/12		96	%	80 - 120
8973103	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/10/12	<4.0		mg/L	
8973103	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/10/12	0.60		%	20
8973562	KPJ	Matrix Spike [XFJ283-07]	Total Ammonia-N	2023/10/13		106	%	75 - 125
8973562	KPJ	Spiked Blank	Total Ammonia-N	2023/10/13		101	%	80 - 120
8973562	KPJ	Method Blank	Total Ammonia-N	2023/10/13	<0.050		mg/L	
8973562	KPJ	RPD [XFJ283-07]	Total Ammonia-N	2023/10/13	NC		%	20
8973582	KPJ	Matrix Spike	Total Ammonia-N	2023/10/13		106	%	75 - 125
8973582	KPJ	Spiked Blank	Total Ammonia-N	2023/10/13		103	%	80 - 120
8973582	KPJ	Method Blank	Total Ammonia-N	2023/10/13	<0.050		mg/L	
8973582	KPJ	RPD	Total Ammonia-N	2023/10/13	NC		%	20
8973856	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/10/12		100	%	80 - 120
8973856	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/10/12		96	%	80 - 120
8973856	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/10/12	<4.0		mg/L	
8973856	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/10/12	NC		%	20
8973958	RTY	Matrix Spike [XFJ277-04]	Total Kjeldahl Nitrogen (TKN)	2023/10/12		111	%	80 - 120
8973958	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/10/12		97	%	80 - 120
8973958	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/12		98	%	80 - 120
8973958	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/12	<0.10		mg/L	
8973958	RTY	RPD [XFJ277-04]	Total Kjeldahl Nitrogen (TKN)	2023/10/12	5.7		%	20
8974503	SPC	Matrix Spike	Total Phosphorus	2023/10/12		107	%	80 - 120
8974503	SPC	QC Standard	Total Phosphorus	2023/10/12		114	%	80 - 120
8974503	SPC	Spiked Blank	Total Phosphorus	2023/10/12		105	%	80 - 120
8974503	SPC	Method Blank	Total Phosphorus	2023/10/12	<0.004		mg/L	
8974503	SPC	RPD	Total Phosphorus	2023/10/12	0		%	20
8976310	MUM	Matrix Spike	Total Phosphorus	2023/10/14		101	%	80 - 120
8976310	MUM	QC Standard	Total Phosphorus	2023/10/14		97	%	80 - 120
8976310	MUM	Spiked Blank	Total Phosphorus	2023/10/14		106	%	80 - 120
8976310	MUM	Method Blank	Total Phosphorus	2023/10/14	<0.004		mg/L	
8976310	MUM	RPD	Total Phosphorus	2023/10/14	16		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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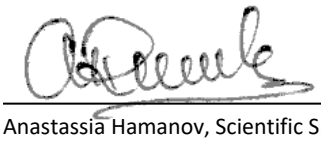
Bureau Veritas Job #: C3V1574
Report Date: 2023/10/16

Golder Associates Ltd
Client Project #: 18108934
Site Location: LIMERICK GROUND WATER
Sampler Initials: KBO

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: LIMERICK
Site Location: Limerick Ground Water
Your C.O.C. #: 957068-02-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866911
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5314
Received: 2023/10/10, 13:57

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2023/10/15	CAM SOP-00448	SM 23 2320 B m
Chloride by Automated Colourimetry	1	N/A	2023/10/16	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	1	N/A	2023/10/17	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/10/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2023/10/16	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	1	N/A	2023/10/17	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2023/10/16		
Total Ammonia-N	1	N/A	2023/10/16	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	1	N/A	2023/10/18	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2023/10/12	2023/10/15	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2023/10/13	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/10/14	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	1	N/A	2023/10/16		Auto Calc
Total Dissolved Solids	1	2023/10/14	2023/10/16	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	1	2023/10/13	2023/10/16	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	1	2023/10/13	2023/10/14	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the

Your Project #: 18108934
Site#: LIMERICK
Site Location: Limerick Ground Water
Your C.O.C. #: 957068-02-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866911
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5314
Received: 2023/10/10, 13:57
customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444
==========
This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas Job #: C3V5314
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Ground Water
Sampler Initials: KB

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XGG591		
Sampling Date		2023/10/10 12:45		
COC Number		957068-02-01		
	UNITS	MW-103D	RDL	QC Batch
Calculated Parameters				
Calculated TDS	mg/L	450	1.0	8973116
Hardness (CaCO3)	mg/L	84	1.0	8974527
Ion Balance (% Difference)	%	2.63	N/A	8973454
Inorganics				
Total Ammonia-N	mg/L	0.17	0.050	8980057
Total Chemical Oxygen Demand (COD)	mg/L	40	4.0	8980244
Total Dissolved Solids	mg/L	520	10	8979735
Total Kjeldahl Nitrogen (TKN)	mg/L	0.29	0.10	8980204
Dissolved Organic Carbon	mg/L	13	0.40	8975500
pH	pH	8.14		8976628
Phenols-4AAP	mg/L	<0.0010	0.0010	8980045
Total Phosphorus	mg/L	0.047	0.004	8980140
Dissolved Sulphate (SO4)	mg/L	56	1.0	8976667
Alkalinity (Total as CaCO3)	mg/L	160	1.0	8976616
Dissolved Chloride (Cl-)	mg/L	110	1.0	8976655
Nitrite (N)	mg/L	<0.010	0.010	8976706
Nitrate (N)	mg/L	<0.10	0.10	8976706
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8976706

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3V5314
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Ground Water
Sampler Initials: KB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XGG591		
Sampling Date		2023/10/10 12:45		
COC Number		957068-02-01		
	UNITS	MW-103D	RDL	QC Batch
Metals				
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	8976939
Dissolved Arsenic (As)	ug/L	<1.0	1.0	8976939
Dissolved Barium (Ba)	ug/L	72	2.0	8976939
Dissolved Boron (B)	ug/L	980	10	8976939
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8976939
Dissolved Calcium (Ca)	ug/L	21000	200	8976939
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8976939
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8976939
Dissolved Iron (Fe)	ug/L	140	100	8976939
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8976939
Dissolved Magnesium (Mg)	ug/L	7900	50	8976939
Dissolved Manganese (Mn)	ug/L	74	2.0	8976939
Dissolved Potassium (K)	ug/L	2600	200	8976939
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8976939
Dissolved Sodium (Na)	ug/L	140000	100	8976939
Dissolved Strontium (Sr)	ug/L	800	1.0	8976939
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	8976939

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8975500	GID	Matrix Spike	Dissolved Organic Carbon	2023/10/12		93	%	80 - 120
8975500	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/12		96	%	80 - 120
8975500	GID	Method Blank	Dissolved Organic Carbon	2023/10/12	<0.40		mg/L	
8975500	GID	RPD	Dissolved Organic Carbon	2023/10/12	7.9		%	20
8976616	YPA	Spiked Blank	Alkalinity (Total as CaCO3)	2023/10/15		98	%	85 - 115
8976616	YPA	Method Blank	Alkalinity (Total as CaCO3)	2023/10/15	<1.0		mg/L	
8976616	YPA	RPD [XGG591-01]	Alkalinity (Total as CaCO3)	2023/10/15	0.56		%	20
8976628	YPA	Spiked Blank	pH	2023/10/15		102	%	98 - 103
8976628	YPA	RPD [XGG591-01]	pH	2023/10/15	0.96		%	N/A
8976655	MJ1	Matrix Spike	Dissolved Chloride (Cl-)	2023/10/16		97	%	80 - 120
8976655	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/10/16		100	%	80 - 120
8976655	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/10/16	<1.0		mg/L	
8976655	MJ1	RPD	Dissolved Chloride (Cl-)	2023/10/16	1.6		%	20
8976667	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2023/10/14		NC	%	75 - 125
8976667	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/10/14		100	%	80 - 120
8976667	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/10/14	<1.0		mg/L	
8976667	ADB	RPD	Dissolved Sulphate (SO4)	2023/10/14	0.049		%	20
8976706	C_N	Matrix Spike	Nitrite (N)	2023/10/18		65 (1)	%	80 - 120
			Nitrate (N)	2023/10/18		84	%	80 - 120
8976706	C_N	Spiked Blank	Nitrite (N)	2023/10/18		105	%	80 - 120
			Nitrate (N)	2023/10/18		99	%	80 - 120
8976706	C_N	Method Blank	Nitrite (N)	2023/10/18	<0.010		mg/L	
			Nitrate (N)	2023/10/18	<0.10		mg/L	
8976706	C_N	RPD	Nitrite (N)	2023/10/18	NC		%	20
			Nitrate (N)	2023/10/18	NC		%	20
8976939	IHP	Matrix Spike	Dissolved Aluminum (Al)	2023/10/17		99	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		100	%	80 - 120
			Dissolved Barium (Ba)	2023/10/17		105	%	80 - 120
			Dissolved Boron (B)	2023/10/17		94	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		102	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		96	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		99	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		99	%	80 - 120
			Dissolved Lead (Pb)	2023/10/17		96	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		90	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		97	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		101	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		98	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		101	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		92	%	80 - 120
8976939	IHP	Spiked Blank	Dissolved Aluminum (Al)	2023/10/17		97	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		99	%	80 - 120
			Dissolved Barium (Ba)	2023/10/17		105	%	80 - 120
			Dissolved Boron (B)	2023/10/17		91	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		99	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		100	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		95	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		96	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		98	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Lead (Pb)	2023/10/17		95	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		93	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		96	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		100	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		96	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		93	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		100	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		93	%	80 - 120
8976939	IHP	Method Blank	Dissolved Aluminum (Al)	2023/10/17	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/10/17	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/10/17	<2.0		ug/L	
			Dissolved Boron (B)	2023/10/17	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/10/17	<0.090		ug/L	
			Dissolved Calcium (Ca)	2023/10/17	<200		ug/L	
			Dissolved Chromium (Cr)	2023/10/17	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/10/17	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/10/17	<100		ug/L	
			Dissolved Lead (Pb)	2023/10/17	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/10/17	<50		ug/L	
			Dissolved Manganese (Mn)	2023/10/17	<2.0		ug/L	
			Dissolved Potassium (K)	2023/10/17	<200		ug/L	
			Dissolved Selenium (Se)	2023/10/17	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/10/17	<100		ug/L	
			Dissolved Strontium (Sr)	2023/10/17	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/10/17	<5.0		ug/L	
8976939	IHP	RPD	Dissolved Aluminum (Al)	2023/10/17	NC		%	20
			Dissolved Arsenic (As)	2023/10/17	NC		%	20
			Dissolved Barium (Ba)	2023/10/17	0.55		%	20
			Dissolved Boron (B)	2023/10/17	1.9		%	20
			Dissolved Cadmium (Cd)	2023/10/17	NC		%	20
			Dissolved Calcium (Ca)	2023/10/17	0.42		%	20
			Dissolved Chromium (Cr)	2023/10/17	NC		%	20
			Dissolved Copper (Cu)	2023/10/17	4.3		%	20
			Dissolved Iron (Fe)	2023/10/17	NC		%	20
			Dissolved Lead (Pb)	2023/10/17	NC		%	20
			Dissolved Magnesium (Mg)	2023/10/17	1.2		%	20
			Dissolved Manganese (Mn)	2023/10/17	4.7		%	20
			Dissolved Potassium (K)	2023/10/17	0.056		%	20
			Dissolved Selenium (Se)	2023/10/17	NC		%	20
			Dissolved Sodium (Na)	2023/10/17	0.79		%	20
			Dissolved Strontium (Sr)	2023/10/17	0.086		%	20
			Dissolved Zinc (Zn)	2023/10/17	NC		%	20
8979735	SHD	Spiked Blank	Total Dissolved Solids	2023/10/16		100	%	90 - 110
8979735	SHD	Method Blank	Total Dissolved Solids	2023/10/16	<10		mg/L	
8979735	SHD	RPD	Total Dissolved Solids	2023/10/16	1.4		%	20
8980045	CPO	Matrix Spike	Phenols-4AAP	2023/10/13		92	%	80 - 120
8980045	CPO	Spiked Blank	Phenols-4AAP	2023/10/13		101	%	80 - 120
8980045	CPO	Method Blank	Phenols-4AAP	2023/10/13	<0.0010		mg/L	
8980045	CPO	RPD	Phenols-4AAP	2023/10/13	NC		%	20
8980057	KPJ	Matrix Spike [XGG591-07]	Total Ammonia-N	2023/10/16		100	%	75 - 125
8980057	KPJ	Spiked Blank	Total Ammonia-N	2023/10/16		101	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8980057	KPJ	Method Blank	Total Ammonia-N	2023/10/16	<0.050		mg/L	
8980057	KPJ	RPD [XGG591-07]	Total Ammonia-N	2023/10/16	15		%	20
8980140	MUM	Matrix Spike	Total Phosphorus	2023/10/14		104	%	80 - 120
8980140	MUM	QC Standard	Total Phosphorus	2023/10/14		101	%	80 - 120
8980140	MUM	Spiked Blank	Total Phosphorus	2023/10/14		100	%	80 - 120
8980140	MUM	Method Blank	Total Phosphorus	2023/10/14	<0.004		mg/L	
8980140	MUM	RPD	Total Phosphorus	2023/10/14	10		%	20
8980204	KJP	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/10/16		100	%	80 - 120
8980204	KJP	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/10/16		97	%	80 - 120
8980204	KJP	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16		104	%	80 - 120
8980204	KJP	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16	<0.10		mg/L	
8980204	KJP	RPD	Total Kjeldahl Nitrogen (TKN)	2023/10/16	NC		%	20
8980244	NS3	Matrix Spike [XGG591-05]	Total Chemical Oxygen Demand (COD)	2023/10/17		89	%	80 - 120
8980244	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/10/17		94	%	80 - 120
8980244	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/10/17	<4.0		mg/L	
8980244	NS3	RPD [XGG591-05]	Total Chemical Oxygen Demand (COD)	2023/10/17	9.1		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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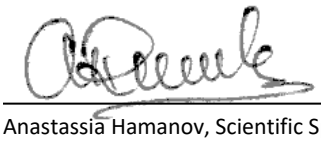
Bureau Veritas Job #: C3V5314
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Ground Water
Sampler Initials: KB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site Location: Limerick Leachate
Your C.O.C. #: 957070-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866852
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5012
Received: 2023/10/10, 14:01

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2023/10/15	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	1	2023/10/12	2023/10/17	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	1	N/A	2023/10/16	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	1	N/A	2023/10/13	CAM SOP-00416	SM 23 5220 D m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2023/10/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2023/10/18	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	1	N/A	2023/10/17	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2023/10/18		
Total Ammonia-N	1	N/A	2023/10/17	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	1	N/A	2023/10/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	1	2023/10/12	2023/10/15	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2023/10/13	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/10/14	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	1	N/A	2023/10/18		Auto Calc
Total Dissolved Solids	1	2023/10/14	2023/10/16	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	1	2023/10/13	2023/10/16	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	1	2023/10/13	2023/10/16	CAM SOP-00407	SM 23 4500-P I

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report.

Your Project #: 18108934
Site Location: Limerick Leachate
Your C.O.C. #: 957070-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866852
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5012

Received: 2023/10/10, 14:01

Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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Bureau Veritas Job #: C3V5012
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Leachate
Sampler Initials: KB

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XGE547		
Sampling Date		2023/10/10 11:15		
COC Number		957070-01-01		
	UNITS	LW-101	RDL	QC Batch
Calculated Parameters				
Calculated TDS	mg/L	1400	1.0	8973116
Hardness (CaCO3)	mg/L	710	1.0	8972316
Ion Balance (% Difference)	%	4.82	N/A	8973454
Inorganics				
Total Ammonia-N	mg/L	92	1.0	8976800
Total BOD	mg/L	<2	2	8975338
Total Chemical Oxygen Demand (COD)	mg/L	80	4.0	8978451
Total Dissolved Solids	mg/L	1160	10	8981133
Total Kjeldahl Nitrogen (TKN)	mg/L	81	5.0	8978504
Dissolved Organic Carbon	mg/L	23	0.40	8975500
pH	pH	7.50		8976628
Phenols-4AAP	mg/L	0.0032	0.0010	8980045
Total Phosphorus	mg/L	0.16	0.020	8979635
Dissolved Sulphate (SO4)	mg/L	1.1	1.0	8976667
Alkalinity (Total as CaCO3)	mg/L	1100	1.0	8976616
Dissolved Chloride (Cl-)	mg/L	190	2.0	8976655
Nitrite (N)	mg/L	<0.010	0.010	8976329
Nitrate (N)	mg/L	<0.10	0.10	8976329
Nitrate + Nitrite (N)	mg/L	<0.10	0.10	8976329

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Bureau Veritas Job #: C3V5012
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Leachate
Sampler Initials: KB

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XGE547		
Sampling Date		2023/10/10 11:15		
COC Number		957070-01-01		
	UNITS	LW-101	RDL	QC Batch
Metals				
Dissolved Aluminum (Al)	ug/L	11	4.9	8976939
Dissolved Arsenic (As)	ug/L	1.4	1.0	8976939
Dissolved Barium (Ba)	ug/L	780	2.0	8976939
Dissolved Boron (B)	ug/L	1500	10	8976939
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	8976939
Dissolved Calcium (Ca)	ug/L	170000	200	8976939
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	8976939
Dissolved Copper (Cu)	ug/L	<0.90	0.90	8976939
Dissolved Iron (Fe)	ug/L	27000	100	8976939
Dissolved Lead (Pb)	ug/L	<0.50	0.50	8976939
Dissolved Magnesium (Mg)	ug/L	69000	50	8976939
Dissolved Manganese (Mn)	ug/L	120	2.0	8976939
Dissolved Potassium (K)	ug/L	57000	200	8976939
Dissolved Selenium (Se)	ug/L	<2.0	2.0	8976939
Dissolved Sodium (Na)	ug/L	140000	100	8976939
Dissolved Strontium (Sr)	ug/L	1800	1.0	8976939
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	8976939

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Sample XGE547 [LW-101] : TKN < Ammonia: Both values fall within the method uncertainty for duplicates and are likely equivalent.

Results relate only to the items tested.

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Bureau Veritas Job #: C3V5012
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Leachate
Sampler Initials: KB

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8975338	GUJ	QC Standard	Total BOD	2023/10/17		93	%	80 - 120
8975338	GUJ	Method Blank	Total BOD	2023/10/17	<2		mg/L	
8975338	GUJ	RPD	Total BOD	2023/10/17	6.3		%	30
8975500	GID	Matrix Spike	Dissolved Organic Carbon	2023/10/12		93	%	80 - 120
8975500	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/12		96	%	80 - 120
8975500	GID	Method Blank	Dissolved Organic Carbon	2023/10/12	<0.40		mg/L	
8975500	GID	RPD	Dissolved Organic Carbon	2023/10/12	7.9		%	20
8976329	C_N	Matrix Spike	Nitrite (N)	2023/10/14		100	%	80 - 120
			Nitrate (N)	2023/10/14		94	%	80 - 120
8976329	C_N	Spiked Blank	Nitrite (N)	2023/10/14		105	%	80 - 120
			Nitrate (N)	2023/10/14		95	%	80 - 120
8976329	C_N	Method Blank	Nitrite (N)	2023/10/14	<0.010		mg/L	
			Nitrate (N)	2023/10/14	<0.10		mg/L	
8976329	C_N	RPD	Nitrite (N)	2023/10/14	5.8		%	20
			Nitrate (N)	2023/10/14	NC		%	20
8976616	YPA	Spiked Blank	Alkalinity (Total as CaCO3)	2023/10/15		98	%	85 - 115
8976616	YPA	Method Blank	Alkalinity (Total as CaCO3)	2023/10/15	<1.0		mg/L	
8976616	YPA	RPD	Alkalinity (Total as CaCO3)	2023/10/15	0.56		%	20
8976628	YPA	Spiked Blank	pH	2023/10/15		102	%	98 - 103
8976628	YPA	RPD	pH	2023/10/15	0.96		%	N/A
8976655	MJ1	Matrix Spike	Dissolved Chloride (Cl-)	2023/10/16		97	%	80 - 120
8976655	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/10/16		100	%	80 - 120
8976655	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/10/16	<1.0		mg/L	
8976655	MJ1	RPD	Dissolved Chloride (Cl-)	2023/10/16	1.6		%	20
8976667	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2023/10/14		NC	%	75 - 125
8976667	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/10/14		100	%	80 - 120
8976667	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/10/14	<1.0		mg/L	
8976667	ADB	RPD	Dissolved Sulphate (SO4)	2023/10/14	0.049		%	20
8976800	KPJ	Matrix Spike	Total Ammonia-N	2023/10/13		100	%	75 - 125
8976800	KPJ	Spiked Blank	Total Ammonia-N	2023/10/13		104	%	80 - 120
8976800	KPJ	Method Blank	Total Ammonia-N	2023/10/13	<0.050		mg/L	
8976800	KPJ	RPD	Total Ammonia-N	2023/10/13	2.3		%	20
8976939	IHP	Matrix Spike	Dissolved Aluminum (Al)	2023/10/17		99	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		100	%	80 - 120
			Dissolved Barium (Ba)	2023/10/17		105	%	80 - 120
			Dissolved Boron (B)	2023/10/17		94	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		102	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		96	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		99	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		99	%	80 - 120
			Dissolved Lead (Pb)	2023/10/17		96	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		90	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		97	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		101	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		98	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		101	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		92	%	80 - 120
8976939	IHP	Spiked Blank	Dissolved Aluminum (Al)	2023/10/17		97	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		99	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Barium (Ba)	2023/10/17		105	%	80 - 120
			Dissolved Boron (B)	2023/10/17		91	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		99	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		100	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		95	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		96	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		98	%	80 - 120
			Dissolved Lead (Pb)	2023/10/17		95	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		93	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		96	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		100	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		96	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		93	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		100	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		93	%	80 - 120
8976939	IHP	Method Blank	Dissolved Aluminum (Al)	2023/10/17	<4.9		ug/L	
			Dissolved Arsenic (As)	2023/10/17	<1.0		ug/L	
			Dissolved Barium (Ba)	2023/10/17	<2.0		ug/L	
			Dissolved Boron (B)	2023/10/17	<10		ug/L	
			Dissolved Cadmium (Cd)	2023/10/17	<0.090		ug/L	
			Dissolved Calcium (Ca)	2023/10/17	<200		ug/L	
			Dissolved Chromium (Cr)	2023/10/17	<5.0		ug/L	
			Dissolved Copper (Cu)	2023/10/17	<0.90		ug/L	
			Dissolved Iron (Fe)	2023/10/17	<100		ug/L	
			Dissolved Lead (Pb)	2023/10/17	<0.50		ug/L	
			Dissolved Magnesium (Mg)	2023/10/17	<50		ug/L	
			Dissolved Manganese (Mn)	2023/10/17	<2.0		ug/L	
			Dissolved Potassium (K)	2023/10/17	<200		ug/L	
			Dissolved Selenium (Se)	2023/10/17	<2.0		ug/L	
			Dissolved Sodium (Na)	2023/10/17	<100		ug/L	
			Dissolved Strontium (Sr)	2023/10/17	<1.0		ug/L	
			Dissolved Zinc (Zn)	2023/10/17	<5.0		ug/L	
8976939	IHP	RPD	Dissolved Aluminum (Al)	2023/10/17	NC		%	20
			Dissolved Arsenic (As)	2023/10/17	NC		%	20
			Dissolved Barium (Ba)	2023/10/17	0.55		%	20
			Dissolved Boron (B)	2023/10/17	1.9		%	20
			Dissolved Cadmium (Cd)	2023/10/17	NC		%	20
			Dissolved Calcium (Ca)	2023/10/17	0.42		%	20
			Dissolved Chromium (Cr)	2023/10/17	NC		%	20
			Dissolved Copper (Cu)	2023/10/17	4.3		%	20
			Dissolved Iron (Fe)	2023/10/17	NC		%	20
			Dissolved Lead (Pb)	2023/10/17	NC		%	20
			Dissolved Magnesium (Mg)	2023/10/17	1.2		%	20
			Dissolved Manganese (Mn)	2023/10/17	4.7		%	20
			Dissolved Potassium (K)	2023/10/17	0.056		%	20
			Dissolved Selenium (Se)	2023/10/17	NC		%	20
			Dissolved Sodium (Na)	2023/10/17	0.79		%	20
			Dissolved Strontium (Sr)	2023/10/17	0.086		%	20
			Dissolved Zinc (Zn)	2023/10/17	NC		%	20
8978451	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/10/13		94	%	80 - 120
8978451	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/10/13		95	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8978451	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/10/13	<4.0		mg/L	
8978451	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/10/13	3.9		%	20
8978504	KJP	Matrix Spike	Total Kjeldahl Nitrogen (TKN)	2023/10/16		104	%	80 - 120
8978504	KJP	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/10/16		98	%	80 - 120
8978504	KJP	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16		99	%	80 - 120
8978504	KJP	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16	<0.10		mg/L	
8978504	KJP	RPD	Total Kjeldahl Nitrogen (TKN)	2023/10/16	12		%	20
8979635	SPC	Matrix Spike	Total Phosphorus	2023/10/16		102	%	80 - 120
8979635	SPC	QC Standard	Total Phosphorus	2023/10/16		107	%	80 - 120
8979635	SPC	Spiked Blank	Total Phosphorus	2023/10/16		107	%	80 - 120
8979635	SPC	Method Blank	Total Phosphorus	2023/10/16	<0.020		mg/L	
8979635	SPC	RPD	Total Phosphorus	2023/10/16	5.6		%	20
8980045	CPO	Matrix Spike	Phenols-4AAP	2023/10/13		92	%	80 - 120
8980045	CPO	Spiked Blank	Phenols-4AAP	2023/10/13		101	%	80 - 120
8980045	CPO	Method Blank	Phenols-4AAP	2023/10/13	<0.0010		mg/L	
8980045	CPO	RPD	Phenols-4AAP	2023/10/13	NC		%	20
8981133	SHD	Spiked Blank	Total Dissolved Solids	2023/10/16		97	%	90 - 110
8981133	SHD	Method Blank	Total Dissolved Solids	2023/10/16	<10		mg/L	
8981133	SHD	RPD	Total Dissolved Solids	2023/10/16	3.6		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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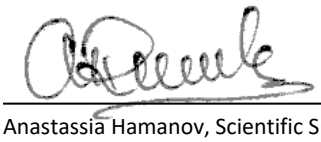
Bureau Veritas Job #: C3V5012
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Leachate
Sampler Initials: KB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

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Your Project #: 18108934
Site#: LIMERICK
Site Location: Limerick Surface Water
Your C.O.C. #: 957071-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866698
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5306
Received: 2023/10/10, 13:53

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Dissolved Aluminum (0.2 u, clay free)	2	N/A	2023/10/16	CAM SOP-00447	EPA 6020B m
Alkalinity	2	N/A	2023/10/15	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	2	2023/10/12	2023/10/17	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	2	N/A	2023/10/16	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	2	N/A	2023/10/13	CAM SOP-00416	SM 23 5220 D m
Colour	2	N/A	2023/10/17	CAM SOP-00412	SM 23 2120C m
Chromium (VI) in Water	2	N/A	2023/10/13	CAM SOP-00436	EPA 7199 m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2023/10/12	CAM SOP-00446	SM 23 5310 B m
Hardness (calculated as CaCO3)	2	N/A	2023/10/17	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals Analysis by ICP	2	2023/10/12	2023/10/17	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	2	2023/10/16	2023/10/16	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	2	N/A	2023/10/17		
Total Ammonia-N	1	N/A	2023/10/13	CAM SOP-00441	USGS I-2522-90 m
Total Ammonia-N	1	N/A	2023/10/17	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (2)	2	N/A	2023/10/14	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2023/10/12	2023/10/15	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	2	N/A	2023/10/13	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	2	N/A	2023/10/14	CAM SOP-00464	SM 23 4500-SO42- E m
Total Dissolved Solids (TDS calc)	2	N/A	2023/10/17		Auto Calc
Total Dissolved Solids	2	2023/10/14	2023/10/16	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	2	2023/10/12	2023/10/16	CAM SOP-00938	OMOE E3516 m
Total Organic Carbon (TOC) (3)	2	N/A	2023/10/13	CAM SOP-00446	SM 23 5310B m
Total Phosphorus (Colourimetric)	2	2023/10/12	2023/10/14	CAM SOP-00407	SM 23 4500-P I
Low Level Total Suspended Solids	2	2023/10/16	2023/10/17	CAM SOP-00428	SM 23 2540D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

Your Project #: 18108934
Site#: LIMERICK
Site Location: Limerick Surface Water
Your C.O.C. #: 957071-01-01

Attention: Fabiano Gondim

Golder Associates Ltd
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/10/18
Report #: R7866698
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3V5306

Received: 2023/10/10, 13:53

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.
(3) Total Organic Carbon (TOC) present in the sample should be considered as non-purgeable TOC.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Christine Gripton, Senior Project Manager
Email: Christine.Gripton@bureauveritas.com
Phone# (519)652-9444

==========

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Bureau Veritas Job #: C3V5306
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Surface Water
Sampler Initials: KB

RESULTS OF ANALYSES OF WATER

Bureau Veritas ID		XGG470		XGG476		
Sampling Date		2023/10/10 12:20		2023/10/10 11:45		
COC Number		957071-01-01		957071-01-01		
	UNITS	LIM-1	QC Batch	LIM-2	RDL	QC Batch
Calculated Parameters						
Calculated TDS	mg/L	440	8973116	440	1.0	8973116
Hardness (CaCO3)	mg/L	390	8974527	390	1.0	8974527
Ion Balance (% Difference)	%	5.17	8973454	5.66	N/A	8973454
Inorganics						
Total Ammonia-N	mg/L	0.32	8976800	0.11	0.050	8976744
Total BOD	mg/L	<2	8975338	<2	2	8975338
Total Chemical Oxygen Demand (COD)	mg/L	19	8978451	23	4.0	8978451
Colour	TCU	25	8982154	25	2	8982154
Total Dissolved Solids	mg/L	490	8979735	505	10	8979735
Total Kjeldahl Nitrogen (TKN)	mg/L	0.87	8976193	0.47	0.10	8976193
Dissolved Organic Carbon	mg/L	7.4	8975500	7.4	0.40	8975500
Total Organic Carbon (TOC)	mg/L	8.0	8977454	7.8	0.40	8977454
pH	pH	8.39	8976628	8.32		8976628
Phenols-4AAP	mg/L	0.0027	8980045	<0.0010	0.0010	8980045
Total Phosphorus	mg/L	0.022	8976310	0.030	0.004	8976310
Total Suspended Solids	mg/L	2	8982731	5	1	8982731
Dissolved Sulphate (SO4)	mg/L	39	8976667	40	1.0	8976667
Alkalinity (Total as CaCO3)	mg/L	280	8976616	280	1.0	8976616
Dissolved Chloride (Cl-)	mg/L	41	8976655	44	1.0	8976655
Nitrite (N)	mg/L	<0.010	8976329	<0.010	0.010	8976329
Nitrate (N)	mg/L	2.16	8976329	2.13	0.10	8976329
Nitrate + Nitrite (N)	mg/L	2.16	8976329	2.13	0.10	8976329

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XGG470	XGG476		
Sampling Date		2023/10/10 12:20	2023/10/10 11:45		
COC Number		957071-01-01	957071-01-01		
	UNITS	LIM-1	LIM-2	RDL	QC Batch
Metals					
Dissolved Aluminum (Al)	mg/L	<0.1	<0.1	0.1	8976314
Dissolved (0.2u) Aluminum (Al)	ug/L	<5	<5	5	8976321
Dissolved Antimony (Sb)	mg/L	<0.2	<0.2	0.2	8976314
Dissolved Arsenic (As)	mg/L	<0.2	<0.2	0.2	8976314
Dissolved Barium (Ba)	mg/L	0.067	0.071	0.005	8976314
Dissolved Beryllium (Be)	mg/L	<0.001	<0.001	0.001	8976314
Dissolved Boron (B)	mg/L	0.02	0.03	0.02	8976314
Dissolved Cadmium (Cd)	mg/L	<0.005	<0.005	0.005	8976314
Dissolved Calcium (Ca)	mg/L	120	130	0.05	8976314
Dissolved Chromium (Cr)	mg/L	<0.01	<0.01	0.01	8976314
Chromium (VI)	ug/L	<0.50	<0.50	0.50	8978148
Dissolved Cobalt (Co)	mg/L	<0.02	<0.02	0.02	8976314
Dissolved Copper (Cu)	mg/L	<0.02	<0.02	0.02	8976314
Dissolved Iron (Fe)	mg/L	0.03	0.03	0.02	8976314
Dissolved Lead (Pb)	mg/L	<0.05	<0.05	0.05	8976314
Dissolved Magnesium (Mg)	mg/L	19	19	0.05	8976314
Dissolved Manganese (Mn)	mg/L	0.04	0.06	0.01	8976314
Dissolved Molybdenum (Mo)	mg/L	<0.02	<0.02	0.02	8976314
Dissolved Nickel (Ni)	mg/L	<0.05	<0.05	0.05	8976314
Dissolved Phosphorus (P)	mg/L	<0.1	<0.1	0.1	8976314
Dissolved Potassium (K)	mg/L	9	9	1	8976314
Dissolved Selenium (Se)	mg/L	<0.2	<0.2	0.2	8976314
Dissolved Silicon (Si)	mg/L	5.5	5.5	0.2	8976314
Dissolved Silver (Ag)	mg/L	<0.01	<0.01	0.01	8976314
Dissolved Sodium (Na)	mg/L	14	15	0.5	8976314
Dissolved Strontium (Sr)	mg/L	0.34	0.35	0.005	8976314
Dissolved Sulphur (S)	mg/L	12	12	0.5	8976314
Dissolved Tin (Sn)	mg/L	<0.2	<0.2	0.2	8976314
Dissolved Titanium (Ti)	mg/L	<0.01	<0.01	0.01	8976314
Dissolved Vanadium (V)	mg/L	<0.01	<0.01	0.01	8976314
Dissolved Zinc (Zn)	mg/L	<0.01	<0.01	0.01	8976314
Total Aluminum (Al)	ug/L	28	68	4.9	8982719
Total Antimony (Sb)	ug/L	<0.50	<0.50	0.50	8982719

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		XGG470	XGG476		
Sampling Date		2023/10/10 12:20	2023/10/10 11:45		
COC Number		957071-01-01	957071-01-01		
	UNITS	LIM-1	LIM-2	RDL	QC Batch
Total Arsenic (As)	ug/L	<1.0	<1.0	1.0	8982719
Total Barium (Ba)	ug/L	62	66	2.0	8982719
Total Beryllium (Be)	ug/L	<0.40	<0.40	0.40	8982719
Total Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	8982719
Total Boron (B)	ug/L	25	25	10	8982719
Total Cadmium (Cd)	ug/L	<0.090	<0.090	0.090	8982719
Total Calcium (Ca)	ug/L	120000	120000	200	8982719
Total Chromium (Cr)	ug/L	<5.0	<5.0	5.0	8982719
Total Cobalt (Co)	ug/L	<0.50	<0.50	0.50	8982719
Total Copper (Cu)	ug/L	1.2	1.1	0.90	8982719
Total Iron (Fe)	ug/L	130	260	100	8982719
Total Lead (Pb)	ug/L	<0.50	<0.50	0.50	8982719
Total Lithium (Li)	ug/L	<5.0	<5.0	5.0	8982719
Total Magnesium (Mg)	ug/L	19000	18000	50	8982719
Total Manganese (Mn)	ug/L	45	69	2.0	8982719
Total Molybdenum (Mo)	ug/L	3.1	3.1	0.50	8982719
Total Nickel (Ni)	ug/L	1.1	1.2	1.0	8982719
Total Potassium (K)	ug/L	8400	8200	200	8982719
Total Selenium (Se)	ug/L	<2.0	<2.0	2.0	8982719
Total Silicon (Si)	ug/L	5700	5500	50	8982719
Total Silver (Ag)	ug/L	<0.090	<0.090	0.090	8982719
Total Sodium (Na)	ug/L	14000	16000	100	8982719
Total Strontium (Sr)	ug/L	310	320	1.0	8982719
Total Tellurium (Te)	ug/L	<1.0	<1.0	1.0	8982719
Total Thallium (Tl)	ug/L	<0.050	<0.050	0.050	8982719
Total Tin (Sn)	ug/L	<1.0	<1.0	1.0	8982719
Total Titanium (Ti)	ug/L	<5.0	<5.0	5.0	8982719
Total Tungsten (W)	ug/L	<1.0	<1.0	1.0	8982719
Total Uranium (U)	ug/L	2.5	2.6	0.10	8982719
Total Vanadium (V)	ug/L	0.71	0.77	0.50	8982719
Total Zinc (Zn)	ug/L	<5.0	<5.0	5.0	8982719
Total Zirconium (Zr)	ug/L	<1.0	<1.0	1.0	8982719

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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GENERAL COMMENTS

Results relate only to the items tested.

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Bureau Veritas Job #: C3V5306
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Surface Water
Sampler Initials: KB

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8975338	GUJ	QC Standard	Total BOD	2023/10/17		93	%	80 - 120
8975338	GUJ	Method Blank	Total BOD	2023/10/17	<2		mg/L	
8975338	GUJ	RPD	Total BOD	2023/10/17	6.3		%	30
8975500	GID	Matrix Spike	Dissolved Organic Carbon	2023/10/12		93	%	80 - 120
8975500	GID	Spiked Blank	Dissolved Organic Carbon	2023/10/12		96	%	80 - 120
8975500	GID	Method Blank	Dissolved Organic Carbon	2023/10/12	<0.40		mg/L	
8975500	GID	RPD	Dissolved Organic Carbon	2023/10/12	7.9		%	20
8976193	RTY	Matrix Spike [XGG470-07]	Total Kjeldahl Nitrogen (TKN)	2023/10/16		112	%	80 - 120
8976193	RTY	QC Standard	Total Kjeldahl Nitrogen (TKN)	2023/10/16		101	%	80 - 120
8976193	RTY	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16		106	%	80 - 120
8976193	RTY	Method Blank	Total Kjeldahl Nitrogen (TKN)	2023/10/16	<0.10		mg/L	
8976193	RTY	RPD [XGG470-07]	Total Kjeldahl Nitrogen (TKN)	2023/10/16	11		%	20
8976310	MUM	Matrix Spike	Total Phosphorus	2023/10/14		101	%	80 - 120
8976310	MUM	QC Standard	Total Phosphorus	2023/10/14		97	%	80 - 120
8976310	MUM	Spiked Blank	Total Phosphorus	2023/10/14		106	%	80 - 120
8976310	MUM	Method Blank	Total Phosphorus	2023/10/14	<0.004		mg/L	
8976310	MUM	RPD	Total Phosphorus	2023/10/14	16		%	20
8976314	SUK	Matrix Spike [XGG476-03]	Dissolved Aluminum (Al)	2023/10/17		97	%	80 - 120
			Dissolved Antimony (Sb)	2023/10/17		83	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		94	%	80 - 120
			Dissolved Barium (Ba)	2023/10/17		95	%	80 - 120
			Dissolved Beryllium (Be)	2023/10/17		95	%	80 - 120
			Dissolved Boron (B)	2023/10/17		96	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		95	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		NC	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		96	%	80 - 120
			Dissolved Cobalt (Co)	2023/10/17		96	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		95	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		95	%	80 - 120
			Dissolved Lead (Pb)	2023/10/17		94	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		NC	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		96	%	80 - 120
			Dissolved Molybdenum (Mo)	2023/10/17		94	%	80 - 120
			Dissolved Nickel (Ni)	2023/10/17		94	%	80 - 120
			Dissolved Phosphorus (P)	2023/10/17		96	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		90	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		97	%	80 - 120
			Dissolved Silicon (Si)	2023/10/17		NC	%	80 - 120
			Dissolved Silver (Ag)	2023/10/17		96	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		NC	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		89	%	80 - 120
			Dissolved Sulphur (S)	2023/10/17		NC	%	80 - 120
			Dissolved Tin (Sn)	2023/10/17		93	%	80 - 120
			Dissolved Titanium (Ti)	2023/10/17		95	%	80 - 120
			Dissolved Vanadium (V)	2023/10/17		96	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		95	%	80 - 120
8976314	SUK	Spiked Blank	Dissolved Aluminum (Al)	2023/10/17		99	%	80 - 120
			Dissolved Antimony (Sb)	2023/10/17		84	%	80 - 120
			Dissolved Arsenic (As)	2023/10/17		97	%	80 - 120
			Dissolved Barium (Ba)	2023/10/17		99	%	80 - 120
			Dissolved Beryllium (Be)	2023/10/17		98	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Boron (B)	2023/10/17		99	%	80 - 120
			Dissolved Cadmium (Cd)	2023/10/17		98	%	80 - 120
			Dissolved Calcium (Ca)	2023/10/17		99	%	80 - 120
			Dissolved Chromium (Cr)	2023/10/17		101	%	80 - 120
			Dissolved Cobalt (Co)	2023/10/17		101	%	80 - 120
			Dissolved Copper (Cu)	2023/10/17		99	%	80 - 120
			Dissolved Iron (Fe)	2023/10/17		100	%	80 - 120
			Dissolved Lead (Pb)	2023/10/17		100	%	80 - 120
			Dissolved Magnesium (Mg)	2023/10/17		98	%	80 - 120
			Dissolved Manganese (Mn)	2023/10/17		101	%	80 - 120
			Dissolved Molybdenum (Mo)	2023/10/17		96	%	80 - 120
			Dissolved Nickel (Ni)	2023/10/17		99	%	80 - 120
			Dissolved Phosphorus (P)	2023/10/17		98	%	80 - 120
			Dissolved Potassium (K)	2023/10/17		100	%	80 - 120
			Dissolved Selenium (Se)	2023/10/17		98	%	80 - 120
			Dissolved Silicon (Si)	2023/10/17		102	%	80 - 120
			Dissolved Silver (Ag)	2023/10/17		102	%	80 - 120
			Dissolved Sodium (Na)	2023/10/17		100	%	80 - 120
			Dissolved Strontium (Sr)	2023/10/17		97	%	80 - 120
			Dissolved Sulphur (S)	2023/10/17		97	%	80 - 120
			Dissolved Tin (Sn)	2023/10/17		97	%	80 - 120
			Dissolved Titanium (Ti)	2023/10/17		97	%	80 - 120
			Dissolved Vanadium (V)	2023/10/17		99	%	80 - 120
			Dissolved Zinc (Zn)	2023/10/17		100	%	80 - 120
8976314	SUK	Method Blank	Dissolved Aluminum (Al)	2023/10/17	<0.1		mg/L	
			Dissolved Antimony (Sb)	2023/10/17	<0.2		mg/L	
			Dissolved Arsenic (As)	2023/10/17	<0.2		mg/L	
			Dissolved Barium (Ba)	2023/10/17	<0.005		mg/L	
			Dissolved Beryllium (Be)	2023/10/17	<0.001		mg/L	
			Dissolved Boron (B)	2023/10/17	<0.02		mg/L	
			Dissolved Cadmium (Cd)	2023/10/17	<0.005		mg/L	
			Dissolved Calcium (Ca)	2023/10/17	<0.05		mg/L	
			Dissolved Chromium (Cr)	2023/10/17	<0.01		mg/L	
			Dissolved Cobalt (Co)	2023/10/17	<0.02		mg/L	
			Dissolved Copper (Cu)	2023/10/17	<0.02		mg/L	
			Dissolved Iron (Fe)	2023/10/17	<0.02		mg/L	
			Dissolved Lead (Pb)	2023/10/17	<0.05		mg/L	
			Dissolved Magnesium (Mg)	2023/10/17	<0.05		mg/L	
			Dissolved Manganese (Mn)	2023/10/17	<0.01		mg/L	
			Dissolved Molybdenum (Mo)	2023/10/17	<0.02		mg/L	
			Dissolved Nickel (Ni)	2023/10/17	<0.05		mg/L	
			Dissolved Phosphorus (P)	2023/10/17	<0.1		mg/L	
			Dissolved Potassium (K)	2023/10/17	<1		mg/L	
			Dissolved Selenium (Se)	2023/10/17	<0.2		mg/L	
			Dissolved Silicon (Si)	2023/10/17	<0.2		mg/L	
			Dissolved Silver (Ag)	2023/10/17	<0.01		mg/L	
			Dissolved Sodium (Na)	2023/10/17	<0.5		mg/L	
			Dissolved Strontium (Sr)	2023/10/17	<0.005		mg/L	
			Dissolved Sulphur (S)	2023/10/17	<0.5		mg/L	
			Dissolved Tin (Sn)	2023/10/17	<0.2		mg/L	
			Dissolved Titanium (Ti)	2023/10/17	<0.01		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Dissolved Vanadium (V)	2023/10/17	<0.01		mg/L	
			Dissolved Zinc (Zn)	2023/10/17	<0.01		mg/L	
8976314	SUK	RPD [XGG476-03]	Dissolved Aluminum (Al)	2023/10/17	NC		%	25
			Dissolved Antimony (Sb)	2023/10/17	NC		%	25
			Dissolved Arsenic (As)	2023/10/17	NC		%	25
			Dissolved Barium (Ba)	2023/10/17	1.7		%	25
			Dissolved Beryllium (Be)	2023/10/17	NC		%	25
			Dissolved Boron (B)	2023/10/17	17		%	25
			Dissolved Cadmium (Cd)	2023/10/17	NC		%	25
			Dissolved Calcium (Ca)	2023/10/17	1.8		%	25
			Dissolved Chromium (Cr)	2023/10/17	NC		%	25
			Dissolved Cobalt (Co)	2023/10/17	NC		%	25
			Dissolved Copper (Cu)	2023/10/17	NC		%	25
			Dissolved Iron (Fe)	2023/10/17	23		%	25
			Dissolved Lead (Pb)	2023/10/17	NC		%	25
			Dissolved Magnesium (Mg)	2023/10/17	1.7		%	25
			Dissolved Manganese (Mn)	2023/10/17	1.0		%	25
			Dissolved Molybdenum (Mo)	2023/10/17	NC		%	25
			Dissolved Nickel (Ni)	2023/10/17	NC		%	25
			Dissolved Phosphorus (P)	2023/10/17	NC		%	25
			Dissolved Potassium (K)	2023/10/17	1.4		%	25
			Dissolved Selenium (Se)	2023/10/17	NC		%	25
			Dissolved Silicon (Si)	2023/10/17	0.13		%	25
			Dissolved Silver (Ag)	2023/10/17	NC		%	25
			Dissolved Sodium (Na)	2023/10/17	1.5		%	25
			Dissolved Strontium (Sr)	2023/10/17	1.9		%	25
			Dissolved Sulphur (S)	2023/10/17	1.9		%	25
			Dissolved Tin (Sn)	2023/10/17	NC		%	25
			Dissolved Titanium (Ti)	2023/10/17	NC		%	25
			Dissolved Vanadium (V)	2023/10/17	NC		%	25
			Dissolved Zinc (Zn)	2023/10/17	NC		%	25
8976321	IHP	Matrix Spike	Dissolved (0.2u) Aluminum (Al)	2023/10/16		98	%	80 - 120
8976321	IHP	Spiked Blank	Dissolved (0.2u) Aluminum (Al)	2023/10/16		98	%	80 - 120
8976321	IHP	Method Blank	Dissolved (0.2u) Aluminum (Al)	2023/10/16	<5		ug/L	
8976321	IHP	RPD	Dissolved (0.2u) Aluminum (Al)	2023/10/16	NC		%	20
8976329	C_N	Matrix Spike	Nitrite (N)	2023/10/14		100	%	80 - 120
			Nitrate (N)	2023/10/14		94	%	80 - 120
8976329	C_N	Spiked Blank	Nitrite (N)	2023/10/14		105	%	80 - 120
			Nitrate (N)	2023/10/14		95	%	80 - 120
8976329	C_N	Method Blank	Nitrite (N)	2023/10/14	<0.010		mg/L	
			Nitrate (N)	2023/10/14	<0.10		mg/L	
8976329	C_N	RPD	Nitrite (N)	2023/10/14	5.8		%	20
			Nitrate (N)	2023/10/14	NC		%	20
8976616	YPA	Spiked Blank	Alkalinity (Total as CaCO3)	2023/10/15		98	%	85 - 115
8976616	YPA	Method Blank	Alkalinity (Total as CaCO3)	2023/10/15	<1.0		mg/L	
8976616	YPA	RPD	Alkalinity (Total as CaCO3)	2023/10/15	0.56		%	20
8976628	YPA	Spiked Blank	pH	2023/10/15		102	%	98 - 103
8976628	YPA	RPD	pH	2023/10/15	0.96		%	N/A
8976655	MJ1	Matrix Spike	Dissolved Chloride (Cl-)	2023/10/16		97	%	80 - 120
8976655	MJ1	Spiked Blank	Dissolved Chloride (Cl-)	2023/10/16		100	%	80 - 120
8976655	MJ1	Method Blank	Dissolved Chloride (Cl-)	2023/10/16	<1.0		mg/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8976655	MJ1	RPD	Dissolved Chloride (Cl-)	2023/10/16	1.6		%	20
8976667	ADB	Matrix Spike	Dissolved Sulphate (SO4)	2023/10/14		NC	%	75 - 125
8976667	ADB	Spiked Blank	Dissolved Sulphate (SO4)	2023/10/14		100	%	80 - 120
8976667	ADB	Method Blank	Dissolved Sulphate (SO4)	2023/10/14	<1.0		mg/L	
8976667	ADB	RPD	Dissolved Sulphate (SO4)	2023/10/14	0.049		%	20
8976744	KPJ	Matrix Spike	Total Ammonia-N	2023/10/17		100	%	75 - 125
8976744	KPJ	Spiked Blank	Total Ammonia-N	2023/10/17		103	%	80 - 120
8976744	KPJ	Method Blank	Total Ammonia-N	2023/10/17	<0.050		mg/L	
8976744	KPJ	RPD	Total Ammonia-N	2023/10/17	2.9		%	20
8976800	KPJ	Matrix Spike	Total Ammonia-N	2023/10/13		100	%	75 - 125
8976800	KPJ	Spiked Blank	Total Ammonia-N	2023/10/13		104	%	80 - 120
8976800	KPJ	Method Blank	Total Ammonia-N	2023/10/13	<0.050		mg/L	
8976800	KPJ	RPD	Total Ammonia-N	2023/10/13	2.3		%	20
8977454	GID	Matrix Spike	Total Organic Carbon (TOC)	2023/10/13		NC	%	80 - 120
8977454	GID	Spiked Blank	Total Organic Carbon (TOC)	2023/10/13		97	%	80 - 120
8977454	GID	Method Blank	Total Organic Carbon (TOC)	2023/10/13	<0.40		mg/L	
8977454	GID	RPD	Total Organic Carbon (TOC)	2023/10/13	0.051		%	20
8978148	TL2	Matrix Spike	Chromium (VI)	2023/10/13		104	%	80 - 120
8978148	TL2	Spiked Blank	Chromium (VI)	2023/10/13		105	%	80 - 120
8978148	TL2	Method Blank	Chromium (VI)	2023/10/13	<0.50		ug/L	
8978148	TL2	RPD	Chromium (VI)	2023/10/13	NC		%	20
8978451	NS3	Matrix Spike	Total Chemical Oxygen Demand (COD)	2023/10/13		94	%	80 - 120
8978451	NS3	Spiked Blank	Total Chemical Oxygen Demand (COD)	2023/10/13		95	%	80 - 120
8978451	NS3	Method Blank	Total Chemical Oxygen Demand (COD)	2023/10/13	<4.0		mg/L	
8978451	NS3	RPD	Total Chemical Oxygen Demand (COD)	2023/10/13	3.9		%	20
8979735	SHD	Spiked Blank	Total Dissolved Solids	2023/10/16		100	%	90 - 110
8979735	SHD	Method Blank	Total Dissolved Solids	2023/10/16	<10		mg/L	
8979735	SHD	RPD	Total Dissolved Solids	2023/10/16	1.4		%	20
8980045	CPO	Matrix Spike	Phenols-4AAP	2023/10/13		92	%	80 - 120
8980045	CPO	Spiked Blank	Phenols-4AAP	2023/10/13		101	%	80 - 120
8980045	CPO	Method Blank	Phenols-4AAP	2023/10/13	<0.0010		mg/L	
8980045	CPO	RPD	Phenols-4AAP	2023/10/13	NC		%	20
8982154	GID	Spiked Blank	Colour	2023/10/17		97	%	80 - 120
8982154	GID	Method Blank	Colour	2023/10/17	<2		TCU	
8982154	GID	RPD	Colour	2023/10/17	NC		%	25
8982719	ADA	Matrix Spike	Total Aluminum (Al)	2023/10/16		104	%	80 - 120
			Total Antimony (Sb)	2023/10/16		106	%	80 - 120
			Total Arsenic (As)	2023/10/16		101	%	80 - 120
			Total Barium (Ba)	2023/10/16		96	%	80 - 120
			Total Beryllium (Be)	2023/10/16		100	%	80 - 120
			Total Bismuth (Bi)	2023/10/16		96	%	80 - 120
			Total Boron (B)	2023/10/16		98	%	80 - 120
			Total Cadmium (Cd)	2023/10/16		99	%	80 - 120
			Total Calcium (Ca)	2023/10/16		NC	%	80 - 120
			Total Chromium (Cr)	2023/10/16		97	%	80 - 120
			Total Cobalt (Co)	2023/10/16		101	%	80 - 120
			Total Copper (Cu)	2023/10/16		100	%	80 - 120
			Total Iron (Fe)	2023/10/16		100	%	80 - 120
			Total Lead (Pb)	2023/10/16		94	%	80 - 120
			Total Lithium (Li)	2023/10/16		92	%	80 - 120
			Total Magnesium (Mg)	2023/10/16		99	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Manganese (Mn)	2023/10/16		96	%	80 - 120
			Total Molybdenum (Mo)	2023/10/16		100	%	80 - 120
			Total Nickel (Ni)	2023/10/16		96	%	80 - 120
			Total Potassium (K)	2023/10/16		99	%	80 - 120
			Total Selenium (Se)	2023/10/16		99	%	80 - 120
			Total Silicon (Si)	2023/10/16		93	%	80 - 120
			Total Silver (Ag)	2023/10/16		94	%	80 - 120
			Total Sodium (Na)	2023/10/16		NC	%	80 - 120
			Total Strontium (Sr)	2023/10/16		NC	%	80 - 120
			Total Tellurium (Te)	2023/10/16		99	%	80 - 120
			Total Thallium (Tl)	2023/10/16		99	%	80 - 120
			Total Tin (Sn)	2023/10/16		103	%	80 - 120
			Total Titanium (Ti)	2023/10/16		95	%	80 - 120
			Total Tungsten (W)	2023/10/16		102	%	80 - 120
			Total Uranium (U)	2023/10/16		99	%	80 - 120
			Total Vanadium (V)	2023/10/16		97	%	80 - 120
			Total Zinc (Zn)	2023/10/16		99	%	80 - 120
			Total Zirconium (Zr)	2023/10/16		106	%	80 - 120
8982719	ADA	Spiked Blank	Total Aluminum (Al)	2023/10/16		97	%	80 - 120
			Total Antimony (Sb)	2023/10/16		101	%	80 - 120
			Total Arsenic (As)	2023/10/16		97	%	80 - 120
			Total Barium (Ba)	2023/10/16		98	%	80 - 120
			Total Beryllium (Be)	2023/10/16		98	%	80 - 120
			Total Bismuth (Bi)	2023/10/16		96	%	80 - 120
			Total Boron (B)	2023/10/16		93	%	80 - 120
			Total Cadmium (Cd)	2023/10/16		97	%	80 - 120
			Total Calcium (Ca)	2023/10/16		99	%	80 - 120
			Total Chromium (Cr)	2023/10/16		95	%	80 - 120
			Total Cobalt (Co)	2023/10/16		100	%	80 - 120
			Total Copper (Cu)	2023/10/16		96	%	80 - 120
			Total Iron (Fe)	2023/10/16		98	%	80 - 120
			Total Lead (Pb)	2023/10/16		94	%	80 - 120
			Total Lithium (Li)	2023/10/16		92	%	80 - 120
			Total Magnesium (Mg)	2023/10/16		99	%	80 - 120
			Total Manganese (Mn)	2023/10/16		96	%	80 - 120
			Total Molybdenum (Mo)	2023/10/16		96	%	80 - 120
			Total Nickel (Ni)	2023/10/16		95	%	80 - 120
			Total Potassium (K)	2023/10/16		95	%	80 - 120
			Total Selenium (Se)	2023/10/16		100	%	80 - 120
			Total Silicon (Si)	2023/10/16		93	%	80 - 120
			Total Silver (Ag)	2023/10/16		93	%	80 - 120
			Total Sodium (Na)	2023/10/16		99	%	80 - 120
			Total Strontium (Sr)	2023/10/16		95	%	80 - 120
			Total Tellurium (Te)	2023/10/16		99	%	80 - 120
			Total Thallium (Tl)	2023/10/16		97	%	80 - 120
			Total Tin (Sn)	2023/10/16		97	%	80 - 120
			Total Titanium (Ti)	2023/10/16		96	%	80 - 120
			Total Tungsten (W)	2023/10/16		98	%	80 - 120
			Total Uranium (U)	2023/10/16		95	%	80 - 120
			Total Vanadium (V)	2023/10/16		93	%	80 - 120
			Total Zinc (Zn)	2023/10/16		97	%	80 - 120

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Zirconium (Zr)	2023/10/16		101	%	80 - 120
8982719	ADA	Method Blank	Total Aluminum (Al)	2023/10/16	<4.9		ug/L	
			Total Antimony (Sb)	2023/10/16	<0.50		ug/L	
			Total Arsenic (As)	2023/10/16	<1.0		ug/L	
			Total Barium (Ba)	2023/10/16	<2.0		ug/L	
			Total Beryllium (Be)	2023/10/16	<0.40		ug/L	
			Total Bismuth (Bi)	2023/10/16	<1.0		ug/L	
			Total Boron (B)	2023/10/16	<10		ug/L	
			Total Cadmium (Cd)	2023/10/16	<0.090		ug/L	
			Total Calcium (Ca)	2023/10/16	<200		ug/L	
			Total Chromium (Cr)	2023/10/16	<5.0		ug/L	
			Total Cobalt (Co)	2023/10/16	<0.50		ug/L	
			Total Copper (Cu)	2023/10/16	<0.90		ug/L	
			Total Iron (Fe)	2023/10/16	<100		ug/L	
			Total Lead (Pb)	2023/10/16	<0.50		ug/L	
			Total Lithium (Li)	2023/10/16	<5.0		ug/L	
			Total Magnesium (Mg)	2023/10/16	<50		ug/L	
			Total Manganese (Mn)	2023/10/16	<2.0		ug/L	
			Total Molybdenum (Mo)	2023/10/16	<0.50		ug/L	
			Total Nickel (Ni)	2023/10/16	<1.0		ug/L	
			Total Potassium (K)	2023/10/16	<200		ug/L	
			Total Selenium (Se)	2023/10/16	<2.0		ug/L	
			Total Silicon (Si)	2023/10/16	<50		ug/L	
			Total Silver (Ag)	2023/10/16	<0.090		ug/L	
			Total Sodium (Na)	2023/10/16	<100		ug/L	
			Total Strontium (Sr)	2023/10/16	<1.0		ug/L	
			Total Tellurium (Te)	2023/10/16	<1.0		ug/L	
			Total Thallium (Tl)	2023/10/16	<0.050		ug/L	
			Total Tin (Sn)	2023/10/16	<1.0		ug/L	
			Total Titanium (Ti)	2023/10/16	<5.0		ug/L	
			Total Tungsten (W)	2023/10/16	<1.0		ug/L	
			Total Uranium (U)	2023/10/16	<0.10		ug/L	
			Total Vanadium (V)	2023/10/16	<0.50		ug/L	
			Total Zinc (Zn)	2023/10/16	<5.0		ug/L	
			Total Zirconium (Zr)	2023/10/16	<1.0		ug/L	
8982719	ADA	RPD	Total Aluminum (Al)	2023/10/16	0		%	20
			Total Antimony (Sb)	2023/10/16	NC		%	20
			Total Arsenic (As)	2023/10/16	NC		%	20
			Total Barium (Ba)	2023/10/16	0.61		%	20
			Total Cadmium (Cd)	2023/10/16	NC		%	20
			Total Calcium (Ca)	2023/10/16	3.4		%	20
			Total Chromium (Cr)	2023/10/16	NC		%	20
			Total Cobalt (Co)	2023/10/16	3.8		%	20
			Total Copper (Cu)	2023/10/16	2.2		%	20
			Total Iron (Fe)	2023/10/16	2.1		%	20
			Total Lead (Pb)	2023/10/16	NC		%	20
			Total Manganese (Mn)	2023/10/16	1.5		%	20
			Total Molybdenum (Mo)	2023/10/16	0.18		%	20
			Total Nickel (Ni)	2023/10/16	0.037		%	20
			Total Selenium (Se)	2023/10/16	NC		%	20
			Total Silver (Ag)	2023/10/16	NC		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Strontium (Sr)	2023/10/16	1.3		%	20
			Total Thallium (Tl)	2023/10/16	NC		%	20
			Total Tin (Sn)	2023/10/16	NC		%	20
			Total Uranium (U)	2023/10/16	2.3		%	20
			Total Vanadium (V)	2023/10/16	13		%	20
			Total Zinc (Zn)	2023/10/16	8.3		%	20
			Total Zirconium (Zr)	2023/10/16	NC		%	20
8982731	RTB	Spiked Blank	Total Suspended Solids	2023/10/17		102	%	85 - 115
8982731	RTB	Method Blank	Total Suspended Solids	2023/10/17	<1		mg/L	
8982731	RTB	RPD	Total Suspended Solids	2023/10/17	0		%	20

N/A = Not Applicable

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

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

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

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

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

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

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

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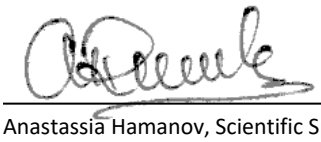
Bureau Veritas Job #: C3V5306
Report Date: 2023/10/18

Golder Associates Ltd
Client Project #: 18108934
Site Location: Limerick Surface Water
Sampler Initials: KB

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

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