Municipality of Greenstone

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone, Ontario

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Legal Notification

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1 Introduction and Background

EXP Services Inc. (EXP) was commissioned by the Municipality of Greenstone to prepare the Environmental Quality Monitoring Report (2021) for the Beardmore Landfill site, in accordance with the Ontario Ministry of the Environment, Conservation and Parks (MECP) Amendment to Environmental Compliance Approval (ECA) No. A7249502 - Notice No. 1, issued February 8, 2017. This Notice forms part of the approval issued under Approval No. A7249502, dated July 15, 1979. Copies of the original approval and the amendment notice, as well as other MECP documentation concerning the Beardmore Landfill, are provided in Appendix A. The site is located just north of the community of Beardmore on the west side of Highway 11, approximately 400 m northwest of the Blackwater River, in the Municipality of Greenstone, as shown on Figure 1 in Appendix B.

Details concerning the historical development and operation of the Beardmore Landfill are given in the most recent Design and Operations Plan for the site[1] (awaiting MECP review – submitted August 1, 2019). The currently-approved landfill and attenuation zone areas are as follows:

- Total area of site (including attenuation zone): 22.4 ha (see Figure 2 – Appendix B).
- Landfilling area: 4.20 ha.

The approved attenuation zone boundaries for the Beardmore Landfill extend into Crown land. In January 2019, the Municipality of Greenstone submitted an application to the Ministry of Natural Resources and Forestry (MNRF) to obtain these lands, and in July 2019 the lands were surveyed. It is understood that based on an email dated September 9, 2021 from Nicole Horde (MRNF Regional Lands Specialist, Northwest Region), the Municipality will need to obtain a Crown Easement; Greenstone is currently working on this.

The MECP most recently inspected the site on June 19, 2017. A copy of the inspection report is given in Appendix A. No action items were identified.

This report represents the fifth monitoring report for the site prepared in compliance with the current ECA. It provides results of the 2021 monitoring program in the context of available historical results (from the 2017, 2018, 2019 and 2020 monitoring program[2] and from an initial hydrogeological evaluation[3]) and applicable criteria. Analytical results for groundwater are compared to the MECP's Ontario Drinking Water Standards (ODWS, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines,* June 2003), as well as to MECP Guideline B-7 (which incorporates the Reasonable Use concept into MECP groundwater management activities) and the MECP's Aquatic Protection Values (APV's, from

[1] EXP Services Inc. (2018). *Design and Operations Plan, Beardmore Waste Disposal Site, Municipality of Greenstone, Ontario.* Project No. THB-00011174-HE, July 23, 2019.
[2] EXP Services Inc. (2021). *2020 Environmental Quality Monitoring Report, Beardmore Landfill, Municipality of Greenstone*, Ontario. Project No. THB-00011174-IE, April 22, 2021.
[3] Trow Consulting Engineers Ltd. (1991). *Hydrogeological Study for the Beardmore Landfill Site*. Ref. No. F-90211-A/G, March 1991.

Appendix B2 of *Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario,* April 2011). In addition, the analytical results for surface water are compared to the MECP's Provincial Water Quality Objectives (PWQO), 1994 (updated 1999).

The MECP issued a memorandum (dated June 26, 2018) regarding their review of the 2017 Environmental Quality Monitoring Report. A copy of the memorandum is included in Appendix A. No MECP memorandum has been received to date regarding their review of the 2018, 2019 or 2020 Environmental Quality Monitoring Reports. The following recommendations were made by the MECP regarding the 2017 monitoring report, with EXP comments (updated as appropriate) in *italics*:

- During the monitoring of the wells the temperature readings were not taken as specified in ECA. Temperatures must be monitored and recorded in the field in the future. *EXP recorded field temperatures during each sampling event beginning in 2018 and will record field temperatures during each subsequent sampling event.*
- It is recommended to continue the monitoring twice a year for all the wells in accordance with the amended ECA with one cycle of comprehensive parameters specified in schedule 5 of Reg. 232 and one cycle of indicator parameters. *EXP will continue the monitoring program as indicated.*
- BH-A must be checked at each monitoring event and if water is observed it must be measured and sampled. *EXP has and will continue to check well BH-A during each sampling event*.
- The exceedance in BH-G points to the formation of leachate but needs to be confirmed in the next monitoring events. *This issue is discussed in the current report and will continue to be evaluated in future*.
- The analytical results indicate that the maximum concentrations as measured in the trigger well BH-F are below the APV and below the calculated trigger levels for protection of surface water quality. No surface water monitoring is required at this point. *EXP concurred with this assessment. However, in connection with an Environmental Screening currently nearing completion to approve a 60,000 m^3 site expansion, a First Nations group has requested that Blackwater River water quality be monitored. Surface water sampling at two locations in the Blackwater River was initiated in the spring of 2021.*
- In the future ALL the electronic copies of the report sent to this office must be signed/stamped. *EXP will include signatures on all digital reports going forward.*

This report also contains additional site information required by the ECA.

2 Site Setting and Geology

Based on a review of geological mapping, the site generally comprises three landforms. The landform of the main (south) part of the site, which includes the waste footprint, is sand and gravel glaciofluvial outwash plain, with mainly low local relief. The northernmost edge of the site is located in an area that includes two landforms, namely till ground moraine deposits, and bedrock knobs. The topography of both of these landforms is described as undulating to rolling and washed/reworked, again with mainly low local relief. Drainage of all three landforms is described as mixed wet and dry.

Surrounding features are indicated on Figure 2 in Appendix B. The nearest residence is located within the Town of Beardmore, about 700 m southeast of the site; however, a camper and Quonset hut/house are located about 475 m east of the site, which are understood to be occupied occasionally during the year. The nearest potable water well, according to the MECP well records (www.ontario.ca/environment-and-energy/map-well-records) is located at the camper and Quonset hut/house property; however, the online well location information appears to be imprecise and the actual location of the wells has not been confirmed. The next closest potable well is understood to be located at MTO's road maintenance facility about 900 m northeast of the site. A Bell Canada building is located about 350 m east of the site; however, it is understood that there are no water or sanitary systems servicing the building.

The area of the site itself is relatively flat, with a rise in elevation of several meters at the northwest corner. A topographic survey was conducted on October 11, 2011; and was updated on September 30, 2015; June 26, 2017; October 10, 2017; September 11, 2020, and most recently on September 7, 2021, by Delta Survey Inc. A copy of the updated survey plan is provided on Figure 3 (all elevations geodetic).

Locally, on-site and off-site surface drainage follows the topography in the area, which generally slopes toward the Blackwater River located about 350 m downgradient (southeast) of the site. The elevation of the river was surveyed at two locations (see Figure 2) in fall 2017; the levels are shown in Table 1 (Appendix D).

3 Site Hydrogeology

There are six monitoring wells on and in the vicinity of the site (see Figures 2 & 3). Wells BH-G, BH-H and BH-I were installed in May 2017 (in accordance with the ECA), and wells BH-A, BH-C and BH-F were installed during the initial hydrogeological evaluation previously referenced. Borehole logs are found in Appendix C.

Groundwater levels in the wells are summarized in Table 1 (Appendix D).

BH-A, located just inside the access gate, was installed to a depth of 4.35 m (elevation 304.17 m). It was dry during the spring and fall 2021 sampling events (also dry during previous four years' sampling events in 2017 to 2020, and at the time of installation in November 1990). Three additional historical wells (BH-B, BH-D and BH-E [also dry at the time of installation]) were not found in 2011, or 2017 to 2021 (i.e., they have either been destroyed or buried).

Similar to EXP's 2017 to 2020 reports, the 2021 data indicate that the groundwater flow direction is generally to the southeast, towards the Blackwater River. It is noted that at BH-H (located south of the waste filling area), groundwater is elevated by nearly 2 m compared to the nearby wells (historical groundwater levels in 2017 to 2020 also were about 2 m higher).

Two different groundwater gradients are noted on the site (Figure 4). The first groundwater gradient is from the northwest part of the site to the approximate center of the site (BH-I to BH-G) and is about 0.09 m/m. The second gradient is from the approximate center of the site to near the downgradient attenuation zone boundary (BH-G to BH-F), and is smaller, at about 0.002 m/m.

In 2017, grain size analyses, including hydrometer analyses, were conducted on three representative soil samples (one from each new monitoring well [BH-G, BH-H and BH-I]) collected below the apparent groundwater table. Samples of the silt from BH-G – S6 and BH-H – S4 were tested using hydrometer analysis, and one sample of the sand and gravel from BH-I – S4 was tested using sieve analysis; refer to the Grain Size Distribution curves in Appendix C. In addition, grain size analysis was conducted on one representative sample below the apparent groundwater table during the 1990 Trow hydrogeological study at BH-C – S8 (sand). Based on the grain size analysis, the particle size corresponding to the 10% finer than fraction (D_{10}) was determined/estimated, for use in the Hazen empirical estimation of hydraulic conductivity (K). While the Hazen method of estimating hydraulic conductivity, where K (cm/s) = $[D_{10}\ (mm)]^2$, was originally determined for uniformly graded sands, it can provide a rough, but useful, approximation for most cohesionless (non-plastic) soils. The hydraulic conductivity (K) values for the silt ranged from about 2.0×10^{-6} to 4.0×10^{-6} cm/s and for the sand and gravel to sand from about 9.0×10^{-4} cm/s to 2.5×10^{-3} cm/s.

Using Darcy's Law, $V = K\ i\ /\ n$

where $K_{Silt\ 1} = 2.0 \times 10^{-6}$ cm/s & $K_{Silt\ 2} = 4.0 \times 10^{-6}$ cm/s

$K_{S\&G\ 1} = 9.0 \times 10^{-4}$ cm/s & $K_{S\&G\ 2}$ 2.5×10^{-3} cm/s

i = 0.09 m/m (calculated hydraulic gradient between BH-I and BH-G)

i = 0.002 m/m (calculated hydraulic gradient between BH-G and BH-F)

n = 0.3 (assumed porosity)

Based on the above, the flow velocities on site for the silt range between about 0.2 m/yr and 0.4 m/yr where the hydraulic gradient is 0.09 m/m, and between about 0.004 m/yr and 0.008 m/yr where the hydraulic gradient is 0.002 m/m. The flow velocities for the sand and gravel to sand range between about 85 m/yr and 235 m/yr where the hydraulic gradient is 0.09 m/m, and between about 1.9 m/yr and 5.3 m/yr where the hydraulic gradient is 0.002 m/m.

As previously noted, initial groundwater monitoring at the site was conducted in the early 1990's. Historical groundwater monitoring data (presented in the 1991 Trow report) revealed levels of iron and manganese above the PWQOs, but whether this reflected natural conditions or landfill impact is unknown. Regardless, as noted in a previous (2009) MECP review memorandum, the historical water quality data are unlikely to reflect current conditions. However, the limited historical results (available for existing well BH-C only) are presented and discussed along with current data for the historical and new wells in the present report (see Section 7).

4 Monitoring and Reporting Requirements

As specified in the amendment to the ECA, dated February 8, 2017 (see Appendix A), an annual report must be prepared and submitted to the MECP by April 30th. The report must include the following information:

- a summary of the type and quantity of incoming waste accepted during the reporting period;
- discussion indicating the landfill capacity, current fill volume, volume filled in the last year, and the status of any control measures such as interim, final or progressive cover;
- a summary of the site's operation procedure and compliance as per the Design and Operation Plan;
- a summary of recycling operations;
- an accurately scaled site plan illustrating the location of all buried wastes, the site boundaries, monitoring well locations, the location of the contaminant attenuation zone, and any other significant site features;
- an accurately scaled location map illustrating topography and the site relative to nearby potentially sensitive groundwater/surface water features (i.e., lakes, streams, wells), or any other potentially significant receptors;
- a section describing the field monitoring and sampling program including QA/QC measure and any variance from normal sampling procedures and/or conditions;
- a water table contour map based on current date;
- stratigraphic cross-sections which clearly illustrate the subsurface distribution of geological materials;
- borehole and monitoring well logs for all monitoring wells;
- tables presenting historical water chemistry and water level data, and graphs illustrating quality trends with time for key parameters at all monitoring locations;
- discussion and assessment of groundwater flow direction and velocities, estimates of leachate generation/impacts, effectiveness of mitigation measures, and compliance with the Reasonable Use Policy;
- recommendations as required for future mitigation, monitoring and site characterization activities;
- recommendations for trigger levels as related to contingency plans, considering both the Reasonable Use Policy and Aquatic Protection Values.

Note that other issues regarding site operations are discussed in detail in the updated Design and Operations (D & O) Plan (referenced above). It is understood that any additional operational information required by the ECA and not included in the present report has been or will be provided to the MECP by the Municipality of Greenstone.

In addition, and as previously indicated, in connection with an Environmental Screening currently nearing completion to approve a 60,000 m^3 site expansion, a First Nations group has requested that Blackwater River water quality be monitored. Surface water sampling at two locations from the Blackwater River was initiated in the spring of 2021 and results are discussed herein.

5 Operational Information

5.1 Surveyed Landfill Waste Volumes

In 2011, Delta Survey Inc. was commissioned to estimate the volume of waste and cover material deposited at the site since 1990, based on the difference between the 1990 topographical survey and their 2011 survey. This figure was 31,520 m^3, which represents an average about 1,500 m^3/yr over this 21-year period. As previously stated, the topographical survey was updated in October 2015, and the volume of waste and cover material deposited on site since 2011 was about 5,800 m^3, which is, again, about 1,500 m^3/yr. The site was surveyed again on October 10, 2017, and the volume of waste and cover material deposited on site since 2015 was about 2,600 m^3, which is about 1,300 m^3/yr. The September 2020 survey indicated a volume of waste and cover material deposited on site since 2017 was about 4,775 m^3, which is about 1,600 m^3/yr. The site was most recently surveyed on September 7, 2021, and the volume of waste and cover material deposited on site since September 2020 was about 2,579 m^3 (about 2,600 m^3/yr). As detailed in the most recent (draft) Design and Operations (D&O) Plan, assuming average waste deposition rates since the site commenced operations in about 1962 have remained relatively constant (i.e., around 1,500 m^3/yr., and based on population figures, this is probably a reasonable assumption), the total volume of waste and interim cover material placed on the site, as of September 2021, is estimated to be some 89,254 m^3. It should be noted that the annual increase from about 1,500 m^3/yr historically to about 2,600 m^3/yr between September 2020 and September 2021 is likely due to the soil needed to construct the bermed walls of the waste cells.

The north and south pits were filled in 2020 and waste placement is proceeding in accordance with the most recent D&O Plan, as shown on Figure 5 (Waste Filling Conceptual Site Plan – Year 2027).

Stratigraphic sections (based on Delta Survey plans updated September 2021) are given in Figures 6A and 6B.

5.2 Waste Volume Summary for 2021

Based on quantities provided by the Municipality of Greenstone, the weekly/bi-weekly volumes (uncompacted) of waste received/deposited at the Beardmore Landfill in 2021 are summarized in the following table.

Weekly As-Delivered Waste Volumes – 2021					
Week	Volume (m^3)	Week	Volume (m^3)	Week	Volume (m^3)
Jan. 1 – 8	32.0	May 10 - 19	67.5	Sept. 19 – 27	62.5
Jan. 9 – 16	47.0	May 20 - 31	41.0	Sept. 28 – Oct. 8	53.0
Jan. 17 – 25	53.0	Jun. 1 - 11	53.5	Oct. 9 – 18	57.0
Jan. 26 – Feb. 14	44.0	Jun. 12 - 19	55.0	Oct. 19 – 25	40.5
Feb. 15 - 22	57.5	Jun. 20 - 28	61.0	Oct. 26 – Nov. 5	46.0
Feb. 23 – Mar. 2	57.0	Jun. 29 - Jul. 5	51.0	Nov. 6 – 13	46.0
Mar. 3 - 13	50.5	Jul. 6 - Jul. 12	45.5	Nov. 14 – 20	39.5
Mar. 14 - 20	56.0	Jul. 13 - 23	51.5	Nov. 21 – 27	36.5
Mar. 21 - 28	61.0	Jul. 24 - 31	63.5	Nov. 28 - Dec. 4	47.0
Mar. 29 - Apr. 6	59.5	Aug. 1 - 13	29.5	Dec. 5 – 11	42.5
Apr. 7 - 17	40.0	Aug. 14 - 21	63.5	Dec. 12 – 18	43.5
Apr.18 - 25	68.0	Aug. 22 - 30	59.0	Dec. 19 – 31	37.0
Apr. 26 - May 2	48.0	Aug. 31 - Sept. 7	44.0	**TOTAL**	**2002.5**
May 3 - 9	41.5	Sept. 8 - 18	51.0		

As indicated in the table above, the total estimated waste volume received at the Beardmore Landfill in 2021 was about 2,002.5 m^3, which is less than the estimated total in 2020 of about 2,233.5 m^3. These figures are uncompacted volumes estimated from load sizes delivered to the landfill site. It is greater than the average annual historical waste volume (compacted, including interim cover) of approximately 1,500 m^3 based on historical survey data; however, based on typical compaction ratios of 3:1 to 4:1, the estimated as-delivered volume appears to be below the historical average. Note that the actual *in situ* quantities (in place and machine compacted, and including daily/interim soil cover), based on the September 2021 survey, indicated an annual increase of about 2,600 m^3/yr (again, likely due to soil used for constructing the bermed waste cell walls).

In 2021, from the above tabulated data, the maximum volume of as-delivered (uncompacted) waste received in a week was 68.0 m^3, during the period of April 18 to 25. The maximum daily

volume of 28.75 m^3 was received on March 14, 2021 and is attributed to typical household waste. The average daily volume in 2021 was about 12.8 m^3 (based on the landfill being open three days per week or 156 days/yr).

5.3 Remaining Life Expectancy

As indicated above, as of September 7, 2021, the waste volume including interim cover on site was estimated to be about 89,254 m^3. Using the surveyed quantity increase of about 1,600 m^3 per year, or 133 m^3 per month, based on the September 2020 survey (increase in 2021 appears to be an anomaly – likely due to soil used to construct the bermed walls of the waste cells) the estimated volume on site as of December 31, 2021, is about 89,653 m^3, which slightly exceeds the currently approved capacity of 89,300 m^3.

However, the Environmental Screening Process to increase the landfill capacity by 60,000 m^3 (to 149,300 m^3) is nearly complete (awaiting receipt of Crown Easement from MNRF) and should extend the life of the landfill until beyond the middle of the century (subject to confirmation of waste volume estimates).

5.4 Operational Problems and Complaints

Municipality of Greenstone personnel advised that there were no operational problems or public complaints regarding the Beardmore Landfill in 2021.

5.5 Waste Types and Waste Diversion

The landfill only accepts solid non-hazardous municipal waste, including wood, as well as certain recyclable materials (see below).

It was recommended in the Design and Operations Plan (referenced above) that a recycling depot (i.e., for standard recyclables such as glass, plastic, metal containers [steel and aluminum], tetra packs, paper and cardboard) be established at the site. It is understood that no action has yet been taken on this matter. However, the following recyclable materials are accepted at the site: used tires, scrap metal, batteries, electronic waste, fluorescent bulbs, refrigerators/freezers (tagged).

In the D&O Plan, a household hazardous waste (HHW) depot was also recommended. Approval should be obtained from the MECP. It is noted however, that residents of the Beardmore area are currently being directed to use the HHW events at the Geraldton and Longlac Landfills.

Additional details concerning operation of the landfill are provided in the D&O Plan.

6 Field Procedures

6.1 Monitoring Well Condition

As previously indicated, EXP was commissioned to conduct two monitoring events (spring and fall) in 2021.

At the time of monitoring, above-ground well components were inspected for condition and compliance with O.Reg. 903. All monitoring wells were in compliance and in generally good condition as of the fall 2021 sampling event. Note that the 75 mm diameter plastic ABS pipe (acting as a well protector) at BH-C which was reported as broken near the ground surface in the 2020 report (previously referenced), was replaced in May 2021 with a new above-ground well protector.

6.2 Sampling Protocol

EXP personnel collected water samples on May 29 and 30, and again on October 4 and 5, 2021. The fieldwork was to include collection of groundwater samples from all six monitoring wells and from two surface water locations in the Blackwater River (upstream and downstream of the landfill attenuation zone boundaries) during both sampling events. However, consistent with historical conditions, no groundwater samples were obtained from well BH-A because it was dry.

Prior to purging, static water levels were measured in each sampled well using an electronic water level indicator. Between measurements, the stainless-steel probe of the indicator was rinsed with distilled water in order to prevent cross-contamination of the wells. Each well was then purged (minimum 3 well volumes or to dryness) using the dedicated Waterra® sampling equipment and allowed to recover to at least 80% of static level prior to sampling. Upon reaching at least 80% recovery, field measurements of pH, electrical conductivity and temperature were recorded for the groundwater samples. The groundwater samples were collected directly from the sampling equipment into bottles provided precleaned and with appropriate preservatives by the laboratory.

Surface water samples were collected directly from the water body using the unpreserved bottles supplied by the laboratory. Sample bottles containing preservatives were then filled from unpreserved sampling bottles.

Groundwater samples for metals, including mercury, were filtered in the field at the time of sample collection using in-line 0.45-micron filter cartridges. In accordance with standard MECP protocol, no field filtering was conducted on the surface water samples, except for mercury.

The water samples were placed in an insulated cooler for transport to EXP's offices in Thunder Bay. The samples were then picked up by a representative of Bureau Veritas Laboratories (BV Labs), in a secure cooler under chain of custody, and were ultimately sent via courier to

their Standards Council of Canada certified and accredited laboratory in Mississauga, Ontario, for analysis of the required parameters.

7 Results and Discussion

The laboratory reports containing the groundwater analytical results for 2021 are provided in Appendix E. The ECA-stipulated monitoring program consists of twice-annual (spring and fall) sampling of all wells. In addition, two surface water sampling locations were added to the program in 2021. Samples are to be analyzed for the MECP's Landfill Standards Guideline (Schedule 5 – rev. 2010) "comprehensive" parameter list for one of the two annual events, and for the "indicator" list for the other sampling event, which are to alternate in successive years. In 2021, the spring samples were analyzed for the comprehensive parameter list, while the fall samples were analyzed for the indicator parameter list.

Summary tables of the 2021 results, along with the historical results, are given in Appendix D (Table 2), where they are compared to criteria given in the MECP's *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (ODWS, June 2003). The ODWS criteria can be either standards (**Maximum Acceptable Concentrations** and **Interim Maximum Acceptable Concentrations**) or objectives (**Aesthetic Objectives** and **Operational Guidelines**). Surface water results are compared to the PWQOs are given in Appendix D (Table 3). Analytical results in excess of criteria are highlighted in the summary tables.

7.1 Background Conditions (BH-I)

Monitoring well BH-I (screened from 2.0 to 5.0 m depth in sandy silt to sand and gravel, terminating in possible bedrock) is immediately upgradient of the identified waste footprint. A single exceedance of ODWS criteria was noted in 2021, this being manganese (0.22 mg/L versus 0.05 mg/L ODWS) in spring. Historically, manganese exceeded the ODWS criterion during each comprehensive parameter analysis event (spring 2017, fall 2018, spring 2019 and fall 2020). A historical exceedance for organic nitrogen was also reported (spring 2019). This indicates that groundwater on and in the vicinity of the site can be naturally high in manganese and organic nitrogen. In general, the 2021 results were similar to historical concentrations.

7.2 Source Well Conditions (BH-G)

Monitoring well BH-G (screened from 6.0 to 10.5 m depth, below waste, in silt fill and silt) is located in the southeast (downgradient) part of the identified waste footprint. Similar to 2017 to 2020, ODWS criteria exceedances in 2021 were reported for TDS, DOC, organic nitrogen, alkalinity, sulphate and manganese. In addition, iron exceeded the criterion in 2020 (both events) and also exceeded the criterion in the fall 2021 sample but was below the ODWS criterion in the spring 2021 sample. Historically, chloride levels exceeded the criterion; however, since fall 2019, levels have been below the applicable criterion and appear to be decreasing. Overall, parameters at BH-G were notably higher than in any of the other wells, reflecting leachate generation from the waste. The concentrations in 2021 were similar to historical levels with the exception of historical lows for conductivity, TDS and nitrate in the

fall (the latter below laboratory detection limits – a decreasing trend is suggested) and sulphate in the spring (blind replicate sample only - possibly anomalous).

The following table compares source well concentrations with those in the background well.

Parameter (Concentration Units)	Average 2021 Source Well Concentration	Average 2021 Background Well Concentration	Leachate Concentration Factor (LCF)
Conductivity (µS/cm)	2,900	505	5.7
COD (mg/L)	88	4.5	19.5
TDS (mg/L)	2,140	268	8.0
DOC (mg/L)	33	1.95	17.0
Organic Nitrogen (mg/L)	0.97	0.14	6.9
Alkalinity (mg/L)	978	270	3.6
Chloride (mg/L)	213	1.6	133
Nitrate (mg/L)	0.45	<0.1	9.0
Sulphate (mg/L)	488	14.5	33.7
Barium (mg/L)	0.045	0.0108	4.2
Boron (mg/L)	1.113	0.031	35.9
Iron (mg/L)	0.29	<0.1	5.8
Manganese (mg/L)	1.1	0.22	5.0

Similar to historical findings, positive leachate concentration factors (i.e.., higher levels in source well than in background well) are present for all tabulated parameters, ranging from a low of 3.6 (alkalinity) to a high of 133 (chloride).

7.3 Proximate Wells (BH-A, BH-C, BH-H)

Well BH-A (historical well screened from 3.0 to 4.5 m depth in fine sand) is located due east of the waste footprint. This well was dry at the time of installation in 1990, and during the sampling events in 2017 to 2021, inclusive.

Wells BH-H (screened from 1.5 to 6.0 m depth in silt) and BH-C (historical well screened from 5.0 to 6.5 m depth in sandy silt and sand) are situated a short distance southeast of the waste footprint. BH-H is slightly closer to the waste (and to the source well), but the groundwater table at BH-H is at a higher elevation than at the source well (i.e., the groundwater is apparently locally mounded). As a result, in general, BH-H historically has had lower levels of potential leachate indicators compared to BH-C, although BH-H is located closer and BH-C is located further away from the waste footprint. However, the fall 2021 results were generally higher at BH-H than BH-C, and historical highs at BH-H were observed for conductivity, TDS, DOC, calcium, magnesium, sodium, alkalinity, nitrate and sulphate. In

2021, ODWS exceedances were noted for TDS and alkalinity, both only during the fall event. At BH-C, one exceedance of ODWS criteria was noted in 2021 (organic nitrogen), while in 2020, six ODWS exceedances had been noted including: TDS, DOC, organic nitrogen, alkalinity, iron and manganese. The 2021 results at BH-C were generally similar to historical results.

Well BH-C is the only well for which there are historical laboratory results prior to 2017. As shown on Table 2 (Appendix D), ODWS exceedances for iron and manganese were reported in this well in December 1990.

7.4 Distant Well (BH-F)

Well BH-F is a historical well located about 200 m from the Blackwater River, and is the furthest well downgradient of the landfill. Construction records for this well are not available, but the current well depth is about 6.4 m below ground surface. No ODWS exceedances were noted in 2021; however, on occasion, historical exceedances for organic nitrogen were reported. 2021 results were generally similar to historical levels.

Being the furthest well from the waste footprint, levels of potential leachate indicator parameters are generally lower than in the other downgradient wells. Due to its location relatively near the downgradient attenuation zone boundary, this well has been selected as a "trigger well", to assess whether contingency measures may need to be implemented to prevent unacceptable off-site impacts (refer to Section 8.1).

7.5 Durov Plots

Durov plots of the major ion chemistry were prepared and are included in Appendix F. The results continue to indicate that the groundwater on site is generally calcium bicarbonate dominated. The groundwater results at source well BH-G have historically been generally calcium sulphate dominated; however, the 2021 results for this well suggest a shift toward calcium bicarbonate dominance.

Calcium bicarbonate dominated groundwater is typical of background (unimpacted) groundwater.

7.6 Time Series Charts

Time Series graphs depicting concentrations over the monitoring period have been prepared for selected parameters of interest (alkalinity, chloride, DOC, iron, manganese, sulphate and TDS), and are included in Appendix G. Although five years of data may be insufficient for trend analysis, possible increasing trends are observed for alkalinity at BH-G (source well) and BH-H, while possible decreasing trends are observed for chloride, sulphate and TDS at BH-G. Also, marginally increasing trends are suggested for DOC and TDS at BH-H.

In addition, alkalinity, DOC, sulphate and TDS concentrations at BH-H spiked to historical highs in the fall 2021 sample. Additional monitoring is indicated.

7.7 Reasonable Use Assessment

The MECP's Guideline B-7, which incorporates the Reasonable Use Policy (RUP) into the Ministry's groundwater management activities, allows off-site impacts from waste disposal sites within established guidelines based on ODWS criteria in order to allow for attenuation of impacts while protecting existing and potential downgradient groundwater users. The guideline allows for increases in concentrations up to 25 and 50 percent of the difference between background and ODWS concentrations for health-related and non-health-related parameters, respectively. The guideline applies only to groundwater at or beyond the attenuation zone boundary.

RUP criteria for 2021 were calculated using the arithmetic mean of the most recent three years results for background well BH-I (which is hydraulically upgradient of the waste footprint and has the highest groundwater elevation of any of the wells). The assessment is provided for all wells on Table 2 in Appendix D. The attenuation zone, by definition, is intended to allow for contaminant concentrations to decrease to Guideline B-7 levels as the groundwater migrates toward the attenuation boundary. Exceedances of RUP criteria are normal and not unexpected within an attenuation zone. Although no wells are located at or outside the attenuation zone boundary, BH-F is nearest the downgradient attenuation zone boundary; therefore, Guideline B-7 criteria are considered most applicable to the results for this well. Exceedances of the calculated criteria in 2021 and historically are summarized in the following table.

Parameters Exceeding Guideline B-7 (RUP) Criteria		
Monitoring Well	**Exceedance(s)**	
	2021	**Historical**
BH-A	None – dry well	None – dry well
BH-C	Organic nitrogen	TDS, DOC, organic nitrogen, alkalinity, sulphate, iron and manganese
BH-F	**None**	**Organic nitrogen**
BH-G	TDS, DOC, organic nitrogen, sodium, alkalinity, chloride, sulphate, boron, iron, manganese	TDS, DOC, organic nitrogen, sodium, alkalinity, chloride, nitrate, sulphate, boron, iron, manganese
BH-H	TDS, alkalinity, nitrate	Organic nitrogen
BH-I	None	Organic nitrogen, Manganese

Note: **Bold** indicates well nearest attenuation zone boundary (i.e., RUP criteria are potentially applicable).

At well BH-F, no parameters exceeded the B-7 (RUP) criterion in 2021. Historically on occasion, organic nitrogen has exceeded B-7. The historical exceedances for organic nitrogen in well BH-F are not considered significant, since the well is about 200 m from the attenuation zone boundary (Blackwater River) and there is no Aquatic Protection Value (APV) or PWQO for organic nitrogen (see Section 8.1.2).

7.8 Surface Water Quality Results

As previously indicated, in connection with an Environmental Screening currently underway to approve a 60,000 m^3 site expansion, a First Nation group has requested that Blackwater River water quality be monitored. Surface water sampling at two locations, SW1 and SW2, in the Blackwater River was initiated in the spring of 2021. Refer to Figure 2 in Appendix B for sampling locations.

The Blackwater River is located about 400 m southeast of the Beardmore Landfill. The river flows generally southwestward near the landfill, and empties into Lake Nipigon about 16 km southwest of the landfill. It is noted that the historical Northern Empire Mine site is located east of the Beardmore Landfill, and the southeast limit of the Beardmore Landfill attenuation zone borders the Blackwater River downstream of the mine site (refer to Figure 2 in Appendix B).

7.8.1 **SW1**

SW1 is located upstream of the landfill site attenuation zone boundary and is intended to represent levels in the Blackwater River not influenced by the landfill (i.e., background levels). One exceedance of PWQO criteria was noted for iron (fall only); note that the laboratory detection limit for cadmium exceeds the PWQO criterion. Concentrations of conductivity, TDS, TSS, alkalinity, chloride and iron were lower in the spring than in the fall, likely due to dilution from spring freshet.

7.8.2 **SW2**

SW2 is located downgradient of the Beardmore LF and is located at the downstream limit of the attenuation zone. In addition, SW2 is located in a relatively long and narrow bay of the Blackwater River. Three exceedances of PWQO criteria were noted in 2021, including phenols (fall) and iron (spring and fall); the laboratory detection limit for chromium exceeds the PWQO criterion. In addition, the arsenic concentration exceeded the PWQO interim criterion. Similar to SW1, concentrations of conductivity, phenols, alkalinity and sulphate were notably higher in the fall than the spring, possibly due to spring freshet.

7.9 QA/QC

7.9.1 **Cation/Anion Balances**

In general, a cation/anion balance difference of up to 10% is considered acceptable. However, since the chemistry of groundwater affected by landfills can be quite complex and

may not be balanced by the method indicated, the anion-cation balances of background monitoring wells are considered to be a better indicator of the reliability of results.

For the present results, the ion balance differences (shown on the tables in Appendix D) were all $\leq$ 10%, with the exception of the spring 2021 sample from BH-C, which had an ion balance of plus 10.9% (marginally high).

7.9.2 Duplicates and Blanks

In 2021, a blind duplicate groundwater sample (i.e., a duplicate sample collected in the field and labelled with a different but logical sample number) was submitted to the laboratory for each of the sampling events. The blind duplicate samples were collected from BH-G in the spring and fall events.

The relative percent difference (RPD) between the results for the sample and the field duplicate sample for each analysed parameter (excluding organic nitrogen which is obtained by difference) was calculated as the absolute value of the following:

$$RPD = \frac{(\text{Sample Result} - \text{Duplicate Result}) \times 100}{(\text{Sample Result} + \text{Duplicate Result}) / 2}$$

The RPD calculation is not considered valid for parameters reported to be present in very low concentrations (i.e., where the average of the two duplicates is <5 times the laboratory detection limit). For laboratory duplicates, the maximum RPD considered acceptable for most parameters in this study is 20%[4], with the notable exception of the following:

- Electrical conductivity – 10%
- pH – 0.3 pH units.

Although there are no set standards for RPDs for field duplicates, which introduce sampling variability, values up to 40% may be considered acceptable.

For the 2021 results, the only elevated RPD (i.e., above 40%) was for sulphate in the spring (RPD = 75%).

Overall, agreement between the original and duplicate samples was good with RPDs generally below 40%. Only one elevated RPD was noted in 2021 and was for sulphate in the spring (RPD = 75%); however, the differences do not affect the conclusions or recommendations of this report.

[4] MECP (2011). *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act*, July 1, 2011.

7.9.3 **Hold Times**

The samples were received by the laboratory within three days of collection. Based on the analysis dates reported by the laboratory, the MECP's recommended hold times appear to have been generally met.

7.9.4 **Internal QA/QC**

Internal quality control results (for blanks, spiked samples and lab duplicates) reported by the laboratory appear to be acceptable.

8 Contingency Plan

In accordance with the ECA, a contingency plan and trigger mechanisms relative to groundwater and surface water quality are required for the site.

8.1 Trigger Levels

Trigger levels for implementation of one or more aspects of a groundwater and surface water contingency plan would consist of predicted or actual exceedances of applicable criteria at or beyond the attenuation zone boundaries. The applicable criteria for groundwater at the north and south attenuation zone boundaries, and the north part of the east attenuation zone boundary, are Reasonable Use Policy (RUP) criteria calculated according to Guideline B-7. The applicable criteria for groundwater at the downgradient (east and southeast) attenuation zone boundary (where discharge is to the Blackwater River) are the Aquatic Protection Values. The applicable criteria for surface water (Blackwater River) are the Provincial Water Quality Objectives. Note, however, that surface water sampling is not a part of the currently mandated monitoring program but was implemented in the spring of 2021, as requested by a First Nation group.

8.1.1 Groundwater Protection

As previously discussed, the groundwater flow pathway to the southeast (i.e., discharging to the river) is considered to be the main route of concern for migration of the contaminant plume from the landfill site. This pathway, and the applicable trigger levels for protection of surface water quality, are discussed in Section 8.1.2 below. With regard to protection of groundwater quality, monitoring well BH-F is the most downgradient well at this site. It is located approximately 230 m from the east attenuation zone boundary that is formed by Highway 11. Although the predominant groundwater flow direction beneath the waste footprint is to the southeast (see Figure 4), the groundwater elevation at well BH-H near the southeast edge of the waste footprint is relatively high, which could tend to skew leachate flow in a more easterly direction toward the highway. Trigger levels at well BH-F are parameter concentrations that are predicted to have the potential to result in exceedances of Reasonable Use Policy (RUP) Guideline B-7 criteria at this boundary location, assuming a linear decrease in concentration with distance from the landfill.

The calculated 2021 trigger levels for protection of groundwater quality are provided in Table 4 in Appendix D.

Based on the available analytical results, similar to the 2017 through 2020 findings, the following parameters have the potential to exceed their B-7 criterion in downgradient groundwater: alkalinity, chloride, DOC, iron, manganese, organic nitrogen, sodium, sulphate and TDS. However, the maximum concentrations measured in the trigger well BH-F were all below the respective B-7 criteria, and were, therefore, even further below the calculated trigger levels for protection of groundwater quality. There were, therefore, no exceedances of trigger levels for protection of groundwater quality in 2021.

8.1.2 **Surface Water Protection**

In general accordance with the requirements of the ECA, trigger levels for protection of Blackwater River water quality have been developed that are based on predicted exceedances of Aquatic Protection Values (APV's) in groundwater at the downgradient limit of the attenuation zone, adjacent to the river, with reference to concentrations measured in the downgradient well BH-F and in the source well BH-G. We note that the ECA references the GW3 values found in Appendix A3 of the MECP's *Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario* (April 2011). The GW3 values (applicable to groundwater within 30 m of surface water) are equal to 10 times the APV's. However, in a memorandum reviewing a report for another waste disposal site, the MECP's Regional Hydrogeologist stated that groundwater quality results for wells located near, and presumably discharging to, surface water need to be compared directly to the APV criteria rather than to 10 times the criteria. Therefore, the present assessment utilizes the APV criteria directly, as found in Appendix B2 of the 2011 rationale document referenced above. This is considered a conservative approach (i.e., assumes no dilution). The trigger levels calculated in this manner are given in Table 5 (Calculation of Alert Criteria – Evaluation of Surface Water Impact Using APV Criteria) in Appendix D. In addition, similar trigger calculations were conducted using PWQO standards instead of APV standards; results are presented on Table 6 (Calculation of Alert Criteria – Evaluation of Surface Water Impact Using PWQO Criteria).

Alert Criteria Using APV Standards

Based on the available analytical results, only chloride has the potential to exceed the APV in downgradient groundwater. However, the maximum concentration measured in the trigger well BH-F is well below the APV criterion and is therefore even further below the calculated trigger levels for protection of surface water quality. There were, therefore, no exceedances of APV-based trigger levels for protection of surface water quality in 2021.

Surface water results for SW2 (at the downstream attenuation zone limit) are included on Table 5 in Appendix D, and the SW2 results for chloride were also below the APV criterion. Of note, a number of SW2 results exceeded the source concentrations at BH-G, including arsenic, lead, phenols and zinc. Therefore, the higher concentrations of these parameters in the river water cannot be attributed to landfill leachate impact.

Alert Criteria Using PWQO Standards

Based on the available analytical results, only boron in impacted (source well) groundwater has the potential to cause an exceedance of the PWQO in downgradient groundwater and surface water. However, the maximum concentration measured in the trigger well BH-F is below the laboratory detection limit and well below the PWQO criterion and is therefore even further below the calculated trigger levels for protection of surface water quality. There were, therefore, no exceedances of PWQO-based trigger levels for protection of surface water quality in 2021.

Surface water results for SW2 (at the downstream attenuation zone limit) are also included in Table 6 in Appendix D. As previously indicated, the iron level at SW2 exceeds the PWQO criteria and the results for chromium were below laboratory detection limits but the detection limit exceeded the PWQO criteria. Of note, a number of SW2 results exceeded the source concentrations at BH-G, including arsenic, iron, lead, phenols and zinc, and as indicated above, the measured levels of these parameters in surface water are therefore not attributable to landfill leachate impact.

8.1.3 **Landfill Gas**

Landfill gas has not been identified as an issue of concern at this site, and no monitoring for downwell methane levels has been conducted. There are no permanent enclosed structures on or in the immediate vicinity of the site that are considered to have the potential to accumulate landfill gases to potentially hazardous levels. Therefore, a contingency plan for landfill gas should not be required at this time.

8.2 **Contingency Plan Measures**

As discussed above, no exceedances of MECP Guideline B-7 criteria or Trigger Levels indicative of potential unacceptable landfill leachate effects at or beyond the established attenuation zone boundary are evident or anticipated, based on available monitoring results.

Should future monitoring results reveal or predict exceedances of applicable criteria indicating possible unacceptable current or future impact beyond the attenuation zone boundary, the data would first be scrutinized to ensure that they are valid and representative of actual conditions. It might be appropriate to require additional monitoring data before any decisions on remedial actions are made. If it is determined that an unacceptable risk of criteria exceedances downgradient of the landfill (i.e., impact to the Blackwater River) is present, the following measures could be undertaken to reduce leachate volumes and/or strength:

- The groundwater table beneath the waste pile could be lowered through ditching to intercept upgradient surface water and possible shallow groundwater inflow, and/or through other site drainage improvements.
- Landfill waste possibly buried below the groundwater table in some areas could be excavated and deposited above the water table, or alternatively moved to a different approved location.
- The amount and frequency of cover material applications could be increased.
- Lower permeability cover material could be used.
- Volumes of waste deposited in the landfill could be restricted and/or reduced through increased recycling efforts.
- If necessary, active leachate control (e.g., interception via a “French drain” system and redirection or capture for recirculation or treatment) could be implemented.

If the above measures are not successful, as a last recourse, the landfill could require premature capping and closure.

Additional details on contingency measures which would enable the particular nature of the potential impact to be assessed and properly addressed are found in the Design and Operations Plan.

9 Summary and Conclusions

The 2021 groundwater monitoring results confirm that leachate with concentrations of several potential indicator parameters that exceed ODWS criteria, and that are typically one or two orders of magnitude higher than background, is being generated at the site.

However, leachate-contaminated groundwater appears to be largely confined to the immediate vicinity of the waste footprint. There were no exceedances of the B-7 criterion in downgradient well BH-F, and this well is about 200 m from the attenuation zone boundary (Blackwater River). There were no exceedances of calculated trigger levels predictive of potential future unacceptable impact to groundwater or surface water. Therefore, there is no requirement to implement contingency plan measures at this time.

Surface water sampling was introduced in 2021 and surface water samples were collected from two locations (upstream to represent background levels [SW1] and at the downstream attenuation zone limit to represent possible impact from the landfill [SW2]). The downstream (SW2) location is near the end of a long and narrow bay, which could promote relatively stagnant water conditions. The surface water results were generally below PWQO criteria with the exception of iron (SW1 fall only and SW2 both events) and phenols (SW2 fall only). However, the iron and phenol levels were higher in the surface water than at the source groundwater monitoring well (BH-G), indicating that the elevated iron and phenol concentrations in the Blackwater River are attributable to natural levels or other sources, rather than to landfill leachate impact. Similarly, concentrations of arsenic, lead and zinc at SW2 were elevated compared to the groundwater results at source well BH-G.

As indicated above, as of September 7, 2021, the waste volume including interim cover on site was estimated to be about 89,254 m^3. Using the surveyed quantity increase of about 1,600 m^3 per year, or 133 m^3 per month, based on the September 2020 survey (volume increase in 2021 appears to be an anomaly – likely due to soil required for the bermed walls of the waste cells) the estimated volume on site as of December 31, 2021 was about 89,653 m^3, which slightly exceeds the currently approved capacity of 89,300 m^3.

However, the Environmental Screening Process to increase the landfill capacity by 60,000 m^3 (to 149,300 m^3) is nearly complete (awaiting receipt of Crown Easement from MNRF) and should extend the life of the landfill until beyond the middle of the century (subject to confirmation of waste volume estimates).

10 Recommendations

- In general, the analytical program should be continued in 2022, in accordance with the Amendment to ECA, and including surface water sampling.

- The laboratory should be instructed to utilize detection limits for all parameters that are at least equal to or lower than PWQO standards.

- To minimize leachate production, when areas of the landfill are brought up to final elevation, they should be capped and seeded as soon as possible (refer to the previously referenced D&O Plan).

- The Municipality should increase waste diversion and recycling activities to the extent possible/practical.

- The Municipality should consider seeking MECP approval to operate an annual (summer) HHW depot at the site.

- The approved attenuation zone boundaries for the Beardmore Landfill extend into Crown land. In January 2019, the Municipality of Greenstone submitted an application to the Ministry of Natural Resources and Forestry (MNRF) to obtain these lands, and in July 2019 the lands were surveyed. It is understood that based on an email dated September 9, 2021 from Nicole Horde (MRNF Regional Lands Specialist, Northwest Region), the Municipality will need to obtain a Crown Easement; Greenstone is currently working on this.

- The ECA and MECP Inspection Reports should be carefully reviewed to ensure that all requirements, including record keeping, reporting, staff training, marking limits of fill boundaries, litter fencing, etc. have been complied with.

- The actual annual waste quantities (in place and machine compacted) should be confirmed from the results of the next landfill volume survey to be provided with the annual report for the year 2023.

11 Closing Comments

This report has been prepared for and is intended for the use of the client (Municipality of Greenstone) and the MECP to assess compliance. The contents of this report may not be reproduced in whole or in part, or used or relied upon in whole or in part by any other party for any purpose whatsoever without the expressed written consent of EXP. Any use which a third party makes of this report, or any reliance on or decision made based on it, is the sole responsibility of such third party and EXP accepts no responsibility for any damages of any kind or nature whatsoever, suffered by any other third party as a result of decisions made or actions based upon this report. The findings are relevant for the date(s) of the investigation and should not be relied upon to represent conditions of other dates.

This report provides certain information concerning the results of the 2021 groundwater monitoring program at the Beardmore Landfill, as described herein. It is based on an authorized scope of work. Professional judgement was exercised in gathering and interpreting the information obtained and in the formulation of conclusions.

Conclusions regarding site conditions are based on observations of current and historical conditions and the results of limited chemical analyses. The groundwater and surface water results are only directly applicable to the actual locations sampled, and conditions could differ in areas not tested. Substances could also exist in forms not indicated by the limited analytical testing conducted. Additionally, the scope of work was based, in part, on rules and regulations that we understand to be current or expected at the time of the work. Changes in regulations, interpretations and/or enforcement policies may occur in the future. Such changes could be reflected in the degree of remediation actually required, if any, at the time of the action.

If additional relevant information becomes available concerning this site, such information should be provided to EXP so that our report may be reviewed and modified as necessary. EXP accepts no responsibility for the consequential effects of this factual report on the real or perceived value of this site, or on the ability to sell, finance or insure the property.

All reports, field data, notes, laboratory test data, calculations, estimates and other documents which are communicated by EXP to the client or third parties, are instruments of service and will be retained by EXP. These records will be stored in our files for a period of 10 years following submission of the final report, during which time they will be made available to the client, at all reasonable times, for review.

EXP has conducted the services reported herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practising in the same locality and under similar conditions as this project. No other representation, expressed or implied, is included or intended in this document.

We trust that this report is satisfactory for your present requirements. Should you have any questions, please contact the undersigned at your convenience.

Yours truly,

EXP Services Inc.

Ahileas Mitsopoulos, P.Eng.
Project Engineer

Robert J. Rinne, M.Sc., QEP
Senior Scientist

Demetri N. Georgiou, MASc., P.Eng.
Principal Engineer/Branch Manager

APPENDIX A – MECP Documentation

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

AMENDMENT TO ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER A7249502
Notice No. 1
Issue Date: February 8, 2017

The Corporation of the Municipality of Greenstone
1800 Main St
Post Office Box, No. 70
Geraldton, Ontario
P0T 1M0

Site Location: Beardmore Waste Disposal Site
North of Mining Claim TB 10597, Twp of Summer, Municipality of Greenstone
Greenstone Municipality, District of Thunder Bay

You are hereby notified that I have amended Approval No. A7249502 issued on July 15, 1979 for a 4.20 hectare landfill site within a total site area of 22.40 hectares , as follows:

For the purpose of this Environmental Compliance Approval and the terms and conditions specified below, the following definitions apply:

a) "***Approval***" means this Environmental Compliance Approval including all Notices of Amendment;

b) "***CAZ*** " means the Contaminant Attenuation Zone, as defined in Section 4 of Regulation 232;

c) "***Director*** " means Director, Section 39, Environmental Protection act, R.S.0. 1990, C.E-19 as amended;

d) "***District Manager*** " means the District Manager in the Ministry's Thunder Bay District Office

e) "***EPA*** " means the Environmental Protection Act, R.S.O. 1990, C.E-19 as amended;

f) "***Ministry*** " means the Ontario Ministry of the Environment and Climate Change;

g) "***Operator*** " means the Municipality of Greenstone, its officers, employees, agents or contractors; and

h) "***Owner*** " means any person that is responsible for the establishment or operation of the site being approved by this *Approval* , and includes the Municipality of Greenstone, its successors and assigns;;

i) "***OWRA*** " mean the Ontario Water Resource Act, R.S.O 1990, Chapter O.40

j) "***PA*** " means the *Pesticides Act* , R.S.O. 1990, c. P-11, as amended from time to time;

k) "***Reasonable Use Guideline*** " means the Ministry Guideline B-7 entitled "Incorporation of the Reasonable Use Concept into MOE Groundwater Management Activities, dated April 1994, as amended

l.) "***Regulation 347*** " means Regulation 347 R.R.O. 1990;

m.) "***Regulation 232*** " means Ontario Regulation 232 R.R.O. 1990;

n.) "***Site*** " means the Beardmore Waste Disposal Site located in the Municipality of Greenstone;

o.) "***Transfer Station*** " means the recycling/public waste drop-off facility as shown in Item (1) of Schedule "A".

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

GENERAL

Compliance

1. (1) 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.

(2) The *Owner* shall ensure that *MOE* Guideline B-7 Reasonable Use Guideline are applied and met at all points on the property line which are impacted by leachate generated at the *Site* .

2. 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

3. Except as otherwise provided for in this *Approval* , the *Site* shall be designed, developed, built, operated and maintained in accordance with the original application for this *Approval* , the condition herein this *Approval* and the supporting documentation listed in Schedule "A".

Interpretation

4. Where there is a conflict between a provision of any document, including the application, referred to in this *Approval* , and the conditions of this *Approval,* the conditions in this *Approval* shall take precedence.

5. Where there is a conflict between the application and a provision in any documents 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 that the *Ministry* approved the amendment.

6. Where there is a conflict between any two documents listed in Schedule "A", other than the application, the document bearing the most recent date shall take precedence.

7. 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

8. 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; or

    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* ;

Adverse Effect

9. 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 *Site,* including such accelerated or additional monitoring as may be necessary to determine the nature and extent of the effect or impairment.

10. 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.

Change of Owner

11. 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* ;
    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;

12. 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. In the event of any change in *Ownership* of the works, 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.*

Inspections

13. No person shall hinder or obstruct a *Provincial Officer* from carrying out any and all inspections authorized by the *OWRA* , the *EPA* , or the *PA* , 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* or the *PA* .

Information and Record Retention

14. a) Any information requested, by the *Ministry,* 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, in a timely manner.

b) Records shall be retained for 5 years except for as otherwise authorized in writing by the *Director*.

15. 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; or
b. acceptance by the *Ministry* of the information's completeness or accuracy.

Contaminant Attenuation Zone

16. By **September 30, 2017**, the Owner shall provide written documentation to the Director that the 18.2 hectare CAZ identified in Item (1) of Schedule "A" has been established in accordance with Section 4 of Regulation 232.

Site Capacity and Service Area

17. The approved capacity for the Site is **89, 300** cubic meters. The Owner shall construct, operate and manage the Site in accordance with the Design and Operations Plan listed as Item (1) of Schedule "A". The maximum amount of waste, daily cover, intermediate cover and final cover placed shall not exceed the final contours shown in Figure 6 of Item (1).

18. Wastes generated only from within the geographic boundaries of the Municipality of Greenstone, the Rocky Bay (Biinjitiwaabik Zaaging Anishinaabek) First Nation, the Lake Nipigon (Animbiigoo Zaagi igan Anishinaabek) First Nation and the Sand Point First Nation (Bingwi Neyaasli Anishinaabek) may be received at this *Site* .

19. Only municipal waste which includes wastes generated by residential, commercial, institutional and industrial sectors, and contaminated fill shall be accepted at the *Site* .

20. Waste may only be disposed of in the approved 4.20 hectare fill area as identified in Item (1) of Schedule "A".

(a) By no later than **August 31, 2017**, the *Owner* shall clearly define the boundaries of the limit of waste by installing permanent markers that can be visible year-round; and
(b) By no later than **June 30** of each year, the Owner shall clearly define the boundaries of the fill area to be used for waste disposal over the following year by installing markers visible to Site operators.

Operating Hours, Signage and Site Operations

21. The Owner shall ensure that all Site employees receive initial and ongoing training with respect to the following: the Approval and conditions attached to the Approval, conceptual design and operations; relevant waste management regulations and legislation; environmental concerns related to the waste being handled at the Site; occupational health and safety concerns pertaining to the waste being handled at the Site; fire fighting protocol; and emergency and contingency measures for the preventing of off-site impacts.

22. A sign shall be posted in a prominent location at the *Site* entrance clearly stating the following:

    i. *Owner* 's name;
    ii. Operator's name;
    iii. Approval Number;
    iv. Applicable Municipal By-Laws;
    v. The hours of operation; and
    vi. Municipal government contact telephone number to call with complaints or in the event of an emergency.

23. (1) The hours of operation for the *Site* are:

    i. Monday, Wednesday and Friday between the hours of 1:00 p.m. and 6:00 p.m. and Saturdays from noon to 6:00 pm during the summer; and

    ii. Monday, Wednesday and Friday between the hours of noon and 5:00 p.m. and Saturdays from 11:00 am to 5:00 pm during the winter;

    (2) The hours of operation may be changed as necessary with the written concurrence of the *District Manager* .

24. No waste shall be received, landfilled or removed from the *Site* unless a site supervisor or attendant is present and supervises the operations during operating hours unless otherwise approved by this *Approval* . The *Site* shall be closed when a site attendant is not present to supervise operations.

25. During non-operating hours, the *Owner* shall ensure that the *Site* entrance and exit gates are locked and the *Site* is secured against access by unauthorized persons.

26. Burning of clean wood and brush is only permitted during daylight hours under controlled and supervised conditions in a segregated portion of the site. Burning shall not be conducted during periods of elevated forest fire hazards.

27. Waste shall be deposited in a manner that minimizes the area of exposed waste at the working face and shall be compacted before cover material is applied.

Landfill Covers

28. On at least a weekly basis, the Owner shall ensure that exposed waste is covered with cover material as specified in Section 28(2) of Regulation 232.

29. Intermediate Cover shall be placed in areas where landfilling has been temporarily discontinued for six (6) months or more. A minimum thickness of 300 mm of soil cover or an approved thickness of alternative cover material shall be placed.

30. Final cover shall be applied progressively, as each part of the Site reaches final grades. The design of the final cover shall comply with the specifications contained in Section 29 of Regulation 232. Vegetation of completed final cover shall occur within one month of its placement of the final cover, or as soon as weather permits.

Transfer Station Operation

31. The Owner may operate a *Transfer Station* for the purposes of diverting waste from final disposal.

32. The *Owner* shall ensure that an attendant(s) is/are on duty at all times when the *Transfer Station* is open to ensure proper supervision of all activities.

33. All waste types shall be segregated either into bins, or in designated areas defined by barriers. All bins and designated waste storage areas shall be clearly labelled.

34. The Owner shall employ a licensed technician to drain refrigerants from appliances. Appliances that have been drained of refrigerants shall be clearly tagged and segregated from those appliances that have not been drained.

35. The Owner shall remove all scrap metal and appliances from the Transfer Station at an interval not to exceed six (6) months.

36. The Owner shall install and maintain an electric fence around the perimeter of the active disposal area to eliminate access for bears and the *Owner* shall ensure that adequate fire fighting and contingency spill clean up equipment is available and that emergency response personnel are familiar with its use and location.

Litter and Vermin

37. The Owner shall take all practical steps to prevent the escape of litter from the Site. Periodic pick-up of litter at the Site and along roads in the vicinity of the Site shall be carried out as required, or every two weeks as a minimum. Property adjacent to the Site shall be inspected weekly and litter shall be collected if necessary, with permission of access from the property owner. Litter fencing shall be erected around the working area of the landfill.

Hydrogeological Monitoring

38. The *Owner* shall conduct groundwater monitoring at the *Site* in accordance with the environmental monitoring program outlined in Section 3.12 of Item 1 in Schedule "A" and the following conditions:

(a) By **June 30, 2017**, the Owner shall install 3 new monitoring wells (BH-G, BH-H and BH-I) that are situated in close proximity to the locations indicated on Figure 3 of Item 1 in Schedule "A". The Owner shall submit a report to the District Manager, identifying the specific locations of the new wells and shall indicate casing or groundwater elevations that are surveyed with reference to the same datum as existing wells.

(b) Groundwater samples shall be collected at all five monitoring wells (BH-C, BH-F, BH-G, BH-H and BH-I) twice (2) per year in the Spring and Fall. Sample collection shall include measurement of water levels, temperature and conductivity in each well.

(c) Collected samples must be submitted to a certified lab for analysis. Each year, the samples from one event are to be analysed for the full list of comprehensive parameters as specified in Schedule 5 of Regulation 232 and the set of samples from the remaining event should be analysed for the indicator parameters as set out in Schedule 5. The spring and fall sampling events should be alternated from year to year as comprehensive or indicator parameters.

(d) At each sampling event, monitoring well BH-A should be inspected, and if water is found in the well, the level should be recorded and the water sampled for the full suite of parameters pertaining to that sampling event, assuming adequate water volume is available.

(e) For any changes to the monitoring program recommended in the annual report, the *Owner* shall in a cover letter for the report request the acceptance of the changes by the *District Manager* . The *Owner* shall make clear reference to the proposed changes in separate letter that shall accompany the annual report.

(f) Within fourteen (14) days of receiving the written correspondence from the District Office confirming that the District Office is in agreement with the proposed changes to the environmental monitoring program identified in Condition 43, 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 Condition 43, to the *Director* requesting the *Approval* be amended to approve the proposed changes to the environmental monitoring plan.

(g) 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.

39. The *Owner* shall ensure that all groundwater monitoring wells are properly labelled, capped, secure and protected from damage. Any well that is damaged must be re replaced forthwith with a suitable replacement well if damage with written concurrence by the *District Manager*

Inspections and Record Keeping

40. The *Owner* shall establish and maintain a written record of daily operations at the *Site* . This record must be in a form of a log or a dedicated electronic file and it shall include as a minimum the following information:

a) date of record;
b) hours of operation;
c) an approximation of the type, amount and source of waste received and removed from the site;
d) type of the emergency situation and the resulting environmental impact;
e) actions taken to address the impact; and
f) actions taken to prevent the re-occurrence of a similar emergency situation in the future.
g) date and time of any complaints received at the Site and their nature;
h) name, address and telephone number of the complainant;
i) nature of the complaint;
j) date and description of any remedial actions taken to address the received complaints; and
k) actions taken to prevent the re-occurrence of a similar incident, in the future.

41. The *Owner* shall establish inspections of the Site for every day that the Site is operating and maintain a written record of the Site inspections. This record shall be in the form of a log or a dedicated electronic file and it shall include, as a minimum, the following information:

a) date and time of inspection;
b) name, title and signature of trained personnel conducting the inspection; and
c) a listing of all equipment, fencing, signs, etc. inspected and any deficiencies observed; and
d) recommendations for remedial action and the completion date of such action.

Annual Report

42. By **April 30, 2018** and by every April 30 thereafter, the Owner shall submit, to the *District Manager* , an annual report covering the previous calendar year. The report shall be prepared by a qualified Professional Engineer or Professional Geoscientist in the Province of Ontario. The report shall contain, but is not limited to, the following information:

a) a summary of type and quantity of incoming waste accepted during the reporting period;
b) Discussion indicating the landfill capacity, current fill volume, volume filled in the last year, and the status of any control measures such as interim, final or progressive cover
c) a summary of the site's operation procedure and compliance as per the Design and Operation Plan;
d) a summary of recycling operations;
e) An accurately scaled site plan illustrating the location of all buried wastes, the site boundaries, monitoring well locations, the location of the contaminant attenuation zone, and any other significant site features.
f) An accurately scaled location map illustrating topography and the site relative to nearby potentially sensitive groundwater/surface water features (i.e., lakes, streams, wells), or any other potentially significant receptors.
g) A section describing the field monitoring and sampling program including QA/QC measures and any variance from normal sampling procedures and/or conditions.
h) A water table contour map based on current data.
i) Stratigraphic cross-sections which clearly illustrate the subsurface distribution of geological materials.
j) Borehole and monitoring well logs for all monitoring wells.
k) Tables presenting historical water chemistry and water level data, and graphs illustrating quality trends with time for key parameters at all monitoring locations.
l) Discussion and assessment of groundwater flow direction and velocities, estimates of leachate generation/impacts, effectiveness of mitigation measures, and compliance with the Reasonable Use Policy;
m) Recommendations as required for future mitigation, monitoring and site characterization activities.

43. The first annual monitoring report, due **April 30, 2018** should include recommendations for trigger levels as related to contingency plans. The trigger levels should be developed in consideration of both the Reasonable Use Policy and the Aquatic Protection Values (GW3 values as described in Appendix A3 of the MOECC's "Rationale for the Development of Ground Water Standards for Use at Contaminated Sites in Ontario" April 15, 2011).

Closure Plan

44. By December 31, 2019, the Owner shall submit to the Director, for approval, a Closure Plan for the site which includes, as a minimum, the following:

i. Site plan and profiles showing the proposed post-closure topography;
ii. Procedures for completion of installing, inspecting and maintaining the final cover and landscaping;
iii. Site security (e.g. fencing and access control)
iv. Proposal for post closure monitoring
v. Identification of structures to be removed from the Site;
vi, Identification of post-closure land use;

vii. Advance public notification of closure and of alternate waste disposal site; and

viii. Any other improvements or alterations of the Site.

Schedule "A"

This Schedule "A" forms part of this Approval. If there is a conflict between documents listed in Schedule "A", the document bearing the most recent date shall apply:

1. Report entitled "*Design and Operations Plan - Beardmore Landfill Site* ", dated February 22, 2016, prepared for the Municipality of Greenstone by exp Services Inc..

2. Environmental Compliance Approval Application, dated June 11, 2015 and signed by Brian Aaltonen, Director of Public Services, Municipality of Greenstone requesting approval of and updated Design and Operations Plan for the Beardmore Landfill Site.

3. Letter dated September 18, 2015 to Mr. Dale Gable, MOECC from D. Georgiou/A Mitsopoulos, exp Services Inc, providing additional information on the Expansion of the Beardmore Landfill Site.

The reasons for this amendment to the Approval are as follows:

1. *The reason for inclusion of the definitions is to define the specific meaning of terms and simplify the wording of conditions in this Approval.*

2. *The reason for Condition 3 is 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.*

3. *The reason for Conditions 1, 2, 4, 5, 6, 7, 8, 9, 10, 14 and 15 is to clarify the legal rights and responsibilities of the Owner under this Approval.*

4. *The reasons for Condition 12 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 ECA of Approval.*

5. *The reasons for Conditions 11 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.*

6. *The reason for Condition 13 is to ensure that appropriate Ministry staff have ready access to the Site for inspection of facilities, equipment, practices and operations required by the conditions in this ECA of Approval. These conditions are supplementary to the powers of entry afforded a Provincial Officer pursuant to the EPA and OWRA.*

7. *The reason for Condition 16 is to ensure that there sufficient land available for the attenuation of contaminants and for implementing control measures, if required.*

8. *The reasons for Condition 21 are to ensure that users of the Site are fully aware of important information and restrictions related to Site operations under this ECA of Approval.*

9. *The reasons for Conditions 23 is to specify the normal hours of operation for the landfill Site and a mechanism for amendment of the hours of operation.*

10. *The reasons for Conditions 24 and 25 is to specify site access to/from the Site and to ensure the controlled access and integrity of the Site by preventing unauthorized access when the Site is closed and no site attendant is on duty.*

11. *The reasons for Conditions 27, 31, 33, 34, 35, 36 and 37 are to ensure the site is operated in an manner in which as adverse effect does not occur. This is to ensure the long-term protection of the environment and human health..*

12. *The reason for Conditions 18 and 19 is to specify the approved areas from which waste may be accepted at the Site and the types and amounts of waste that may be accepted for disposal at the*

Site, based on the Owner's application and supporting documentation.

13. *The reason for Condition 17 and 20 is to specify restrictions on the extent of landfilling at this Site based on the Owner's application and supporting documentation. These limits define the approved volumetric capacity of the site. Approval to landfill beyond these limits would require an application with supporting documentation submitted to the Director.*

14. *The reason for Condition 28, 29 and 30 is to ensure that landfilling operations are conducted in an environmentally acceptable manner. Daily and intermediate cover is used to control potential nuisance effects, to facilitate vehicle access on the site, and to ensure an acceptable site appearance is maintained. The proper closure of a landfill site requires the application of a final cover which is aesthetically pleasing, controls infiltration, and is suitable for the end use planned for the site.*

15. *The reason for Condition 26 is to ensure the burning of clean wood is conducted in an acceptable manner and best practices.*

16. *The reason for Conditions 40 and 41 to ensure regular inspections of the site are conducted in order to protect the natural environment and that accurate records are maintained to ensure compliance with the conditions in this Approval, the EPA and its regulations. Record keeping is necessary to determine compliance with this ECA of Approval, the EPA and its regulations.*

17. *The reason for Conditions 32 and 34 is to ensure that the Site is supervised and operated by properly trained staff in a manner which does not result in a hazard or nuisance to the natural environment or any person.*

18. *The reason for Condition 38 and 39 is to demonstrate that the landfill 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..*

19. *The reason for Condition 42 and 43 is 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.*

20. *The reasons for Condition 44 is to ensure that final closure of the Site is completed in an aesthetically pleasing manner and to ensure the long-term protection of the natural environment.*

This Notice shall constitute part of the approval issued under Approval No. A7249502 dated July 15, 1979

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:

1. 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;
2. 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:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. 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 and Climate Change
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 February, 2017

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

IP/

c: District Manager, MOECC Thunder Bay - District
Demetri Georgiou, exp Services Inc., The Corporation of the Municipality of Greenstone

LEVEL OF LAKE CONTROLLED BY A DAM ... YES ... NO X

BOUNDARIES COMPLETELY / PARTIALLY CUT OUT

PRELIMINARY SURVEY BY J. N. Auger,

DATE OF PRELIMINARY SURVEY Nov. 20, 62.

NAME OF APPLICANT Improvement District of

ADDRESS BEARDMORE, Ont. Beardmore

REMARKS Land Use Permit for garbage disposal.

DISTRICT OFFICE

ONTARIO PROVINCIAL GOVERNMENT

DATE

TOWNSHIP

LOT CONCESSION

APPROVED

District Forester

COPY

November 21st, 62.

District Forester,
Att. B. Parker:
GERALDTON, Ontario.

MACDIARMID, Ontario.

Mining Claim TB-11545 - Summers Township
Our Telephone conversation of Nov. 20th, 1962.

Please find attached a Preliminary Survey S-1 of disposal grounds for the Improvement District of Beardmore.

In regards to fire safety stand point, it is suggested that a 20' fire guard be bulldozed down to mineral soil as outlined on sketch in red.

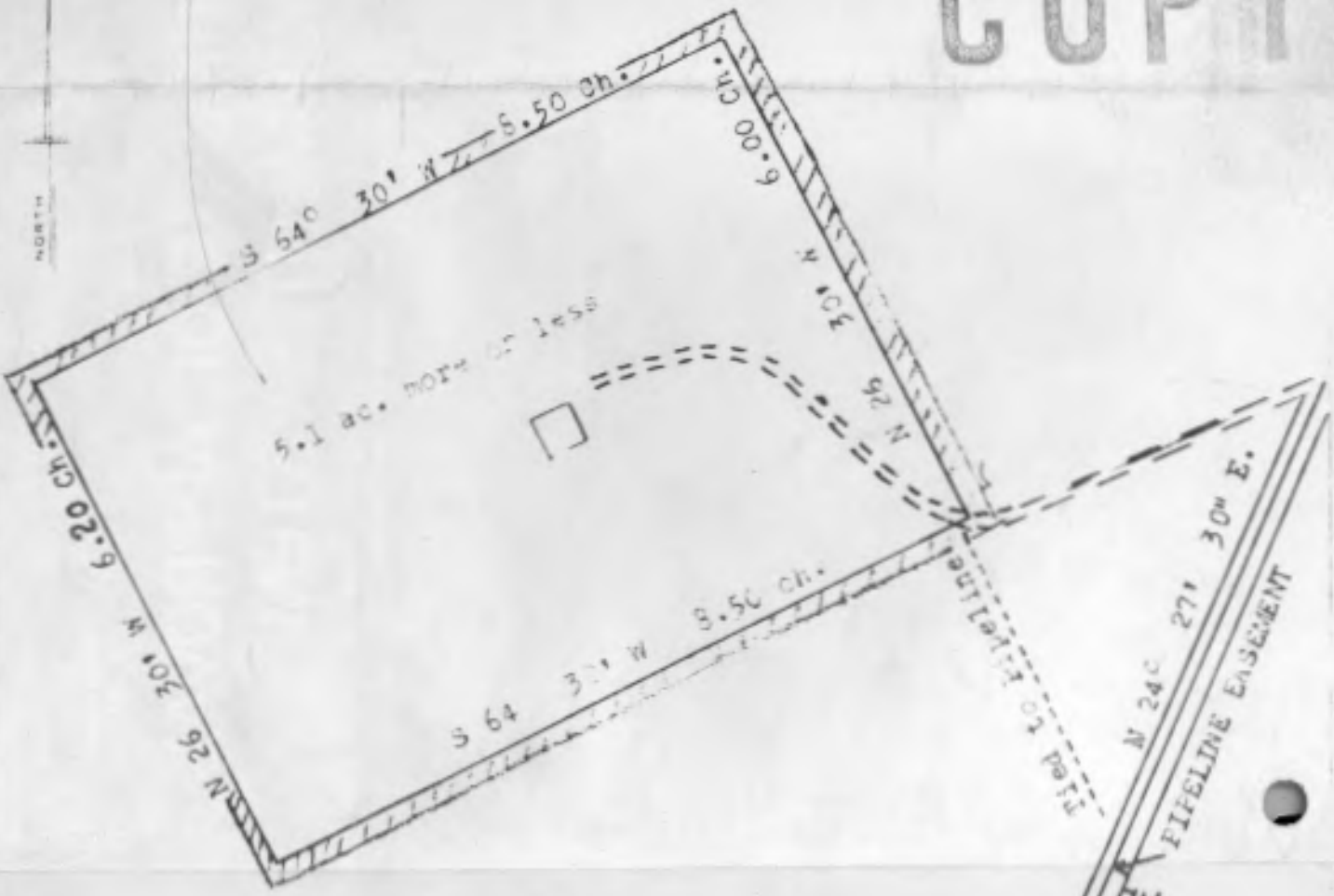
It is also suggested that 4 pack-cans be filled with water and placed at each corner of the dump; and no burning during high fire hazard and high wind periods.

COPY

FILE

DIVISION OF SURVEYS

DETAIL PLAN - (Position of shore line taken from most recent information available)



SCALE 132 FEET TO 1 INCH (Not to be less than 200 feet to 1 inch)

PRIVATE USE COMMERCIAL USE SPECIAL USE X

LOT NO. OF PRELIMINARY SUBDIVISION

INDIVIDUAL LOCATION X

To be used by District Offices in submitting applications for summer resort locations and locations for special use

ONTARIO

Department of Energy and Resources Management
Waste Management Branch

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

TO: THE DEPARTMENT OF ENERGY AND RESOURCES MANAGEMENT
880 Bay Street,
Toronto, Ontario

To be submitted through Regional Waste Management Engineer

(1) Under the Waste Management Act, 1970 and the regulations, this application is made by CORPORATION OF THE IMPROVEMENT DISTRICT OF BEARDMORE

Owner of Facility

Address

(2) for the ~~Renewal~~ / Issue of a Certificate of Approval for a ~~DUMP~~ LANDFILL ~~INCINERATOR~~ DISPOSAL Site

Delete item inapplicable

Type of Disposal

(3) located North of Mining Claim TB10597 in the Township of Summer

Full particulars of Location

(4) A Certificate / Provisional Certificate of Approval No. ..... for this site was issued ..... 19.....

Delete item inapplicable

(5) No change in use, operation, or ownership of the site has occurred since the date of the original application.

Dated this 3rd. day of February 19 71

Improvement District of Beardmore

(Sec.-Treas.)

Signature of Applicant

(6) The following changes in use, operation or ownership (have occurred since the date of the original application) (are proposed)

Delete item inapplicable

If necessary, provide additional details on separate sheets and attach to application.

Continued on Attached Sheets ☐

(7) The site will be operated in accordance with The Waste Management Act, 1970 and the regulations by THE CORPORATION OF THE IMPROVEMENT DISTRICT OF BEARDMORE

Name of Operator

Address

The required supporting information to the application is appended hereto.

(8) Notice of this application has been published in the .....

.....on....., ...and

.....19..... and a copy of the notice is attached.

(9) A certificate that the site does not contravene any of the by-laws of the municipality is attached.

To be completed if applicant is other than a municipality

See notes on sections 1 to 9 on back of last copy (pink) which is to be retained by Applicant.

Dated this 3rd. day of February 19 71

Improvement District of Beardmore

(Sec.-Treas)

Signature of Applicant

No Carbon Paper Required

W.M.B. n 2.02

Department of Energy and Resources Management
Waste Management Bi h

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

For Head Office Use

1. Wastes to be Disposed of Comprise

Domestic	80 %
Commercial	20 %
Industrial Waste	%
Hauled Liquid Industrial Waste	%
Agricultural Waste	%
Hazardous Waste	%
Hauled Sewage	%
*Other	%
	100%

*Describe

Total 10 tons per week Tons/Day

Population Served 796 (last census figure)

2. Origin and Composition of Principal Components of Waste (other than domestic and commercial)

3. Distance to Nearest Watercourse 1600 Ft.
Distance to Source of Potable Water 1800 Ft.
Distance to Dwelling 1800 Ft.
Distance to Public Road 800 Ft.
Distance to Cemetery Ft.

Total Area of Site 5 Acres
Anticipated Life Years
General Description of Site

Flat sandy area. Slightly higher at the north end.

4. Maximum Depth of Excavation Below Surface 8 Ft.
Maximum Height of Fill Above Surface Ft.
Type(s) of Material Encountered From Surface

Ft.
Ft.
Ft.
Depth of Watertable Below Surface 10 Ft.
on 3 Feb 71 (Date)

5. Proposed Future Land Use

N.O.N.

6. Operating Equipment

D-6 Tractor
944

Hours of Operation

7. The Following Documents are Attached

Copy of Department of Lands & Forests plan showing location of dump area

Prepared by
Mr. R. Nylund,
Secretary-Treasurer,
Improvement District of Beardmore,
Beardmore, Ontario

DATED February 3rd, 1971

SIGNED R. Nylund

FOR DEPARTMENTAL USE

8. Authorities Consulted:

Health Unit	☐ Objection	☑ No Objection
O.W.R.C.	☐ Objection	☑ No Objection
A.M.B.	☐ Objection	☑ No Objection
Municipality	☐ Objection	☐ No Objection
Conservation Authority	☐ Objection	☐ No Objection

Other

Inspection Record Forms Attached

Regional Engineer's Report Attached ☐

RECOMMENDATION

Subject to further inspection by Lands Staff

DATED

SIGNED W. H. Wright

W.M.B. Form No. 2.07

No Carbon Paper Required

HEAD OFFICE USE
File A —

ONTARIO

Department of the Environment

Waste Management Branch

APPLICATION FOR A CERTIFICATE OF APPROVAL FOR A WASTE DISPOSAL SITE

Waste Management Branch
1111 Victoria Avenue
THUNDER BAY, "F" ONT.

IMPORTANT NOTE

THIS FORM MUST BE SUBMITTED THROUGH THE OFFICE OF THE REGIONAL WASTE MANAGEMENT ENGINEER

A 59/501

(SEE SECOND SHEET FOR INSTRUCTIONS FOR COMPLETING THIS FORM)

1. Owner (Applicant)	Under the Environmental Protection Act and the Regulations, this application is made by:—	CORPORATION OF THE IMPROVEMENT (Name) DISTRICT OF BEARDMORE (Address) BEARDMORE ONTARIO
2. Type of disposal site	For the ~~Issue~~ Reissue of a Certificate of Approval for a	LAND FILL Site
3. Site location	Located	NORTH OF MINING CLAIM T.B. 10597, TOWNSHIP of SUMMER
IF APPLICATION IS FOR **REISSUE**, COMPLETE SECTIONS 4 AND 5 (A OR B)		
4. Previous Certificate details	~~Certificate~~ Provisional Certificate of Approval:— for this site was issued on:—	No. 591501 10 AUGUST 1971
5. Changes.	(A) The following changes in use, operation or ownership (have occurred since the date of the original application) OR (are proposed)	
	(B) No change in use, operation or ownership of the site has occurred since the date of the original application.	☑
IF APPLICATION IS FOR **ISSUE**, COMPLETE SECTIONS 6, 7, 8 AND 9		
6. Operator.	The site will be operated in conformity with the Environmental Protection Act and the regulations by:—	THE IMPROVEMENT DISTRICT (Name) of BEARDMORE (Address) BEARDMORE ONTARIO
7. Publication of Notice.	Notice of this application has been published in the on the following dates	(Name of Newspaper)
	and a copy of the notice is attached.	☐
8. Municipal Certificate (Non-municipal applicants only)	A certificate, that the site does not contravene any of the by-laws of the	(Municipality)
	Signed by is attached.	(Name) (Position)
9. Additional information	The required supporting information to this application is attached.	☐

WASTE MANAGEMENT BRANCH
RECEIVED
MAY 8 1972
NORTH BAY
NORTHERN REGION

Dated this 17th day of April 19 72

Signature of Owner-Applicant

W.M. 302 3-72

No Carbon Paper Required

A5915

Department of the Environment
Waste Management E ch

SUPPORTING INFORMATION TO AN APPLICATION FOR APPROVAL OF A LANDFILL DISPOSAL SITE

APPLICANT TO COMPLETE ITEMS 1-4 INCLUSIVE

FOR DEPARTMENTAL USE

For Head Office Use

File A

1. SITE DETAILS

Applicant IMPROVEMENT DISTRICT OF BEARDMORE

Site Location NORTH OF MINING CLAIM

TB 10597 TOWNSHIP OF SUMMER

Total area of Site	5 Acres
Total usable area for waste disposal	..... Acres
Anticipated Lifetime	..... Years
Distance to nearest watercourse	1600 ft.
Distance to nearest potable well water supply	1800 ft.
Depth of well noted above	[redacted] ft.
Distance to dwelling	1800 ft.
Distance to public road measured from working area	800 ft.
Distance to cemetery	..... ft.
Depth from original surface to bottom of waste	8 ft.
Depth from original surface to top of fill	- ft.

Ground conditions encountered measured from original surface

FINE SAND From 0' To 10'6"

..... From ..... To .....

..... From ..... To .....

..... From ..... To .....

Depth to watertable below surface ..... 10 ..... ft.

on ..... 3 FEB 1971

General description of site (location, topography etc.)

FLAT SANDY AREA RISING GENTLY A HALL AT NORTH END

Proposed use of land after site fully utilized

NONE

2. Wastes to be Disposed of Comprise

Domestic	80 %
Commercial	20 %
Industrial Waste	..... %
Hauled Liquid Industrial Waste	..... %
Agricultural Waste	..... %
Hazardous Waste	..... %
Hauled Sewage	..... %
*Other	..... %
	100%

*Describe .....

Origin and Composition of Principal Components of Waste (other than domestic and commercial)

FOR REGIONAL USE

Authorities Consulted:

Health Unit	☐ Objection	☐ No Objecti
O.W.R.C.	☐ Objection	☐ No Objecti
A.M.B.	☐ Objection	☐ No Objecti
Municipality	☐ Objection	☐ No Objecti
Conservation Authority	☐ Objection	☐ No Objecti

Other .....

Inspection Record Forms Attached Yes ☐ No ☐

Number of Forms .....

Regional Engineer's Report Attached ☐

Ground water monitoring Yes ☐ No ☑

Surface water monitoring Yes ☐ No ☑

3. Quantities

Total Tons per Day ..... 10 TONS / WEEK

Total Gallons per Day .....

Estimated ☑ or Measured ☐

Site operated 7 days from ..... to .....

Population served 786

Names of Municipalities served

IMPROVEMENT DISTRICT OF BEARDMORE

Official Plan ☐ Zoning Bylaw ☑

Site land zoned GREEN BELT ZONE

Adjacent land zoned FARM LAND ZONE

Equipment Owned ☐ Rented ☑

4. The Following Documents are Attached

WASTE MANAGEMENT BRANCH
RECEIVED
MAY 8 1972
NORTH BAY
NORTHERN REGION

Prepared by .....

DATED 17 April 72

Signature of Owner (Applicant)

W.M. 303 2-72

No Carbon Paper Requir

Ontario
Ministry of the Environment

Provisional Certificate No.
D 7249501

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Improvement District of Beardmore,
P.O. Box 293,
Beardmore, Ontario. P0T 1G0

for the Derelict Motor Vehicle Site
located Municipal Landfill Site,
Beardmore, Township of Summers

subject to the following conditions:

This Provisional Certificate expires on the 15th day of June, 19 75

Dated this 24th day of October, 19 74.

D. P. Caplice
DIRECTOR, SECTION 3 (a) E.P.A.

Ontario
Ministry of the Environment

Provisional Certificate No.
7249502

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE DISPOSAL SITE

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Improvement District of Beardmore,
P. O. Box 239,
Beardmore, Ontario.

for the Landfill Site
located North of Mining Claim TB 10597,
Township of Summer,
District of Thunder Bay.

subject to the following conditions:

This Provisional Certificate expires on the 15th day of July, 19 79

Dated this 16th day of July, 19 75

D. P. Caplice
DIRECTOR, SECTION 3 (a) E.P.A.

14-201

Ontario
Ministry of the Environment

Provisional Certificate No.
A 591550

PROVISIONAL CERTIFICATE OF APPROVAL
FOR A
WASTE MANAGEMENT SYSTEM

Under The Environmental Protection Act, 1971 and the regulations and subject to the limitations thereof, this Provisional Certificate of Approval is issued to:

Improvement District of Beardmore
P.O. Box 239
Beardmore, Ontario
P0T 1G0

for the Waste Management System serving Improvement District of Beardmore

in the approved or provisionally approved waste disposal sites and facilities listed below.

	SITE CERTIFICATE No.	EXPIRY DATE
North of Mining Claim TB 10597 Township of Summer, Thunder Bay District	A 7249502	

and

subject to the following conditions:

THIS IS A TRUE COPY OF
ORIGINAL CERTIFICATE MADE
ON Feb. 16/81
(Signed)

Dated this 10th day of February, 1981

DIRECTOR, SECTION 3(a) E.P.A.

E 14-200

Ministry of the Environment and Climate Change

435 James Street South
Suite 331
Thunder Bay ON P7E 6S7
Tel.: (807) 475-1617
Fax: (807) 475-1754

Ministère de l'Environnement et de l'Action en matière de changement climatique

435, rue James sud
Bureau 331
Thunder Bay ON P7E 6S7
Tél. : (807) 475-1617
Téléc.: (807) 475-1754

Ontario

June 26, 2018

MEMORANDUM

TO: Mike Landers
Senior Environmental Officer
Thunder Bay District Office

FROM: Riffat Shamsi
Hydrogeologist
Northern Region Technical Support

RE: 2017 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone, Ontario

As requested, I have reviewed the groundwater related portions of the *2017 Environmental Quality Monitoring Report, Beardmore Landfill, Municipality of Greenstone, ON* (the report), dated April 30, 2018 prepared by EXP Services Inc. (the consultants).

This report was prepared by the consultants in accordance with the Ministry of the Environment and Climate Change (MOECC) Amendment to Environmental Compliance Approval (ECA) No. A7249502 - Notice No. 1, issued February 8, 2017. This Notice forms part of the approval issued under Approval No. A7249502 dated July 15, 1979 and represents the initial monitoring carried out for the site prepared in compliance with the current ECA. It provides results of the 2017 monitoring program in the context of available historical results (from an initial hydrogeological evaluation) and applicable criteria. Analytical results for groundwater were compared to the MOECC's Ontario Drinking Water Standards (ODWS, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines,* June 2003), as well as to MOECC Guideline B-7 (which incorporates the Reasonable Use Guidelines) RUG and the MOECC's Aquatic Protection Values (APV's, from Appendix B2 of *Rationale for the Development of Soil and Groundwater Standards for Use at Contaminated Sites in Ontario,* April 2011).

1. Background (from the report)

The site is located just north of the community of Beardmore on the west side of Highway 11, approximately 400 m northwest of the Blackwater River, in the Municipality of Greenstone. Total area of site (including attenuation zone) is 22.4 ha with a landfilling area of 4.20ha. The site generally comprises three landforms. The landform of the main (south) part of the site, which includes the waste footprint, is sand and gravel glacio-fluvial outwash plain, with mainly low local relief. The northernmost edge of the site is located in an area that includes two landforms, namely till ground moraine deposits, and bedrock knobs. The topography of both of these landforms is described as undulating to rolling and ashed/reworked, again with mainly low local relief. Drainage of all three landforms is described as mixed wet and dry.

2. Hydrogeology (from the report)

There are six monitoring wells on and in the vicinity of the site, wells BH-G, BH-H and BH-I were installed in May 2017 in accordance with the ECA and wells BH-A, BH-C and BH-F were installed during the initial hydrogeological evaluation in 1991. Current and historical groundwater levels suggest groundwater flow is generally to the southeast, towards the Blackwater River. Based on the grain size analysis the estimated flow velocity within the silt ranged from about 2.3 x 10^{-6} to 4.0 x 10^{-6} cm/s (0.8 m/yr to 1.3 m/yr), while the flow velocity within the sand and gravel to sand was much greater, ranging from about 9 x 10^{-4} cm/s to 2.5 x 10^{-3} cm/s (285 m/yr to 790 m/yr).

3. Report Review

Two groundwater monitoring/sampling events (May 18, 2017 and September 28, 2017) were completed during the period under review for all the wells.

3.1 Groundwater Monitoring

In compliance with MOECC regulations, the groundwater quality findings were referenced to the MOECC's Reasonable Use Guidelines (RUG) criteria defined using the methods outlined in the MOECC Guideline B-7.

The consultant presented the following findings regarding groundwater quality:

- The samples collected from the background groundwater sampling point, BH-I which is up-gradient of the landfill, was in exceedance of ODWS criterion for manganese. Current and historical results at this location are consistent and there are no apparent trends.
- At monitoring well BH-G in the southeast (downgradient) part of the identified waste footprint, ODWS criteria exceedances were reported for TDS, DOC, organic nitrogen, alkalinity, chloride, sulphate and manganese. The levels of all of these parameters, as well as several other parameters, were notably higher than in any of the other wells, reflecting leachate generation from the waste.
- Well BH-A is located due east of the waste footprint. This well was dry at the time of installation in 1990 and was also dry during the 2017 sampling events.
- Wells BH-H and BH-C are screened in sandy silt and sand and are situated a short distance southeast of the waste. BH-H is slightly closer to the waste (and to the source well), but the groundwater table at BH-H is at a higher elevation than at the source well. As a consequence, although BH-C is further away from the waste, it has levels of leachate indicators that are generally higher than at BH-H. In 2017, both wells had ODWS exceedances for organic nitrogen, but the only other ODWS exceedance was for DOC at BH-C (again, with a lower concentration than in the source well). Well BH-C is the only well of these two for which there are historical laboratory results.
- Well BH-F is a historical well located about 200 m from the Blackwater River, and is the furthest well downgradient of the landfill. Construction records for this well are not available. The only ODWS exceedance was for organic nitrogen. In general, levels of potential leachate indicator parameters are lower than in the other downgradient wells. Due to its location relatively near to the downgradient attenuation zone boundary, this well has been selected as a "trigger well", to assess whether contingency measures may need to be implemented to prevent unacceptable off-site impacts.

The water quality data was not collected from 1992 to 2016. Trends cannot be identified based on two years of data (1991 and 2017); however, now that regular water quality sampling is occurring, it will be possible to assess trends in a year or two. The changes in the parameters may be due to seasonal influences and can only be confirmed by additional monitoring.

Recommendations

1. During the monitoring of the wells the temperature reading were not taken as specified in ECA. Temperature must be monitored and recorded in the field in the future.

2. It is recommended to continue the monitoring twice a year for all the wells in accordance with the amended ECA with one cycle of comprehensive parameters specified in schedule 5 of Reg. 232 and one cycle of indicator parameters.

3, BHA must be checked at each monitoring event and if water is observed it must be measured and sampled.

3. The exceedance in BH-G points to the formation of leachate but needs to be confirmed in the next monitoring events.

4. The analytical results indicate the maximum concentration as measured in the trigger well BH-F are below the APV and also below the calculated trigger levels for protection of the surface water quality. No surface water monitoring is required at this point.

5. In future All the electronic copies of the report sent to this office must be signed/stamped.

If you have any questions regarding the above comments and recommendations, please do not hesitate to contact me. The purpose of the preceding review is to provide advice to the Ministry of the Environment and Climate Change regarding matters pertaining to groundwater flow and chemistry, based on the information provided in the above referenced document(s). The conclusions, opinions, and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted; therefore, the Ministry cannot guarantee that the information is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the material being reviewed.

Riffat Shamsi, P.Geo.

cc:Nelson, Leif
Innis Shannon
Regional File: GW 01 02 Beardmore Landfill

Ahileas Mitsopoulos

From: Holenstein, Monika (MOECC) <Monika.Holenstein@ontario.ca>
Sent: Thursday, December 08, 2016 5:43 PM
To: Ahileas Mitsopoulos
Cc: brian.aaltonen@greenstone.ca; Stajkowski, Drew (MOECC)
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Ahileas – you've been very patient! Sorry for the delays – crazy busy!

On the Geraldton site - I did get a verbal ok from our hydrogeologist and we concur the intent is for every 3 year reporting – next one due in 2019. I can give you something more formal on that from the District Manager in the New Year.

I have had a quick look at the Beardmore D and O plan and generally, it looks reasonable. A few specific comments:

- The service area should be specified. I assume the Municipality of Greenstone, but may want to include some additional surrounding townships?
- Should have a section on signage.
- The Plan does not contain too much detail on operating areas – just south pit to be filled (estimated by January 2017), then north pit, then site closed.
- The operating plan should note that waste fill boundaries and final contours will be clearly marked and updated on an annual basis as needed.
- Litter Control section should outline what measures to be taken (i.e. snow fencing around working area, regular litter pick up, etc).
- Record Keeping section only requires records of industrial/commercial loads – should also have residential loads.
- Should include more detailed information on operator training – what will be included in the training (can get this from Longlac/Geraldton C of A's).
- In the burning of waste section – operating plan should require an area be established for brush and clean waste only (no painted or treated wood) and signed to ensure only appropriate woodwaste is burned.
- The notes on Figures 7 and 8 (grading and waste placement) should make it into the text of the report in the appropriate sections as they provided detail on how the development/closure will occur.
- The last inspection noted: *At the time of inspection, it was suggested to the municipality that this area could be better organized - with signs clearly indicating where drained fridges/freezers were to be kept versus those still to be drained.* Perhaps the Operating Plan should provide information on how the fridge/freezer area could be set up?

- The MOECC hydrogeologist had previously commented: *I concur with the consultant's recommendations regarding the size and location of the CAZ, as well as the recommendations for the monitoring program. The contingency plan provides a reasonable selection of contingency measures, but needs to be more specific on how contingency measures might be triggered. Specifically, a plan which references the monitoring program and applicable assessment criteria to establish trigger criteria for actions should be developed. With respect to the consultant's recommendations regarding cover for the final closure, the prescribed design may be warranted with respect to the current understanding of potential leachate impacts. However, a contingency which provides for a low permeability cap is needed if at closure (or beyond) the leachate concentrations increase to levels that are indicative of off-site impacts. It is recommended that the closure plan will need to be reviewed and details updated closer to the actual closure of the site."*

I suggest you proceed with the ESR to increase the capacity. The current Certificate of Approval is clearly not appropriate for the current use at site and must be updated. Once in the ECA amendment process is underway, an updated D and O plan could be submitted and any final comments could be made at that time.

Please note as you proceed with ESR for improved capacity, that recent discussions with BZA (Rocky Bay) and the Department of Indigenous and Northern Affairs indicated that there is some interest in BZA to bring waste from that community to the Beardmore site.

Again, sorry for the delay,

Monika

Monika Holenstein
Sr. Environmental Officer
Thunder Bay District
Ministry of the Environment and Climate Change
435 James St. S., Suite 331
Thunder Bay, Ontario
P7E 6S7
(807)475-1699
E-mail: Monika.Holenstein@ontario.ca

From: Ahileas Mitsopoulos [mailto:ahileas.mitsopoulos@exp.com]
Sent: December 08, 2016 11:44 AM
To: Holenstein, Monika (MOECC)
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Monika,

Just wanted to follow-up again about this, as well as the clarification/issues at the Geraldton LF and Beardmore LF.

As a reminder,

Geraldton LF - ECA indicates report due in March 2017 but we provided a report in March/April 2016 for a three year period (2013, 2014 and 2015). We suspect the ECA intended March 2016. Please confirm that the next monitoring report for the Geraldton LF is due March 2019 (for the years 2016, 2017 and 2018).

Beardmore LF – The Beardmore LF likely reached 90% capacity in mid 2016. As such, a Closure Plan needs to be started but we discussed that **exp** would prepare an Environmental Screening Report to increase the capacity of the landfill to 100,000 m3. To do this we are still waiting for comments on the revised draft D&O Plan which was submitted in February 2016.

Thank you,

Ahileas Mitsopoulos, P.Eng. | exp
Project Engineer
exp Services Inc.
t: +1.807.623.9495 x223 | m: +1.807.620.6306 | e: Ahileas.Mitsopoulos@exp.com
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Thunder Bay, ON P7B 5M4
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keep it green, read from the screen

From: Ahileas Mitsopoulos
Sent: Monday, November 28, 2016 10:20 AM
To: 'Holenstein, Monika (MOECC)' <Monika.Holenstein@ontario.ca>
Cc: 'Stajkowski, Drew (MOECC)' <Drew.Stajkowski@ontario.ca>; 'Brian Aaltonen' <brian.aaltonen@greenstone.ca>; Demetri Georgiou <demetri.georgiou@exp.com>; Rob Rinne <Rob.Rinne@exp.com>; 'Katherine Alton' <katherine.alton@greenstone.ca>
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation

Hi Monika,

Just wanted to follow-up on this. Any word?

Thank you,

Ahileas Mitsopoulos, P.Eng. | exp
Project Engineer
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From: Ahileas Mitsopoulos
Sent: Monday, November 14, 2016 11:58 AM
To: 'Holenstein, Monika (MOECC)' <Monika.Holenstein@ontario.ca>
Cc: Stajkowski, Drew (MOECC) <Drew.Stajkowski@ontario.ca>; Brian Aaltonen <brian.aaltonen@greenstone.ca>; Demetri Georgiou <demetri.georgiou@exp.com>; Rob Rinne <Rob.Rinne@exp.com>; 'Katherine Alton' <katherine.alton@greenstone.ca>
Subject: RE: Nakina Landfill - Initial Hydrogeological Evaluation
Importance: High

Hi Monika,

Based on the comments below regarding the Initial Hydrogeological Evaluation of the Nakina Landfill, we conducted our first sampling event this fall at the landfill.

In the Initial Hydrogeological Evaluation, we recommended that the monitoring report be submitted after three years of sampling (i.e. six sampling events) with the first sampling event being conducted in the spring of 2015, as such the report would be submitted by April 2018. Since the first round of sampling was conducted in the fall 2016, we request that the first monitoring report be submitted by April 2019. This would allow 2.5 years of sampling (5 sampling events) rather than 1.5 years of sampling (3 sampling events) if the report is due April 2018 (originally proposed date).

Please advise if the first monitoring report submitted by April 2019 is acceptable.

Thank you,

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Project Engineer
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1142 Roland Street
Thunder Bay, ON P7B 5M4
CANADA

From: Holenstein, Monika (MOECC) [mailto:Monika.Holenstein@ontario.ca]
Sent: Monday, October 17, 2016 2:12 PM
To: Brian Aaltonen <brian.aaltonen@greenstone.ca>; Ahileas Mitsopoulos <ahileas.mitsopoulos@exp.com>
Cc: Stajkowski, Drew (MOECC) <Drew.Stajkowski@ontario.ca>
Subject: FW: Nakina Landfill - Initial Hydrogeological Evaluation

Brian, Ahileas
Below find the comments from the MOECC Hydrogeologist regarding the Initial Hydrogeological Evaluation – Nakina Landfill. No comments yet from MOECC Approvals Branch on the theoretical capacity work, but hopefully the application to amend ECA can move ahead....

Monika

Monika Holenstein
Sr. Environmental Officer
Thunder Bay District
Ministry of the Environment and Climate Change
435 James St. S., Suite 331
Thunder Bay, Ontario
P7E 6S7
(807)475-1699
E-mail: Monika.Holenstein@ontario.ca

From: Haslam, Simon (MOECC)
Sent: September 22, 2016 4:25 PM
To: Holenstein, Monika (MOECC)
Subject: Nakina Landfill - Initial Hydrogeological Evaluation

Ms. Holenstein,

I have completed a preliminary review of the groundwater-related portions of the report prepared by exp Services Inc., "*Municipality of Greenstone – Initial Hydrogeological Evaluation – Nakina Landfill – Nakina, Ontario,*" dated March 16, 2015. In general the report is reasonable and I am in agreement with the proposed actions moving forward. It is apparent that the site is not currently in compliance with Guideline B-7 ("*Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities*", dated April 1994, as amended). However, the consultant has made recommendations to attempt to bring the site into compliance, which involves expansion of the contaminant attenuation zone (CAZ). Based on the initial evaluation, the consultant has provided the following recommendations.

1. Consideration of installation of an additional monitoring well in the future should monitoring results suggest the need.
2. Establishment of a surface water sampling location in the unnamed lake within the proposed CAZ.
3. Twice annual sampling of 5 monitoring wells and the surface water location with analyses for the Schedule 5 comprehensive list of parameters.
4. Submission of a monitoring report to the Ministry of the Environment and Climate Change (MOECC) once every 3 (three) years, with the first report due by April 30, 2018.
5. Reassessment of the monitoring program after 3 (three) full years of data have been obtained.
6. Future reports should include an assessment of compliance with Guideline B-7.

I concur with all of these recommendations. I note that since there is a surface water receiver within the proposed CAZ, it will be necessary to assess impacts to surface water using appropriate guidelines. Such an assessment, with appropriate guidelines, should be provided in future monitoring reports.

The proposed contingency plan appears reasonable. The consultant notes that the plan will be updated as additional monitoring results are collected and analysed. This method is reasonable and I suggest that a revised contingency plan be provided and assessed in the next monitoring report.

In summary:

- The site is not currently in compliance with Guideline B-7.
- The consultant has recommended actions to bring the site into compliance, including a proposed CAZ expansion.
- I provide the following recommendations related to groundwater:
    - The proposed CAZ expansion should be pursued and finalized as soon as is reasonable to attempt to bring the site into compliance with Guideline B-7.
    - The recommendations proposed by the consultant shall be implemented as soon as is reasonable, including twice annual monitoring and reporting once every 3 (three) years, with the first report due to the MOECC by April 30, 2018.
    - Appropriate guidelines shall be included in all future monitoring reports to assess potential impacts to the surface water receiver within the proposed CAZ expansion.
    - A revised contingency plan shall be provided and assessed in the next monitoring report.

If you have any questions regarding the above comments and recommendations, do not hesitate to contact the undersigned. The purpose of the preceding review is to provide advice to the MOECC regarding groundwater conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on the information provided by others, except where otherwise specifically noted. The MOECC cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Sincerely,
Simon

--

Simon R. Haslam, MASc, P.Eng. | Regional Hydrogeologist | 807.475.1428 | Ontario Ministry of the Environment and Climate Change | Northern Region Technical Support

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

Solid Non-Hazardous Waste Disposal Site Inspection Report

Client:	The Corporation of the Municipality of Greenstone Mailing Address: 1800 Main St, Post Office Box, 70, Geraldton, Ontario, Canada, P0T 1M0 Physical Address: 1800 Main St Geraldton, Greenstone, Municipality, District of Thunder Bay, Ontario, Canada, P0T 1M0 Telephone: (807)854-1100, Extension: 2060, FAX: (807)854-1150, email: brian.aaltonen@greenstone.ca Client #: 0380-4TKQAV, Client Type: Municipal Government, NAICS: 913910 Additional Address Info: Geraldton		
Inspection Site Address:	Beardmore Waste Disposal Site Address: North of Mining Claim TB 10597 Twp of Summer Municipality of Greenstone, Greenstone, Municipality, District of Thunder Bay District Office: Thunder Bay - District Site #: 8237-6YSLW2		
Contact Name:	John Fendley	**Title:**	Operations Foreman
Contact Telephone:	(807)854-8637 ext	**Contact Fax:**	
Last Inspection Date:	2011/05/16		
Inspection Start Date:	2017/06/19	**Inspection Finish Date:**	2017/07/06
Region:	Northern		

1.0 INTRODUCTION

The community of Beardmore is located on Highway 11 on the eastern edge of the Municipality of Greenstone, approximately 150 km north east of Thunder Bay. Beardmore became part of the Municipality of Greenstone in 2001 through an amalgamation, which joined the communities of Geraldton, Longlac, Nakina, and Beardmore. Beardmore has a population of approximately 250 people. The waste disposal site appears to have been established in the 1960's, with the last Certificate of Approval for the site issued in 1975. The waste disposal site is located just north of the community on the west side of Highway 11, approximately 500 metres north of the Blackwater River.

The 2011 inspection of the Beardmore site required a number of actions to bring the site into full compliance. Progress was documented and the site has made improvements to the operation of the site and in June, 2015, an application to amend the Certificate of Approval, to reflect the current operation and expand the site capacity, was submitted to the Ministry of Environment and Climate Change (MOECC). The Site received the Notice 1 to the Environmental Compliance Approval #A7249502 on February 8, 2017.

The purpose of this inspection was to assess compliance with Ministry of Environment legislation,

specifically the Environmental Compliance Approval , Regulation 347 and the waste management provisions of the Environmental Protection Act. The inspection consisted of a review of files and reports, as well as a site visit on June 19, 2017, accompanied by John Findley and Kim Brunet of the Municipality of Greenstone.

2.0 INSPECTION OBSERVATIONS

Certificate of Approval Number(s):
Environmental Compliance Approval (ECA) # A7249502 issued July 15, 1979 and the Environmental Compliance Approval Amendment Notice 1 issued on February 8, 2017 for a landfill located at: North of Mining ClaimTB10597, Township of Summer, District of Thunder Bay. The Amendment Notice 1 allowed for an expansion of the fill area from 2 ha to 4.2 ha (with a corresponding volume increase of 40,000 m3 to a total of 89,300 m3), this resolved the fill beyond approved boundaries issue, and brought the site into compliance by ensuring that all historic and future waste placement is within the approved boundaries. In addition, the amendment designated a 18.2 ha contaminant attenuation zone located downgradient of the fill area which needs to be completed by September 30 2017 as in accordance of Section 4 of Regulation 232.

2.1 FINANCIAL ASSURANCE:

Specifics:
The MOECC does not require Financial Assurance for waste disposal sites owned and operated by Municipal governments.

2.2 APPROVED AREA OF THE SITE:

Specifics:
The newly approved ECA has an operating 4.20 Ha landfill site within a total site area of 22.40 Ha

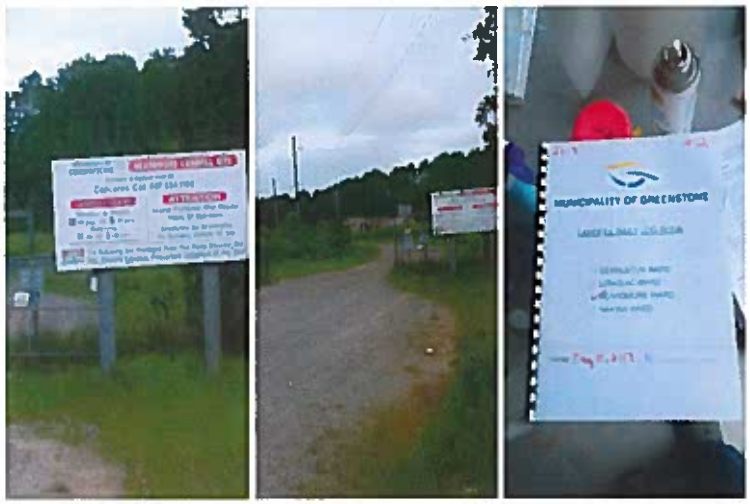
2.3 APPROVED CAPACITY:

Specifics:
During the 2011 investigation, the estimated total volume of waste and interim cover material placed on the site was 76,000 m3. This exceeds the theoretical approved capacity of 49,300 m3. Therefore the Municipality applied to increase the approved landfill volume which would allow the operation to continue. The approval now states the site capacity is approved for 89,300 m3.

2.4 ACCESS CONTROL:

Specifics:
Access to the site is controlled by a locked gate which is only opened when an attendant is on duty. Since the last inspection, Beardmore Public Works staff have implemented a policy that keys will not be provided to any contractors using the site. Instead, municipal staff will meet contractors at the site to open the gate.

The attendant is also required to maintain a log book to record the types and quantities of wastes delivered to the site and to make note of any unusual occurrences at the site.



2.5 COVER MATERIAL:

Specifics:

The newly adopted practice for the site is to cover the waste at the end of the day for each day the site is open (Monday, Wednesday, Friday and Saturday).

2.6 WASTE BURNING:

Specifics:

There was no evidence of burning wood waste at the time of inspection. Noted was a small pile of brush being segregated to burn in the fall. There is also another location where "other wood- not clean wood" gets deposited as waste. This waste does not get covered as frequently as there are minimal chance of vermin and wind throw.

2.7 GROUNDWATER/SURFACEWATER IMPACT:

Specifics:

As part of the approval that amended the current ECA, the contamination attenuation zone (CAZ) is to be established, as per section 4 of regulation 232, which will extend down gradient to the Blackwater River, with an area of 18.2 hectares. This CAZ has been estimated based on the loading and attenuation estimates from the 1991 hydrogeological study. It is understood that the lands for the CAZ will need to be obtained from the MNRF.

In addition to the CAZ, a groundwater monitoring program has been established. The monitoring program includes existing wells BH-C and BH-F; and the three new wells (source, background, and down gradient) which were installed May are included in the program. Sampling twice each year (spring and fall) with samples analysed for the comprehensive parameter list from Schedule 5 of the MOECC"s Landfill Standards for one sampling event each year, and for the indicator list the other sampling event.

The Design and Operations Plan also includes a contingency plan. The plan states that if "adverse levels of leachate impact" are confirmed, then actions will be taken. A list of potential contingency measures that would be considered is presented, including moving waste, lowering the water table, improved cover, improved drainage, expansion of the CAZ, restriction on waste volumes, leachate control system, or closure

The MOECC has reviewed the relevant groundwater sections provided in the Application to Amend the Certificate of Approval and has provided the following comments: "*I concur with the consultant's recommendations regarding the size and location of the CAZ, as well as the recommendations for the monitoring program. The contingency plan provides a reasonable selection of contingency measures, but needs to be more specific on how contingency measures might be triggered. Specifically, a plan which references the monitoring program and applicable assessment criteria to establish trigger criteria for actions should be developed. With respect to the consultant's recommendations regarding cover for the final closure, the prescribed design may be warranted with respect to the current understanding of potential leachate impacts. However, a contingency which provides for a low permeability cap is needed if at closure (or beyond) the leachate concentrations increase to levels that are indicative of off-site impacts. It is recommended that the closure plan will need to be reviewed and details updated closer to the actual closure of the site.*"

Newly constructed well

2.8 LEACHATE CONTROL SYSTEM:

Specifics:

There is no Leachate Control System required at this site. The site is considered to be naturally attenuating, and a large attenuation zone has been proposed as part of the amendments to the Certificate of Approval currently before the MOECC. The Design and operation Plan for the site

does speak of Leachate control if adverse affects are noted in the sampling program.

2.9 METHANE GAS CONTROL SYSTEM:

Specifics:

There is no requirement for a Methane Gas Control System at this site due to its small size. The production of significant amounts of Methane Gas is not anticipated.

2.10 OTHER WASTES:

Specifics:

The site is organized with a number of areas for specific waste types:

1. The brush waste area which only accepts "clean wood";
2. The wood waste area accepts both treated and contaminated wood waste;
3. There is an area for fridges/freezers. The municipality periodically hires a licensed technician to come to the site and drain the refrigerants. The fridges and freezers get drained a few days in advance of the metal recycling company (Dutchak) arriving to the site.
4. There is a shipping container to collect electronic wastes. (Pack Pro)
5. The municipality periodically holds household hazardous waste days to allow area residents to dispose of household hazardous wastes.
6. There is a general scrap metal area. Scrap metal is removed by Duchak Recycling at a minimum, within the entire Municipality, every 6 months. At the time of inspection there were no refrigerants noted in the general scrap metal pile.
7. Tire storage location. Recycling company from Thunder Bay picks up within the entire Municipality yearly.


E waste


used tires


Refridgerants


metals

3.0 REVIEW OF PREVIOUS NON-COMPLIANCE ISSUES

The previous non-compliance issue identified in the 2015 inspection was related to amending the ECA. This has been completed and the ECA was issued February 8, 2017.

4.0 SUMMARY OF INSPECTION FINDINGS (HEALTH/ENVIRONMENTAL IMPACT)

Was there any indication of a known or anticipated human health impact during the inspection and/or review

of relevant material, related to this Ministry's mandate?
No

Specifics:

Was there any indication of a known or anticipated environmental impact during the inspection and/or review of relevant material ?
No

Specifics:

Was there any indication of a known or suspected violation of a legal requirement during the inspection and/or review of relevant material which could cause a human health impact or environmental impairment ?
No

Specifics:

Was there any indication of a potential for environmental impairment during the inspection and/or the review of relevant material ?
No

Specifics:

Was there any indication of minor administrative non-compliance?
No

Specifics:
Staff are trained on the administrative and working operations of the waste disposal site.

5.0 ACTION(S) REQUIRED

There were no required actions identified at the time of inspection

6.0 OTHER INSPECTION FINDINGS

The New ECA has a few administrative components.

- One is to have documentation/recording system in place on site for complaints. The current practice is to forward complaints to the Greenstone main office in Geraldton. Bob Gendreau - Manager of Public Works will forward documentation to the Beardmore WDS for future use. This will satisfy condition 40 in the ECA.
- Hours of operation have changed at the location to maintain consistency between winter and summer hours. The ECA allows for this administrative change with a letter to the District Manager advising of the change. A letter will be sent shortly to identify the change of summer hours to 1200 Noon - 5:00 PM (Monday, Wednesday, Fridays) and 11 AM - 500 PM on Saturdays. This relates to one hour earlier then previously approved. This will satisfy condition 23 of the ECA.

7.0 INCIDENT REPORT

Not Applicable

8.0 ATTACHMENTS

PREPARED BY:
Environmental Officer:

Name: Mike Landers
District Office: IEB Thunder Bay District
Date: 2017/07/06
Signature

REVIEWED BY:
District Supervisor:
Name: Drew Stajkowski
District Office: Thunder Bay District Office
Date: 2017/07/17

Signature:

File Storage Number: TB BE SU 610

Note:
"This inspection report does not in any way suggest that there is or has been compliance with applicable legislation and regulations as they may apply to this facility. It is, and remains, the responsibility of the owner and/or the operating authority to ensure compliance with all applicable legislative and regulatory requirements"

Ministry of the Environment
435 James Street South
Suite 331
Thunder Bay, ON P7E 6S7

Ministère de l'Environnement
435 rue James sud
Bureau 331
Thunder Bay, ON P7E 6S7

Ontario

Fax: (807) 475-1754
Direct Line: (807) 475-1218

August 4, 2009

MEMORANDUM:

TO: Monika Holenstein
Senior Environmental Officer
Thunder Bay District Office

FROM: Alisdair Brown
Regional Hydrogeologist
Technical Support Section, Northern Region

RE: GROUNDWATER MONITORING
MUNICIPAL WASTE DISPOSAL SITE
BEARDMORE, ONTARIO

As requested, I have reviewed the hydrogeological study prepared by Trow Consulting Engineers Ltd. entitled *"Hydrogeological Study for the Beardmore Landfill"* dated March, 1991. In support of this review, I accompanied you on a site visit on July 29, 2009.

The hydrogeological study was prepared in 1991, and the water quality data provided is unlikely to reflect current conditions. In 1991, Trow installed five monitoring wells at the site. However, based on our site visit, it would appear that at least two of those wells have since been lost to the filling operations at the site. The three wells understood to remain are BH-A, BH-D, and BH-C, which are all located on the down gradient side of the waste disposal site, along the anticipated migration pathway from the waste disposal site to the Blackwater River. Based on current information, the Blackwater River is the most likely sensitive down gradient receptor.

In the 1991 hydrogeological study, using hypothetical dilution rates, Trow calculated the required down gradient attenuation zone for the site based on the concentration of key contaminants. Based on these calculations, Trow recommended an attenuation zone extending from the WDS all the way to the bank of the River.

It is my understanding that groundwater monitoring has not been undertaken at the site for several years, nor has the attenuation zone recommended by Trow been put in place.

Based on the currently available data, I recommend that the municipality needs to resume a groundwater monitoring program at this site. It is recommended that the three existing wells should be sampled twice this year – once this summer and again in the fall. Sampling should be done in accordance with the sampling protocols described in the Ministry of Environment's publication *"Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario"*, December 1996. Samples should be submitted for analysis to a certified environmental analytical laboratory for the parameters specified in Column 2 of Schedule 5 in the Ministry of Environment's *"Landfill Standards: A Guideline on the Regulatory and Approval Requirements for New or Expanding Landfilling Sites"* May 1998. Upon completion of both rounds of sampling, the analytical results should be submitted to the MOE's Thunder Bay District Office.

In addition to the sampling program, it is recommended that the Municipality should establish an attenuation zone as recommended by Trow, extending to the bank of the Blackwater River. The purpose of the Blackwater River would be to limit the development of groundwater resources between the waste disposal site and the river. This generally can be done through either the municipality's ownership of these lands, or through restrictions on title to these lands. With

respect to the pipeline located in this area, this is a lar[illegible]use which already restricts development of the groundwater, and this would not affect the attenuation zone.

If you have any questions regarding the above comments and recommendations, do not hesitate to contact me. The purpose of the preceding review is to provide advice to the Ministry of the Environment regarding groundwater conditions based on the information provided in the above referenced documents. The conclusions, opinions and recommendations of the reviewer are based on information provided by others, except where otherwise specifically noted. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Alisdair Brown, P.Eng.
Regional Hydrogeologist

c.c. Regional File: TB BE SU 410

U:\gw reviews\municipal landfills\beardmore wds jul 30 09.doc

APPENDIX B – Figures

LIST OF FIGURES

Figure 1: Site Location Plan

Figure 2: Monitoring Well Location Plan and Attenuation Zone

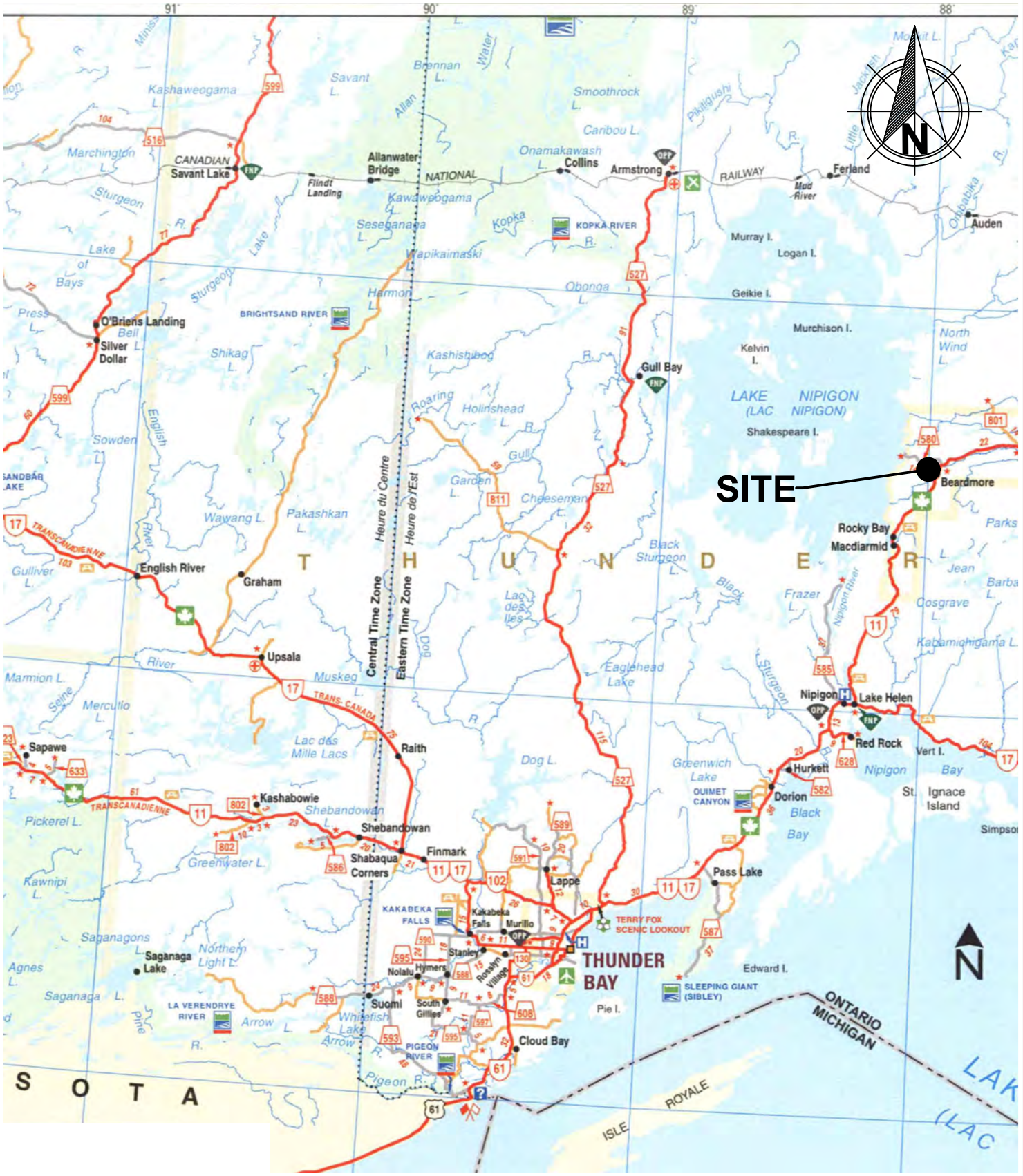
Figure 3: Monitoring Well Location Plan

Figure 4: Groundwater Contour Plan

Figure 5: Waste Filling Conceptual Site Plan – Year 2027

Figure 6A: Stratigraphic Section A-A

Figure 6B: Stratigraphic Section B-B



exp.

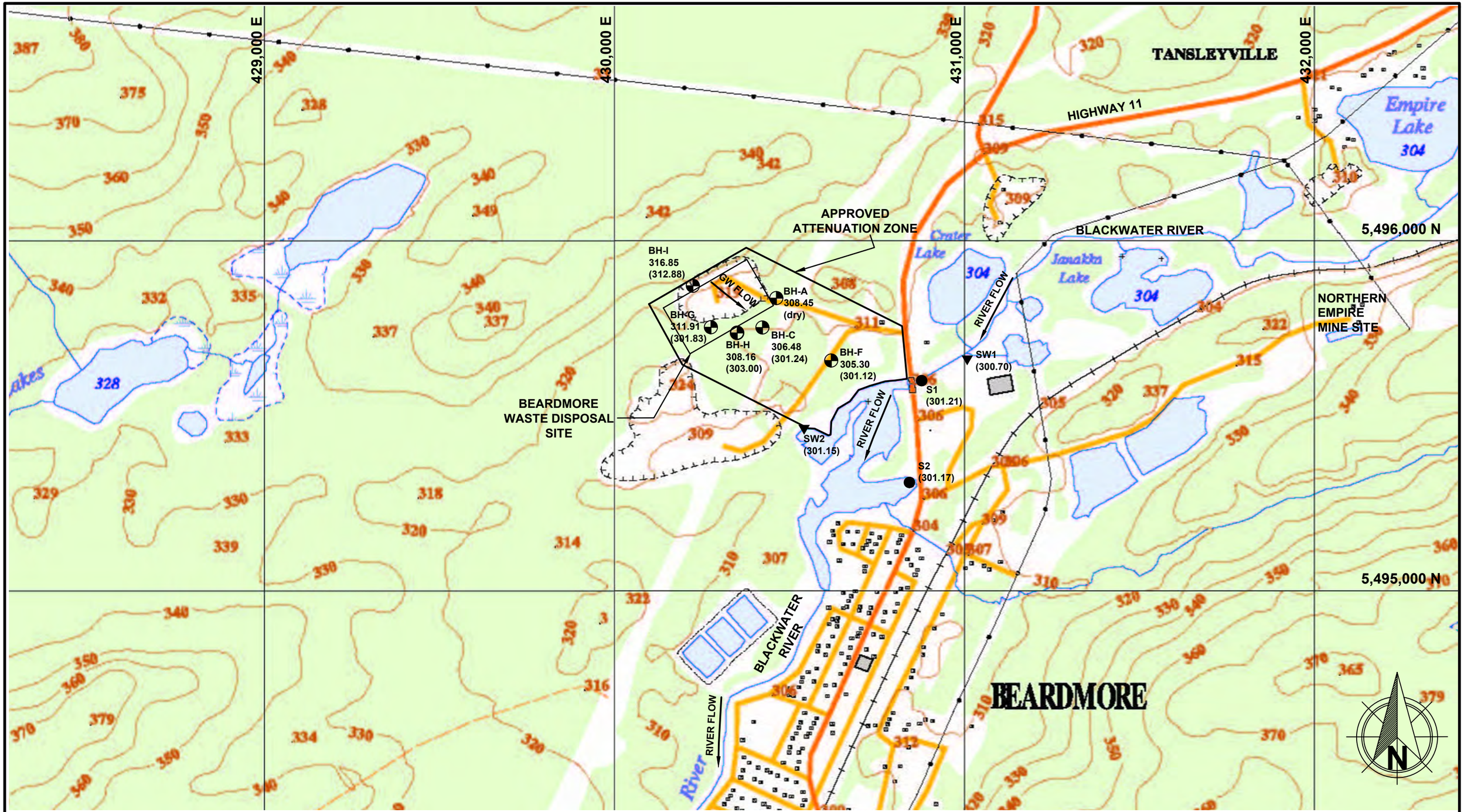
Thunder Bay, Ontario

FIGURE 1

SITE LOCATION PLAN

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	AS SHOWN
DRAWN BY:	MS
CHECKED BY:	AM
DATE:	January 5, 2022



LEGEND:

BH-C	MONITORING WELL LOCATION
306.48	GROUND SURFACE ELEVATION IN METRES
(301.24)	GROUNDWATER ELEVATION IN METRES (OCT. 4/21)
S1	SPOT SURFACE WATER ELEVATION LOCATION
(301.21)	TOP OF WATER ELEVATION IN METRES (OCT. 19/17)
SW1	SURFACE WATER ELEVATION LOCATION
(300.70)	TOP OF WATER ELEVATION IN METRES (SEP. 7/21)

100 0 100 200
IN METRES

NOTES:

1. REFERENCE: 1:20,000 ONTARIO BASE MAPS, MAP Nos. 20 16 4200 54900 AND 20 16 4300 54900.
2. GROUND SURFACE AND TOP OF PIPE ELEVATIONS WERE SURVEYED BY DELTA SURVEY INC., ON SEPTEMBER 11, 2020.
3. SPOT SURFACE WATER ELEVATIONS (S1 & S2) WERE SURVEYED BY DELTA SURVEY INC. ON OCTOBER 19, 2017.
4. SURFACE WATER ELEVATIONS (SW1 & SW2) WERE SURVEYED BY DELTA SURVEY INC. ON SEPTEMBER 7, 2021.

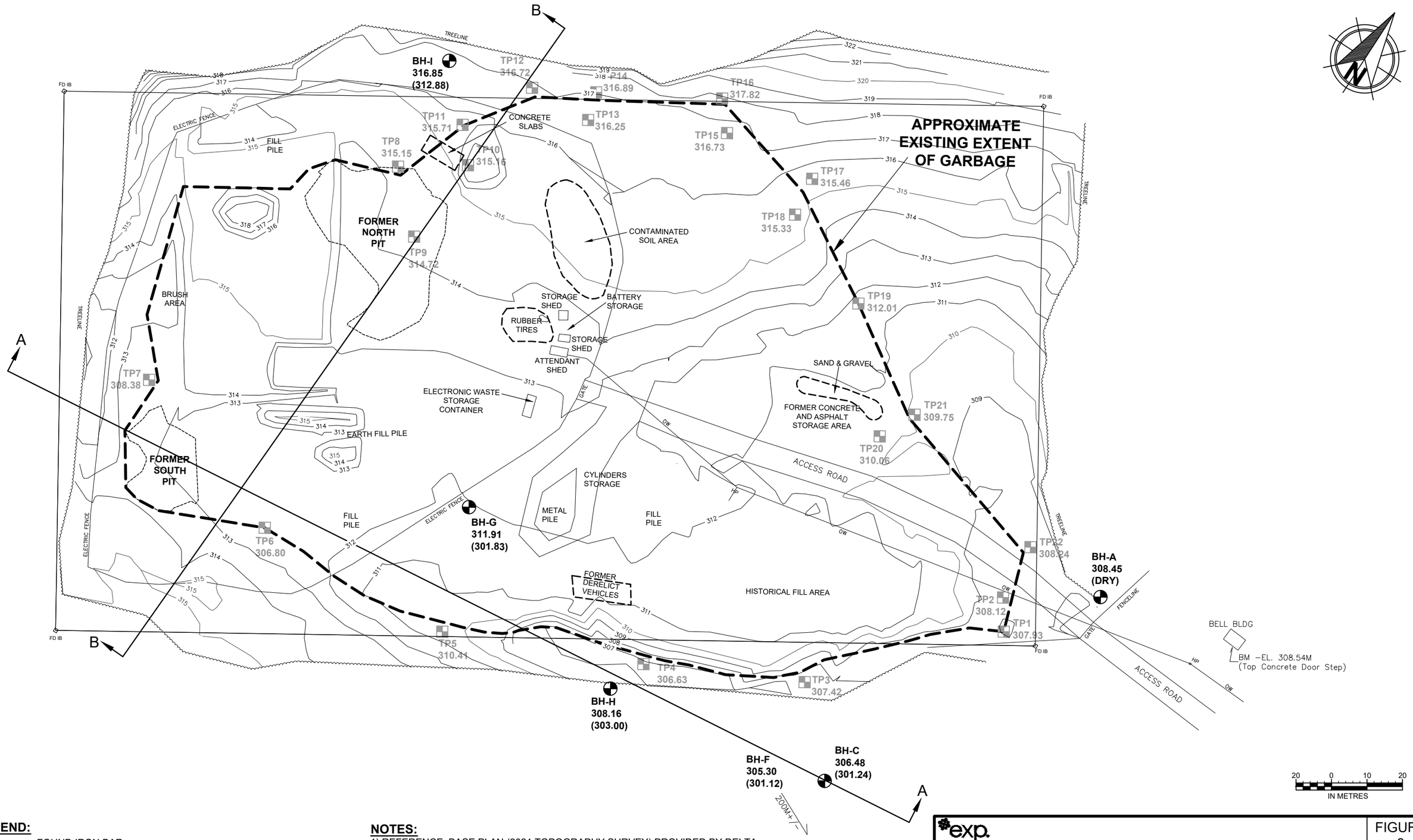
exp. Thunder Bay, Ontario

FIGURE 2

MONITORING WELL LOCATION PLAN & APPROVED ATTENUATION ZONE

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:10,000
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 19, 2022



LEGEND:

FD IB	FOUND IRON BAR
BH-C **306.48** **(301.24)**	MONITORING WELL LOCATION GROUND SURFACE ELEVATION IN METRES GROUNDWATER ELEVATION IN METRES (OCT. 4/21)
TP4 306.63	HISTORICAL TEST PIT LOCATION (2011) GROUND SURFACE ELEVATION IN METRES

NOTES:

1) REFERENCE: BASE PLAN (2021 TOPOGRAPHY SURVEY) PROVIDED BY DELTA SURVEY INC. DATED SEPTEMBER 7, 2021.
2) MONITORING WELLS BH-A, BH-C, BH-F WERE INSTALLED IN 1990 AND 1991, AND MONITORING WELLS BH-G, BH-H AND BH-I WERE INSTALLED IN MAY 2017.
3) SEE FIGURES 6A & 6B FOR STRATIGRAPHIC SECTIONS.
4) TEST PITS TP1 TO TP22 WERE ADVANCED IN OCTOBER 2011.
5) GROUNDWATER LEVELS WERE MEASURED BY EXP ON OCTOBER 4, 2021.

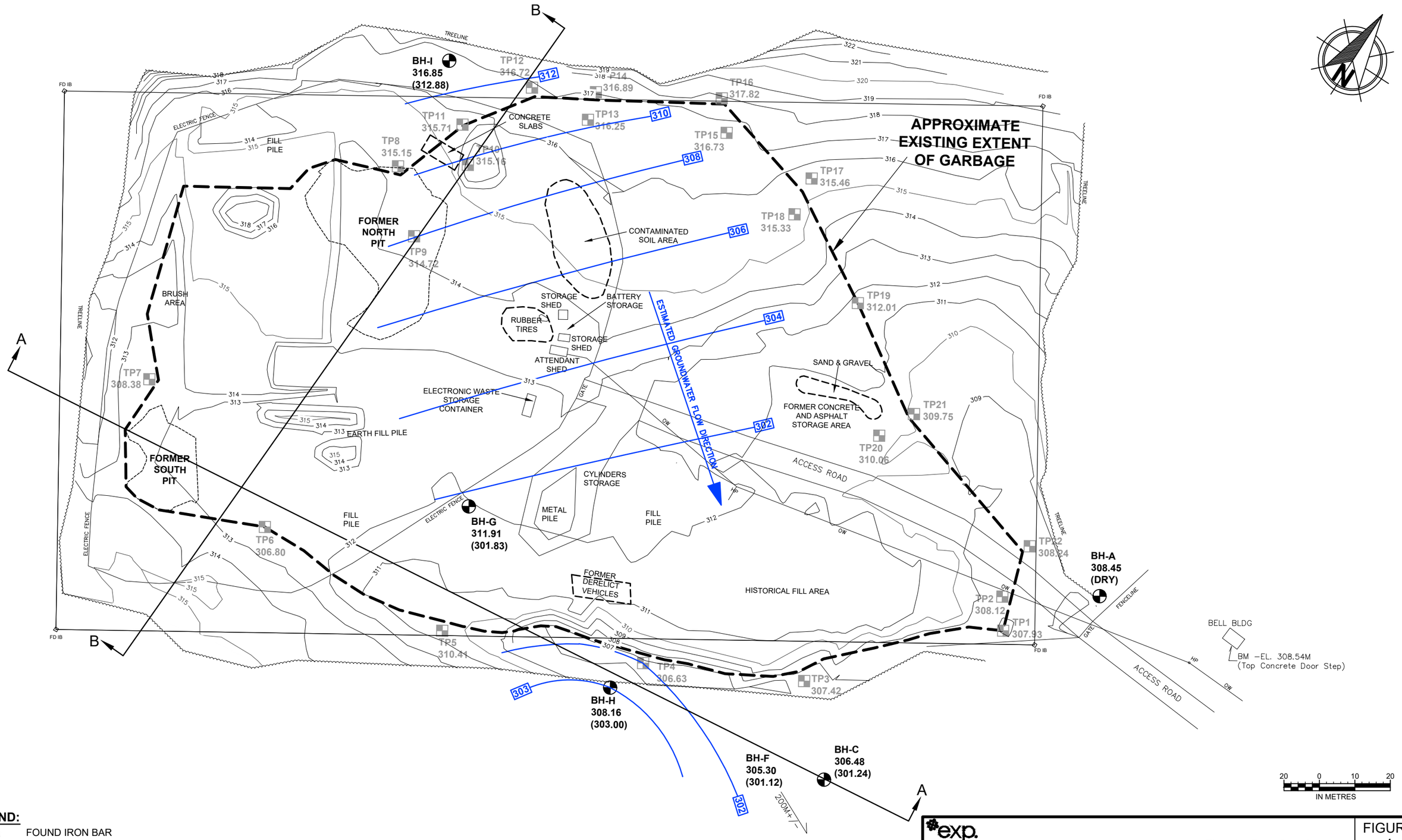
exp. Thunder Bay, Ontario

FIGURE 3

MONITORING WELL LOCATION PLAN

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:1,000
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022



LEGEND:

FD IB	FOUND IRON BAR
BH-C **306.48** **(301.24)**	MONITORING WELL LOCATION GROUND SURFACE ELEVATION IN METRES GROUNDWATER ELEVATION IN METRES (OCT. 4/21)
TP4 306.63	HISTORICAL TEST PIT LOCATION (2011) GROUND SURFACE ELEVATION IN METRES
312	INTERPOLATED GROUNDWATER CONTOUR

NOTES:

1) REFERENCE: BASE PLAN (2021 TOPOGRAPHY SURVEY) PROVIDED BY DELTA SURVEY INC. DATED SEPTEMBER 7, 2021.
2) MONITORING WELLS BH-A, BH-C, BH-F WERE INSTALLED IN 1990 AND 1991, AND MONITORING WELLS BH-G, BH-H AND BH-I WERE INSTALLED IN MAY 2017.
3) TEST PITS TP1 TO TP22 WERE ADVANCED IN OCTOBER 2011.
4) GROUNDWATER LEVELS WERE MEASURED BY EXP ON OCTOBER 4, 2021.

exp. Thunder Bay, Ontario

FIGURE 4

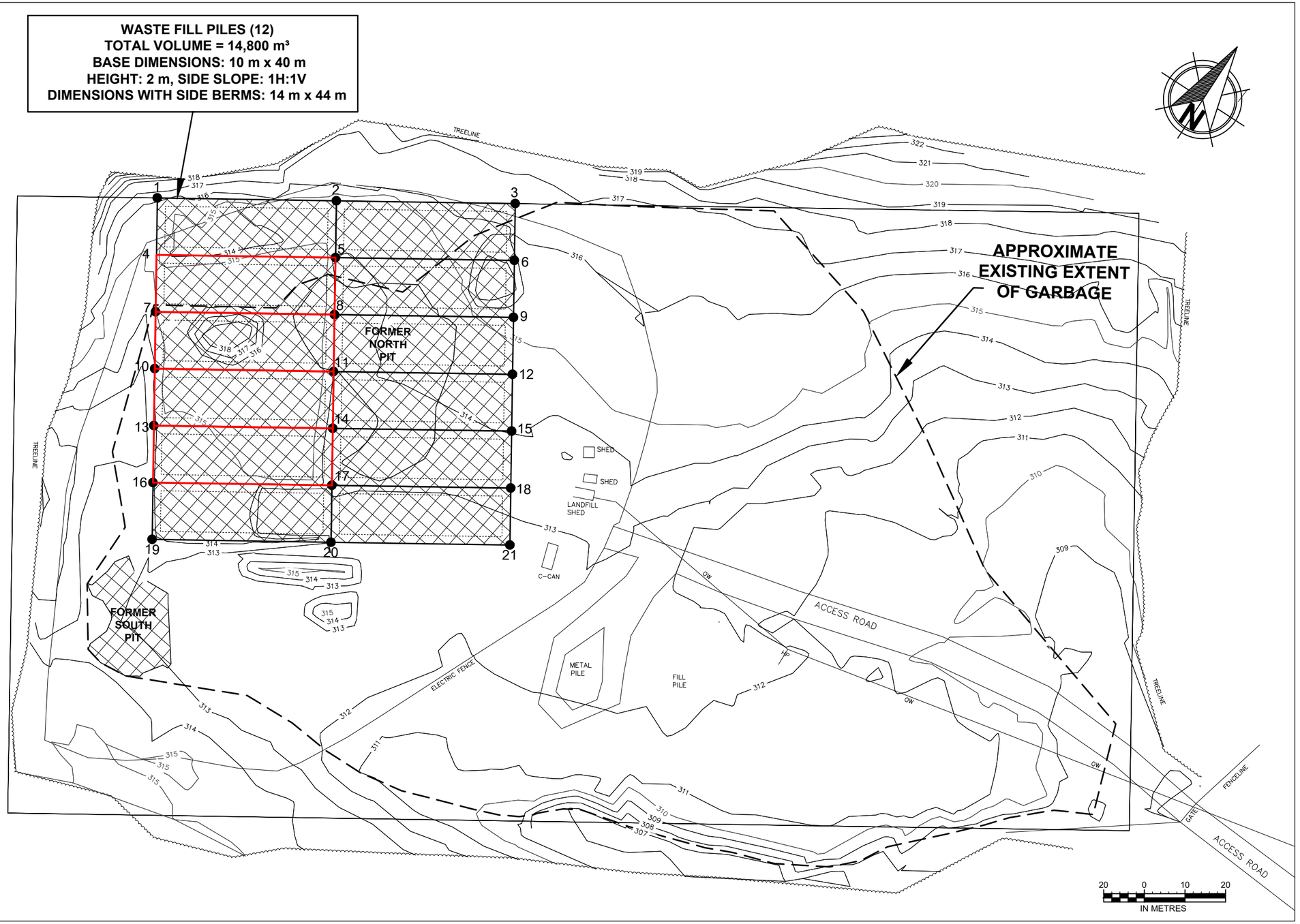
GROUNDWATER CONTOUR PLAN

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:1,000
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

STAGE 2 - 12 WASTE FILL PILES

1) THE SOUTH PIT AND NORTH PIT WERE BACKFILLED TO SURROUNDING GRADE BY 2020.
2) WASTE FILL PILES ARE TO BE USED FOR WASTE STORAGE MOVING FORWARD AND WERE INITIATED IN 2020. THE BASE DIMENSIONS OF THE WASTE FILL PILE ARE 10 m X 40 m X 2 m IN HEIGHT. BERMS ARE TO BE SLOPED AT ABOUT 1H:1V (1 HORIZONTAL TO 1 VERTICAL) AND BE ABOUT 2 m HIGH. THE DIMENSIONS OF THE WASTE FILL PILE WITH THE BERMS IS 14 m X 44 m AND THE THE TOTAL VOLUME OF THE WASTE FILL PILE IS ABOUT 1,230 m^3.
3) A TOTAL OF TWELVE (12) WASTE FILL PILES ARE INCLUDED IN THIS STAGE, WHICH WILL REPRESENT A TOTAL VOLUME OF 14,800 m^3. AT A RATE OF 1,500 m^3/yr, THE TWELVE (12) WASTE FILL PILES SHOULD BE FILLED IN 2027. AT THE TIME OF THE SEPTEMBER 2021 SURVEY, 4.5 WASTE FILL PILES WERE FILLED.
4) THE WASTE FILL PILES SHOULD BE CONSTRUCTED ONE AT A TIME, AND THE BERMS OF THE THE NEXT PILE SHOULD BE CONSTRUCTED WHEN THE CURRENT PILE IS ABOUT 80% FULL.
5) TARGET MARKERS INDICATING LOCATION AND ELEVATION WERE INSTALLED IN THE FIELD AT THE TIME OF THE SEPTEMBER 2021 SURVEY.



LEGEND:

- 309 — GROUND ELEVATION CONTOUR (SEPTEMBER 2021) IN METRES
- PIT BOUNDARY
- PROPOSED WASTE FILL PILE TO BE FILLED BY 2027
- WASTE FILL PILE FILLED BY SEPTEMBER 2021
- BASE OF WASTE FILL PILE

NOTES:

1. REFERENCE: BASE PLAN (2021 TOPOGRAPHY SURVEY) PROVIDED BY DELTA SURVEY INC. DATED SEPTEMBER 7, 2021.
2. ELEVATION CONTOURS ARE IN METRES.

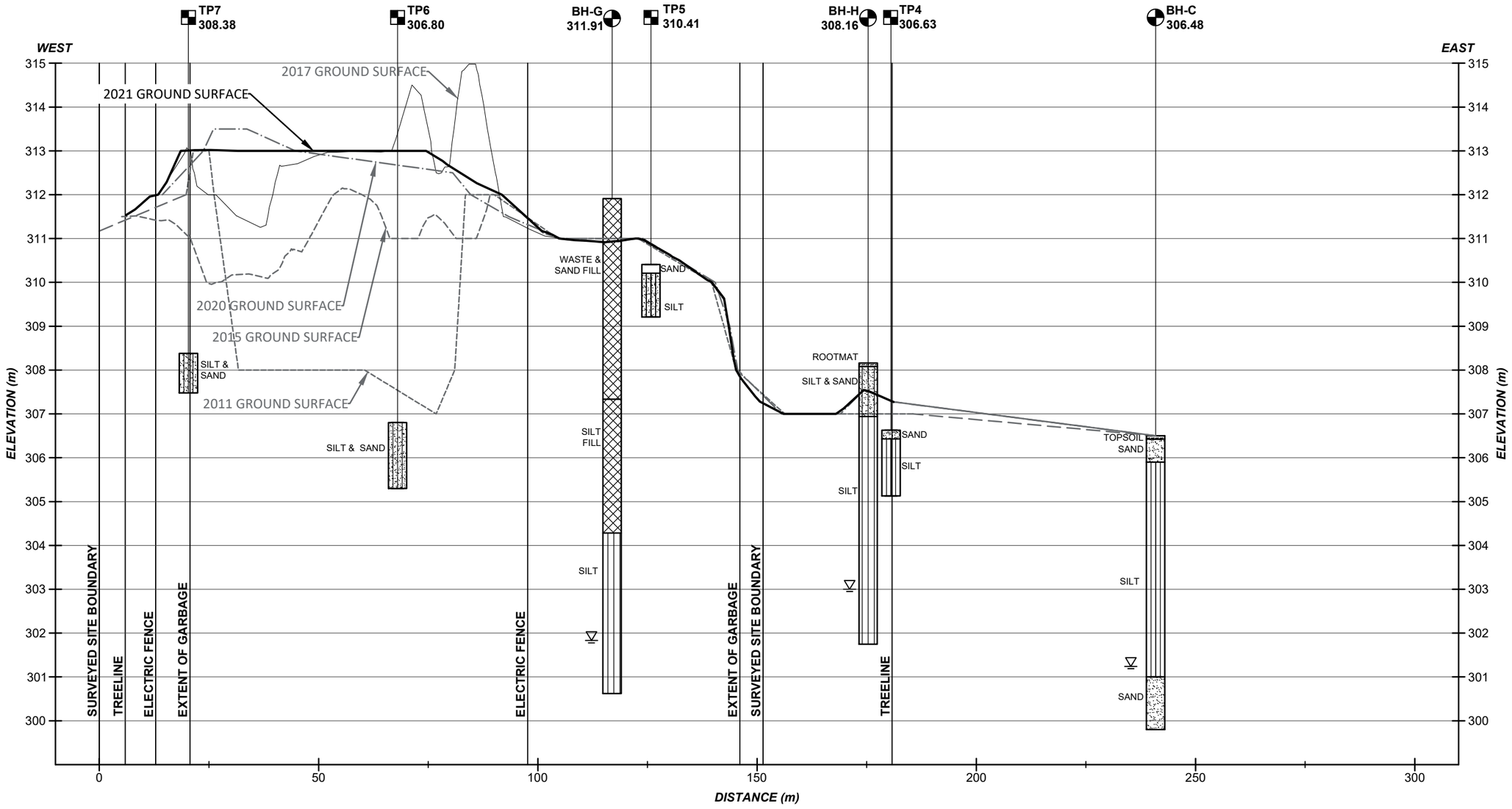
exp. Thunder Bay, Ontario

FIGURE 5

WASTE FILLING CONCEPTUAL SITE PLAN - YEAR 2027

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:1,000
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	February 23, 2022



LEGEND:

BH-C **306.48**	MONITORING WELL LOCATION GROUND SURFACE ELEVATION IN METRES
TP4 **306.63**	HISTORICAL TEST PIT LOCATION (2011) GROUND SURFACE ELEVATION IN METRES
▽	GROUNDWATER ELEVATION - OCTOBER 4, 2021

NOTES:

1) REFERENCE: BASE PLAN PROVIDED BY DELTA SURVEY INC, DATED SEPTEMBER 7, 2021. 2011, 2015 AND 2020 GROUND SURFACE ELEVATIONS ARE BASED ON DELTA SURVEY'S 2011, 2015 AND 2020 SURVEY PLAN.
2) MONITORING WELLS BH-A, BH-C, BH-F WERE INSTALLED IN 1990 AND 1991, AND MONITORING WELLS BH-G, BH-H AND BH-I WERE INSTALLED IN MAY 2017.
3) TEST PITS TP1 TO TP22 WERE ADVANCED IN OCTOBER 2011.
4) GROUNDWATER LEVELS OBTAINED ON OCTOBER 4, 2021.
5) SEE FIGURE 3 FOR SECTION LOCATION.
6) BOREHOLES / MONITORING WELLS AND TEST PITS NOT DIRECTLY ON THE SECTION LINE ARE PROJECTED PERPENDICULAR TO THE SECTION LINE.

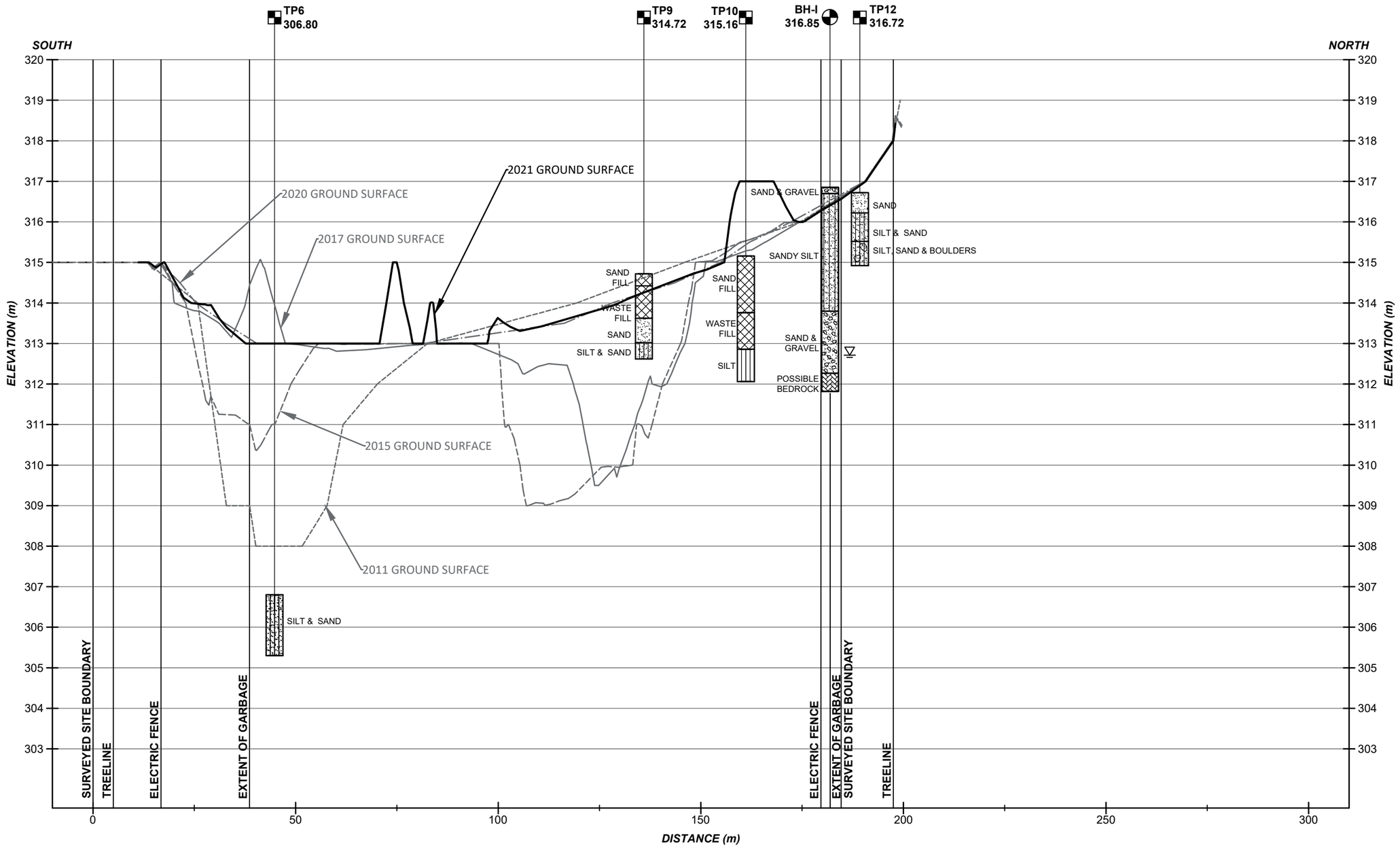
exp. Thunder Bay, Ontario

FIGURE 6A

STRATIGRAPHIC SECTION A-A

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:1000H / 1:100V
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022



LEGEND:

BH-I 316.85	MONITORING WELL LOCATION GROUND SURFACE ELEVATION IN METRES
TP4 306.63	HISTORICAL TEST PIT LOCATION (2011) GROUND SURFACE ELEVATION IN METRES
▽	GROUNDWATER ELEVATION - OCTOBER 4, 2021

NOTES:

1) REFERENCE: BASE PLAN PROVIDED BY DELTA SURVEY INC, DATED SEPTEMBER 7, 2021. 2011, 2015 AND 2020 GROUND SURFACE ELEVATIONS ARE BASED ON DELTA SURVEY'S 2011, 2015 AND 2020 SURVEY PLAN.
2) MONITORING WELLS BH-A, BH-C, BH-F WERE INSTALLED IN 1990 AND 1991, AND MONITORING WELLS BH-G, BH-H AND BH-I WERE INSTALLED IN MAY 2017.
3) TEST PITS TP1 TO TP22 WERE ADVANCED IN OCTOBER 2011.
4) GROUNDWATER LEVELS OBTAINED ON OCTOBER 4, 2021.
5) SEE FIGURE 3 FOR SECTION LOCATION.
6) BOREHOLES / MONITORING WELLS AND TEST PITS NOT DIRECTLY ON THE SECTION LINE ARE PROJECTED PERPENDICULAR TO THE SECTION LINE.

exp. Thunder Bay, Ontario

FIGURE 6B

STRATIGRAPHIC SECTION B-B

2021 GROUNDWATER MONITORING
BEARDMORE LANDFILL
MUNICIPALITY OF GREENSTONE

PROJECT NO.:	THB-00011174-JE
SCALE:	1:1000H / 1:100V
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

APPENDIX C – Borehole Logs and Grain Size Curves

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or slit and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes.
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional	less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' – value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sample one foot (305mm) into the soil.

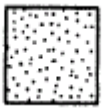
Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength		'N' Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

STRATA PLOT


Gravel & Boulders

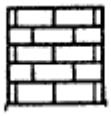

Sand


Silt


Clay


Fill

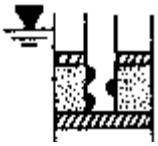

Igneous Bedrock


Sedimentary Bedrock


Metamorphic Bedrock

WATER LEVEL MEASUREMENT


Borehole or Standpipe


Piezometer

SAMPLES

SS…	Split spoon sample (obtained by performing the standard penetration test)
ST…	Shelby tube or thin wall tube
PS…	Piston sample
BS…	Bulk sample
WS…	Wash sample
RC…	Rock core AXT, BXL. etc… Rock core samples obtained with the use of standard diamond drilling bits.

OTHER TESTS

G…	Specific gravity
H…	Hydrometer analysis
S…	Sieve analysis
γ	Unit weight
C….	Consolidation
CD…	Consolidated drained triaxial
CU…	Consolidated undrained triaxial with pore pressure measurements
UU…	Unconsolidated undrained triaxial
DS…	Direct shear
P….	Field permeability

ROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD). The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal insitu fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

Beardmore Landfill Site	Borehole advanced November 7, 1990.	BOREHOLE No. 90211-A
Township of Beardmore	Water level measured November 26, 1990.	Project No: F-90211-A/G
CME-45 Drill Unit		ELEVATION 308.23 (m)

SAMPLE TYPE: SHELBY TUBE | GRAB | AUGER | SPT SAMPLE | CORING | CORE RECOVERY

▲ Shear Strength – ksf ▲ (0.6, 1.2, 1.8, 2.4)
■ N Value ■ (20, 40, 60, 80)
PLASTIC M.C. LIQUID (20, 40, 60, 80)

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE NO
0.0		SAND – brown, fine to medium grain, some rootlets, very loose.	1
		– some pebbles. –moist.	2
-1.0		– brown to grey, trace of silt, loose to compact.	3
-2.0		– fine to large grain, silty, grey, a few small pebbles, compact.	4
		– fine, grey, compact, some silt.	5
-3.0		–fine to medium grain, a few rocks and pebbles, compact.	6
-4.0		– gravelly, grey, fine to medium grain, moist, dense.	7
-5.0			8
-6.0		BEDROCK– shale, trace to some sand, brown, wet, dense to very dense.	9
		END OF BOREHOLE – 6.0 m (19.75 ft.)	
7.0		NOTES: 1) Well installed to 4.35 m (14.3 ft.). 2) Top of well at elevation 309.88 m. 3) 1.5 m of screen installed.	

COMMENTS: Concrete; Bentonite; Ottawa Sand; Well Screen

88/9

DEPTH (ft): 0.0, -2.0, -4.0, -6.0, -8.0, -10.0, -12.0, -14.0, -16.0, -18.0, -20.0, -22.0

Trow Ontario Ltd. Thunder Bay, Ontario	COMPLETION DEPTH 6.0 m	COMPLETE
	LOGGED BY BM	DWG NO.1
		Page 1 of 1

Beardmore Landfill Site	Water Level Mearsured November 26, 1990.	BOREHOLE No. 90211-C
Township of Beardmore	Borehole Advanced November 8, 1990.	Project No: F-90211-A/G
CME-45 Drill Unit		ELEVATION 306.62 (m)

SAMPLE TYPE ■ SHELBY TUBE ⧄ GRAB ☒ AUGER ▤ SPT SAMPLE ▥ CORING ▮ CORE RECOVERY

DEPTH (m)	USC	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	▲ Shear Strength – ksf ▲ 0.4 0.8 1.2 1.6 ■ N Value ■ 20 40 60 80 PLASTIC M.C. LIQUID 20 40 60 80	COMMENTS	DEPTH (ft)
0.0		TOPSOIL – 3 in., brown, rootlet, leaves.					0.0
		SAND – grey to brown, fine to medium grain, very loose.		1			
		– trace of silt, brown.					
1.0		SILT – some clay, brown, damp, stiff, trace of fine sand, rootlets.		2			4.0
		– moist to wet.		3			6.0
2.0				4			8.0
		– grey, saturated, loose to compact.		5			
3.0		– saturated, trace of fine sand.		6			12.0
4.0							14.0
	▼	– sandier.		7			16.0
5.0							18.0
6.0		SAND – some silt, trace of pebbles, fine to medium grained, trace of gravel, saturated.					20.0
		– trace of silt.		8			22.0
7.0		END OF BOREHOLE – 6.7 m (22 ft.)					24.0
		NOTES: 1) Well installed to 6.7 m (22 ft.). 2) 1.5 m of screen installed. 3) Top of well elevation at 307.3 m.					26.0
8.0							28.0

Trow Ontario Ltd. Thunder Bay, Ontario	COMPLETION DEPTH 6.7 m	COMPLETE
	LOGGED BY BM	DWG NO.
		Page 1 of 1

exp. Thunder Bay Branch

BOREHOLE LOG

BH-F

Sheet 1 of 1

PROJECT Monitoring Well Installation, Beardmore Landfill, Ontario

PROJECT NO. THB-00011174-BE

CLIENT Municipality of Greenstone

DATUM

DRILL TYPE/METHOD

DATES: Boring Aug. 9, 1991

Water Level Oct. 2011

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0		**SILTY SAND** - loose, light brown, damp, some organics, fine to medium grained			SS	S1		6	
1					SS	S2		6	
	1.22								
2		**SILT AND SAND** - compact to dense, grey, damp, fine grained			SS	S3		30	
					SS	S4		37	
		- becoming wet at about 2.4 m depth			SS	S5		30	
3					SS	S6		20	
4				▼					
5					SS	S7		37	
6					SS	S8		19	
7									
8					SS	S9		22	
9									
					SS	S10		26	
	9.76								
10		**End of Borehole**							

SHEAR STRENGTH

✤ S Field Vane Test (#=Sensitivity)

▲ Penetrometer ■ Torvane

40 80 kPa

Atterberg Limits and Moisture

W_P W W_L

● SPT N Value × Dynamic Cone

20 40 60 80

NOTES

1) For definition of symbols & terms used on logs, see sheets prior to logs.

2) Borehole log generated using field borehole log from August 9, 1991. Limited information was available on the field log.

3) A monitoring well was installed at the borehole location; however, well construction records were not found. Based on exp's site visit, the depth of the well extends to about 6.4 m below ground surface and the top of riser pipe is about 0.95 m above ground surface. The inside diameter of the pipe is 30 mm. The well is protected with a 75 mm ABS pipe. No other well construction details such as screen and filter sand depths are known.

SAMPLE LEGEND

☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube

▥ Rock Core (eg. BQ, NQ, etc.) ▣ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS

▽ Apparent ▼ Measured ▲ Artesian (see Notes)

exp. Thunder Bay Branch

BOREHOLE LOG

BH-G

Sheet 1 of 1

PROJECT **Monitoring Well Installations, Beardmore Waste Disposal Site, Beardmore, ON** PROJECT NO. **THB-00011174-FE**

CLIENT **Municipality of Greenstone** DATUM **Geodetic**

DRILL TYPE/METHOD **CME 850 Track Mount / HSA** DATES: Boring **May 9, 2017** Water Level **May 18/17**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0	311.88	**WASTE AND SAND (FILL)**							
1									
2		- some gravel, some silt at about 1.5 m depth			SS	S1	150	16	
3					SS	S2	250	11	
4	307.30								
5		**SILT (FILL)** - dense, grey, moist, trace to some sand			SS	S3	310	34	
6		- becoming compact, dark brown, moist to wet, trace to some peat, trace waste at about 6.1 m depth			SS	S4	230	20	
7	304.25								
8		**SILT** - compact, brown, wet, trace sand, trace to some clay			SS	S5	360	13	
9									
10					SS	S6	360	16	H
11	300.59				SS	S7	310	14	
12		**End of Borehole**							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
40 80 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
20 40 60 80

NOTES

1) For definition of symbols & terms used on logs, see sheets prior to logs.

2) 50 mm PVC monitoring well installed upon completion, screened from about 5.9 m to 10.5 m below ground surface.

3) Top of pipe elevation is 312.65 m.

4) GPS coordinates in UTM NAD83 16 U 430293E 5495765N.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

exp. Thunder Bay Branch

BOREHOLE LOG

BH-H

Sheet 1 of 1

PROJECT **Monitoring Well Installations, Beardmore Waste Disposal Site, Beardmore, ON** PROJECT NO. **THB-00011174-FE**

CLIENT **Municipality of Greenstone** DATUM **Geodetic**

DRILL TYPE/METHOD **CME 850 Track Mount / HSA** DATES: Boring **May 10, 2017** Water Level **May 18/17**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS	SHEAR STRENGTH / Atterberg Limits and Moisture
	308.27									S Field Vane Test (#=Sensitivity); ▲ Penetrometer ■ Torvane; 40 80 kPa; W_P W W_L; ● SPT N Value × Dynamic Cone; 20 40 60 80
0	308.19	**ROOTMAT** - brown, frozen			AS	S1				
		SILT AND SAND - loose, brown, wet, trace gravel, some roots and rootlets, some oxidation			AS	S2				
1	307.05	**SILT** - loose, light brown, moist, some sand to sandy, trace clay			SS	S3	360	8		
2										
3		- becoming compact, wet at about 2.8 m depth			SS	S4	410	12	H	
4										
5					SS	S5	410	17		
6	301.86				SS	S6	430	17		
		End of Borehole								
7										
8										
9										
10										
11										
12										

NOTES

1) For definition of symbols & terms used on logs, see sheets prior to logs.

2) 50 mm PVC monitoring well installed upon completion, screened from about 1.5 m to 6.1 m below ground surface.

3) Top of pipe elevation is 308.88 m.

4) GPS coordinates in UTM NAD83 16 U 430364E 5495734N.

SAMPLE LEGEND

☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▯ Rock Core (eg. BQ, NQ, etc.) ▯ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS

▽ Apparent ▼ Measured ▲ Artesian (see Notes)

exp. Thunder Bay Branch

BOREHOLE LOG

BH-I

Sheet 1 of 1

PROJECT **Monitoring Well Installations, Beardmore Waste Disposal Site, Beardmore, ON** PROJECT NO. **THB-00011174-FE**

CLIENT **Municipality of Greenstone** DATUM **Geodetic**

DRILL TYPE/METHOD **CME 850 Track Mount / HSA** DATES: Boring **May 9, 2017** Water Level **May 18/17**

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or (%)	SAMPLES N VALUE (blows) or RQD (%)	OTHER TESTS
0	316.80								
0	316.65	**SAND AND GRAVEL** - very loose, brown, moist, some silt, some roots and rootlets			AS	S1			
		SANDY SILT - loose to compact, grey to brown, moist to wet, some cobbles and boulders, trace gravel, trace clay			AS	S2			
1									
2					SS	S3	310	15	
3	313.75								
		SAND AND GRAVEL - very dense, grey to brown, moist, some silt			SS	S4	460	85	S
4									
	312.22				SS	S5	80	100	
5	311.77	**POSSIBLE BEDROCK** - shale, grey							
		End of Borehole - refusal to auger							
6									
7									
8									
9									
10									
11									
12									

SHEAR STRENGTH

S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane

40 80 kPa

Atterberg Limits and Moisture

W_P W W_L

● SPT N Value × Dynamic Cone

20 40 60 80

NOTES

1) For definition of symbols & terms used on logs, see sheets prior to logs.

2) 50 mm PVC monitoring well installed upon completion, screened from about 2.0 m to 5.0 m below ground surface.

3) Top of pipe elevation is 317.47 m.

4) GPS coordinates in UTM NAD83 16 U 430223E 5495869N.

SAMPLE LEGEND

☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube

▯ Rock Core (eg. BQ, NQ, etc.) ▯ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS

▽ Apparent ▼ Measured ▲ Artesian (see Notes)

GRAIN SIZE DISTRIBUTION

Monitoring Well Installations, Beardmore Waste Disposal Site, Beardmore, ON

FIGURE No. 3

Ref. No. THB-00011174-FE

DATE August 9, 2017

APPENDIX D – Summary Tables

LIST OF TABLES

Table 1: Summary of Groundwater and Surface Water Levels and Elevations

Table 2: Groundwater Data

Table 3: Surface Water Data

Table 4: Calculation of Alert Criteria – Groundwater Impact

Table 5: Calculation of Alert Criteria – Surface Water Impact Using APV Criteria

Table 6: Calculation of Alert Criteria – Surface Water Impact Using PWQO Criteria

General Notes for Tables

1. Concentrations are mg/L (ppm), unless indicated otherwise.

2. ODWS: MECP Ontario Drinking Water Standards, from *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines,* June 2003. Exceedances are indicated in **bold** type face.

3. Background = arithmetic mean of the results for the most recent three years from background well BH-I. Non-detect (<) values are assumed equal to one-half of the detection limit.

4. MECP Guideline B-7, Incorporation of the Reasonable Use Concept into MOE Ground Water Management Activities (1994). Underlining indicates exceedance (current reporting period results only). Asterisk (*) indicates that background exceeds ODWS; therefore, B-7 criterion = background.

5. PWQO: MECP Provincial Water Quality Objectives, 1994 (updated 1999). Exceedances are indicated in **bold** type face. Interim PWQO criteria are bracketed and interim exceedances are underlined.

All tables are to be read in conjunction with the accompanying report.

Table 1: Summary of Groundwater Levels and Elevations (m)

THB-00011174-JE

Monitoring Well No.		BH-A	BH-C	BH-F	BH-G	BH-H	BH-I	SW1[6]	SW2[6]	S1[4]	S2[4]
Well Completion Date		Nov. 7, 1990	Nov. 8, 1990	Aug. 9, 1991	May 9, 2017	10-May-17	May 9, 2017	--	--	--	--
Ground Surface Elevation[1]		308.52	306.48	305.30	311.88	308.27	316.78	--	--	--	--
Top of Pipe Elevation[1]		309.84	307.18	306.22	312.65	308.88	317.47	--	--	--	--
Ground Surface Elevation[5]		308.45	306.48	305.30	311.91	308.16	316.85	--	--	--	--
Top of Pipe Elevation[5]		309.89	307.22	306.24	312.67	308.85	317.49	--	--	--	--
May 18, 2017	GW Depth[2]	Dry[3]	3.95	3.35	9.29	3.55	4.51	--	--	--	--
	GW Elevation	--	303.23	302.87	303.36	305.33	312.96	--	--	--	--
Sep. 28, 2017	GW Depth[2]	Dry[3]	4.89	4.09	10.24	4.72	4.57	--	--	--	--
	GW Elevation	--	302.29	302.13	302.41	304.16	312.90	--	--	--	--
Oct. 19, 2017	Water Elevation	--	--	--	--	--	--	--	--	301.21	301.17
May 16, 2018	GW Depth[2]	Dry[3]	4.32	3.43	9.59	4.03	4.51	--	--	--	--
	GW Elevation	--	302.86	302.79	303.06	304.85	312.96	--	--	--	--
Oct. 15, 2018	GW Depth[2]	Dry[3]	5.41	4.67	10.38	4.59	4.57	--	--	--	--
	GW Elevation	--	301.77	301.55	302.27	304.29	312.90	--	--	--	--
May 5, 2019	GW Depth[2]	Dry[3]	4.51	4.84	9.79	4.00	4.54	--	--	--	--
	GW Elevation	--	302.67	301.38	302.86	304.88	312.93	--	--	--	--
Oct. 22, 2019	GW Depth[2]	Dry[3]	5.06	4.10	9.77	3.93	4.53	--	--	--	--
	GW Elevation	--	302.12	302.12	302.88	304.95	312.94	--	--	--	--
May 27, 2020	GW Depth[2]	Dry[3]	4.64	3.89	9.49	4.04	4.51	--	--	--	--
	GW Elevation	--	302.58	302.35	303.18	304.81	312.98	--	--	--	--
Sep. 22, 2020	GW Depth[2]	Dry[3]	4.72	4.14	9.58	4.14	4.61	--	--	--	--
	GW Elevation	--	302.50	302.10	303.09	304.71	312.88	--	--	--	--
May 30, 2021	GW Depth[2]	Dry[3]	4.62	3.87	9.80	4.48	4.52	--	--	--	--
	GW Elevation	--	302.60	302.37	302.87	304.37	312.97	--	--	--	--
Sep 07, 2021	Water Elevation	--	--	--	--	--	--	300.70	301.15	--	--
Oct. 04, 2021	GW Depth[3]	Dry[3]	5.98	5.12	10.84	5.85	4.61	--	--	--	--
	GW Elevation	--	301.24	301.12	301.83	303.00	312.88	--	--	--	--

Notes:
1. Ground surface and top of pipe elevations were surveyed by Delta Survey Inc. on October 10, 2017.
2. Depths are relative to top of riser pipe.
3. Monitoring well BH-A extends to about 4.35 m below ground surface or to elevation 304.17 m.
4. Spot surface water location at Blackwater River; refer to Figure 2 for locations. Top of water at location surveyed by Delta Survey Inc. on October 19, 2017.
5. Ground surface and top of pipe elevations were surveyed by Delta Survey Inc. on September 11, 2020.
6. Surface water elevations at sampling locations (SW1 and SW2) were surveyed by Delta Survey Inc. on September 7, 2021.

THB-00011174-IE

Table 2: Groundwater Data[1]

Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-A									
				18 May 2017	28 Sept. 2017	16-May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	23 Sept. 2020	29 May 2021	5 Oct. 2021
General													
pH	6.5 to 8.5	7.92	--	Well	Well	Well	Well	Well	Well	Well	Well	Well	Well
Field pH	--	--	--	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
Water Temperature (°C)	--	--	--	--	--	--	--	--	--	--	--	--	--
Conductivity (uS/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--
Field Conductivity (uS/cm)	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Dissolved Solids	500	273	386	--	--	--	--	--	--	--	--	--	--
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics													
Dissolved Organic Carbon	5	1.8	3.4	--	--	--	--	--	--	--	--	--	--
Total Chemical Oxygen Demand	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenols	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Kjeldahl Nitrogen	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia-N	--	--	--	--	--	--	--	--	--	--	--	--	--
Organic Nitrogen	0.15	0.16	0.16*	--	--	--	--	--	--	--	--	--	--
Cations													
Calcium	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium	200	10.37	105	--	--	--	--	--	--	--	--	--	--
Anions													
Alkalinity as $CaCO_3$	30-500	257	378	--	--	--	--	--	--	--	--	--	--
Chloride	250	1.22	126	--	--	--	--	--	--	--	--	--	--
Nitrate	10	0.05	2.54	--	--	--	--	--	--	--	--	--	--
Nitrite	1	0.005	0.25	--	--	--	--	--	--	--	--	--	--
Total Phosphorus	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulphate	500	11.6	256	--	--	--	--	--	--	--	--	--	--
Ion Balance	--	--	--	--	--	--	--	--	--	--	--	--	--
Metals - Dissolved													
Arsenic	0.025	0.0051	0.010	--	--	--	--	--	--	--	--	--	--
Barium	1	0.011	0.26	--	--	--	--	--	--	--	--	--	--
Boron	5	0.025	1.27	--	--	--	--	--	--	--	--	--	--
Cadmium	0.005	0.00002	0.0013	--	--	--	--	--	--	--	--	--	--
Chromium	0.05	0.0025	0.014	--	--	--	--	--	--	--	--	--	--
Copper	1	0.0006	0.50	--	--	--	--	--	--	--	--	--	--
Iron	0.3	0.05	0.180	--	--	--	--	--	--	--	--	--	--
Lead	0.01	0.00025	0.0027	--	--	--	--	--	--	--	--	--	--
Manganese	0.05	0.227	0.227*	--	--	--	--	--	--	--	--	--	--
Mercury	0.001	0.00005	0.003	--	--	--	--	--	--	--	--	--	--
Zinc	5	0.0025	2.50	--	--	--	--	--	--	--	--	--	--
VOCs													
Benzene	0.005	0.00005	0.0013	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	--	--	--	--	--	--	--	--	--	--
Dichloromethane	0.05	0.00025	0.013	--	--	--	--	--	--	--	--	--	--
Toluene	0.024	0.00010	0.012	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	0.002	0.00010	0.00058	--	--	--	--	--	--	--	--	--	--

THB-00011174-IE	Table 2 (cont'd): Groundwater Data[1]													
Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-C										
				06 Dec. 1990	18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	22 Sept. 2020	30 May 2021	4 Oct. 2021
General														
pH	6.5 to 8.5	7.92	--	7.6	8.04	7.93	8	7.89	8.04	7.97	7.91	7.77	8.0	8.11
Field pH	--	--	--	--	7.86	7.55	7.15	8.02	7.76	7.34	7.32	6.98	7.55	7.36
Water Temperature (°C)	--	--	--	--	--	--	6.4	3.2	6.5	7.2	7.7	11.9	6.5	12.1
Conductivity (uS/cm)	--	--	--	440	270	610	170	700	600	620	630	2,200	700	610
Field Conductivity (uS/cm)	--	--	--	--	315	600	115	675	566	520	522	731	683	371
Total Dissolved Solids	500	273	386	172	168	330	140	345	340	360	455	**1,620**	385	290
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics														
Dissolved Organic Carbon	5	1.8	3.4	--	4.5	**14**	**5.9**	1.4	1.3	2.4	<0.40	**18**	1.6	0.84
Total Chemical Oxygen Demand	--	--	--	--	18	67	15	5.9	<4.0	20	16	55	7.2	<4.0
Phenols	--	--	--	<0.5	<0.0010	--	--	<0.0010	<0.0010	--	--	0.0021	<0.0010	--
Total Kjeldahl Nitrogen	--	--	--	--	1.1	--	--	0.48	0.11	--	--	1.1	0.31	--
Ammonia-N	--	--	--	--	0.12	7.1	0.11	0.25	0.14	0.066	<0.050	0.17	0.055	0.089
Organic Nitrogen	0.15	0.16	0.16*	--	**0.98**	--	--	**0.23**	~0	**--**	--	**0.93**	**0.26**	--
Cations														
Calcium	--	--	--	72.9	40	77	25	110	97	100	110	290	92	110
Magnesium	--	--	--	22.1	5.1	18	2.8	27	22	18	25	100	20	27
Potassium	--	--	--	1.3	0.87	--	--	1.3	1.3	--	--	3.7	1.7	--
Sodium	200	10.37	105	5	1.8	3.9	1.3	4.3	4	3.4	3.9	96	4	5.2
Anions														
Alkalinity as $CaCO_3$	30-500	257	378	263	130	300	92	350	300	300	310	**680**	350	330
Chloride	250	1.22	126	7	2.3	7.2	2.5	5.8	3.3	4.8	3.8	120	5.7	2.9
Nitrate	10	0.05	2.54	0.09	0.42	<0.10	0.14	1	0.65	0.75	0.72	0.36	0.56	0.32
Nitrite	1	0.005	0.25	0.01	<0.010	--	--	<0.010	<0.010	--	--	<0.010	<0.010	--
Total Phosphorus	--	--	--	<0.5	8.7	--	--	5.9	0.8	--	--	0.69	0.13	--
Sulphate	500	11.6	256	6	5.2	27	1.1	33	14	30	28	470	37	19
Ion Balance	--	--	--	--	5.02	--	NC	1.11	3.17	0.94	4.81	0.88	10.9	3.47
Metals - Dissolved														
Arsenic	0.025	0.0051	0.010	0.005	0.0013	--	--	<0.001	<0.001	--	--	0.0013	<0.001	--
Barium	1	0.011	0.26	0.014	0.0057	0.037	0.0064	0.025	0.018	0.025	0.024	0.046	0.028	0.026
Boron	5	0.025	1.27	0.01	0.015	0.014	0.012	0.025	0.016	0.017	0.016	0.66	0.026	0.033
Cadmium	0.005	0.00002	0.0013	<0.005	<0.0001	--	--	<0.0001	<0.0001	--	--	0.00023	<0.00009	--
Chromium	0.05	0.0025	0.014	<0.01	<0.005	--	--	<0.005	<0.005	--	--	<0.005	<0.005	--
Copper	1	0.0006	0.50	<0.01	0.0018	--	--	0.0082	0.0088	--	--	0.009	0.0012	--
Iron	0.3	0.05	0.180	**0.490**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.32**	<0.1	<0.1	<0.1
Lead	0.01	0.00025	0.0027	<0.05	<0.0005	--	--	<0.0005	<0.0005	--	--	<0.0005	<0.0005	--
Manganese	0.05	0.227	0.227*	**0.11**	<0.002	--	--	<0.002	<0.002	--	--	**0.42**	0.0034	--
Mercury	0.001	0.00005	0.003	0.00009	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.0001	<0.0001	--
Zinc	5	0.0025	2.50	0.12	<0.005	--	--	0.01	0.011	--	--	0.018	<0.005	--
VOCs														
Benzene	0.005	0.00005	0.0013	--	<0.0001	--	--	<0.00010	<0.0001	--	--	<0.00025	<0.0001	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	--	<0.0002	--	--	<0.00020	<0.0002	--	--	<0.0005	<0.0002	--
Dichloromethane	0.05	0.00025	0.013	--	<0.0005	--	--	<0.00050	<0.0005	--	--	<0.0013	<0.0005	--
Toluene	0.024	0.00010	0.012	--	0.00025	--	--	<0.00020	<0.0002	--	--	<0.0005	<0.0002	--
Vinyl Chloride	0.002	0.00010	0.00058	--	<0.0002	--	--	<0.00020	<0.0002	--	--	<0.0005	<0.0002	--

THB-00011174-IE	Table 2 (cont'd): Groundwater Data[1]												
Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-F									
				18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	23 Sept. 2020	30 May 2021	4 Oct. 2021
General													
pH	6.5 to 8.5	7.92	--	8.08	8.01	7.88	8.01	8.05	8.05	7.98	8.07	8.06	7.98
Field pH	--	--	--	7.53	7.82	7.45	8.6	8.27	7.52	8.52	7.63	7.79	7.38
Water Temperature (°C)	--	--	--	--	--	6.8	3.7	6.4	6.1	13.6	12.9	9.6	11.7
Conductivity (uS/cm)	--	--	--	420	440	470	470	450	420	420	410	440	440
Field Conductivity (uS/cm)	--	--	--	412	449	406	586	509	359	420	245	413	259
Total Dissolved Solids	500	273	386	246	275	190	230	265	220	210	255	230	245
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics													
Dissolved Organic Carbon	5	1.8	3.4	0.6	0.96	0.62	0.52	0.98	0.54	<0.40	0.69	0.59	0.68
Total Chemical Oxygen Demand	--	--	--	<4.0	6.5	<4.0	<4.0	<4.0	<4.0	12	<4.0	7.50	<4.0
Phenols	--	--	--	<0.0010	--	--	<0.0010	<0.0010	--	--	0.0014	<0.0010	--
Total Kjeldahl Nitrogen	--	--	--	0.64	--	--	0.13	<0.10	--	--	0.25	0.12	--
Ammonia-N	--	--	--	<0.050	<0.050	<0.050	0.06	0.073	0.19	<0.050	<0.050	<0.050	<0.050
Organic Nitrogen	0.15	0.16	0.16*	**0.64**	--	--	0.07	~0	--	--	**0.225**	0.12	--
Cations													
Calcium	--	--	--	68	64	73	79	78	67	67	74	74	78
Magnesium	--	--	--	13	13	14	15	14	12	13	13	13	14
Potassium	--	--	--	0.26	--	--	0.33	5	--	--	0.38	0.33	--
Sodium	200	10.37	105	1.6	1.4	1.6	2	1.8	1.5	2.1	1.80	2.00	2.30
Anions													
Alkalinity as $CaCO_3$	30-500	257	378	230	240	250	240	230	220	230	220	240	250
Chloride	250	1.22	126	2.5	3.5	5.8	8	7.5	3.5	2.4	2.2	2.9	3
Nitrate	10	0.05	2.54	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite	1	0.005	0.25	<0.010	--	--	<0.010	<0.010	--	--	<0.010	<0.010	--
Total Phosphorus	--	--	--	9	--	--	0.12	0.81	--	--	0.76	0.94	--
Sulphate	500	11.6	256	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.20
Ion Balance	--	--	--	5.47	--	3.36	1.37	4.33	1.48	0.82	2.89	0.31	0.90
Metals - Dissolved													
Arsenic	0.025	0.0051	0.010	<0.001	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--
Barium	1	0.011	0.26	0.0041	0.0044	0.0048	0.0041	0.0087	0.0045	0.0045	0.0054	0.0045	0.0055
Boron	5	0.025	1.27	0.016	<0.01	<0.01	0.016	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.005	0.00002	0.0013	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.00009	<0.00009	--
Chromium	0.05	0.0025	0.014	<0.005	--	--	<0.005	<0.005	--	--	<0.005	<0.005	--
Copper	1	0.0006	0.50	0.001	--	--	0.016	0.0036	--	--	0.0012	0.0027	--
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.1	<0.1
Lead	0.01	0.00025	0.0027	<0.0005	--	--	0.00069	<0.0005	--	--	<0.0005	<0.0005	--
Manganese	0.05	0.227	0.227*	<0.002	--	--	<0.002	<0.002	--	--	<0.002	<0.002	--
Mercury	0.001	0.00005	0.003	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.0001	<0.0001	--
Zinc	5	0.0025	2.50	<0.005	--	--	0.017	<0.005	--	--	<0.005	<0.005	--
VOCs													
Benzene	0.005	0.00005	0.0013	<0.0001	--	--	<0.00010	<0.00010	--	--	<0.0001	<0.0001	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	<0.0002	--	--	<0.00020	<0.00020	--	--	<0.0002	<0.0002	--
Dichloromethane	0.05	0.00025	0.013	<0.0005	--	--	<0.00050	<0.00050	--	--	<0.0005	<0.0005	--
Toluene	0.024	0.00010	0.012	<0.0002	--	--	0.0002	<0.00020	--	--	<0.0002	<0.0002	--
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002	--	--	<0.00020	<0.00020	--	--	<0.0002	<0.0002	--

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Table 2 (cont'd): Groundwater Data[1]

Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-G																			
				18 May 2017	18 May 2017	28 Sept. 2017	28 Sept. 2017	16 May 2018	16 May 2018	15 Oct. 2018	15 Oct. 2018	5 May 2019	5 May 2019	Oct 22 2019	Oct 22 2019	27 May 2020	27 May 2020	22 Sept. 2020	22 Sept. 2020	30 May 2021	30 May 2021	4 Oct. 2021	4 Oct. 2021
General					Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.		Blind Dup.
pH	6.5 to 8.5	7.92	--	7.35	7.38	7.52	7.4	7.16	7.14	7.42	7.42	7.5	7.31	7.14	7.1	7.2	7.22	7.46	7.44	7.34	7.49	7.27	7.39
Field pH	--	--	--	6.87	--	7.12	--	6.7	--	7.2	--	7.28	--	6.56	--	7.86	--	6.79	--	6.64	--	6.52	--
Water Temperature (°C)	--	--	--	--	--	--	--	7.9	--	4	--	6.3	--	7.1	--	7.9	--	9.1	--	9.3	--	11.9	--
Conductivity (uS/cm)	--	--	--	4,000	4,000	3,800	3,800	3,600	3,600	4,000	4,100	3,800	3,800	3,400	3,400	3,200	3,200	3,000	3,000	3,100	3,100	2,700	2,700
Field Conductivity (uS/cm)	--	--	--	3,181	--	2,834	--	3,047	--	2,995	--	2,138	--	1,951	--	1,122	--	940	--	2,804	--	825	--
Total Dissolved Solids	500	273	386	**3,310**	**3,290**	**3,010**	**3,140**	**2,810**	**2,830**	**3,160**	**3,180**	**2,990**	**2,970**	**2,610**	**2,570**	**2,300**	**2,390**	**2,210**	**2,360**	**2,160**	**2,100**	**2,150**	**2,150**
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics																							
Dissolved Organic Carbon	5	1.8	3.4	**25**	**25**	**29**	**29**	**26**	**26**	**27**	**27**	**30**	**30**	**35**	**35**	<0.40	<0.40	**28**	**28**	**38**	**38**	**28**	**28**
Total Chemical Oxygen Demand	--	--	--	80	79	88	89	86	83	77	75	75	76	96	96	140	140	81	80	100	100	69	82
Phenols	--	--	--	0.007	0.0059	--	--	--	--	0.001	<0.001	0.001	<0.001	--	--	--	--	<0.001	<0.001	<0.001	<0.001	--	--
Total Kjeldahl Nitrogen	--	--	--	2.2	1.7	--	--	--	--	0.97	1.1	1.1	1.2	--	--	--	--	0.9	0.88	1.1	1.1	--	--
Ammonia-N	--	--	--	<0.050	<0.050	0.075	0.079	0.13	0.093	0.27	0.29	0.13	0.081	0.14	<0.050	0.079	0.053	0.19	0.073	0.13	0.13	0.16	0.11
Organic Nitrogen	0.15	0.16	0.16*	**2.2**	**1.7**	--	--	--	--	**0.7**	**0.81**	**0.97**	**1.12**	--	--	--	--	**0.71**	**0.807**	**0.97**	**0.97**	--	--
Cations																							
Calcium	--	--	--	490	480	460	460	460	470	450	450	490	490	410	410	310	300	380	400	340	350	380	370
Magnesium	--	--	--	200	200	180	180	180	180	170	170	200	200	170	170	210	210	140	140	180	180	150	150
Potassium	--	--	--	4.7	4.6	--	--	--	--	4.2	4.1	3.7	3.6	--	--	--	--	2.8	2.9	3.2	3.1	--	--
Sodium	200	10.37	105	170	170	170	170	160	160	170	170	180	190	160	160	160	160	130	130	170	170	160	170
Anions																							
Alkalinity as $CaCO_3$	30-500	257	378	**670**	**670**	**740**	**740**	**790**	**790**	**700**	**680**	**780**	**780**	**920**	**920**	**1,100**	**1,100**	**930**	**940**	**1,000**	**1,000**	**960**	**950**
Chloride	250	1.22	126	**290**	**300**	**280**	**280**	**260**	**260**	**360**	**360**	**290**	**280**	220	220	210	210	170	160	230	240	190	190
Nitrate	10	0.05	2.54	6.31	6.43	6.81	6.8	4.57	4.41	8.13	8.71	5.07	5	1.49	1.69	0.56	0.59	0.13	0.14	0.85	0.85	<0.10	<0.10
Nitrite	1	0.005	0.25	0.15	0.15	--	--	--	--	0.198	0.19	0.11	0.108	--	--	--	--	0.032	0.032	0.051	0.053	--	--
Total Phosphorus	--	--	--	25	25	--	--	--	--	7	8.1	0.3	0.29	--	--	--	--	0.39	0.26	0.11	0.16	--	--
Sulphate	500	11.6	256	**1,300**	**1,300**	**1,100**	**1,200**	**1,100**	**1,100**	**1,200**	**1,300**	**1,100**	**1,100**	**800**	**820**	**510**	**510**	**760**	**750**	**550**	250	**570**	**580**
Ion Balance	--	--	--	1.98	1.72	--	--	1.6	0.94	6.2	7.56	3.41	2.71	1.01	0.28	1.14	0.87	3.46	2.15	1.5	9.48	2.46	2.87
Metals - Dissolved																							
Arsenic	0.025	0.0051	0.010	<0.001	<0.001	--	--	-	-	<0.001	<0.001	0.001	0.0011	--	--	--	--	0.002	0.0019	0.0021	0.002	--	--
Barium	1	0.011	0.26	0.066	0.065	0.075	0.073	0.056	0.058	0.07	0.068	0.051	0.054	0.046	0.042	0.046	0.045	0.045	0.047	0.038	0.039	0.051	0.052
Boron	5	0.025	1.27	2.5	2.5	1.1	1.1	1.4	1.4	1.3	1.2	1.1	1.1	1	1	0.9	0.91	0.90	0.93	0.98	0.97	1.20	1.30
Cadmium	0.005	0.00002	0.0013	<0.0001	<0.0001	--	--	--	--	<0.0001	<0.0001	<0.0001	<0.0001	--	--	--	--	<0.00009	<0.00009	<0.00009	<0.00009	--	--
Chromium	0.05	0.0025	0.014	<0.005	<0.005	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--	--
Copper	1	0.0006	0.50	0.0072	0.0071	--	--	--	--	0.0055	0.0049	0.007	0.0066	--	--	--	--	0.003	0.004	0.0042	0.0044	--	--
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.35**	**0.35**	**0.51**	**0.58**	0.1	<0.1	**0.49**	**0.51**
Lead	0.01	0.00025	0.0027	<0.0005	<0.0005	--	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--	<0.0005	<0.0005	<0.0005	<0.0005	--	--
Manganese	0.05	0.227	0.227*	**1.3**	**1.3**	--	--	--	--	**0.66**	**0.66**	**0.92**	**0.92**	--	--	--	--	**0.56**	**0.57**	**1.1**	**1.1**	--	--
Mercury	0.001	0.00005	0.003	<0.0001	<0.0001	--	--	--	--	<0.0001	<0.0001	<0.0001	<0.0001	--	--	--	--	<0.0001	<0.0001	<0.0001	<0.0001	--	--
Zinc	5	0.0025	2.50	<0.005	<0.005	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--	--
VOCs																							
Benzene	0.005	0.00005	0.0013	0.00015	0.00016	--	--	--	--	0.00018	0.00017	<0.001	<0.001	--	--	--	--	<0.00025	<0.00025	<0.0005	<0.0005	--	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	<0.0002	<0.0002	--	--	--	--	<0.0002	<0.0002	<0.002	<0.002	--	--	--	--	<0.0005	<0.0005	<0.001	<0.001	--	--
Dichloromethane	0.05	0.00025	0.013	<0.0005	<0.0005	--	--	--	--	<0.0005	<0.0005	<0.005	<0.005	--	--	--	--	<0.0013	<0.0013	<0.0025	<0.0025	--	--
Toluene	0.024	0.00010	0.012	0.00033	0.00036	--	--	--	--	0.00023	0.00021	<0.002	<0.002	--	--	--	--	<0.0005	<0.0005	<0.001	<0.001	--	--
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002	<0.0002	--	--	--	--	<0.0002	<0.0002	<0.002	<0.002	--	--	--	--	<0.0005	<0.0005	<0.001	<0.001	--	--

THB-00011174-IE	Table 2 (cont'd): Groundwater Data[1]												
Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-H									
				18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	27 May 2020	22 Sept. 2020	30 May 2021	4 Oct. 2021
General													
pH	6.5 to 8.5	7.92	--	8.07	8.13	8.01	7.93	8.01	7.84	7.93	8.19	7.98	7.63
Field pH	--	--	--	8.09	7.95	7.29	8.66	7.87	7.46	7.53	6.79	7.61	6.95
Water Temperature (°C)	--	--	--	--	--	6.3	3.5	4.7	8	7.6	10.6	9.4	11.9
Conductivity (uS/cm)	--	--	--	240	500	360	500	350	560	430	570	520	990
Field Conductivity (uS/cm)	--	--	--	223	480	312	491	324	442	367	485	525	453
Total Dissolved Solids	500	273	386	142	275	155	160	225	300	230	325	270	**575**
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics													
Dissolved Organic Carbon	5	1.8	3.4	1.6	1.5	1	1.4	1.1	1.2	1.5	1.7	1.1	3
Total Chemical Oxygen Demand	--	--	--	4.1	9.7	<4.0	39	<4.0	<4.0	12	6.4	<4.0	<4.0
Phenols	--	--	--	<0.0010	--	--	<0.0010	<0.0010	--	--	<0.0010	<0.0010	--
Total Kjeldahl Nitrogen	--	--	--	0.79	--	--	0.19	0.18	--	--	0.33	0.11	--
Ammonia-N	--	--	--	<0.050	<0.050	0.068	0.22	<0.050	<0.050	<0.050	0.15	<0.050	<0.050
Organic Nitrogen	0.15	0.16	0.16*	**0.79**	--	--	~0	**0.155**	--	--	**0.18**	0.11	--
Cations													
Calcium	--	--	--	32	75	57	86	65	92	73	170	93	180
Magnesium	--	--	--	4.6	9.5	5.8	8.9	5.1	9	6	17	8.6	19
Potassium	--	--	--	0.97	--	--	1.8	1.3	--	--	3.1	1.4	--
Sodium	200	10.37	105	8.9	7.2	6.1	8	4.6	6.5	6.2	73	6.7	41
Anions													
Alkalinity as $CaCO_3$	30-500	257	378	120	250	180	240	170	290	210	300	260	**530**
Chloride	250	1.22	126	2.5	8.9	5.8	12	8.1	4.7	10	3.3	15	9.9
Nitrate	10	0.05	2.54	0.14	<0.10	0.18	<0.10	<0.10	<0.10	<0.10	0.37	<0.10	2.55
Nitrite	1	0.005	0.25	<0.010	--	--	<0.010	<0.010	--	--	<0.010	<0.010	--
Total Phosphorus	--	--	--	16	--	--	5.6	0.39	--	--	0.80	<0.10	--
Sulphate	500	11.6	256	<1.0	4.1	3.5	8.7	3.6	5.6	5.3	22	7.3	53
Ion Balance	--	--	--	5.28	--	4.44	1.25	3.12	2.73	1.44	34.40	0.05	0.13
Metals - Dissolved													
Arsenic	0.025	0.0051	0.010	<0.001	--	--	<0.001	<0.001	--	--	<0.001	<0.001	--
Barium	1	0.011	0.26	0.0096	0.037	0.021	0.038	0.023	0.031	0.022	0.078	0.028	0.072
Boron	5	0.025	1.27	0.022	0.041	0.016	0.038	0.022	0.027	0.013	0.047	0.022	0.048
Cadmium	0.005	0.00002	0.0013	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.00009	<0.00009	--
Chromium	0.05	0.0025	0.014	<0.005	--	--	<0.005	<0.005	--	--	<0.005	<0.005	--
Copper	1	0.0006	0.50	<0.001	--	--	<0.001	0.011	--	--	0.0033	0.0013	--
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	0.01	0.00025	0.0027	<0.0005	--	--	<0.0005	0.0005	--	--	<0.0005	<0.0005	--
Manganese	0.05	0.227	0.227*	0.028	--	--	0.0038	<0.002	--	--	0.0026	<0.002	--
Mercury	0.001	0.00005	0.003	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.0001	<0.0001	--
Zinc	5	0.0025	2.50	<0.005	--	--	<0.005	0.011	--	--	<0.005	<0.005	--
VOCs													
Benzene	0.005	0.00005	0.0013	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.0001	<0.0001	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	<0.0002	--	--	<0.0002	<0.0002	--	--	<0.0002	<0.0002	--
Dichloromethane	0.05	0.00025	0.013	<0.0005	--	--	<0.0005	<0.0005	--	--	<0.0005	<0.0005	--
Toluene	0.024	0.00010	0.012	0.00021	--	--	<0.0002	<0.0002	--	--	<0.0002	<0.0002	--
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002	--	--	<0.0002	<0.0002	--	--	<0.0002	<0.0002	--

THB-00011174-IE	Table 2 (cont'd): Groundwater Data[1]												
Parameter	ODWS[2]	2021 Background[3]	2021 B-7 Criteria[4]	BH-I									
				18 May 2017	28 Sept. 2017	16 May 2018	15 Oct. 2018	5 May 2019	22 Oct. 2019	26 May 2020	22 Sept. 2020	30 May 2021	4 Oct. 2021
General													
pH	6.5 to 8.5	7.92	--	7.97	8.17	7.95	7.98	7.86	8	7.79	7.92	7.97	8.14
Field pH	--	--	--	7.67	8.22	7.32	8.22	7.71	7.43	7.53	7.08	7.64	7.41
Water Temperature (°C)	--	--	--	--	--	6.9	6.6	6.5	10.3	9.1	9.4	6.6	12.1
Conductivity (uS/cm)	--	--	--	440	500	470	500	480	470	460	510	500	510
Field Conductivity (uS/cm)	--	--	--	427	496	413	459	475	196	210	214	499	282
Total Dissolved Solids	500	273	386	256	290	200	315	270	265	255	310	280	255
Total Suspended Solids	--	--	--	--	--	--	--	--	--	--	--	--	--
Organics													
Dissolved Organic Carbon	5	1.8	3.4	2.5	1.8	2.5	1.8	2.8	2.4	<0.4	1.7	2.4	1.5
Total Chemical Oxygen Demand	--	--	--	5.5	9	5.9	5.9	<4.0	7.4	18	<4.0	<4.0	6.80
Phenols	--	--	--	<0.0010	--	--	<0.0010	<0.0010	--	--	<0.0010	<0.0010	--
Total Kjeldahl Nitrogen	--	--	--	0.14	--	--	0.16	0.38	--	--	0.18	0.21	--
Ammonia-N	--	--	--	<0.050	<0.050	0.055	0.13	0.097	0.1	<0.050	0.12	0.074	0.057
Organic Nitrogen	0.15	0.16	0.16*	0.14	--	--	0.03	**0.283**	--	--	0.06	0.14	--
Cations													
Calcium	--	--	--	58	54	68	64	72	65	66	70	69	73
Magnesium	--	--	--	16	18	15	20	17	16	16	19	18	20
Potassium	--	--	--	2.1	--	--	1.7	1.5	--	--	1.70	1.30	--
Sodium	200	10.37	105	10	16	4.9	16	8.4	7.4	7.4	13	11	15
Anions													
Alkalinity as $CaCO_3$	30-500	257	378	230	260	250	260	250	240	240	270	260	280
Chloride	250	1.22	126	1.7	<1.0	1	1.2	1.3	1.8	<1.0	<1.0	2.00	1.2
Nitrate	10	0.05	2.54	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nitrite	1	0.005	0.25	<0.010	--	--	<0.010	<0.010	--	--	<0.010	<0.010	--
Total Phosphorus	--	--	--	2.1	--	--	0.75	1.3	--	--	0.067	<0.040	--
Sulphate	500	11.6	256	7.1	14	6.3	13	8.4	9.3	6.7	16	14	15
Ion Balance	--	--	--	5.63	--	2.99	0.3	2.18	1.96	0.19	0.19	1.51	0.77
Metals - Dissolved													
Arsenic	0.025	0.0051	0.010	0.003	--	--	0.0031	0.0047	--	--	0.0063	0.0042	--
Barium	1	0.011	0.26	0.017	0.018	0.01	0.012	0.012	0.012	0.0098	0.013	0.0095	0.012
Boron	5	0.025	1.27	0.024	0.041	0.012	0.04	0.021	0.025	0.015	0.027	0.023	0.039
Cadmium	0.005	0.00002	0.0013	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.00009	<0.00009	--
Chromium	0.05	0.0025	0.014	<0.005	--	--	<0.005	<0.005	--	--	<0.005	<0.005	--
Copper	1	0.0006	0.50	0.0014	--	--	<0.001	<0.001	--	--	<0.0009	0.0014	--
Iron	0.3	0.05	0.180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10	<0.1	<0.1
Lead	0.01	0.00025	0.0027	<0.0005	--	--	<0.0005	<0.0005	--	--	<0.0005	<0.0005	--
Manganese	0.05	0.227	0.227*	**0.2**	--	--	**0.29**	**0.071**	--	--	**0.39**	**0.22**	--
Mercury	0.001	0.00005	0.003	<0.0001	--	--	<0.0001	<0.0001	--	--	<0.0001	<0.0001	--
Zinc	5	0.0025	2.50	<0.005	--	--	<0.005	<0.005	--	--	<0.005	<0.005	--
VOCs													
Benzene	0.005	0.00005	0.0013	0.00013	--	--	<0.00010	<0.00010	--	--	<0.0001	<0.0001	--
1,4-Dichlorobenzene	0.005	0.00010	0.0013	<0.0002	--	--	<0.00020	<0.00020	--	--	<0.0002	<0.0002	--
Dichloromethane	0.05	0.00025	0.013	<0.0005	--	--	<0.00050	<0.00050	--	--	<0.0005	<0.0005	--
Toluene	0.024	0.00010	0.012	0.0011	--	--	<0.00020	<0.00020	--	--	<0.0002	<0.0002	--
Vinyl Chloride	0.002	0.00010	0.00058	<0.0002	--	--	<0.00020	<0.00020	--	--	<0.0002	<0.0002	--

Table 3: Surface Water Data[1]			
SW1			
Parameter	PWQO[5]	30 May 2021	4 Oct. 2021
General			
pH	6.5 to 8.5	7.85	7.89
Field pH	--	8	7.81
Conductivity (uS/cm)	--	150	260
Field Conductivity (uS/cm)	--	153	223
Field Temperature (˚C)	--	14.4	14.1
Total Dissolved Solids	--	95	155
Total Suspended Solids	--	4	18
Organics			
Total Biochemical Oxygen Demand (BOD)		<2	<2
Total Chemical Oxygen Demand (COD)	--	43	26
Phenols	0.001	<0.0010	<0.0010
Total Kjeldahl Nitrogen (TKN)	--	0.4	0.48
Ammonia-N	--	0.055	0.054
Organic Nitrogen	--	0.345	0.426
Anions (mg/L)			
Alkalinity as $CaCO_3$	--	57	110
Chloride	--	12	21
Nitrate	--	<0.10	<0.10
Nitrite	--	<0.010	<0.010
Total Phosphorus	--	0.027	0.02
Sulphate	--	<1.0	<1.0
Metals (mg/L) - Total			
Arsenic	0.1 (0.005)	0.003	--
Barium	--	0.0099	--
Boron	0.2	<0.01	--
Cadmium	0.0002 (0.0001)	<0.00009	--
Chromium	0.001	<0.005	--
Copper	0.005	<0.0009	--
Iron	0.3	<0.1	**0.57**
Lead	0.01 (0.003)	<0.0005	--
Mercury	0.0002	<0.00010	--
Zinc	0.03 (0.02)	<0.005	--

Table 3: Surface Water Data[1]			
SW2			
Parameter	PWQO[5]	30 May 2021	5 Oct. 2021
General			
pH	6.5 to 8.5	7.87	7.69
Field pH	--	7.88	7.8
Conductivity (uS/cm)	--	170	290
Field Conductivity (uS/cm)	--	166	199
Field Temperature (˚C)	--	14.6	23.1
Total Dissolved Solids	--	140	160
Total Suspended Solids	--	15	13
Organics			
Total Biochemical Oxygen Demand (BOD)		5	2
Total Chemical Oxygen Demand (COD)	--	35	25
Phenols	0.001	<0.0010	**0.0024**
Total Kjeldahl Nitrogen (TKN)	--	0.42	0.47
Ammonia-N	--	0.071	0.06
Organic Nitrogen	--	0.349	0.41
Anions (mg/L)			
Alkalinity as $CaCO_3$	--	80	130
Chloride	--	8	12
Nitrate	--	<0.10	<0.10
Nitrite	--	<0.010	<0.010
Total Phosphorus	--	0.023	0.038
Sulphate	--	<1.0	18
Metals (mg/L) - Total			
Arsenic	0.1 (0.005)	0.023	--
Barium	--	0.014	--
Boron	0.2	<0.01	--
Cadmium	0.0002 (0.0001)	<0.00009	--
Chromium	0.001	<0.005	--
Copper	0.005	0.0032	--
Iron	0.3	**0.46**	**0.56**
Lead	0.01 (0.003)	0.00063	--
Mercury	0.0002	<0.00010	--
Zinc	0.03 (0.02)	0.01	--

Table 4: Calculation of Alert Criteria

Groundwater Impact

Parameter	Source Concentration (BH-G)	Background Concentration (BH-I)	B-7 Criteria	BH-F Tigger Levels	BH-F Maximum 2021 Concentration
Alkalinity	978	270	378	597	250
Arsenic	0.00205	0.0042	0.010	n/a	<0.001
Barium	0.045	0.01075	0.26	n/a	0.0055
Benzene	<0.0005	<0.0001	0.0013	n/a	<0.0001
Boron	1.113	0.031	1.27	n/a	<0.01
Cadmium	<0.00009	<0.00009	0.0013	n/a	<0.00009
Chloride	212.5	1.60	126	157	3.0
Chromium	<0.005	<0.005	0.014	n/a	<0.005
Copper	0.0043	0.0014	0.50	n/a	0.0027
1,4-Dichlorobenzene	<0.001	<0.0002	0.0013	n/a	<0.0002
Dichloromethane	<0.0025	<0.0005	0.013	n/a	<0.0005
DOC	33	1.95	3.4	14.2	0.68
Iron	0.290	<0.10	0.180	0.22	<0.10
Lead	<0.0005	<0.0005	0.0027	n/a	<0.0005
Manganese	1.1	0.22	0.227	0.55	<0.002
Mercury	<0.0001	<0.0001	0.003	n/a	<0.0001
Nitrate	0.450	<0.10	2.54	n/a	<0.10
Nitrite	0.052	<0.010	0.25	n/a	<0.010
Organic Nitrogen	0.970	0.14	0.16	0.46	0.120
Sodium	168	13.0	105	128	2.3
Sulphate	488	14.5	256	341	1.2
Toluene	<0.001	<0.0002	0.012	n/a	<0.0002
TDS	2,140	268	386	1027	245
Vinyl Chloride	<0.001	<0.0002	0.00058	n/a	<0.0002
Zinc	<0.005	<0.005	2.50	n/a	<0.005

Distance from source well BH-G to trigger well BH-F (m)	365.00
Distance from source well BH-G to east attenuation zone boundary (m)	575.00

Notes:

1. Source and background concentrations are the arithmetic means of 2021 results for the respective wells.
2. Non-detectable background concentrations have been assumed to be one-half of the detection limit.
3. Where background exceeds the ODWS, the B-7 criterion defaults to background (i.e., no further deterioration of groundwater quality is acceptable).
4. Where the source concentration is lower than or equal to the B-7 criterion, a trigger level is not applicable (n/a).
5. All concentrations expressed in milligrams per litre (mg/L).

Table 5: Calculation of Alert Criteria

Evaluation of Surface Water Impact Using APV Criteria

Parameter	Source Concentration (BH-G)	Background Concentration (BH-I)	APV[3]	BH-F Trigger Levels	BH-F Maximum 2021 Concentration	SW2 Maximum 2021 Concentration
Arsenic	0.00205	0.0042	0.15	n/a	<0.001	0.023
Barium	0.045	0.01075	2.30	n/a	0.0055	0.014
Benzene	<0.0005	<0.0001	0.46	n/a	<0.0001	--
Boron	1.113	0.031	3.55	n/a	<0.01	<0.01
Cadmium	<0.00009	<0.00009	0.00021	n/a	<0.00009	<0.00009
Chloride	212.5	1.60	180	192	3.0	12
Chromium	<0.005	<0.005	0.064	n/a	<0.005	<0.005
Copper	0.0043	0.0014	0.0069	n/a	0.0027	0.0032
1,4-Dichlorobenzene	<0.001	<0.0002	0.76	n/a	<0.0002	--
Dichloromethane	<0.0025	<0.0005	1.30	n/a	<0.0005	--
Lead	<0.0005	<0.0005	0.0020	n/a	<0.0005	0.00063
Mercury	<0.0001	<0.0001	0.00077	n/a	<0.0001	<0.0001
Phenols	<0.001	<0.001	0.961	n/a	<0.0010	0.0024
Sodium	168	13.0	180	n/a	2.3	--
Toluene	<0.001	<0.0002	1.40	n/a	<0.0002	--
Vinyl Chloride	<0.001	<0.0002	36.0	n/a	<0.0002	--
Zinc	<0.005	<0.005	0.089	n/a	<0.005	0.01
Distance from source well BH-G to trigger well BH-F (m)				365.00		
Distance from source well BH-G to east attenuation zone boundary (m)				575.00		

Notes:

1. Source and background concentrations are the arithmetic means of 2021 results for the respective wells.
2. Non-detectable background concentrations have been assumed to be one-half of the detection limit.
3. APV (Aquatic Protection Values) as found in Appendix B2 of the MECP's *Rationale for the Development of Soil and Ground Water Standards for Use at Contaminated Sites in Ontario* (April 2011).
4. Where the source concentration is lower than or equal to the APV criterion, a trigger level is not applicable (n/a).
5. Maximum results exceeding trigger levels are **bolded**. Maximum results greater than source concentrations are underlined.
6. All concentrations expressed in milligrams per litre (mg/L).

Table 6: Calculation of Alert Criteria

Evaluation of Surface Water Impact Using PWQO Criteria

Parameter	Source Concentration (BH-G)	Background Concentration (BH-I)	PWQO[3]	BH-F Trigger Levels	BH-F Maximum 2021 Concentration	SW2 Maximum 2021 Concentration
Arsenic	0.00205	0.0042	0.10	n/a	<0.001	0.023
Boron	1.113	0.031	0.20	0.53	<0.01	<0.01
Cadmium	<0.00009	<0.00009	0.0002	n/a	<0.00009	<0.00009
Chromium	<0.005	<0.005	0.001	n/a	<0.005	<0.005
Copper	0.0043	0.0014	0.005	n/a	0.0027	0.0032
Iron	0.29	<0.10	0.30	n/a	<0.10	0.56
Lead	<0.0005	<0.0005	0.01	n/a	<0.0005	0.00063
Mercury	<0.0001	<0.0001	0.0002	n/a	<0.0001	<0.0001
Phenols	<0.001	<0.001	0.001	n/a	<0.0010	0.0024
Zinc	<0.005	<0.005	0.03	n/a	<0.005	0.01
Distance from source well BH-G to trigger well BH-F (m)				365.00		
Distance from source well BH-G to east attenuation zone boundary (m)				575.00		

Notes:

1. Source and background concentrations are the arithmetic means of 2021 results for the respective wells.
2. Non-detectable background concentrations have been assumed to be one-half of the detection limit.
3. MECP Provincial Water Quality Objectives, 1994 (updated 1999).
4. Where the source concentration is lower than or equal to the PWQO criterion, a trigger level is not applicable (n/a).
5. Maximum results exceeding trigger levels are **bolded**. Maximum results greater than source concentrations are underlined.
6. All concentrations expressed in milligrams per litre (mg/L).

APPENDIX E – Laboratory Reports of Analysis

Your Project #: THB-00011174-JE
Site#: BEARDMORE LANDFILL
Site Location: BEARDMORE LANDFILL
Your C.O.C. #: 825024-01-01

Attention: Ahileas Mitsopoulos

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
CANADA P7B 5M4

Report Date: 2021/06/07
Report #: R6665822
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E7618
Received: 2021/05/31, 12:50

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	8	N/A	2021/06/03	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	2	2021/06/02	2021/06/07	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	8	N/A	2021/06/03	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	7	N/A	2021/06/03	CAM SOP-00416	SM 23 5220 D m
Chemical Oxygen Demand	1	N/A	2021/06/04	CAM SOP-00416	SM 23 5220 D m
Conductivity	8	N/A	2021/06/03	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	6	N/A	2021/06/04	CAM SOP-00446	SM 23 5310 B m
Field Measured Dissolved Oxygen (2)	2	N/A	2021/05/31		Field pH Meter
Field Measured Conductivity (2)	2	N/A	2021/05/31		Field Meter
Mercury in Water by CVAA	8	2021/06/03	2021/06/03	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	6	N/A	2021/06/03	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	2	N/A	2021/06/04	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	6	N/A	2021/06/04		
Total Ammonia-N	8	N/A	2021/06/04	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (3)	8	N/A	2021/06/03	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	8	2021/06/02	2021/06/03	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	8	N/A	2021/06/03	CAM SOP-00444	OMOE E3179 m
Field Measured pH (2)	2	N/A	2021/05/31		Field pH Meter
Sulphate by Automated Colourimetry	8	N/A	2021/06/03	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	8	2021/06/03	2021/06/04	CAM SOP-00428	SM 23 2540C m
Field Temperature (2)	2	N/A	2021/05/31		Field Thermometer
Total Kjeldahl Nitrogen in Water	4	2021/06/02	2021/06/02	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	3	2021/06/02	2021/06/03	CAM SOP-00938	OMOE E3516 m
Total Kjeldahl Nitrogen in Water	1	2021/06/02	2021/06/04	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	2	2021/06/03	2021/06/03	CAM SOP-00407	SM 23 4500 P B H m
Total Phosphorus (Colourimetric)	6	2021/06/03	2021/06/04	CAM SOP-00407	SM 23 4500 P B H m
Low Level Total Suspended Solids	2	2021/06/03	2021/06/04	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	6	N/A	2021/06/03	CAM SOP-00226	EPA 8260C m

Remarks:

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

Your Project #: THB-00011174-JE
Site#: BEARDMORE LANDFILL
Site Location: BEARDMORE LANDFILL
Your C.O.C. #: 825024-01-01

Attention: Ahileas Mitsopoulos

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
CANADA P7B 5M4

Report Date: 2021/06/07
Report #: R6665822
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1E7618
Received: 2021/05/31, 12:50

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.

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.
(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.
(2) This is a field test, therefore, the results relate to items that were not analysed at Bureau Veritas Laboratories.
(3) 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 your Project Manager.
Michelle Huth, Project Manager Assistant
Email: michelle.brescacin@bureauveritas.com
Phone# (807)344-4220
==========
This report has been generated and distributed using a secure automated process.
BV Labs 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 Signature Page.

BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB744			PSB745		
Sampling Date					2021/05/30 13:20			2021/05/30 12:30		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - C**	**RDL**	**QC Batch**	**BH - F**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-	0.055	0.050	7385604	<0.050	0.050	7385604
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	7.2	4.0	7385507	7.5	4.0	7385507
Conductivity	umho/cm	-	-	-	700	1.0	7384787	440	1.0	7384787
Total Dissolved Solids	mg/L	-	-	500	385	10	7388366	230	10	7388366
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.31	0.10	7385549	0.12	0.10	7385549
Dissolved Organic Carbon	mg/L	-	-	5	1.6	0.40	7387686	0.59	0.40	7387686
pH	pH	6.5:8.5	-	6.5:8.5	8.00		7384790	8.06		7384790
Phenols-4AAP	mg/L	0.001	-	-	<0.0010	0.0010	7385046	<0.0010	0.0010	7385046
Total Phosphorus	mg/L	0.01	-	-	0.13	0.040	7387007	0.94	0.10	7387355
Dissolved Sulphate (SO4)	mg/L	-	-	500	37	1.0	7384803	<1.0	1.0	7384803
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	350	1.0	7384776	240	1.0	7384776
Dissolved Chloride (Cl-)	mg/L	-	-	250	5.7	1.0	7384795	2.9	1.0	7384795
Nitrite (N)	mg/L	-	1	-	<0.010	0.010	7385173	<0.010	0.010	7385173
Nitrate (N)	mg/L	-	10	-	0.56	0.10	7385173	<0.10	0.10	7385173
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-	<0.00010	0.00010	7386815	<0.00010	0.00010	7386815
Dissolved Arsenic (As)	ug/L	100	10	-	<1.0	1.0	7387332	<1.0	1.0	7387332
Dissolved Barium (Ba)	ug/L	-	1000	-	28	2.0	7387332	4.5	2.0	7387332
Dissolved Boron (B)	ug/L	200	5000	-	26	10	7387332	<10	10	7387332
Dissolved Cadmium (Cd)	ug/L	0.2	5	-	<0.090	0.090	7387332	<0.090	0.090	7387332
Dissolved Calcium (Ca)	ug/L	-	-	-	92000	200	7387332	74000	200	7387332
Dissolved Chromium (Cr)	ug/L	-	50	-	<5.0	5.0	7387332	<5.0	5.0	7387332
Dissolved Copper (Cu)	ug/L	5	-	1000	1.2	0.90	7387332	2.7	0.90	7387332
Dissolved Iron (Fe)	ug/L	300	-	300	<100	100	7387332	<100	100	7387332
Dissolved Lead (Pb)	ug/L	5	10	-	<0.50	0.50	7387332	<0.50	0.50	7387332
Dissolved Magnesium (Mg)	ug/L	-	-	-	20000	50	7387332	13000	50	7387332
Dissolved Manganese (Mn)	ug/L	-	-	50	3.4	2.0	7387332	<2.0	2.0	7387332
Dissolved Potassium (K)	ug/L	-	-	-	1700	200	7387332	330	200	7387332
Dissolved Sodium (Na)	ug/L	-	-	200000	4000	100	7387332	2000	100	7387332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB744			PSB745		
Sampling Date					2021/05/30 13:20			2021/05/30 12:30		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - C**	**RDL**	**QC Batch**	**BH - F**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	ug/L	30	-	5000	<5.0	5.0	7387332	<5.0	5.0	7387332
Volatile Organics										
Benzene	ug/L	100	1	-	<0.10	0.10	7384242	<0.10	0.10	7384242
1,4-Dichlorobenzene	ug/L	4	5	1	<0.20	0.20	7384242	<0.20	0.20	7384242
Methylene Chloride(Dichloromethane)	ug/L	100	50	-	<0.50	0.50	7384242	<0.50	0.50	7384242
Toluene	ug/L	0.8	60	24	<0.20	0.20	7384242	<0.20	0.20	7384242
Vinyl Chloride	ug/L	600	1	-	<0.20	0.20	7384242	<0.20	0.20	7384242
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	-	-	-	96		7384242	96		7384242
D4-1,2-Dichloroethane	%	-	-	-	96		7384242	94		7384242
D8-Toluene	%	-	-	-	102		7384242	102		7384242

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB745			PSB746		
Sampling Date					2021/05/30 12:30			2021/05/30 15:00		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - F Lab-Dup**	**RDL**	**QC Batch**	**BH - G**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-				0.13	0.050	7385604
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-				100	4.0	7384389
Conductivity	umho/cm	-	-	-				3100	1.0	7384787
Total Dissolved Solids	mg/L	-	-	500				2160	10	7388366
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-				1.1	0.10	7385527
Dissolved Organic Carbon	mg/L	-	-	5				38	0.40	7387686
pH	pH	6.5:8.5	-	6.5:8.5				7.34		7384790
Phenols-4AAP	mg/L	0.001	-	-				<0.0010	0.0010	7385046
Total Phosphorus	mg/L	0.01	-	-				0.11	0.10	7387007
Dissolved Sulphate (SO4)	mg/L	-	-	500				550	5.0	7384803
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500				1000	1.0	7384776
Dissolved Chloride (Cl-)	mg/L	-	-	250				230	2.0	7384795
Nitrite (N)	mg/L	-	1	-				0.051	0.010	7385173
Nitrate (N)	mg/L	-	10	-				0.85	0.10	7385173
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-				<0.00010	0.00010	7386582
Dissolved Arsenic (As)	ug/L	100	10	-	<1.0	1.0	7387332	2.1	1.0	7387332
Dissolved Barium (Ba)	ug/L	-	1000	-	5.1	2.0	7387332	38	2.0	7387332
Dissolved Boron (B)	ug/L	200	5000	-	<10	10	7387332	980	10	7387332
Dissolved Cadmium (Cd)	ug/L	0.2	5	-	<0.090	0.090	7387332	<0.090	0.090	7387332
Dissolved Calcium (Ca)	ug/L	-	-	-	73000	200	7387332	340000	200	7387332
Dissolved Chromium (Cr)	ug/L	-	50	-	<5.0	5.0	7387332	<5.0	5.0	7387332
Dissolved Copper (Cu)	ug/L	5	-	1000	2.5	0.90	7387332	4.2	0.90	7387332
Dissolved Iron (Fe)	ug/L	300	-	300	<100	100	7387332	100	100	7387332
Dissolved Lead (Pb)	ug/L	5	10	-	<0.50	0.50	7387332	<0.50	0.50	7387332
Dissolved Magnesium (Mg)	ug/L	-	-	-	13000	50	7387332	180000	50	7387332
Dissolved Manganese (Mn)	ug/L	-	-	50	<2.0	2.0	7387332	1100	2.0	7387332
Dissolved Potassium (K)	ug/L	-	-	-	310	200	7387332	3200	200	7387332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB745			PSB746		
Sampling Date					2021/05/30 12:30			2021/05/30 15:00		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - F Lab-Dup**	**RDL**	**QC Batch**	**BH - G**	**RDL**	**QC Batch**
Dissolved Sodium (Na)	ug/L	-	-	200000	2000	100	7387332	170000	100	7387332
Dissolved Zinc (Zn)	ug/L	30	-	5000	<5.0	5.0	7387332	<5.0	5.0	7387332
Volatile Organics										
Benzene	ug/L	100	1	-				<0.50	0.50	7384242
1,4-Dichlorobenzene	ug/L	4	5	1				<1.0	1.0	7384242
Methylene Chloride(Dichloromethane)	ug/L	100	50	-				<2.5	2.5	7384242
Toluene	ug/L	0.8	60	24				**<1.0 (1)**	1.0	7384242
Vinyl Chloride	ug/L	600	1	-				<1.0	1.0	7384242
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	-	-	-				95		7384242
D4-1,2-Dichloroethane	%	-	-	-				91		7384242
D8-Toluene	%	-	-	-				101		7384242

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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(1) RDL exceeds criteria

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB747			PSB748		
Sampling Date					2021/05/30 14:40			2021/05/30 15:30		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - H**	**RDL**	**QC Batch**	**BH - I**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-	<0.050	0.050	7385604	0.074	0.050	7385575
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	<4.0	4.0	7385507	<4.0	4.0	7384389
Conductivity	umho/cm	-	-	-	520	1.0	7384787	500	1.0	7384787
Total Dissolved Solids	mg/L	-	-	500	270	10	7388366	280	10	7388366
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.11	0.10	7385549	0.21	0.10	7385549
Dissolved Organic Carbon	mg/L	-	-	5	1.1	0.40	7387686	2.4	0.40	7387686
pH	pH	6.5:8.5	-	6.5:8.5	7.98		7384790	7.97		7384790
Phenols-4AAP	mg/L	0.001	-	-	<0.0010	0.0010	7385046	<0.0010	0.0010	7385046
Total Phosphorus	mg/L	0.01	-	-	<0.10 (1)	0.10	7387355	<0.040 (1)	0.040	7387007
Dissolved Sulphate (SO4)	mg/L	-	-	500	7.3	1.0	7384803	14	1.0	7384803
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	260	1.0	7384776	260	1.0	7384776
Dissolved Chloride (Cl-)	mg/L	-	-	250	15	1.0	7384795	2.0	1.0	7384795
Nitrite (N)	mg/L	-	1	-	<0.010	0.010	7385173	<0.010	0.010	7385173
Nitrate (N)	mg/L	-	10	-	<0.10	0.10	7385173	<0.10	0.10	7385173
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-	<0.00010	0.00010	7386582	<0.00010	0.00010	7386815
Dissolved Arsenic (As)	ug/L	100	10	-	<1.0	1.0	7387332	4.2	1.0	7387332
Dissolved Barium (Ba)	ug/L	-	1000	-	28	2.0	7387332	9.5	2.0	7387332
Dissolved Boron (B)	ug/L	200	5000	-	22	10	7387332	23	10	7387332
Dissolved Cadmium (Cd)	ug/L	0.2	5	-	<0.090	0.090	7387332	<0.090	0.090	7387332
Dissolved Calcium (Ca)	ug/L	-	-	-	93000	200	7387332	69000	200	7387332
Dissolved Chromium (Cr)	ug/L	-	50	-	<5.0	5.0	7387332	<5.0	5.0	7387332
Dissolved Copper (Cu)	ug/L	5	-	1000	1.3	0.90	7387332	1.4	0.90	7387332
Dissolved Iron (Fe)	ug/L	300	-	300	<100	100	7387332	<100	100	7387332
Dissolved Lead (Pb)	ug/L	5	10	-	<0.50	0.50	7387332	<0.50	0.50	7387332
Dissolved Magnesium (Mg)	ug/L	-	-	-	8600	50	7387332	18000	50	7387332
Dissolved Manganese (Mn)	ug/L	-	-	50	<2.0	2.0	7387332	220	2.0	7387332
Dissolved Potassium (K)	ug/L	-	-	-	1400	200	7387332	1300	200	7387332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB747			PSB748		
Sampling Date					2021/05/30 14:40			2021/05/30 15:30		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - H**	**RDL**	**QC Batch**	**BH - I**	**RDL**	**QC Batch**
Dissolved Sodium (Na)	ug/L	-	-	200000	6700	100	7387332	11000	100	7387332
Dissolved Zinc (Zn)	ug/L	30	-	5000	<5.0	5.0	7387332	<5.0	5.0	7387332
Volatile Organics										
Benzene	ug/L	100	1	-	<0.10	0.10	7384242	<0.10	0.10	7384242
1,4-Dichlorobenzene	ug/L	4	5	1	<0.20	0.20	7384242	<0.20	0.20	7384242
Methylene Chloride(Dichloromethane)	ug/L	100	50	-	<0.50	0.50	7384242	<0.50	0.50	7384242
Toluene	ug/L	0.8	60	24	<0.20	0.20	7384242	<0.20	0.20	7384242
Vinyl Chloride	ug/L	600	1	-	<0.20	0.20	7384242	<0.20	0.20	7384242
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	-	-	-	96		7384242	96		7384242
D4-1,2-Dichloroethane	%	-	-	-	93		7384242	92		7384242
D8-Toluene	%	-	-	-	102		7384242	102		7384242

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999

MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB748			PSB749		
Sampling Date					2021/05/30 15:30			2021/05/30 14:10		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - I Lab-Dup**	**RDL**	**QC Batch**	**BH - J**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-				0.13	0.050	7385575
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-				100	4.0	7384389
Conductivity	umho/cm	-	-	-	500	1.0	7384787	3100	1.0	7384787
Total Dissolved Solids	mg/L	-	-	500	300	10	7388366	2100	10	7388366
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-				1.1	0.10	7385527
Dissolved Organic Carbon	mg/L	-	-	5				38	0.40	7387686
pH	pH	6.5:8.5	-	6.5:8.5	8.01		7384790	7.49		7384790
Phenols-4AAP	mg/L	0.001	-	-				<0.0010	0.0010	7385046
Total Phosphorus	mg/L	0.01	-	-				0.16	0.040	7387007
Dissolved Sulphate (SO4)	mg/L	-	-	500				250	1.0	7384803
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	260	1.0	7384776	1000	1.0	7384776
Dissolved Chloride (Cl-)	mg/L	-	-	250				240	3.0	7384795
Nitrite (N)	mg/L	-	1	-				0.053	0.010	7385173
Nitrate (N)	mg/L	-	10	-				0.85	0.10	7385173
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-				<0.00010	0.00010	7386815
Dissolved Arsenic (As)	ug/L	100	10	-				2.0	1.0	7387332
Dissolved Barium (Ba)	ug/L	-	1000	-				39	2.0	7387332
Dissolved Boron (B)	ug/L	200	5000	-				970	10	7387332
Dissolved Cadmium (Cd)	ug/L	0.2	5	-				<0.090	0.090	7387332
Dissolved Calcium (Ca)	ug/L	-	-	-				350000	200	7387332
Dissolved Chromium (Cr)	ug/L	-	50	-				<5.0	5.0	7387332
Dissolved Copper (Cu)	ug/L	5	-	1000				4.4	0.90	7387332
Dissolved Iron (Fe)	ug/L	300	-	300				<100	100	7387332
Dissolved Lead (Pb)	ug/L	5	10	-				<0.50	0.50	7387332
Dissolved Magnesium (Mg)	ug/L	-	-	-				180000	50	7387332
Dissolved Manganese (Mn)	ug/L	-	-	50				1100	2.0	7387332
Dissolved Potassium (K)	ug/L	-	-	-				3100	200	7387332

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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LANDFILL STANDARDS SCH 5 - GW COMP. LIST (WATER)

BV Labs ID					PSB748			PSB749		
Sampling Date					2021/05/30 15:30			2021/05/30 14:10		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH - I Lab-Dup**	**RDL**	**QC Batch**	**BH - J**	**RDL**	**QC Batch**
Dissolved Sodium (Na)	ug/L	-	-	200000				170000	100	7387332
Dissolved Zinc (Zn)	ug/L	30	-	5000				<5.0	5.0	7387332
Volatile Organics										
Benzene	ug/L	100	1	-				<0.50	0.50	7384242
1,4-Dichlorobenzene	ug/L	4	5	1				<1.0	1.0	7384242
Methylene Chloride(Dichloromethane)	ug/L	100	50	-				<2.5	2.5	7384242
Toluene	ug/L	0.8	60	24				**<1.0 (1)**	1.0	7384242
Vinyl Chloride	ug/L	600	1	-				<1.0	1.0	7384242
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	-	-	-				95		7384242
D4-1,2-Dichloroethane	%	-	-	-				93		7384242
D8-Toluene	%	-	-	-				101		7384242

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)
(1) RDL exceeds criteria

BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - SW COMP. LIST (WATER)

BV Labs ID					PSB750			PSB750		
Sampling Date					2021/05/30 14:50			2021/05/30 14:50		
	UNITS	**Criteria**	**MAC**	**A/O**	**SW1**	**RDL**	**QC Batch**	**SW1 Lab-Dup**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-	0.055	0.050	7385575			
Total BOD	mg/L	-	-	-	<2	2	7384155			
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	43	4.0	7384389			
Conductivity	umho/cm	-	-	-	150	1.0	7384787			
Total Dissolved Solids	mg/L	-	-	500	95	10	7388366			
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.40	0.10	7385527			
pH	pH	6.5:8.5	-	6.5:8.5	7.85		7384790			
Phenols-4AAP	mg/L	0.001	-	-	<0.0010	0.0010	7385046	<0.0010	0.0010	7385046
Total Phosphorus	mg/L	0.01	-	-	0.027	0.004	7386729			
Total Suspended Solids	mg/L	-	-	-	4	1	7384783			
Dissolved Sulphate (SO4)	mg/L	-	-	500	<1.0	1.0	7384803			
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	57	1.0	7384776			
Dissolved Chloride (Cl-)	mg/L	-	-	250	12	1.0	7384795			
Nitrite (N)	mg/L	-	1	-	<0.010	0.010	7385173			
Nitrate (N)	mg/L	-	10	-	<0.10	0.10	7385173			
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-	<0.00010	0.00010	7386582			
Total Arsenic (As)	ug/L	100	10	-	3.0	1.0	7389079			
Total Barium (Ba)	ug/L	-	1000	-	9.9	2.0	7389079			
Total Boron (B)	ug/L	200	5000	-	<10	10	7389079			
Total Cadmium (Cd)	ug/L	0.2	5	-	<0.090	0.090	7389079			
Total Chromium (Cr)	ug/L	-	50	-	<5.0	5.0	7389079			
Total Copper (Cu)	ug/L	5	-	1000	<0.90	0.90	7389079			
Total Iron (Fe)	ug/L	300	-	300	<100	100	7389079			
Total Lead (Pb)	ug/L	5	10	-	<0.50	0.50	7389079			
Total Zinc (Zn)	ug/L	30	-	5000	<5.0	5.0	7389079			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - SW COMP. LIST (WATER)

BV Labs ID					PSB751			PSB751		
Sampling Date					2021/05/30 15:55			2021/05/30 15:55		
	UNITS	**Criteria**	**MAC**	**A/O**	**SW2**	**RDL**	**QC Batch**	**SW2 Lab-Dup**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-	0.071	0.050	7385604	<0.050	0.050	7385604
Total BOD	mg/L	-	-	-	5	2	7384155	5	2	7384155
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	35	4.0	7385507	36	4.0	7385507
Conductivity	umho/cm	-	-	-	170	1.0	7384787			
Total Dissolved Solids	mg/L	-	-	500	140	10	7388366			
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.42	0.10	7385527	0.46	0.10	7385527
pH	pH	6.5:8.5	-	6.5:8.5	7.87		7384790			
Phenols-4AAP	mg/L	0.001	-	-	<0.0010	0.0010	7385046			
Total Phosphorus	mg/L	0.01	-	-	0.023	0.004	7386729			
Total Suspended Solids	mg/L	-	-	-	15	1	7384783			
Dissolved Sulphate (SO4)	mg/L	-	-	500	<1.0	1.0	7384803			
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	80	1.0	7384776			
Dissolved Chloride (Cl-)	mg/L	-	-	250	8.0	1.0	7384795			
Nitrite (N)	mg/L	-	1	-	<0.010	0.010	7385173	<0.010	0.010	7385173
Nitrate (N)	mg/L	-	10	-	<0.10	0.10	7385173	<0.10	0.10	7385173
Metals										
Mercury (Hg)	mg/L	0.0002	0.001	-	<0.00010	0.00010	7386815			
Total Arsenic (As)	ug/L	100	10	-	23	1.0	7389079			
Total Barium (Ba)	ug/L	-	1000	-	14	2.0	7389079			
Total Boron (B)	ug/L	200	5000	-	<10	10	7389079			
Total Cadmium (Cd)	ug/L	0.2	5	-	<0.090	0.090	7389079			
Total Chromium (Cr)	ug/L	-	50	-	<5.0	5.0	7389079			
Total Copper (Cu)	ug/L	5	-	1000	3.2	0.90	7389079			
Total Iron (Fe)	ug/L	300	-	300	460	100	7389079			
Total Lead (Pb)	ug/L	5	10	-	0.63	0.50	7389079			
Total Zinc (Zn)	ug/L	30	-	5000	10	5.0	7389079			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

RESULTS OF ANALYSES OF WATER

BV Labs ID		PSB744	PSB745	PSB746	PSB747	PSB748	PSB749	
Sampling Date		2021/05/30 13:20	2021/05/30 12:30	2021/05/30 15:00	2021/05/30 14:40	2021/05/30 15:30	2021/05/30 14:10	
	UNITS	**BH - C**	**BH - F**	**BH - G**	**BH - H**	**BH - I**	**BH - J**	**QC Batch**
Calculated Parameters								
Ion Balance (% Difference)	%	10.9	0.310	1.50	0.0500	1.51	9.48	7381625
QC Batch = Quality Control Batch								

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: PSB744
Sample ID: BH - C
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7385507	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386815	2021/06/03	2021/06/03	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	7385549	2021/06/02	2021/06/03	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7387007	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

BV Labs ID: PSB745
Sample ID: BH - F
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7385507	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386815	2021/06/03	2021/06/03	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	7385549	2021/06/02	2021/06/03	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7387355	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

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TEST SUMMARY

BV Labs ID: PSB745 Dup
Sample ID: BH - F
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli

BV Labs ID: PSB746
Sample ID: BH - G
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7384389	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386582	2021/06/03	2021/06/03	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	7385527	2021/06/02	2021/06/02	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7387007	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

BV Labs ID: PSB747
Sample ID: BH - H
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7385507	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386582	2021/06/03	2021/06/03	Meghaben Patel
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai

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TEST SUMMARY

BV Labs ID: PSB747
Sample ID: BH - H
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Kjeldahl Nitrogen in Water	SKAL	7385549	2021/06/02	2021/06/03	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7387355	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

BV Labs ID: PSB748
Sample ID: BH - I
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7384389	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386815	2021/06/03	2021/06/03	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385575	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	7385549	2021/06/02	2021/06/04	Rajni Tyagi
Total Phosphorus (Colourimetric)	LACH/P	7387007	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

BV Labs ID: PSB748 Dup
Sample ID: BH - I
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai

BV Labs ID: PSB749
Sample ID: BH - J
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan

BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: PSB749
Sample ID: BH - J
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	7384389	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7387686	N/A	2021/06/04	Nimarta Singh
Mercury in Water by CVAA	CV/AA	7386815	2021/06/03	2021/06/03	Gagandeep Rai
Dissolved Metals by ICPMS	ICP/MS	7387332	N/A	2021/06/03	Azita Fazaeli
Ion Balance (% Difference)	CALC	7381625	N/A	2021/06/04	Automated Statchk
Total Ammonia-N	LACH/NH4	7385575	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Total Kjeldahl Nitrogen in Water	SKAL	7385527	2021/06/02	2021/06/02	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7387007	2021/06/03	2021/06/04	Shivani Shivani
Volatile Organic Compounds in Water	P&T/MS	7384242	N/A	2021/06/03	Dina Wang

BV Labs ID: PSB750
Sample ID: SW1
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Biochemical Oxygen Demand (BOD)	DO	7384155	2021/06/02	2021/06/07	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7384389	N/A	2021/06/03	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Mercury in Water by CVAA	CV/AA	7386582	2021/06/03	2021/06/03	Meghaben Patel
Total Metals Analysis by ICPMS	ICP/MS	7389079	N/A	2021/06/04	Azita Fazaeli
Total Ammonia-N	LACH/NH4	7385575	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Total Kjeldahl Nitrogen in Water	SKAL	7385527	2021/06/02	2021/06/02	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7386729	2021/06/03	2021/06/03	Shivani Shivani
Low Level Total Suspended Solids	BAL	7384783	2021/06/03	2021/06/04	Shivani Desai

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: PSB750 Dup
Sample ID: SW1
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine

BV Labs ID: PSB751
Sample ID: SW2
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7384776	N/A	2021/06/03	Neil Dassanayake
Biochemical Oxygen Demand (BOD)	DO	7384155	2021/06/02	2021/06/07	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7384795	N/A	2021/06/03	Avneet Kour Sudan
Chemical Oxygen Demand	SPEC	7385507	N/A	2021/06/04	Nimarta Singh
Conductivity	AT	7384787	N/A	2021/06/03	Neil Dassanayake
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Mercury in Water by CVAA	CV/AA	7386815	2021/06/03	2021/06/03	Gagandeep Rai
Total Metals Analysis by ICPMS	ICP/MS	7389079	N/A	2021/06/04	Azita Fazaeli
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
pH	AT	7384790	2021/06/02	2021/06/03	Neil Dassanayake
Phenols (4AAP)	TECH/PHEN	7385046	N/A	2021/06/03	Deonarine Ramnarine
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Sulphate by Automated Colourimetry	KONE	7384803	N/A	2021/06/03	Avneet Kour Sudan
Total Dissolved Solids	BAL	7388366	2021/06/03	2021/06/04	Shivani Desai
Field Measured Dissolved Oxygen	PH	0	N/A		Michelle Huth
Total Kjeldahl Nitrogen in Water	SKAL	7385527	2021/06/02	2021/06/02	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7386729	2021/06/03	2021/06/03	Shivani Shivani
Low Level Total Suspended Solids	BAL	7384783	2021/06/03	2021/06/04	Shivani Desai

BV Labs ID: PSB751 Dup
Sample ID: SW2
Matrix: Water

Collected: 2021/05/30
Shipped:
Received: 2021/05/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Biochemical Oxygen Demand (BOD)	DO	7384155	2021/06/02	2021/06/07	Surleen Kaur Romana
Chemical Oxygen Demand	SPEC	7385507	N/A	2021/06/04	Nimarta Singh
Total Ammonia-N	LACH/NH4	7385604	N/A	2021/06/04	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7385173	N/A	2021/06/03	Chandra Nandlal
Total Kjeldahl Nitrogen in Water	SKAL	7385527	2021/06/02	2021/06/02	Massarat Jan

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GENERAL COMMENTS

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

Package 1	5.7°C
Package 2	6.7°C

Sample PSB746 [BH - G] : VOC Water Analysis: Due to foaming, sample required dilution. The detection limits were adjusted accordingly.

Sample PSB749 [BH - J] : VOC Water Analysis: Due to foaming, sample required dilution. The detection limits were adjusted accordingly.

Results relate only to the items tested.

BV Labs Job #: C1E7618
Report Date: 2021/06/07

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7384242	4-Bromofluorobenzene	2021/06/03	96	70 - 130	99	70 - 130	95	%				
7384242	D4-1,2-Dichloroethane	2021/06/03	89	70 - 130	93	70 - 130	87	%				
7384242	D8-Toluene	2021/06/03	102	70 - 130	103	70 - 130	104	%				
7384155	Total BOD	2021/06/07					<2	mg/L	6.3	30	93	80 - 120
7384242	1,4-Dichlorobenzene	2021/06/03	103	70 - 130	108	70 - 130	<0.20	ug/L	NC	30		
7384242	Benzene	2021/06/03	85	70 - 130	90	70 - 130	<0.10	ug/L	NC	30		
7384242	Methylene Chloride(Dichloromethane)	2021/06/03	87	70 - 130	96	70 - 130	<0.50	ug/L	NC	30		
7384242	Toluene	2021/06/03	90	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
7384242	Vinyl Chloride	2021/06/03	93	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
7384389	Total Chemical Oxygen Demand (COD)	2021/06/03	96	80 - 120	101	80 - 120	<4.0	mg/L	15	20		
7384776	Alkalinity (Total as CaCO3)	2021/06/03			97	85 - 115	<1.0	mg/L	0.010	20		
7384783	Total Suspended Solids	2021/06/04					<1	mg/L	NC	25	96	85 - 115
7384787	Conductivity	2021/06/03			101	85 - 115	<1.0	umho/cm	0.20	25		
7384790	pH	2021/06/03			102	98 - 103			0.59	N/A		
7384795	Dissolved Chloride (Cl-)	2021/06/03	108	80 - 120	104	80 - 120	<1.0	mg/L	17	20		
7384803	Dissolved Sulphate (SO4)	2021/06/03	112	75 - 125	105	80 - 120	<1.0	mg/L	3.4	20		
7385046	Phenols-4AAP	2021/06/03	102	80 - 120	103	80 - 120	<0.0010	mg/L	NC	20		
7385173	Nitrate (N)	2021/06/03	98	80 - 120	100	80 - 120	<0.10	mg/L	NC	20		
7385173	Nitrite (N)	2021/06/03	107	80 - 120	107	80 - 120	<0.010	mg/L	NC	20		
7385507	Total Chemical Oxygen Demand (COD)	2021/06/04	94	80 - 120	104	80 - 120	<4.0	mg/L	0.99	20		
7385527	Total Kjeldahl Nitrogen (TKN)	2021/06/02	101	80 - 120	95	80 - 120	<0.10	mg/L	9.1	20	96	80 - 120
7385549	Total Kjeldahl Nitrogen (TKN)	2021/06/03	100	80 - 120	100	80 - 120	<0.10	mg/L	0.48	20	99	80 - 120
7385575	Total Ammonia-N	2021/06/04	96	75 - 125	97	80 - 120	<0.050	mg/L	6.0	20		
7385604	Total Ammonia-N	2021/06/04	96	75 - 125	99	80 - 120	<0.050	mg/L	NC	20		
7386582	Mercury (Hg)	2021/06/03	94	75 - 125	96	80 - 120	<0.00010	mg/L	NC	20		
7386729	Total Phosphorus	2021/06/03	108	80 - 120	102	80 - 120	<0.004	mg/L	6.2	20	100	80 - 120
7386815	Mercury (Hg)	2021/06/03	95	75 - 125	95	80 - 120	<0.00010	mg/L	NC	20		
7387007	Total Phosphorus	2021/06/04	98	80 - 120	99	80 - 120	<0.020	mg/L	0.87	20	100	80 - 120
7387332	Dissolved Arsenic (As)	2021/06/03	101	80 - 120	99	80 - 120	<1.0	ug/L	NC	20		
7387332	Dissolved Barium (Ba)	2021/06/03	99	80 - 120	96	80 - 120	<2.0	ug/L	13	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7387332	Dissolved Boron (B)	2021/06/03	99	80 - 120	96	80 - 120	<10	ug/L	NC	20		
7387332	Dissolved Cadmium (Cd)	2021/06/03	100	80 - 120	97	80 - 120	<0.090	ug/L	NC	20		
7387332	Dissolved Calcium (Ca)	2021/06/03	NC	80 - 120	102	80 - 120	<200	ug/L	2.1	20		
7387332	Dissolved Chromium (Cr)	2021/06/03	101	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
7387332	Dissolved Copper (Cu)	2021/06/03	99	80 - 120	97	80 - 120	<0.90	ug/L	5.3	20		
7387332	Dissolved Iron (Fe)	2021/06/03	99	80 - 120	96	80 - 120	<100	ug/L	NC	20		
7387332	Dissolved Lead (Pb)	2021/06/03	96	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		
7387332	Dissolved Magnesium (Mg)	2021/06/03	101	80 - 120	97	80 - 120	<50	ug/L	1.0	20		
7387332	Dissolved Manganese (Mn)	2021/06/03	100	80 - 120	96	80 - 120	<2.0	ug/L	NC	20		
7387332	Dissolved Potassium (K)	2021/06/03	102	80 - 120	98	80 - 120	<200	ug/L	5.7	20		
7387332	Dissolved Sodium (Na)	2021/06/03	102	80 - 120	98	80 - 120	<100	ug/L	0.10	20		
7387332	Dissolved Zinc (Zn)	2021/06/03	99	80 - 120	97	80 - 120	<5.0	ug/L	NC	20		
7387355	Total Phosphorus	2021/06/04	100	80 - 120	100	80 - 120	<0.020	mg/L	1.9	20	101	80 - 120
7387686	Dissolved Organic Carbon	2021/06/03	93	80 - 120	96	80 - 120	<0.40	mg/L	1.2	20		
7388366	Total Dissolved Solids	2021/06/04					<10	mg/L	6.9	25	97	90 - 110
7389079	Total Arsenic (As)	2021/06/04	101	80 - 120	100	80 - 120	<1.0	ug/L	2.9	20		
7389079	Total Barium (Ba)	2021/06/04	98	80 - 120	98	80 - 120	<2.0	ug/L	0.61	20		
7389079	Total Boron (B)	2021/06/04	96	80 - 120	96	80 - 120	<10	ug/L	2.3	20		
7389079	Total Cadmium (Cd)	2021/06/04	100	80 - 120	100	80 - 120	<0.090	ug/L	NC	20		
7389079	Total Chromium (Cr)	2021/06/04	98	80 - 120	98	80 - 120	<5.0	ug/L	NC	20		
7389079	Total Copper (Cu)	2021/06/04	101	80 - 120	99	80 - 120	<0.90	ug/L	10	20		
7389079	Total Iron (Fe)	2021/06/04	98	80 - 120	97	80 - 120	<100	ug/L				
7389079	Total Lead (Pb)	2021/06/04	96	80 - 120	95	80 - 120	<0.50	ug/L	NC	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7389079	Total Zinc (Zn)	2021/06/04	98	80 - 120	102	80 - 120	<5.0	ug/L	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.

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

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

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

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BV Labs Job #: C1E7618
Report Date: 2021/06/07

exp Services Inc
Client Project #: THB-00011174-JE
Site Location: BEARDMORE LANDFILL
Sampler Initials: EF

VALIDATION SIGNATURE PAGE

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

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Michelle Huth, Project Manager Assistant

BV Labs 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 Signature Page.

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BOD

Bureau Veritas

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:	
Company Name	#17501 exp Services Inc	Company Name	
Attention	accounts payable	Attention	Ahilleas Mitsopoulos, Kaie Pitkanen
Address	1142 Roland St, Thunder Bay ON P7B 5M4	Address	
Tel	(807) 623-9495 Fax (807) 623-8070	Tel	Fax
Email	thunderbay@exp.com; Karen.Burke@exp.com;AP@ex	Email	ahilleas.mitsopoulos@exp.com

PROJECT INFORMATION	
Quotation #	B90990
P.O. #	
Project	THB-00011174-JE
Project Name	
Site #	Beardmore Landfill
Sampled By	EF

Laboratory Use Only:	
BV Labs Job #	Bottle Order #: 825024
COC #: C805024-01-01	Project Manager: Michelle Huth

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☒ PWQO ☐ Reg 406 Table ☐ Other ODWS

Special Instructions

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required: Please provide advance notice for rush projects

Regular (Standard) TAT: ☒ (will be applied if Rush TAT is not specified). Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission): Date Required: ___ Time Required: ___ ☐ Rush Confirmation Number: ___ (call lab for #)

ANALYSES REQUESTED (PLEASE BE SPECIFIC)

#	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Landfill Standards Sch 1 - GW Comp List	Landfill Stand. Sch 5 + SW Comp. 1.34								# of Bottles	Comments
1		BH - C	21-05-30	1:20PM	GW	Y	x									11	
2		BH - F	21-05-30	12:30PM	GW	Y	x									11	
3		BH - G	21-05-30	3:00PM	GW	Y	x									11	
4		BH - H	21-05-30	2:40PM	GW	Y	x									11	
5		BH - I	21-05-30	3:50PM	GW	Y	x									11	31-May-21 12:50 Michelle Huth C1E7618 SBS ENV-1320
6		BH - J	21-05-30	2:10PM	GW	Y	x									11	
7					GW		x										
8		SW 1	21-05-30	4:50PM	SW	Y		X								9	
9		SW 2	21-05-30	5:55PM	SW	Y		X								9	Rec'd in Thunder Bay
10																	

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Kaie Pitkanen	21/05/31	11:45AM	Michelle Huth	2021/05/31	12:50	
				2021/06/01	11:01	

Laboratory Use Only: Time Sensitive | Temperature (°C) on Receipt: 6/4/7 / 9/4/7 | Custody Seal Present / Intact: Yes / No N/A

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Your Project #: THB-00011174-JE
Site#: Beardmore Landfill
Your C.O.C. #: 844775-01-01, 844772-01-01

Attention: Kole Pitkanen

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
CANADA P7B 5M4

Report Date: 2021/10/15
Report #: R6854901
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1T1213
Received: 2021/10/06, 13:05

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	6	N/A	2021/10/10	CAM SOP-00448	SM 23 2320 B m
Alkalinity	2	N/A	2021/10/14	CAM SOP-00448	SM 23 2320 B m
Biochemical Oxygen Demand (BOD)	2	2021/10/08	2021/10/13	CAM SOP-00427	SM 23 5210B m
Chloride by Automated Colourimetry	6	N/A	2021/10/12	CAM SOP-00463	SM 23 4500-Cl E m
Chloride by Automated Colourimetry	2	N/A	2021/10/13	CAM SOP-00463	SM 23 4500-Cl E m
Chemical Oxygen Demand	8	N/A	2021/10/13	CAM SOP-00416	SM 23 5220 D m
Conductivity	6	N/A	2021/10/10	CAM SOP-00414	SM 23 2510 m
Conductivity	2	N/A	2021/10/14	CAM SOP-00414	SM 23 2510 m
Dissolved Organic Carbon (DOC) (1)	6	N/A	2021/10/13	CAM SOP-00446	SM 23 5310 B m
Dissolved Metals by ICPMS	5	N/A	2021/10/12	CAM SOP-00447	EPA 6020B m
Dissolved Metals by ICPMS	1	N/A	2021/10/14	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICP	2	2021/10/12	2021/10/14	CAM SOP-00408	EPA 6010D m
Ion Balance (% Difference)	5	N/A	2021/10/14		
Ion Balance (% Difference)	1	N/A	2021/10/15		
Total Ammonia-N	8	N/A	2021/10/14	CAM SOP-00441	USGS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	6	N/A	2021/10/10	CAM SOP-00440	SM 23 4500-NO3I/NO2B
Nitrate (NO3) and Nitrite (NO2) in Water (2)	2	N/A	2021/10/13	CAM SOP-00440	SM 23 4500-NO3I/NO2B
pH	2	2021/10/12	2021/10/14	CAM SOP-00413	SM 4500H+ B m
pH	6	2021/10/09	2021/10/10	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	2	N/A	2021/10/12	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	6	N/A	2021/10/12	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry	2	N/A	2021/10/14	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids	7	2021/10/12	2021/10/13	CAM SOP-00428	SM 23 2540C m
Total Dissolved Solids	1	2021/10/13	2021/10/14	CAM SOP-00428	SM 23 2540C m
Total Kjeldahl Nitrogen in Water	2	2021/10/13	2021/10/13	CAM SOP-00938	OMOE E3516 m
Total Phosphorus (Colourimetric)	2	2021/10/13	2021/10/14	CAM SOP-00407	SM 23 4500 P B H m
Low Level Total Suspended Solids	2	2021/10/09	2021/10/12	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

Your Project #: THB-00011174-JE
Site#: Beardmore Landfill
Your C.O.C. #: 844775-01-01, 844772-01-01

Attention: Kole Pitkanen

exp Services Inc
Thunder Bay Branch
1142 Roland St
Thunder Bay, ON
CANADA P7B 5M4

Report Date: 2021/10/15
Report #: R6854901
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BV LABS JOB #: C1T1213
Received: 2021/10/06, 13:05

Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, 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.

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

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15 Oct 2021 17:41:34

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Michelle Huth, Project Manager Assistant
Email: michelle.brescacin@bureauveritas.com
Phone# (807)344-4220

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LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID					QWH338		QWH339		
Sampling Date					2021/10/05 12:05		2021/10/05 14:05		
COC Number					844772-01-01		844772-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH-C**	**QC Batch**	**BH-F**	**RDL**	**QC Batch**
Inorganics									
Total Ammonia-N	mg/L	-	-	-	0.089	7633485	<0.050	0.050	7633485
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	<4.0	7633492	<4.0	4.0	7633492
Conductivity	umho/cm	-	-	-	610	7632546	440	1.0	7629558
Total Dissolved Solids	mg/L	-	-	500	290	7631629	245	10	7629011
Dissolved Organic Carbon	mg/L	-	-	5	0.84	7633469	0.68	0.40	7633469
pH	pH	6.5:8.5	-	6.5:8.5	8.11	7632547	7.98		7629567
Dissolved Sulphate (SO4)	mg/L	-	-	500	19	7632452	1.2	1.0	7629650
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	330	7632541	250	1.0	7629566
Dissolved Chloride (Cl-)	mg/L	-	-	250	2.9	7632444	3.0	1.0	7629649
Nitrate (N)	mg/L	-	10	-	0.32	7632489	<0.10	0.10	7629645
Metals									
Dissolved Barium (Ba)	ug/L	-	1000	-	26	7630480	5.5	2.0	7630480
Dissolved Boron (B)	ug/L	200	5000	-	33	7630480	<10	10	7630480
Dissolved Calcium (Ca)	ug/L	-	-	-	110000	7630480	78000	200	7630480
Dissolved Iron (Fe)	ug/L	300	-	300	<100	7630480	<100	100	7630480
Dissolved Magnesium (Mg)	ug/L	-	-	-	27000	7630480	14000	50	7630480
Dissolved Sodium (Na)	ug/L	-	-	200000	5200	7630480	2300	100	7630480

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

BV Labs Job #: C1T1213
Report Date: 2021/10/15

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID					QWH340			QWH340		
Sampling Date					2021/10/05 13:00			2021/10/05 13:00		
COC Number					844772-01-01			844772-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH-G**	**RDL**	**QC Batch**	**BH-G Lab-Dup**	**RDL**	**QC Batch**
Inorganics										
Total Ammonia-N	mg/L	-	-	-	0.16	0.050	7633485			
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	69	4.0	7632210			
Conductivity	umho/cm	-	-	-	2700	1.0	7629558			
Total Dissolved Solids	mg/L	-	-	500	2150	10	7631629			
Dissolved Organic Carbon	mg/L	-	-	5	28	0.40	7633469			
pH	pH	6.5:8.5	-	6.5:8.5	7.27		7629567			
Dissolved Sulphate (SO4)	mg/L	-	-	500	570	5.0	7629650			
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	960	1.0	7629566			
Dissolved Chloride (Cl-)	mg/L	-	-	250	190	2.0	7629649			
Nitrate (N)	mg/L	-	10	-	<0.10	0.10	7629644	<0.10	0.10	7629644
Metals										
Dissolved Barium (Ba)	ug/L	-	1000	-	51	2.0	7630480			
Dissolved Boron (B)	ug/L	200	5000	-	1200	10	7630480			
Dissolved Calcium (Ca)	ug/L	-	-	-	380000	200	7630480			
Dissolved Iron (Fe)	ug/L	300	-	300	490	100	7630480			
Dissolved Magnesium (Mg)	ug/L	-	-	-	150000	50	7630480			
Dissolved Sodium (Na)	ug/L	-	-	200000	160000	100	7630480			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID					QWH341		QWH342		
Sampling Date					2021/10/05 12:30		2021/10/05 13:20		
COC Number					844772-01-01		844772-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH-H**	**QC Batch**	**BH-I**	**RDL**	**QC Batch**
Inorganics									
Total Ammonia-N	mg/L	-	-	-	<0.050	7633485	0.057	0.050	7633485
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	<4.0	7633492	6.8	4.0	7633492
Conductivity	umho/cm	-	-	-	990	7629558	510	1.0	7632546
Total Dissolved Solids	mg/L	-	-	500	575	7634921	255	10	7631629
Dissolved Organic Carbon	mg/L	-	-	5	3.0	7633469	1.5	0.40	7633469
pH	pH	6.5:8.5	-	6.5:8.5	7.63	7629567	8.14		7632547
Dissolved Sulphate (SO4)	mg/L	-	-	500	53	7629650	15	1.0	7632452
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	530	7629566	280	1.0	7632541
Dissolved Chloride (Cl-)	mg/L	-	-	250	9.9	7629649	1.2	1.0	7632444
Nitrate (N)	mg/L	-	10	-	2.55	7629645	<0.10	0.10	7632489
Metals									
Dissolved Barium (Ba)	ug/L	-	1000	-	72	7630480	12	2.0	7630627
Dissolved Boron (B)	ug/L	200	5000	-	48	7630480	39	10	7630627
Dissolved Calcium (Ca)	ug/L	-	-	-	180000	7630480	73000	200	7630627
Dissolved Iron (Fe)	ug/L	300	-	300	<100	7630480	<100	100	7630627
Dissolved Magnesium (Mg)	ug/L	-	-	-	19000	7630480	20000	50	7630627
Dissolved Sodium (Na)	ug/L	-	-	200000	41000	7630480	15000	100	7630627

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

LANDFILL STANDARDS SCH 5 - GW IND. LIST (WATER)

BV Labs ID					QWH343		
Sampling Date					2021/10/05 14:30		
COC Number					844772-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**BH-J**	**RDL**	**QC Batch**
Inorganics							
Total Ammonia-N	mg/L	-	-	-	0.11	0.050	7633485
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	82	4.0	7633492
Conductivity	umho/cm	-	-	-	2700	1.0	7629558
Total Dissolved Solids	mg/L	-	-	500	2150	10	7629011
Dissolved Organic Carbon	mg/L	-	-	5	28	0.40	7633469
pH	pH	6.5:8.5	-	6.5:8.5	7.39		7629567
Dissolved Sulphate (SO4)	mg/L	-	-	500	580	5.0	7629650
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	950	1.0	7629566
Dissolved Chloride (Cl-)	mg/L	-	-	250	190	2.0	7629649
Nitrate (N)	mg/L	-	10	-	<0.10	0.10	7629645
Metals							
Dissolved Barium (Ba)	ug/L	-	1000	-	52	2.0	7630480
Dissolved Boron (B)	ug/L	200	5000	-	1300	10	7630480
Dissolved Calcium (Ca)	ug/L	-	-	-	370000	200	7630480
Dissolved Iron (Fe)	ug/L	300	-	300	510	100	7630480
Dissolved Magnesium (Mg)	ug/L	-	-	-	150000	50	7630480
Dissolved Sodium (Na)	ug/L	-	-	200000	170000	100	7630480

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
(Made under the Ontario Safe Drinking Water Act, 2002)

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BV Labs Job #: C1T1213
Report Date: 2021/10/15

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

LANDFILL STANDARDS SCH 5 - SW IND. LIST (WATER)

BV Labs ID					QWH336	QWH337		
Sampling Date					2021/10/04 17:35	2021/10/05 13:49		
COC Number					844775-01-01	844775-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**SW1**	**SW2**	**RDL**	**QC Batch**
Inorganics								
Total Ammonia-N	mg/L	-	-	-	0.054	0.060	0.050	7633485
Total BOD	mg/L	-	-	-	<2	2	2	7626204
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	26	25	4.0	7633492
Conductivity	umho/cm	-	-	-	260	290	1.0	7629558
Total Dissolved Solids	mg/L	-	-	500	155	160	10	7629011
Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	-	0.48	0.47	0.10	7633496
pH	pH	6.5:8.5	-	6.5:8.5	7.89	7.69		7629567
Phenols-4AAP	mg/L	0.001	-	-	<0.0010	0.0024	0.0010	7630426
Total Phosphorus	mg/L	0.01	-	-	0.020	0.038	0.004	7633191
Total Suspended Solids	mg/L	-	-	-	18	13	1	7629026
Dissolved Sulphate (SO4)	mg/L	-	-	500	<1.0	18	1.0	7629650
Alkalinity (Total as CaCO3)	mg/L	-	-	30:500	110	130	1.0	7629566
Dissolved Chloride (Cl-)	mg/L	-	-	250	21	12	1.0	7629649
Nitrite (N)	mg/L	-	1	-	<0.010	<0.010	0.010	7629645
Nitrate (N)	mg/L	-	10	-	<0.10	<0.10	0.10	7629645
Metals								
Total Iron (Fe)	mg/L	0.3	-	0.3	0.57	0.56	0.02	7631551

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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LANDFILL STANDARDS SCH 5 - SW IND. LIST (WATER)

BV Labs ID					QWH337		
Sampling Date					2021/10/05 13:49		
COC Number					844775-01-01		
	UNITS	**Criteria**	**MAC**	**A/O**	**SW2 Lab-Dup**	**RDL**	**QC Batch**
Inorganics							
Total Chemical Oxygen Demand (COD)	mg/L	-	-	-	24	4.0	7633492

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Provincial Water Quality Objectives
Ref. to MOEE Water Management document dated Feb.1999
MAC,A/O: Ontario Drinking Water Standards - Maximum Acceptable Concentration [MAC] & Table 4-Chemical/Physical Objectives [A/O] - Not Health Related, respectively
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BV Labs Job #: C1T1213
Report Date: 2021/10/15

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

RESULTS OF ANALYSES OF WATER

BV Labs ID		QWH338	QWH339	QWH340	QWH341	QWH342	QWH343	
Sampling Date		2021/10/05 12:05	2021/10/05 14:05	2021/10/05 13:00	2021/10/05 12:30	2021/10/05 13:20	2021/10/05 14:30	
COC Number		844772-01-01	844772-01-01	844772-01-01	844772-01-01	844772-01-01	844772-01-01	
	UNITS	**BH-C**	**BH-F**	**BH-G**	**BH-H**	**BH-I**	**BH-J**	**QC Batch**
Calculated Parameters								
Ion Balance (% Difference)	%	3.47	0.900	2.46	0.130	0.770	2.87	7623746
QC Batch = Quality Control Batch								

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BV Labs Job #: C1T1213
Report Date: 2021/10/15

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: QWH336
Sample ID: SW1
Matrix: Water

Collected: 2021/10/04
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Biochemical Oxygen Demand (BOD)	DO	7626204	2021/10/08	2021/10/13	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Total Metals Analysis by ICP	ICP	7631551	2021/10/12	2021/10/14	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629645	N/A	2021/10/10	Nimarta Singh
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	7630426	N/A	2021/10/12	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7629011	2021/10/12	2021/10/13	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7633496	2021/10/13	2021/10/13	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7633191	2021/10/13	2021/10/14	Shivani Shivani
Low Level Total Suspended Solids	BAL	7629026	2021/10/09	2021/10/12	Shaneil Hall

BV Labs ID: QWH337
Sample ID: SW2
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Biochemical Oxygen Demand (BOD)	DO	7626204	2021/10/08	2021/10/13	Surleen Kaur Romana
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Total Metals Analysis by ICP	ICP	7631551	2021/10/12	2021/10/14	Suban Kanapathippllai
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629645	N/A	2021/10/10	Nimarta Singh
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	7630426	N/A	2021/10/12	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7629011	2021/10/12	2021/10/13	Kristen Chan
Total Kjeldahl Nitrogen in Water	SKAL	7633496	2021/10/13	2021/10/13	Massarat Jan
Total Phosphorus (Colourimetric)	LACH/P	7633191	2021/10/13	2021/10/14	Shivani Shivani
Low Level Total Suspended Solids	BAL	7629026	2021/10/09	2021/10/12	Shaneil Hall

BV Labs ID: QWH337 Dup
Sample ID: SW2
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh

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BV Labs Job #: C1T1213
Report Date: 2021/10/15

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

TEST SUMMARY

BV Labs ID: QWH338
Sample ID: BH-C
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7632541	N/A	2021/10/14	Surinder Rai
Chloride by Automated Colourimetry	KONE	7632444	N/A	2021/10/13	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7632546	N/A	2021/10/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630480	N/A	2021/10/12	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7632489	N/A	2021/10/13	Chandra Nandlal
pH	AT	7632547	2021/10/12	2021/10/14	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7632452	N/A	2021/10/14	Avneet Kour Sudan
Total Dissolved Solids	BAL	7631629	2021/10/12	2021/10/13	Sandeep Kaur

BV Labs ID: QWH339
Sample ID: BH-F
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630480	N/A	2021/10/12	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629645	N/A	2021/10/10	Nimarta Singh
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7629011	2021/10/12	2021/10/13	Kristen Chan

BV Labs ID: QWH340
Sample ID: BH-G
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7632210	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630480	N/A	2021/10/12	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629644	N/A	2021/10/10	Nimarta Singh

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TEST SUMMARY

BV Labs ID: QWH340
Sample ID: BH-G
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7631629	2021/10/12	2021/10/13	Sandeep Kaur

BV Labs ID: QWH340 Dup
Sample ID: BH-G
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629644	N/A	2021/10/10	Nimarta Singh

BV Labs ID: QWH341
Sample ID: BH-H
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630480	N/A	2021/10/12	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629645	N/A	2021/10/10	Nimarta Singh
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7634921	2021/10/13	2021/10/14	Shaneil Hall

BV Labs ID: QWH342
Sample ID: BH-I
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7632541	N/A	2021/10/14	Surinder Rai
Chloride by Automated Colourimetry	KONE	7632444	N/A	2021/10/13	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7632546	N/A	2021/10/14	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630627	N/A	2021/10/14	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/15	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7632489	N/A	2021/10/13	Chandra Nandlal
pH	AT	7632547	2021/10/12	2021/10/14	Surinder Rai
Sulphate by Automated Colourimetry	KONE	7632452	N/A	2021/10/14	Avneet Kour Sudan

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TEST SUMMARY

BV Labs ID: QWH342
Sample ID: BH-I
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids	BAL	7631629	2021/10/12	2021/10/13	Sandeep Kaur

BV Labs ID: QWH343
Sample ID: BH-J
Matrix: Water

Collected: 2021/10/05
Shipped:
Received: 2021/10/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	7629566	N/A	2021/10/10	Yogesh Patel
Chloride by Automated Colourimetry	KONE	7629649	N/A	2021/10/12	Alina Dobreanu
Chemical Oxygen Demand	SPEC	7633492	N/A	2021/10/13	Nimarta Singh
Conductivity	AT	7629558	N/A	2021/10/10	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	7633469	N/A	2021/10/13	Julianna Castiglione
Dissolved Metals by ICPMS	ICP/MS	7630480	N/A	2021/10/12	Nan Raykha
Ion Balance (% Difference)	CALC	7623746	N/A	2021/10/14	Automated Statchk
Total Ammonia-N	LACH/NH4	7633485	N/A	2021/10/14	Amanpreet Sappal
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	7629645	N/A	2021/10/10	Nimarta Singh
pH	AT	7629567	2021/10/09	2021/10/10	Yogesh Patel
Sulphate by Automated Colourimetry	KONE	7629650	N/A	2021/10/12	Alina Dobreanu
Total Dissolved Solids	BAL	7629011	2021/10/12	2021/10/13	Kristen Chan

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GENERAL COMMENTS

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

Package 1	9.0°C

Results relate only to the items tested.

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BV Labs Job #: C1T1213
Report Date: 2021/10/15

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: THB-00011174-JE
Sampler Initials: EF

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7626204	Total BOD	2021/10/13					<2	mg/L	NC	30	95	80 - 120
7629011	Total Dissolved Solids	2021/10/13					<10	mg/L	5.1	25	98	90 - 110
7629026	Total Suspended Solids	2021/10/12					<1	mg/L	0	25	95	85 - 115
7629558	Conductivity	2021/10/09			102	85 - 115	1.1, RDL=1.0	umho/cm	1.5	25		
7629566	Alkalinity (Total as CaCO3)	2021/10/09			97	85 - 115	<1.0	mg/L	1.2	20		
7629567	pH	2021/10/09			101	98 - 103			0.22	N/A		
7629644	Nitrate (N)	2021/10/10	99	80 - 120	100	80 - 120	<0.10	mg/L	NC	20		
7629645	Nitrate (N)	2021/10/10	94	80 - 120	94	80 - 120	<0.10	mg/L	0.58	20		
7629645	Nitrite (N)	2021/10/10	102	80 - 120	101	80 - 120	<0.010	mg/L	6.2	20		
7629649	Dissolved Chloride (Cl-)	2021/10/12	NC	80 - 120	104	80 - 120	<1.0	mg/L	0.39	20		
7629650	Dissolved Sulphate (SO4)	2021/10/12	111	75 - 125	105	80 - 120	<1.0	mg/L	0.42	20		
7630426	Phenols-4AAP	2021/10/12	97	80 - 120	100	80 - 120	<0.0010	mg/L	NC	20		
7630480	Dissolved Barium (Ba)	2021/10/12	100	80 - 120	102	80 - 120	<2.0	ug/L	0.91	20		
7630480	Dissolved Boron (B)	2021/10/12	102	80 - 120	100	80 - 120	<10	ug/L	3.8	20		
7630480	Dissolved Calcium (Ca)	2021/10/12	NC	80 - 120	102	80 - 120	<200	ug/L				
7630480	Dissolved Iron (Fe)	2021/10/12	94	80 - 120	99	80 - 120	<100	ug/L				
7630480	Dissolved Magnesium (Mg)	2021/10/12	NC	80 - 120	100	80 - 120	<50	ug/L				
7630480	Dissolved Sodium (Na)	2021/10/12	NC	80 - 120	98	80 - 120	<100	ug/L	1.3	20		
7630627	Dissolved Barium (Ba)	2021/10/15	103	80 - 120	103	80 - 120	<2.0	ug/L	0.56	20		
7630627	Dissolved Boron (B)	2021/10/15	103	80 - 120	102	80 - 120	<10	ug/L	1.9	20		
7630627	Dissolved Calcium (Ca)	2021/10/14	NC	80 - 120	103	80 - 120	<200	ug/L				
7630627	Dissolved Iron (Fe)	2021/10/14	98	80 - 120	98	80 - 120	<100	ug/L				
7630627	Dissolved Magnesium (Mg)	2021/10/14	NC	80 - 120	102	80 - 120	<50	ug/L				
7630627	Dissolved Sodium (Na)	2021/10/15	NC	80 - 120	100	80 - 120	<100	ug/L	1.6	20		
7631551	Total Iron (Fe)	2021/10/14	101	80 - 120	103	80 - 120	<0.02	mg/L	1.1	25		
7631629	Total Dissolved Solids	2021/10/13					<10	mg/L	3.4	25	98	90 - 110
7632210	Total Chemical Oxygen Demand (COD)	2021/10/13	95	80 - 120	99	80 - 120	<4.0	mg/L	18	20		
7632444	Dissolved Chloride (Cl-)	2021/10/13	NC	80 - 120	106	80 - 120	<1.0	mg/L	0.27	20		
7632452	Dissolved Sulphate (SO4)	2021/10/14	113	75 - 125	101	80 - 120	<1.0	mg/L	1.7	20		
7632489	Nitrate (N)	2021/10/13	104	80 - 120	99	80 - 120	<0.10	mg/L	1.4	20		

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QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
7632541	Alkalinity (Total as CaCO3)	2021/10/14			98	85 - 115	<1.0	mg/L	0.31	20		
7632546	Conductivity	2021/10/14			100	85 - 115	<1.0	umho/cm	0.18	25		
7632547	pH	2021/10/14			101	98 - 103			0.43	N/A		
7633191	Total Phosphorus	2021/10/14	93	80 - 120	95	80 - 120	<0.004	mg/L	5.1	20	89	80 - 120
7633469	Dissolved Organic Carbon	2021/10/13	96	80 - 120	97	80 - 120	<0.40	mg/L	0.11	20		
7633485	Total Ammonia-N	2021/10/14	95	75 - 125	99	80 - 120	<0.050	mg/L	1.3	20		
7633492	Total Chemical Oxygen Demand (COD)	2021/10/13	96	80 - 120	97	80 - 120	<4.0	mg/L	2.8	20		
7633496	Total Kjeldahl Nitrogen (TKN)	2021/10/13	97	80 - 120	104	80 - 120	<0.10	mg/L	1.5	20	99	80 - 120
7634921	Total Dissolved Solids	2021/10/14					<10	mg/L	2.9	25	100	90 - 110

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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VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

BV Labs 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 Signature Page.

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BOD

BOD

Company Name	#17901 [illegible] Inc
Attention	Accounts Payable
Address	1142 Roland St, Thunder Bay ON P7B 5M4
Tel	(807) 623-9495 Fax (807) 623-8070
Email	AP@wsp.com

REPORT TO: Kola Pitkanen, Aldean Mitsopoulos — Email: Kola.Pitkanen@wsp.com

PROJECT INFORMATION: Quotation # B80560 — Project: THB-0001117A-JE — Project Name: Beardmore Landfill — Sampled By: EF

Laboratory Use Only

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Other Regulations: ☒ PWQO

Include Criteria on Certificate of Analysis (Y/N)?

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix		# of Bottles
1		SW.1	10-8-21	5:35 Pm	SW	x	8
2		SW2	10-5-21	1:49 Pm	SW	x	8
3					SW	x	
4							
5							
6							
7							
8							
9							
10							

06-Oct-21 13:05
Michelle Huth
C1T1213
ASR ENV-1089

Rec'd In Thunder Bay

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time
Aldean Mitsopoulos	21/10/06	11:00	Michelle Huth	2021/10/06	13:05
			[illegible]	2021/10/07	09:27

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

#PURO 533167741110 5/5/4

Page 2 of 2

CHAIN OF CUSTODY RECORD

INVOICE TO:
Company Name: #17501 exp Services Inc
Attention: Accounts Payable
Address: 1142 Roland St
Thunder Bay ON P7B 5M4
Tel: (807) 623-9495 Fax: (807) 623-8070
Email: AP@exp.com

REPORT TO:
Attention: Kala Pitkanen, Aliaa Mitsopoulos
Email: Kala.Pitkanen@exp.com, aliaa.mitsopoulos@exp.com

PROJECT INFORMATION:
Quotation #: B90560
Project: THB-00011174-JE
Project Name: Beardmore Landfill
Sampled By: EF

Laboratory Use Only

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BV LABS DRINKING WATER CHAIN OF CUSTODY

Other Regulations: Other: PWQO

Include Criteria on Certificate of Analysis (Y/N)?

Regular (Standard) TAT: [X]

	Sample Location Identification	Date Sampled	Time Sampled	Matrix			# of Bottles
1							
2	BH-C	21-10-5	1205PM	GW	X	X	6
3	BH-F	21-10-5	205PM	GW	X	X	6
4	BH-G	21-10-5	100PM	GW	X	X	6
5	BH-H	21-10-5	1230PM	GW	X	X	6
6	BH-I	21-10-5	1:20PM	GW	X	X	6
7	BH-J	21-10-5	2:30PM	GW	X	X	6

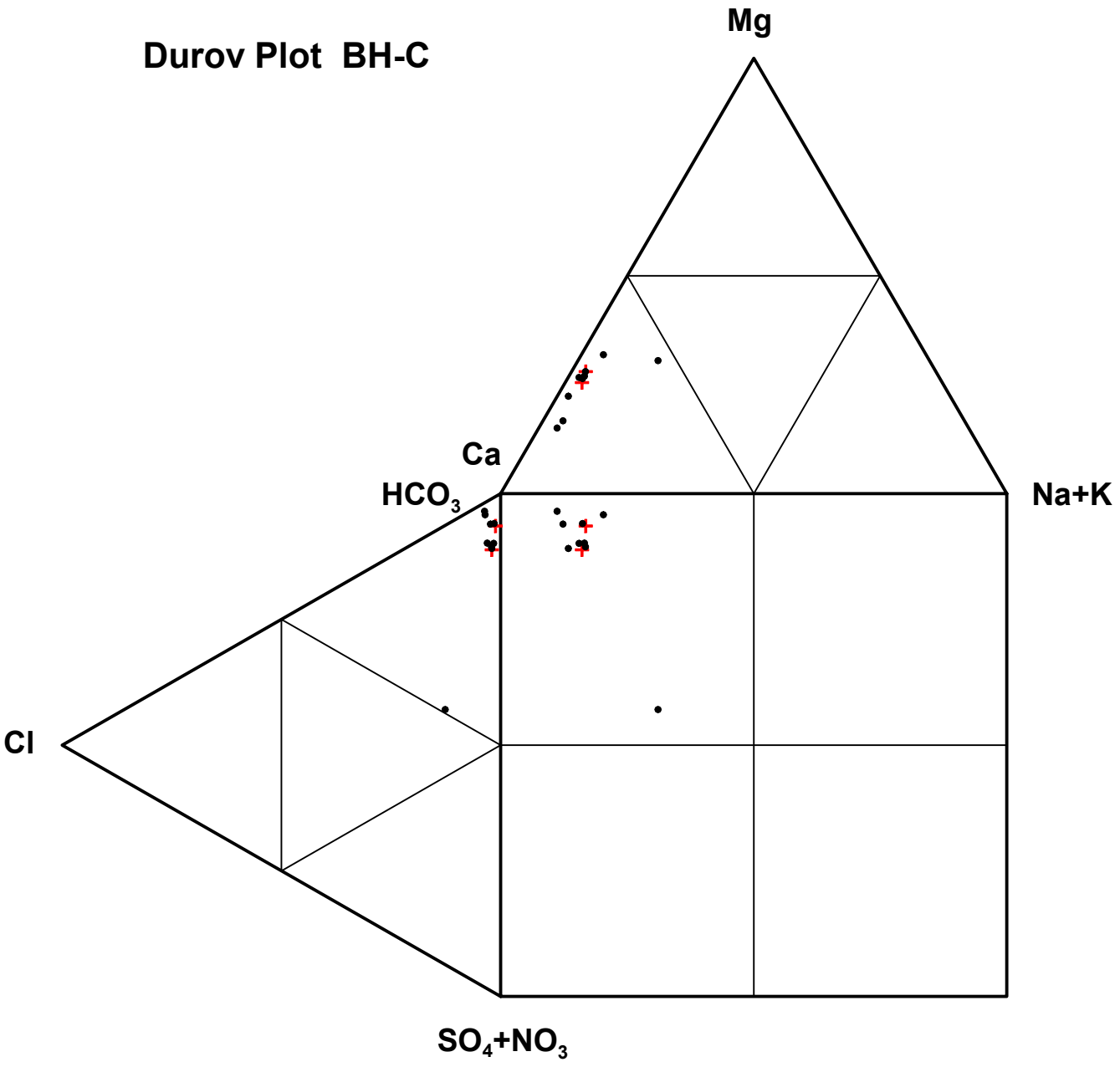
Rec'd In Thunder Bay

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)
Aliaa Mitsopoulos	21/10/06	12:00pm	[signature]

SAMPLES MUST BE KEPT COOL FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

APPENDIX F – Durov Plots

Durov Plot BH-C



Legend

\+ 2021 Data Point

• Historical Data Points

Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

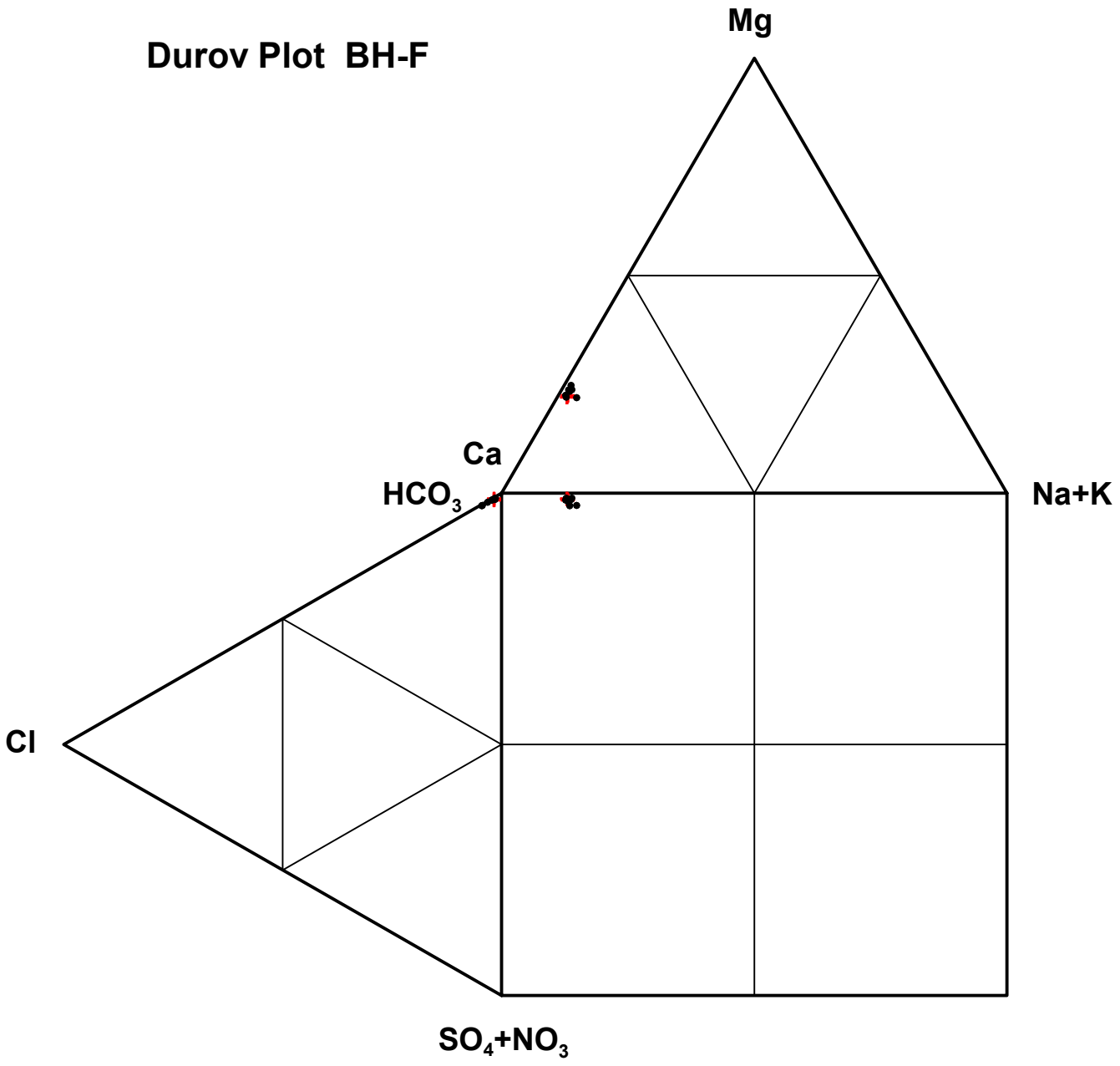
Figure F-1

Monitoring Well BH-C

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Durov Plot BH-F



Legend

+ 2021 Data Point

• Historical Data Points

Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

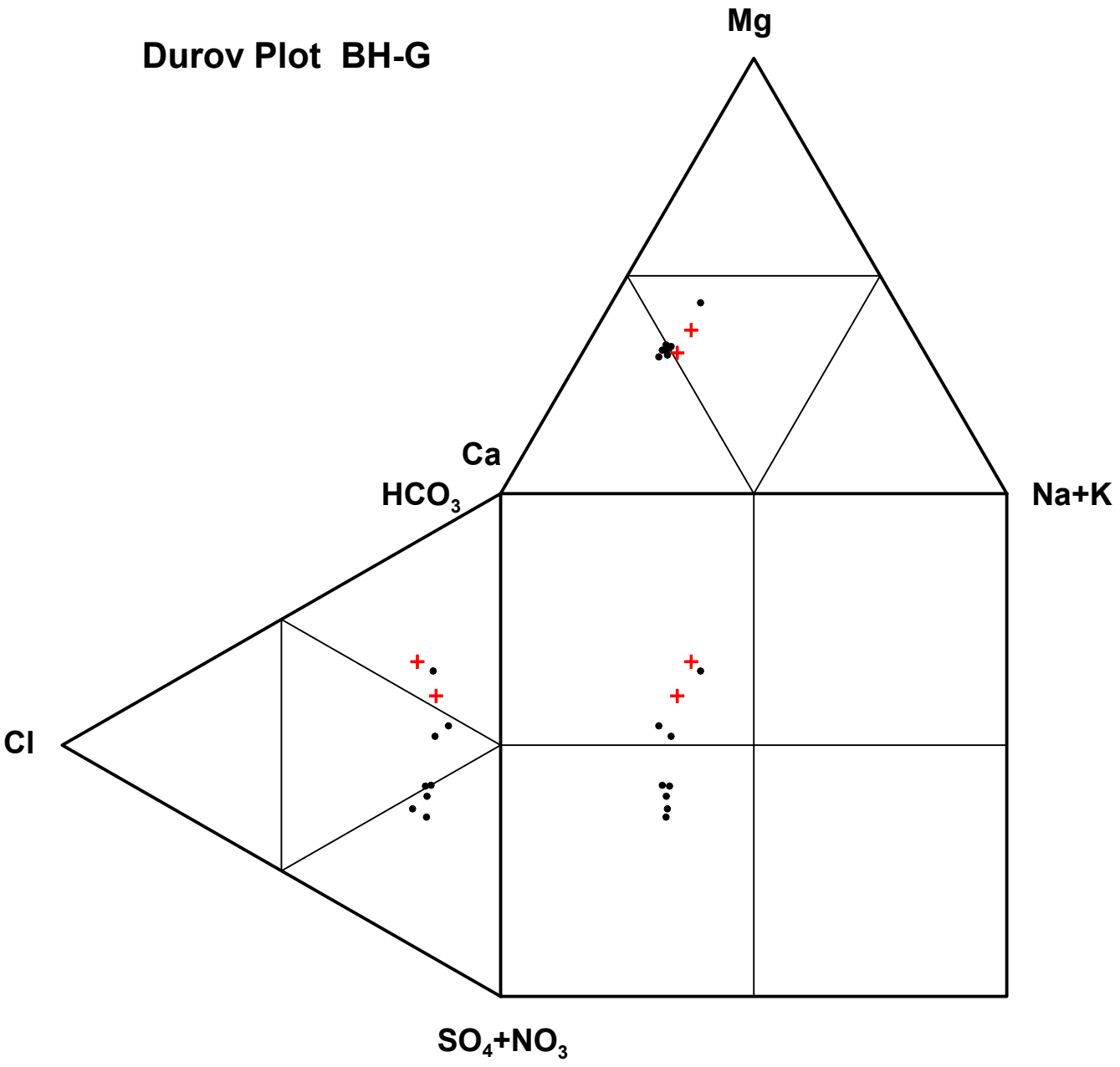
Figure F-2

Monitoring Well BH-F

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Durov Plot BH-G



Legend

\+ 2021 Data Point

• Historical Data Points

Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

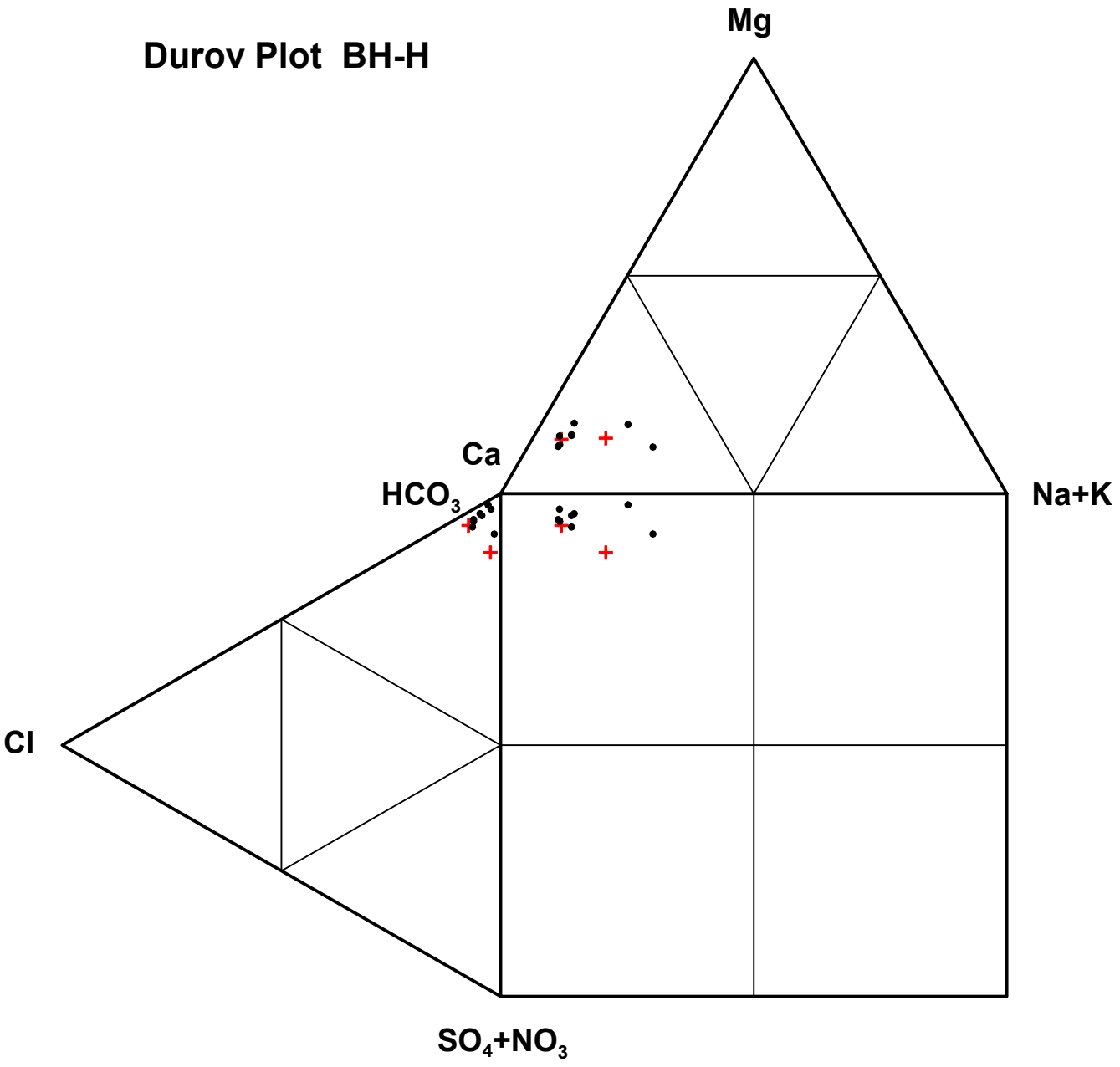
Figure F-3

Monitoring Well BH-G

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Durov Plot BH-H



Legend

+ 2021 Data Point

• Historical Data Points

Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

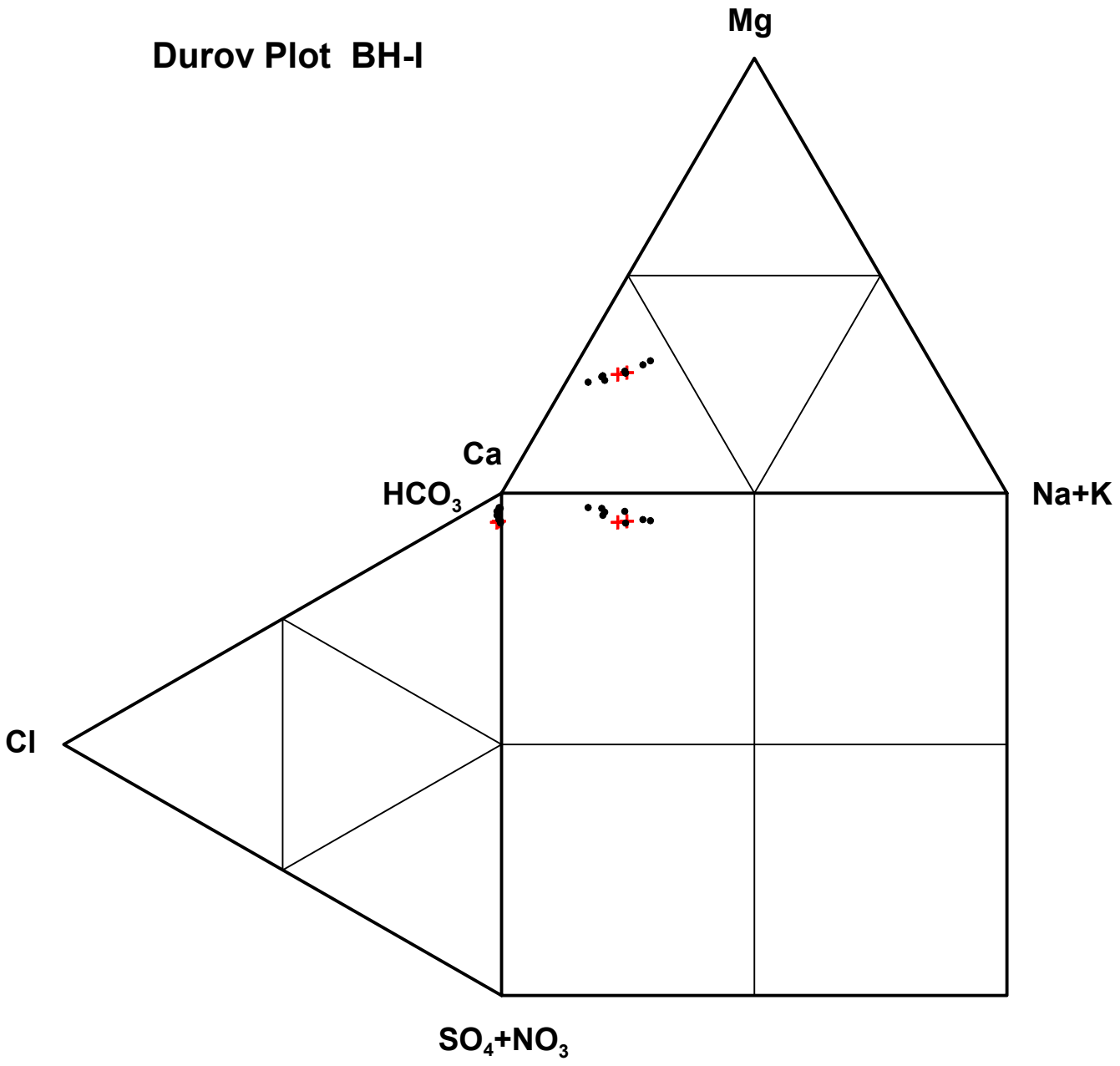
Figure F-4

Monitoring Well BH-H

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Durov Plot BH-I



Legend

+ 2021 Data Point

• Historical Data Points

Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

Figure F-5

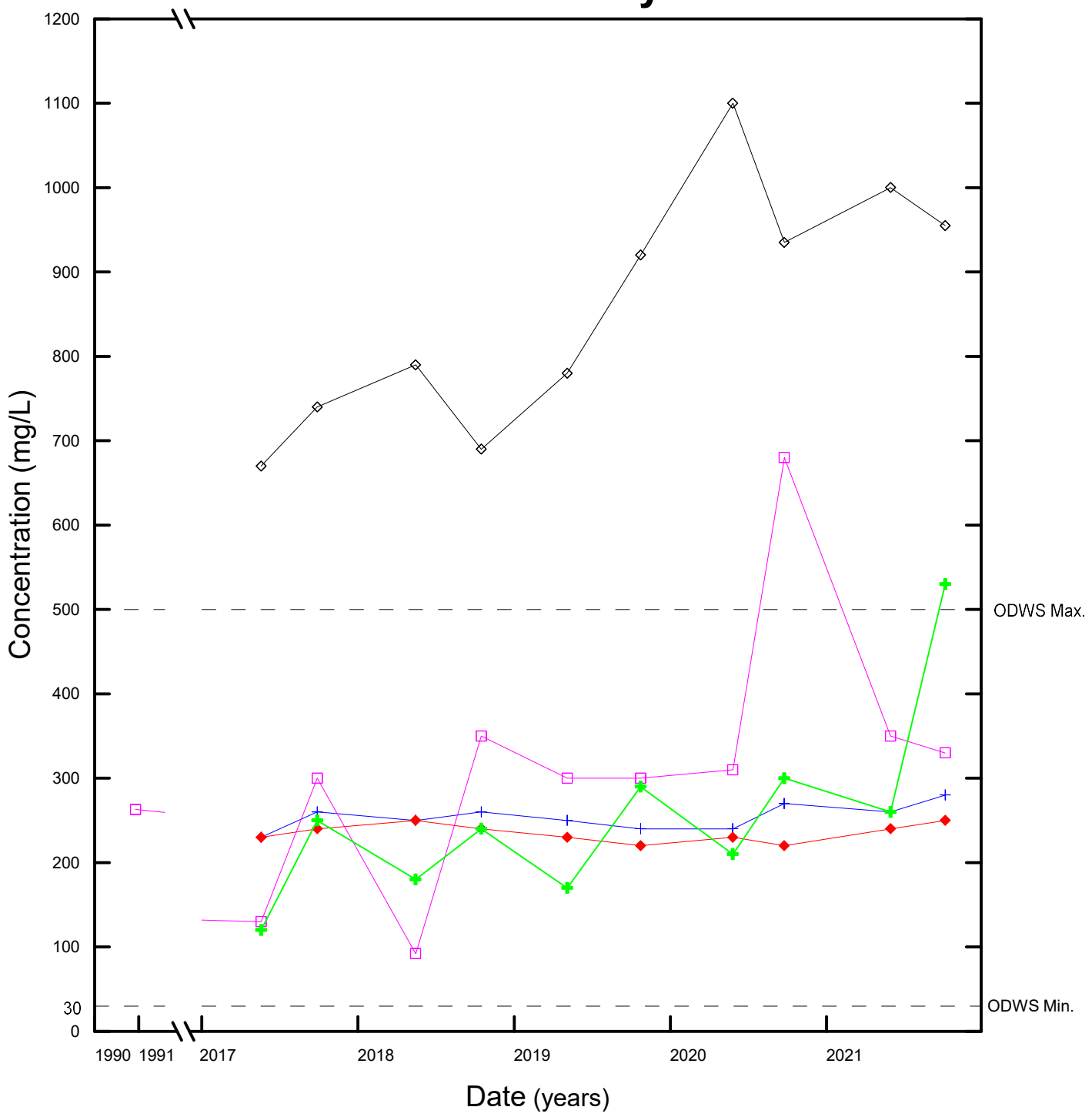
Monitoring Well BH-I

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

APPENDIX G – Time Series Graphs

Alkalinity



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

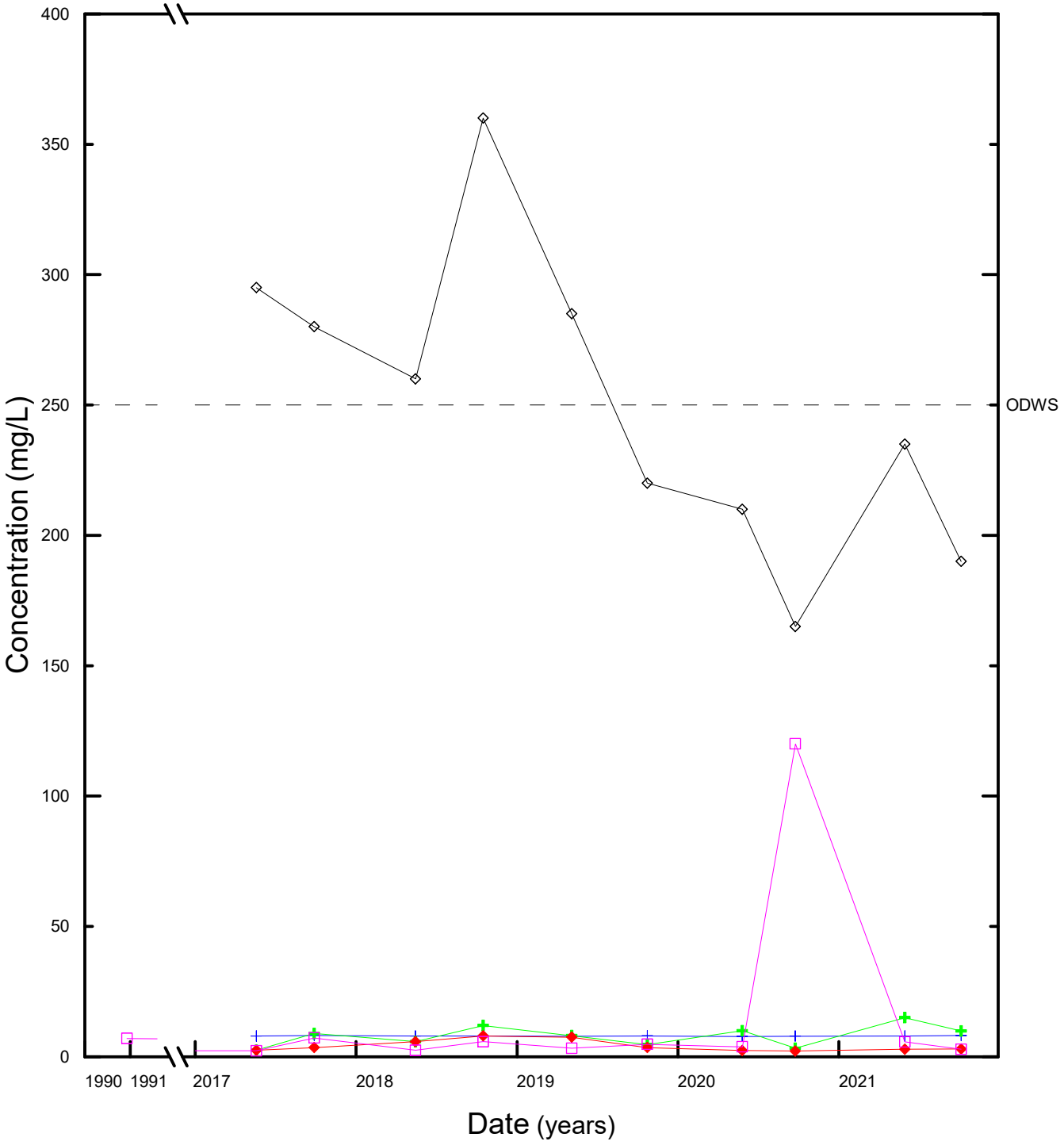
Figure G-1

Alkalinity

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 18, 2022

Chloride



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

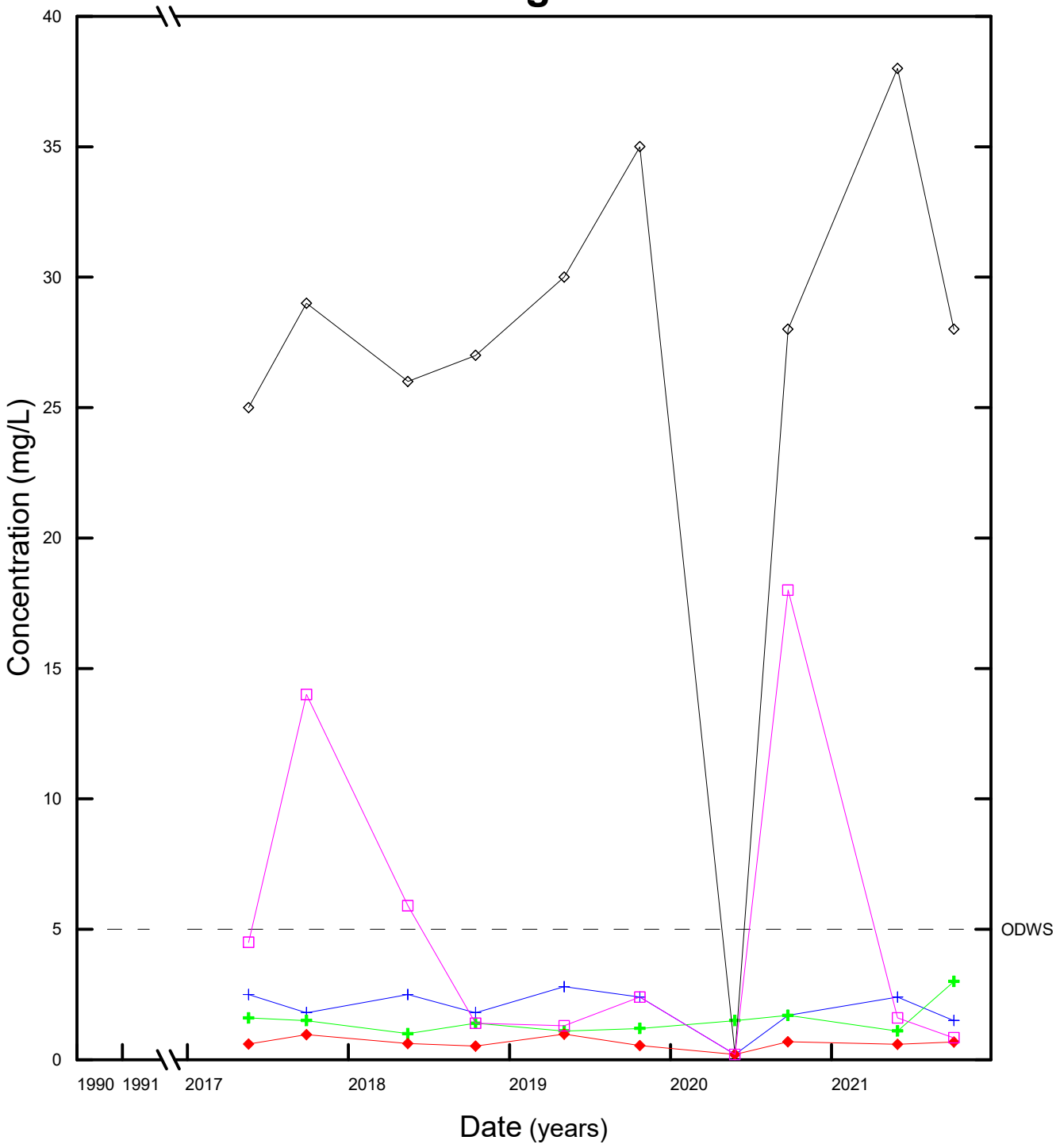
Figure G-2

Chloride

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Dissolved Organic Carbon



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

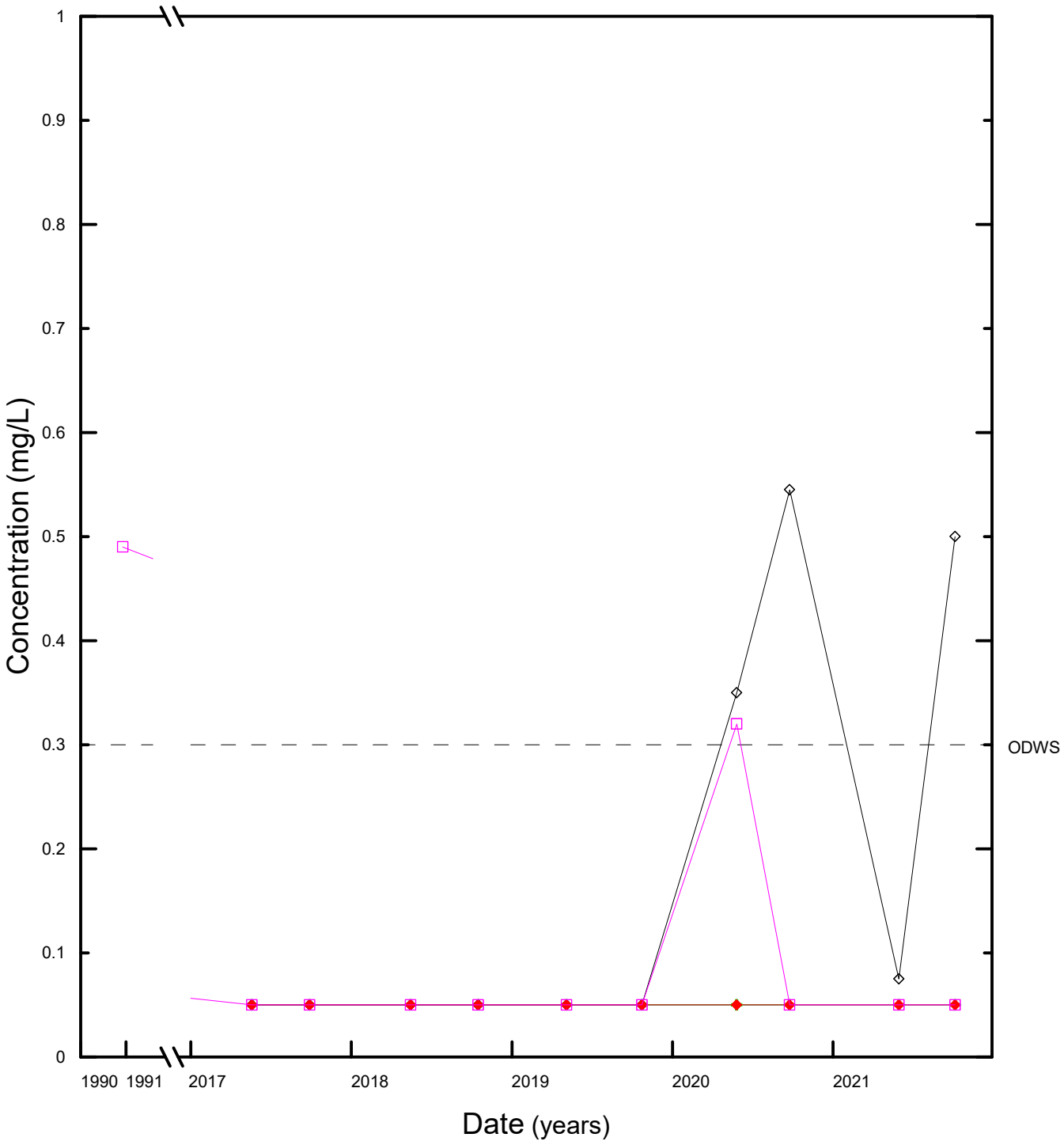
Figure G-3

Dissolved Organic Carbon

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Iron



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

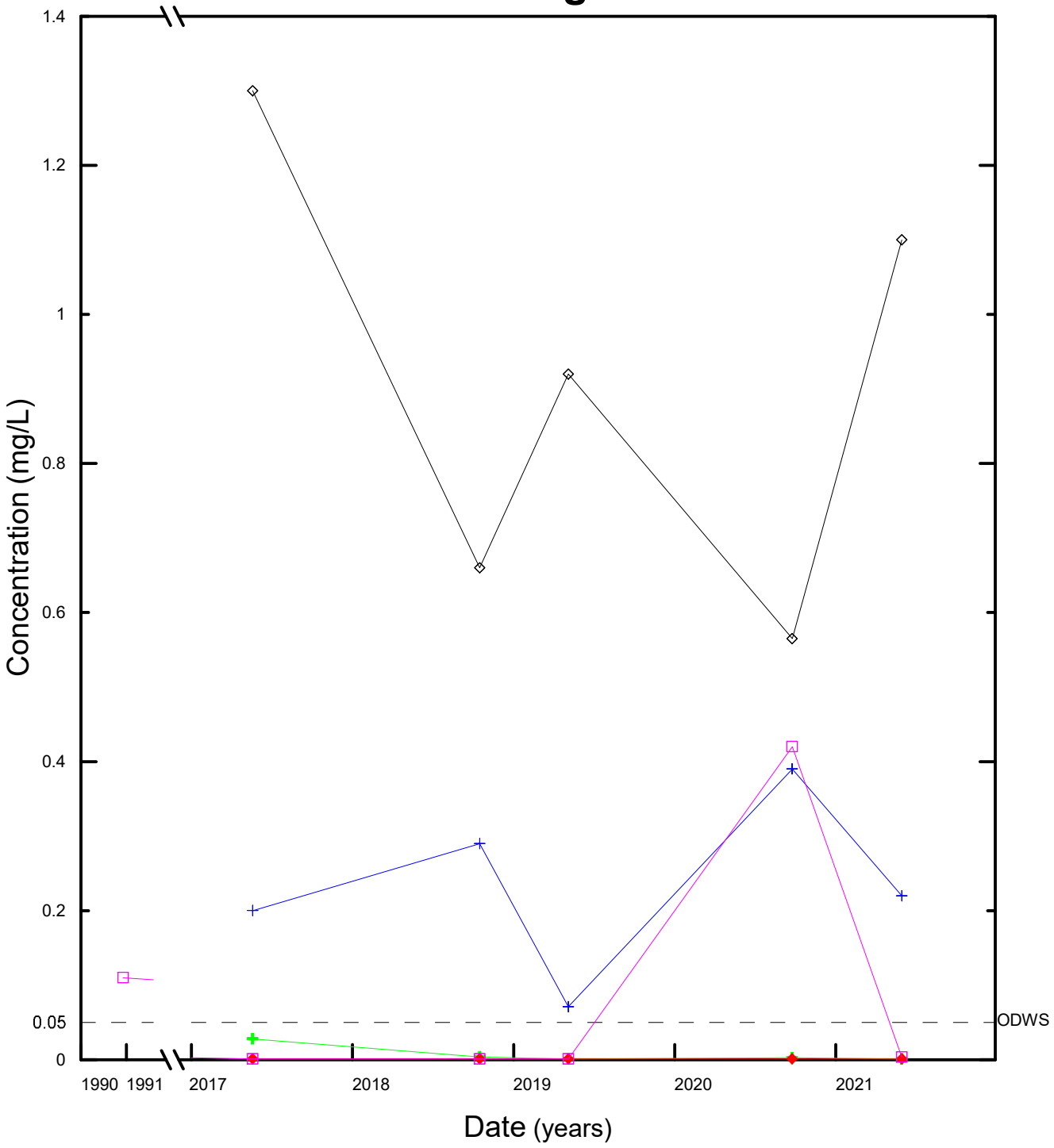
Figure G-4

Iron

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Manganese



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

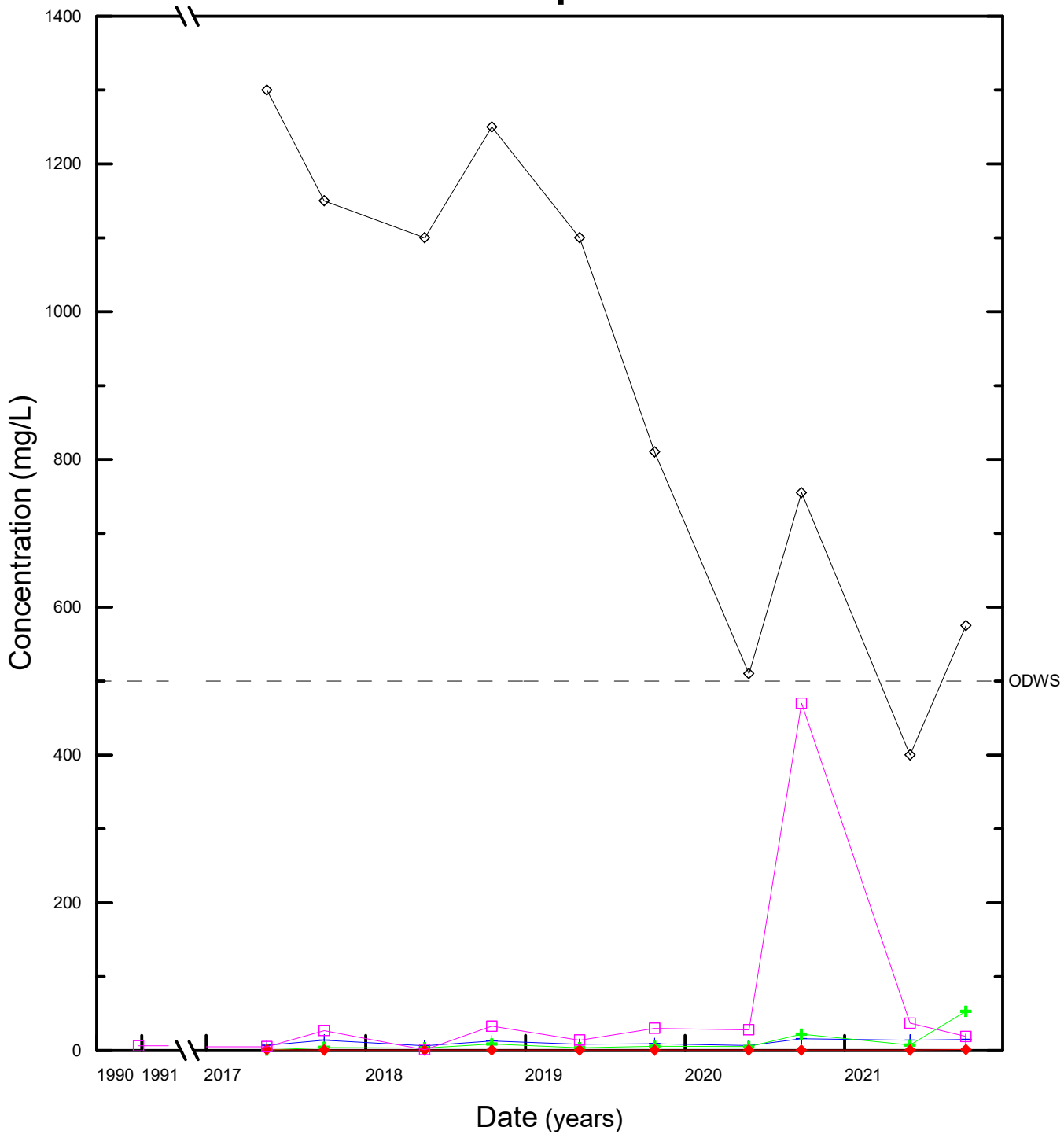
Figure G-5

Manganese

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Sulphate



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

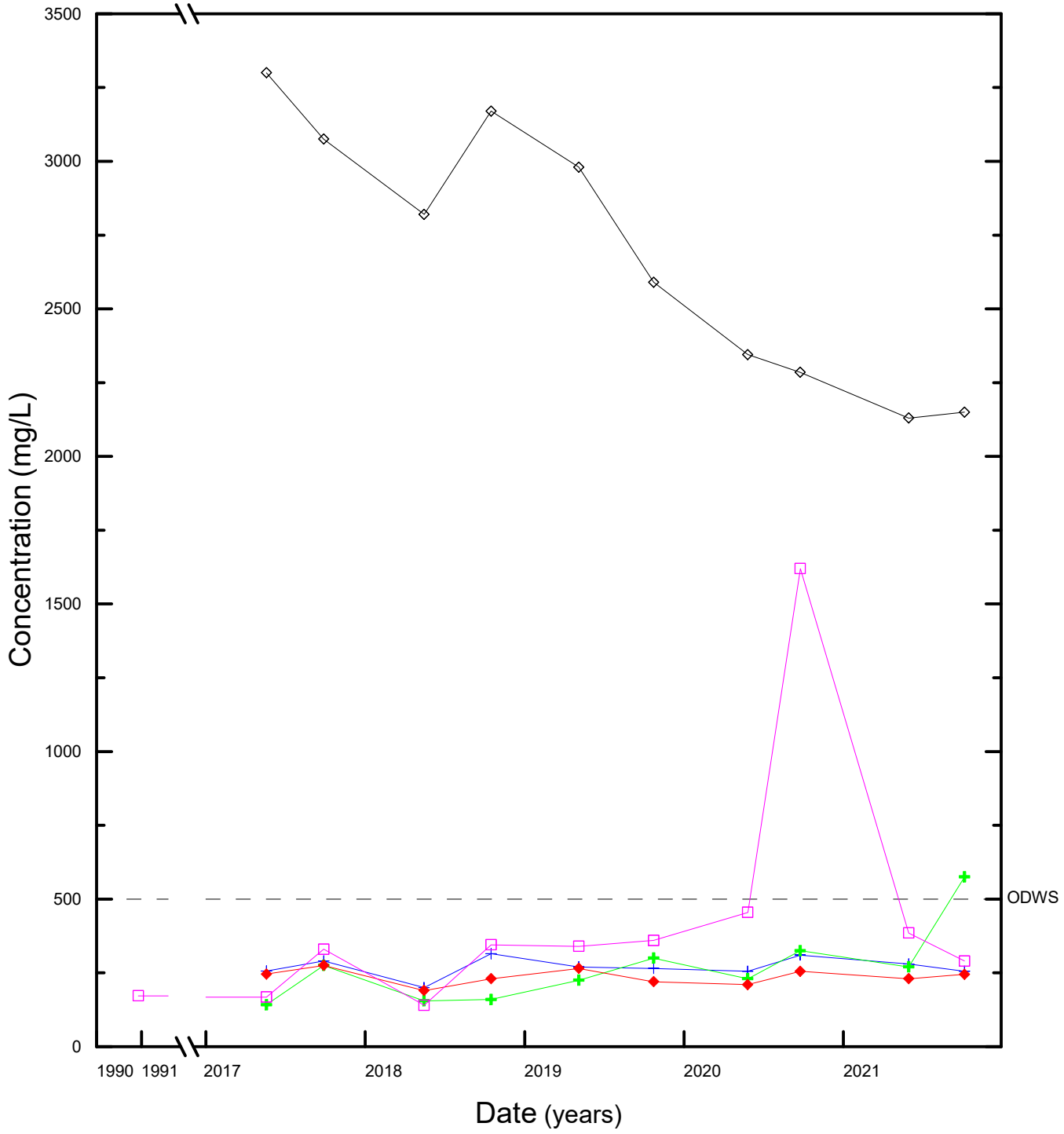
Figure G-6

Sulphate

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022

Total Dissolved Solids



Legend
- BH-C
- BH-F
- BH-G
- BH-H
- BH-I

Notes: 1) ODWS: Ontario Drinking Water Standard rev 2001.
2) Drawing to be read in conjunction with accompanying report.

exp.

Thunder Bay, Ontario

Figure G-7

Total Dissolved Solids

2021 Environmental Quality Monitoring Report
Beardmore Landfill
Municipality of Greenstone

REF. NO.:	THB-00011174-JE
SCALE:	N/A
DRAWN BY:	SW
CHECKED BY:	AM
DATE:	January 12, 2022