12505 Heart Lake Road, Caledon, Ontario

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Preliminary Hydrogeological Investigation and Water Balance Assessment

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1 Introduction

1.1 Project Description

EXP Services Inc. (EXP) was retained by Berkshire Axis Development. to prepare a Preliminary Hydrogeological Investigation and Water Balance Assessment Report associated with the proposed development located at 12505 Heart Lake Road, Caledon, Ontario (hereinafter referred to as the 'Site').

It is our understanding that the proposed development will consist of six (6) single-storey industrial/commercial buildings without basement. Moreover, the development plan includes underground utility systems (i.e., sewer lines and watermain). According to the proposed development plan, part of Highway 410 is planned to cross the development area. The Site location plan is shown on Figure 1. The proposed draft design drawing is provided in Appendix J.

EXP previously conducted a Preliminary Geotechnical Investigations. The pertinent information gathered from the noted investigations is utilized for this report.

1.2 Project Objectives

The main objectives of the Preliminary Hydrogeological Investigation and Water Balance Assessment are as follows:

- Establish the local hydrogeological settings within the Site;
- Conduct seasonal water level monitoring in all monitoring wells for one (1) year (in progress);
- Assess groundwater quality;
- Assess construction dewatering flow rates and potential impacts (short-term);
- Develop site-specific water balance assessment for pre-and post-development phases using Thornthwaite-Mather method and evaluate the infiltration deficit and mitigation measures for post-development phase; and
- Prepare a Preliminary Hydrogeological Investigation and Water Balance Assessment Report.

1.3 Scope of Work

- Reviewed available geological and hydrogeological information of the Site;
- Drilled four (4) boreholes to an approximate depth of 6 meters below ground surface (mbgs) and equipped them with 50-mm diameter (2-inch) monitoring wells;
- Installed two (2) mini-piezometers and one (1) staff-gauge to evaluate groundwater-surface water interactions at the Site;
- Conducted four (4) infiltration tests in the shallow soil horizons to an approximate depth of one (1) mbgs to assess percolation rates in support of the Low Impact Development (LID) design;
- Completed two (2) rounds of groundwater level measurements at all monitoring wells. As per the Toronto and Region Conservation Authority's (TRCA) requirements. A one (1) year groundwater level monitoring program, which is on bi-monthly basis with six (6) events, is currently in progress.
- Evaluated the information collected during the field investigation program, including borehole geological information, Water Well Records (WWR), infiltration testing results, groundwater level measurements and groundwater water quality;
- Prepared site plans, cross section, geological mapping, and groundwater contour mapping for the Site;
- Evaluated construction dewatering flow rates (short-term) and potential dewatering impacts on surround environment;

- Provided recommendations on the Ministry of Environment, Conservation and Parks (MECP) Water Taking Permits and the Region of Peel's Sewer Discharge Agreements (SDA) for the construction and post-construction phases;
- Reviewed Source Water Protection mapping, including Well Head Protection Areas (WHPA), Highly Vulnerable Aquifers (HVA), and Significant Groundwater Recharge Areas (SGRA);
- Assess construction dewatering flow rates for the proposed lateral sewer systems and potential impacts (short-term);
- Conducted pre- and post-development water balance assessment using Thornthwaite and Mather method, as well as a preliminary sizing of mitigation measures (LIDs);
- Prepared a site-specific water balance assessment; and
- Prepared a Preliminary Hydrogeological Investigation and Water Balance Assessment Report.

The Preliminary Hydrogeological Investigation and Water Balance Assessment was prepared in accordance with the Ontario Water Resources Act, Ontario Regulation 387/04, and the Region of Peel Sewer Use By-Law. The scope of work outlined above was made to assess dewatering and did not include a review of Environmental Site Assessments (ESA).

1.4 Review of Previous Reports

The following report was reviewed as part of this Preliminary Hydrogeological Investigation and Water Balance Assessment:

- EXP Services Inc. (July 8, 2021), Preliminary Geotechnical Investigation, 12505 Heart Lake Road, Caledon, ON, prepared for Berkshire Axis Development.

Any past and/or future geotechnical, hydrogeological, environmental and risk assessments, and updated development/architectural plans should be provided to update this hydrogeological report prior to submission of permits and approvals by the municipalities and agencies.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is within a physiographic region known as the South Slope. The physiographic landform is named Till Plains. The South Slope lies to the north of the Peel Plain, east of Niagara Escarpment and south of Oak Ridges Moraine (Chapman & Putnam, 2007). The topography of the South Slope is relatively flat with a gradual slope to the south, toward Lake Ontario.

2.1.2 Regional Geology and Hydrogeology

The surficial geology can be described as glaciolacustrine-derived silty to clayey till (Ministry of Northern Development and Mines, 2022). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Based on the available regional geology maps, the subsurface stratigraphy of the Site from top to bottom is summarized in Table 2-1 (TRCA, 2008 and Oak Ridge Moraine Groundwater Program, 2022). The overburden thickness is approximately between 35 m and 60 m across the Site. The maps retrieved from the ORMGP's website are provided in Appendix H.

Table 2-1: Summary of Subsurface Stratigraphy

Stratigraphic Unit	General Description	Top Elevation of Stratigraphic Unit (masl)
Halton Till or Equivalent (Aquitard)	This lithologic unit typically consists of sandy silt to clayey silt till interbedded with silt, clay, sand, and gravel.	270
Oak Ridges Moraine or Equivalent (Aquifer)	This geology unit mainly consists of interbedded fine-grained sand and silt deposits where coarse-grained sand and gravel along with clay laminae are locally reported.	245
Thorncliffe Formation (Aquifer)	This geology formation generally consists of glaciofluvial (sand, silty sand) or glaciolacustrine deposits (silt, sand, pebbly silt, and clay).	222 Partially Mapped
Queenston Formation	Bedrock primarily consists of shale, siltstone, minor limestone, and sandstone. It belongs to the Upper Ordovician, (Ministry of Northern Development and Mines, 2012).	215-235

Regional groundwater across the area flows southeast, towards Lake Ontario (Oak Ridge Moraine Groundwater Program, 2022). Local deviation from the regional groundwater flow pattern may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

According to ORMGP (2022) confined groundwater conditions exist in the Oak Ridges Aquifer Complex (ORAC). Moreover, a vertical downward hydraulic gradient is present at the Site (Appendix H).

2.1.3 Existing Water Well Survey

Well Records from the Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) Database were reviewed to determine the number of water wells present within a 500-m radius of the Site boundary.

The MECP WWR database reportedly indicates thirty (30) records within a 500-m radius from the Site boundary and three (3) records onsite.

The database further indicates that the offsite wells are at an approximate distance of five (5) meters or greater from the Site boundary. All offsite wells were reportedly identified as water supply wells, observation wells, and listed as either unknown or abandoned. All onsite wells are identified as water supply wells.

The onsite wells reportedly include one (1) domestic and two (2) livestock wells. The offsite water supply wells are at an approximate distance between 38 and 484 meters from the Site boundary. The Well Identification numbers (Well IDs) of the noted water supply wells are highlighted in Appendix A.

The depth to water for all noted well records reportedly range from 4.6 to 60.4 meters below ground surface (mbgs).

The locations of the MECP WWR within 500 m of the Site are shown on Figure 3. A table with the WWRs is included in Appendix A.

Conducting a door-to-door well survey is recommended prior to the construction activities to verify well users in the study area (within 500 m of the Site).

2.2 Site Setting

2.2.1 Site Topography

The Site is non-urban grassland. The local topography is considered relatively flat with a gradual northeasterly slope towards West Humber River. The regional topography slopes southeast towards Lake Ontario.

As indicated on the borehole logs included in Appendix B and available survey data, the surface elevation of the Site ranges between approximately 261.48 to 275.50 meters above sea level (masl).

2.2.2 Local Surface Water Features

Based on the information retrieved from Ontario Source Protection Information Atlas, large portion of the Site lies within West Humber River watershed; whereas the south-southwest portion of the Site lies within Etobicoke Creek watershed. A small section of one of the tributaries of West Humber River crosses the northeast edge of the Site boundary. According to the available floodplain map for the subject area, the noted section overlaps the floodplain area. Moreover, a few offsite wetlands are identified at approximate distances between 33 m and 770 m from the southeastern edge of Site boundary. Accordingly, the noted waterbody features are classified as Provincially Significant Wetlands (Appendix I).

2.2.3 Local Geology and Hydrogeology

A summary of subsurface soil stratigraphy is provided in the following paragraphs. The soil descriptions are based on the geotechnical investigation report (EXP, 2021) and the hydrogeological borehole logs prepared for this investigation. The soil descriptions are summarized for the hydrogeological interpretations. As such, the information provided in this section shall not be used for construction design purposes.

The detailed soil profiles encountered in each borehole and the results of moisture content determinations are presented on the attached borehole logs (Appendix B). The interpreted geological cross-section is shown on Figure 5. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries

are intended to reflect approximate transition zones for the Preliminary Hydrogeological Investigation and Water Balance Assessment and shall not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs form an integral part of the logs and should be read in conjunction with this report. The following is a brief description of the soil conditions encountered during the investigation.

Based on the results of the geotechnical and hydrogeological investigations, the general subsurface soil stratigraphy consists of the following units from top to bottom:

Topsoil

Based on the geotechnical borehole logs (EXP, 2021), surface cover comprises topsoil ranging in thickness from approximately 150 to 400 mm at all borehole locations except for Borehole 6. However, the boreholes were advanced primarily in cultivated fields. As such, topsoil thicknesses up to approximately 600 mm associated with typical ploughed fields should be anticipated. It should be noted that topsoil measurements were carried out at the borehole locations only and could differ at other locations on the site. If required, a more detailed test pit program should be carried out to accurately quantify the amount of topsoil to be removed for construction purposes.

According to the hydrogeological borehole logs, topsoil consists of some organic material mixed with traces of silty clay sediments, and it is brown in color. The recoded thickness of topsoil at all borehole locations is approximately 600 mm. A pocket of silty clay unit undelaying topsoil is reported at BH 102, with an approximate thickness of 0.5 meter.

Clayey Silt Till (Upper Layer)

Based on the geotechnical borehole logs (EXP, 2021), a clayey silt till deposit underlies the topsoil in Boreholes 1, 2 and 8. The upper clayey silt till was encountered from 0.15 to 0.25 mbgs and extended from 0.7 to 1.1 mbgs, corresponding to Elevation 268.8 to 275.0 m above sea level (mASL). The observed thickness of upper clayey silt till varied from 0.7 m to 1.1 m. The upper clayey silt till contains trace sand and trace gravel and is typically brown in colour. A wet silty sand seam was noted within the upper clayey silt till at approximately 0.9 m depth (~Elevation 270.8 mASL) in Borehole 1. The SPT 'N' values recorded in the upper clayey silt till deposit varied from 5 to 8, indicating a consistency of firm to stiff. Moisture contents of the upper clayey silt till were recorded between approximately 12 and 26 percent.

Sandy Silt Till

Based on the geotechnical borehole logs (EXP, 2021), a sandy silt till deposit was intersected below topsoil in Boreholes 3 to 5, 7 and 9 to 12. It was encountered below the upper clayey silt till in Boreholes 1, 2 and 8. The sandy silt till deposit was encountered at surface in Borehole 6. In Borehole 7 the sandy silt till deposit was encountered again below the silty clay till deposit. The sandy silt till layer was encountered from ground surface to 1.1 mbgs and extended from 2.1 to 7.0 mbgs (corresponding to Elevations 262.6 to 275.5 mASL). The observed thickness of the sandy silt till layer varied from 1.1 m to 5.6 m. The sandy silt till contains trace clay, trace gravel and occasional cobble fragments. A wet silty sand was noted within the sandy silt till at approximately 2.3 m depth (~Elevation 269.9 mASL) in Borehole 5. The sandy silt till is brown in colour except for Boreholes 5 where the deposit becomes grey at 4.6 mbgs (~Elevation 267.6 mASL). The SPT 'N' values recorded in the sandy silt till deposit varied from 4 to 53, indicating a loose to very dense degree of compactness. Measured moisture content of the sandy silt till generally ranges from approximately 8 to 24 percent.

According to the hydrogeological borehole logs, a sandy silt unit underlays topsoil in majority of borehole locations except for BH 102. This unit extends to an approximate depth elevation ranging from 270.8 masl (~1.5 mbgs at BH 101) to 261.5 masl (~4.6 mbgs).

Silty Sand

Based on the geotechnical borehole logs (EXP, 2021). a 1.1 m thick layer of silty sand was encountered below the sandy silt till layer in Borehole 4. The silty sand layer was encountered from 2.9 mbgs and extended to 4.0 mbgs (corresponding to Elevations 263.2 to 264.3 mASL). The silty sand contains trace clay and is brown in colour. An SPT 'N' value of 23 was recorded in the silty sand, indicating a compact degree of compactness. A moisture content of 23 percent was measured for this layer.

Silty Clay Till

Based on the geotechnical borehole logs (EXP, 2021), a 1.6 m thick layer of silty clay till was encountered below the sandy silt till layer in Borehole 7. The silty clay till was encountered from 4.0 mbgs and extended to 5.6 mbgs (corresponding to Elevations 264.0 to 265.6 mASL). The silty clay till contains trace clay, trace gravel and is grey in colour. A SPT 'N' value of 24 was recorded in the silty clay till, indicating a very stiff consistency. A moisture content of 13 percent was measured for this layer.

Silty Sand Till

Based on the geotechnical borehole logs (EXP, 2021), a silty sand till deposit was intersected below lower clayey silt till in Borehole 9 and below sandy silt till in Borehole 11. Borehole 9 was terminated in this deposit at depth of 8.1 m (~Elevation 265.5 mASL). The silty sand till layer was encountered from 2.9 to 7.0 mbgs and extended from 5.6 to 8.1 mbgs (corresponding to Elevations 264.4 to 267.1 mASL). The observed thickness of the upper silty sand till layer varied from 1.1 m to 2.7 m. The silty sand till contains trace clay and trace gravel. The encountered silty sand till is grey in colour in Borehole 9 and brown in colour in Borehole11. The SPT 'N' values recorded in the silty sand till deposit varied from 23 to 41, indicating a compact to dense degree of compactness. Measured moisture content of the silty sand till ranges from approximately 9 to 12 percent.

Clayey Silt Till (Lower Layer)

Based on the geotechnical borehole logs (EXP, 2021), a clayey silt till deposit was intersected below sandy silt till in Boreholes 1 to 3, 5 to 10 and 12. It was encountered below silty sand in Borehole 4 and below silty sand till in Borehole 11. The lower clayey silt till was encountered from 2.1 to 7.0 mbgs and extended from 7.0 to 8.1 mbgs (corresponding to Elevations 259.2 to 272.8 mASL). It should be noted that with the exception of Borehole 9, all other boreholes were terminated in this deposit. The observed thickness of lower clayey silt till varied from 1.1 m to 6.0 m. The lower clayey silt till contains trace sand, trace gravel and occasional cobble fragments. This lower clayey silt till layer is typically brown in colour near the top of the layer and becomes grey with depth. The SPT 'N' values recorded in the lower clayey silt till deposit varied from 13 to more than 50 per 150 mm, indicating a consistency of stiff to hard. Moisture contents of the lower clayey silt till were recorded between approximately 9 and 14 percent.

According to the hydrogeological borehole logs, a clayey silt till unit has been identified in all borehole locations. This unit extends to an approximate depth elevation ranging from 270.8 masl (~1.5 mbgs at BH 101) to the maximum depth of drilling at 259.4 masl (~6.7 mbgs at BH 104)

3 Results

3.1 Monitoring Network

Total of seven (7) monitoring wells, two (2) mini-piezometers, and one (1) staff-gauge were installed across the Site. Three (3) monitoring wells were installed as part of the geotechnical investigation in 2011 and four (4) other wells were completed for this hydrogeological assessment in 2022. The details of the monitoring network are described below.

Mini-Piezometers and Monitoring Wells

- Two (2) mini-piezometers, including MP 1 and MP 2 were installed to an approximate depth of 1.8 mbgs;
- Seven (7) monitoring wells, including BH 1, BH 9, BH 12 (geotechnical wells), BH 101 through BH 104 (hydrogeological wells) were installed to an approximated depth ranging from 6.1 mbgs to 7.68 mbgs; and
- Each monitoring well was equipped with overground protective casing, 50-mm (2-inch) PVC tubing, and a three (3)-meter screen length.

Staff-Gauge

- One (1) staff-gauge (SG 1) was installed adjacent to MP 1.

Borehole logs and monitoring well installation details are provided in Appendix B. The monitoring well locations are shown on Figure 4.

3.2 Water Level Monitoring

As part of the Preliminary Hydrogeological Investigation and Water Balance Assessment, static water levels in all monitoring locations were recorded in two (2) monitoring events, including April 28 and May 6, 2022. A summary of all water level data as it relates to the elevation survey is provided in Appendix C. A one (1) year monitoring program is currently in progress. The water levels will be recorded on a bi-monthly basis. The report will be updated upon the completion of the noted monitoring program.

The groundwater elevations recorded for the monitoring wells ranged from 265.6 masl (0.5 mbgs at BH 104 on April 28, 2022) to 274.38 masl (0.57 mbgs at BH 2 on April 28, 2022).

The groundwater elevations recorded for the mini-piezometers ranged from 261.63 masl (0.44 mbgs at MP 1 on April 28, 2022) to 261.76 masl (0.1 mbgs at MP 2 on May 6, 2022).

Water level recorded at the staff-gauge at the site (SG 1) was 261.35 masl (0.13 meters above ground surface on April 28, 2022).

One (1) map was created for the Site to show groundwater contours in the screened water-bearing zones (Figures 6). Accordingly, groundwater mounds at the Site. The flow directions are interpreted to be west, northwest, north, northeast, and east towards one of the tributaries of West Humber River, as well as southwest and south and southeast towards one of the tributaries of Etobicoke Creek. A groundwater divide trending from north to southeast is identified at the Site.

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions. This may also affect the direction and rate of flow. It is recommended to conduct seasonal groundwater level measurements to provide more information on seasonal groundwater level fluctuations.

3.3 Hydraulic Conductivity Testing

Seven (7) Single Well Response Tests (SWRT's) were completed on all monitoring wells at the Site on May 6, 2022. The tests were completed to estimate the saturated hydraulic conductivity (K) of the soils at the well screen depths.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT and constant rate test data as per Hvorslev's solution included in the Aqtesolv Pro. V.4.5 software package. The semi-log plots for normalized drawdown versus time are included in Appendix D. A summary of the hydraulic conductivities (K-values) estimated from the SWRTs are provided in Table 3-1.

Table 3-1: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)*	Screen Interval (mbgs)		Screened Lithologic Unit*	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH 2	7.68	4.68	7.68	Clayey Silt Till	7.2E-8
BH 9	7.04	4.04	7.04	Clayey Silt Till / Silty Sand Till	5.2E-6
BH 12	6.2	3.2	6.2	Silty Sand Till / Clayey Silt Till	1.6E-6
BH 101	6.06	3.06	6.06	Clayey Silt Till	7.0E-8
BH 102	6.19	3.19	6.19	Sandy Silt Till / Clayey Silt Till	1.3E-6
BH 103	6.24	3.24	6.24	Sandy Silt Till / Silty Clay Till	1.2E-7
BH 104	6.16	3.16	6.16	Sandy Silt Till / Clayey Silt Till	3.1E-7
				Highest Estimated K Value	5.2E-6
				Arithmetic Mean of Estimated K-Values	1.2E-6
				Geometric Mean of Estimated K Values	4.1E-7
				Arithmetic Mean of K-Values plus One (1) Standard Deviation	3.1E-6

Note:
*measured in the field
*based on the borehole logs
mbgs: meter below ground surface

SWRTs provide K-estimates of the geological formation surrounding the well screens and may not be representative of bulk formation hydraulic conductivity. As shown in Table 3-1, the highest K-value of the tested water-bearing zone is 5.2E-6 m/s. The geometric and arithmetic means of the K-values are 4.1E-7 m/s and 1.2E-6 m/s, respectively. The estimated arithmetic-mean of K-values plus one standard deviation from the mean is 3.1E-6 m/s.

3.4 Groundwater Quality

To assess the suitability for discharging pumped groundwater into the sewers owned by the Regional Municipality of Peel during dewatering activities, one (1) groundwater sample was collected from monitoring well BH/MW 103 on May 6, 2022, using a peristaltic pump. Prior to collecting the noted water sample, approximately three (3) standing well volumes of groundwater were purged from the referred well. The samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted for analysis to Bureau Veritas Laboratory, a CALA certified independent laboratory in Mississauga, Ontario. Analytical results are provided in Appendix E. Table 3-2 summarizes exceedance(s) of the Sanitary and Storm Sewer Use By-Law parameters.

When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Sanitary and Combined Sewer Discharge Criteria, there were no parameter exceedances to be reported.

When comparing the chemistry of the collected groundwater samples to the Regional Municipality of Peel Storm Sewer Discharge Criteria, the concentrations of both Total and Dissolved Manganese exceeded the applicable criteria.

Reporting detection limits (RDLs) were below the Sewer Use By-Law parameter criteria.

Table 3-2: Summary of Analytical Results

Parameter	Units	The Regional Municipality of Peel Sanitary and Combined Sewer Discharge Limit	The Regional Municipality of Peel Storm Sewer Discharge Limit	Concentration BH/MW 103 May 6, 2022
Total Manganese (Mn)	µg/L	5,000	50	**71**
Dissolved Manganese (Mn)	µg/L	5,000	50	**65**

Notes:
Bold – Exceeds The Regional Municipality of Peel Storm Sewer Discharge Limit.

For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

The water quality results presented in this report may not be representative of the long-term condition of groundwater quality onsite. An agreement to discharge into the sewers owned by The Regional Municipality of Peel will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

4 Dewatering Assessment

The dimensions of the proposed structure to support the dewatering assessment are summarized in Table 4-1 below.

Table 4-1 Building Dimensions for Dewatering Assessment

Input Parameter		Assumption	Units	Notes
Number of Subgrade Levels		0	-	Slab-on-Grade
Ground Elevations		274.95	masl	The measured surface elevation where the highest water level was identified (0.57 mbgs at BH 2 on April 28, 2022)
Groundwater Elevation		274.88	masl	Highest water level measured at BH 2 (274.38 masl on April 28, 2022) plus 0.5 to account for the seasonal fluctuations
Lowest Excavation Elevation	Foundation	274.30	masl	Recommended footing elevation at BH 2 (EXP, 2021)
	Underground Utilities	271.95		Assumed to be 3.0 mbgs
Foundation or Trench Area (Length x Width)		60 (30 x 2)	m^2 (m x m)	Assumed per foundation/trench

4.1 Dewatering Flow Rate Estimate and Zone of Influence

The Dupuit equation for steady linear flow to both sides of an excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate. Dewatering flow rate is expressed as follows:

$$Q_w = xK(H^2 - h^2)/Lo$$

Where:

Qw = Rate of pumping (m^3/s)
X = Length of excavation (m)
K = Hydraulic conductivity (m/s)
H = Hydraulic head beyond the influence of pumping (static groundwater elevation) (m)
h = Hydraulic head above the base of aquifer in an excavation (m)
Lo = Distance of influence (m)
a = Length of excavation (m)
b = Width of excavation (m)

It is expected that the initial dewatering rate will be higher to remove groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, primarily from storage, resulting in lower seepage rates into the excavation.

4.2 Sichardt's Radius of Influence

The radius of influence (Rs) for the construction dewatering was calculated based on Sichardt's equation. This equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This empirical formula was developed to provide representative flow rates using the steady state flow dewatering equations, as discussed below.

The estimated radius of influence due to pumping is based on Sichardt's formula as follows:

$$R_s = C(H - h)\sqrt{(K)}$$

Where:

Rs = Estimated Sichardt's radius of influence (m)
H = Hydraulic head in aquifer (static water level or saturated depth) (m)
h = Dynamic water level (m)
K = Hydraulic conductivity (m/sec)
C = Constant (3,000)

Based on Sichardt's formula and the highest K-value, the calculated distance of influence (Lo = Ro/2) is provided in Appendix F.

4.3 Stormwater

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing stormwater from the excavation.

A 15 mm precipitation event was utilized for estimating the stormwater volume. The calculation of the stormwater volume is included in Appendix F.

The estimate of the stormwater volume only accounts for direct precipitation into the excavation. The dimensions of the excavation are considered in the dewatering calculations. Runoff which originated outside of the excavation's footprint is excluded and it should be directed away from the excavation.

During precipitation events greater than 15 mm (ex: 100-year storm), measures should be taken by the contractor to retain stormwater onsite in a safe manner to not exceed the allowable water taking and discharge limits, as necessary. A two (2) and a one hundred (100) year storm event over a 24-hour period are 53.7 and 125.2 mm (refer to Appendix F).

4.4 Results of Dewatering Rate Estimates

4.4.1 Construction Dewatering Rate Estimate

For this assessment, it was assumed that the proposed construction plans include an excavation with shoring and/or trench boxes. EXP should be retained to review the assumptions outlined in this section, should the assumed shoring design change. Short-term (construction) dewatering calculations are presented in Appendix F. Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 4-2 Summary of Construction Dewatering Rate

Description	Foundation for Slab-On-Grade Building **(L/day)**	Underground Utilities (L/day)
Total Volume of Short-Term Groundwater Discharge (Construction Dewatering) without Safety Factor (including precipitation)	32,000	40,000
Total Volume of Short-Term Groundwater Discharge (Construction Dewatering) with Safety Factor (including precipitation)	64,000	79,000
Total Volume of Short-Term Groundwater Discharge (Construction Dewatering) with Safety Factor (excluding Precipitation) for EASR and PTTW	63,000	78,000

The peak dewatering flow rates do not account for flow from utility beddings and variations in hydrogeological properties beyond those encountered during this investigation.

All grading around the perimeter of the excavation should be graded away from the shoring the systems and ramp/site access to redirect runoff away from excavation. The dewatering assumptions are based on using shoring system without open cuts and sloped excavations.

The contractor is responsible for the design of the dewatering systems (depth of wells, screen length, number of wells, spacing sand pack around screens, prevent soil loss etc.) to ensure that dry conditions are always maintained within the excavation at all costs.

Dewatering should be monitored using dedicated monitoring wells within and around the perimeter of the excavation, and these wells should be monitored using manual measurements and with electronic data loggers; records should be maintained onsite to track dewatering progress. Discharge rates should be monitored using calibrated flow meters and records of dewatering progress, and daily precipitation as per MECP requirements should be maintained.

4.4.2 Post-Construction Considerations

It is our understanding that the proposed development will be slab-on-grade and as such dewatering assessment for the permanent drainage system is not required.

4.5 MECP Water Taking Permits

4.5.1 Short-Term Discharge Rate (Construction Phase)

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering is more than 50,000 L/day but less than 400,000 L/day, then an online registration in the Environmental Activity and Sector Registry (EASR) with the MECP will be required. If groundwater dewatering rates onsite exceed 400,000 L/day, a Category 3 Permit to Take Water (PTTW) will be required from the MECP.

As of July 1, 2021, an amendment of O. Reg. 63/16 has come into effect and replaced the former subsection 7 (5) such that the EASR water taking limit of 400,000 L/day would apply to groundwater takings of each dewatered work area only, excluding stormwater.

The dewatering estimate including a safety factor is greater than 50,000 L/day and less than 400, 000 L/day as shown on Table 4-2. The MECP construction dewatering rate excludes the precipitation amount and is the rate used for the permit application. Based on the MECP construction dewatering an EASR will be required to facilitate the construction dewatering program of the Site.

A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. Monitoring of both water quantity and water quality must be carried out for the entire duration of the construction dewatering phase. During this phase, the Discharge Plan and the daily water taking records must be available onsite.

The EASR, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must also be available at the construction Site during the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design, since the EASR will need to be updated to reflect these modifications. Altogether, the hydrogeological report, EASR, Discharge Plan and geotechnical assessment constitute the Water Taking Plan which needs to be available onsite during the construction dewatering.

5 Environmental Impact

5.1 Surface Water Features

Based on the information retrieved from Ontario Source Protection Information Atlas, large portion of the Site lies within the West Humber River watershed; whereas the south-southwest portion of the Site lies within the Etobicoke Creek watershed. A small section of one of the tributaries of the West Humber River crosses the northeast edge of the Site boundary. According to available mapping of the subject area, the noted section lies in the floodplain. Moreover, a few offsite swamps are identified at approximate distances between 33 m and 770 m from the southeastern edge of Site boundary. Accordingly, the noted waterbody features are classified as Provincially Significant Wetlands (Appendix I).

Due to the extent of estimated zone influence of construction dewatering and the proximity of onsite and nearby water body features to the proposed construction areas, it is recommended that the noted waterbody features be monitored for water quantity during the construction phase.

5.2 Highly Vulnerable Aquifers and Significant Groundwater Recharge Areas (HVAs and SGRAs)

Based on the Ontario Source Protection Information Atlas website, the northwest portion of the Site is identified within Category-4 of Significant Groundwater Recharge Area (SGRA). Moreover, the subject property has not been identified within a Highly Vulnerable Aquifer (HVA) area. However, a small area of HVA is identified within a few meters from the Site boundary and to the northwest bank of one of the tributaries of West Humber River (Appendix I).

5.3 Wellhead Protection Areas (WHPA) and Recharge Management

Based on the Ontario Source Protection Information Atlas website, the Site is not identified within any Wellhead Protection Areas (Appendix I).

5.4 Groundwater Sources

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the presence and number of water supply wells within a 500 m radius of the Site boundaries. Due to the presence of onsite water supply wells and the proximity of several offsite water supply wells to the proposed development area, conducting a door-to-door well survey is recommended prior to the construction activities. The well survey will be conducted within 500-m from the Site boundary to verify well users in the study area, prevent and mitigate possible detrimental impacts on the noted water supply wells that may arise because of construction activities.

5.5 Geotechnical Considerations

As per the MECP technical requirement for EASR, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities, etc.). A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

5.6 Groundwater Quality

It is our understanding that the potential effluent from the dewatering system during the construction will be released into the municipal sewer system. As such, the quality of groundwater discharge is required to conform The Regional Municipality of Peel Sewer Use By-Law.

Dewatering (short and long-term) may induce migration of contaminants within the zone of influence and beyond due to changing hydraulic gradients, hydrogeological conditions beyond Site boundaries and preferential pathways in utility beddings etc. The water quality sampling conducted as part of this assessment was performed under static conditions. As a result,

monitoring may be required during dewatering activities (short-term) to monitor potential migration, and this should be performed more frequently during early dewatering stages.

For the short-term (construction) discharge to the sanitary sewer system (post-development phase) and based on the water quality results, it is recommended to implement a suitable pre-treatment, as required.

An agreement to discharge into the sewers owned by The Regional Municipality of Peel will be required prior to releasing dewatering effluent.

The Environmental Site Assessment Report(s) shall be reviewed for more information on the groundwater quality conditions at the Site.

5.7 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

6 Site-Specific Water Balance

6.1 Estimated Design Infiltration Rate

6.1.1 Percolation Test Methodology

The percolation tests were performed as falling head tests in 50-mm diameter open holes with an approximate depth between 0.8 and one (1) mbgs. In the falling head test approach, each test hole was filled with water to ground surface (top of the hole). The dropping water levels were recorded with data-loggers, which were installed at each location. The field test results were analyzed using Reynolds' analytical solution (Reynolds, 2015). The percolation tests and data analysis were completed as per the Toronto and Region Conservation Authority's guidelines (TRCA, 2012 and TRCA, 2019).

6.1.2 Percolation Test Results and Estimated Design Infiltration Rate

EXP completed four (4) infiltration tests, including IT 1 through IT 4 at the Site. A Site Plan showing the noted test locations is included in the enclosed Figure 4. The infiltration test results are summarized in Table 6-1 below.

The design infiltration rates include a safety factor of 2.5 to account for some soil heterogeneity, which was applied according to Stormwater Management Criteria, Appendix C: Water Balance and Recharge (TRCA, 2012). The noted locations were selected to maximize coverage of the Site and examine the subsurface soil conditions at each of test locations.

Table 6-1: Summary of Infiltration Test Results

Test Location	Initial Depth to Water (mbgs)	Total Water Displacement (cm)	Total Test Duration (t) (min)	Estimated K_{fs} (m/s) *	Infiltration Rate (IR) (mm/hr) **	Percolation Time (min/cm)
IT 1	Dry	2.7	225.2	4.7E-9	11	190
IT 2	0.6	8.4	54.9	7.3E-8	23	91
IT 3	Dry	0.3	59.0	3.0E-9	10	214
IT 4	Dry	6.9	55.5	4.1E-8	20	107
	Design Infiltration Rate with factor of safety of 3.5			---	**4**	-

Note:
* based on Reynold's method (2016).
** based on Appendix C of Stormwater Management (TRCA, 2012).

Based on the infiltration test results, the geometric mean of estimated design infiltration rates is 4 mm/hr after applying a safety factor of 2.5. Since the estimated design infiltration rate is less than 15 mm/hr, as such a sub-drain system may be required to be installed below the infiltration systems as per the TRCA's guidelines for stormwater systems. The design infiltration rates can be used for designing LID systems to enhance post-development groundwater infiltration to help maintain the pre-development groundwater infiltration rate at the Site. The TRCA's infiltration rate calculation sheet and the respective LID calculations are provided in Appendices G-1 and G-2, respectively.

6.2 Pre- and Post-Development Site Characteristics

6.2.1 Pre-Development Site Characteristics

The Site currently consists of grassland and unevaluated wetland. A summary of the existing (pre-development) landscape features is provided in Table 6-2 below.

Table 6-2: Pre-Development (Existing) Land Use

Description	Pre-Construction (Existing) (m^2)
Asphalt/Concrete	7,200
Existing Buildings	3,600
Landscape, Woodlot, Unevaluated Wetland, Open Space	283,100
Total Site Area	**293,900**

The pre-development areas provided in Table 6-2 were determined based on a review of available Site plans and are considered appropriate for estimating the water balance. Most of the Site area is slightly pervious under pre-development conditions.

6.2.2 Post-Development Site Characteristics

Table 6-3 provides a summary of the post-development site characteristics based on the provided design drawing (Appendix J). Under post-development conditions, almost 79 % of the Site area is anticipated to be impervious

Table 6-3: Post-Development Site Characteristics

Description	Impervious Areas (ex: Buildings, Roads) m^2	Pervious Areas (ex: Landscape, Roads) m^2	Total Areas Post Construction (Proposed) m^2
Previously Existing Retained Impervious	0	0	0
Buildings Roofs (Based on the Design Drawings)	95,000	0	95,000
Paved Surface (Parking Area, Sidewalks, Proposed Hwy 410, etc.)	137,200	0	137,200
Landscaped, Unevaluated Wetland and Woodlot Areas	0	61,700	61,700
Total	**232,200**	**61,700**	**293,900**

6.3 Methodology

6.3.1 Meteorological Data

Meteorological data including average monthly precipitation and average temperatures were obtained from the National Climate Data and Information Archive (Environment Canada) for Toronto Lester B. Pearson International Airport, MOE weather station (Station ID No.6158733).

Meteorological data of 30 years from 1983 to 2012 was utilized for this assessment. Summaries of the climate data is provided in Appendices G-3.

6.3.2 Modeling

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is a counting method used to analyze the allocation of water among various components of the hydrologic cycle. This methodology was used to complete the pre-construction (existing conditions) and post development water balance. The model inputs include monthly mean temperature, total precipitation, runoff factor, soil-moisture storage capacity, rain temperature threshold, snow temperature threshold, maximum melt rate and the latitude of the Site. The model outputs include monthly potential and actual evapotranspiration, soil moisture storage, soil moisture storage change, surplus, infiltration, and runoff.

When precipitation (P) occurs, it can either runoff (R) on the surface water system, infiltrate (I) into the ground and evaporate or transpire (ET) from the earth's surface and through the vegetation. The difference between total precipitation (P) and the total of evaporation and evapotranspiration (ET) is defined to be the water surplus (S) which is available for both infiltration (recharge to the groundwater system including interflow) and for runoff. When long-term averages of P, R, I, and ET are used, no net change in groundwater storage (ST) is assumed. Annually, however, there is a potential for small changes in ST.

The annual water budget can be stated as follows:

$$\mathbf{P = ET + R + I + \Delta ST}$$

Where:
P = precipitation
ET = evapotranspiration
R = surface water runoff
I = Infiltration
ΔST = change in groundwater storage

For this assessment, the Thornthwaite and Mather method was used to estimate average infiltration rates. Based on the site conditions, components for infiltration in the noted model were used to estimate infiltration, also accounting for the lateral movement of water in the unsaturated zone in the shallow sub-surface (first few meters) which discharges to surface water features.

Infiltration is governed by the surficial soil types, topography, and land cover. On areas with shallow water table, the percolation rate of precipitation into the soils is reduced and considered negligible.

For ease of calculation, a spreadsheet model was used for the computation. The Thornthwaite and Mather Model is based on the United Stated Geological Survey (USGS) graphical user interface (Thornthwaite Monthly Water-Balance program, 2007).

6.4 Climate Data Analysis and Estimating Infiltration Factors

6.4.1 Climate Data Analysis

The mean annual water surplus was calculated using the Thornthwaite and Mather (1955) method. Monthly average precipitation values were obtained for 30 years from 1983 to 2012. Soil moisture storage of 200 mm/yr was assumed for soils and considered representative of the preconstruction site conditions. The closest latitude to the Site is 43^0, which was used in the USGS model (2007). Table 6-4 provides a summary of the climatic water balance analysis. Summaries of the input and output climate data are provided in Appendixes G-3 and G-4, respectively.

Table 6-4: Summary of Climatic Water Balance Analysis in Pre-Development Conditions

Soil Moisture Storage (mm/yr)	Precipitation (mm/yr)	Actual ET (mm/yr)	Surplus (mm/yr)
200	786.9	568.0	218.9

Note: ET = Evapotranspiration

The results of climatic water balance analysis for the Site suggest that a water surplus of 218.9 mm/year is available to become surface runoff and infiltration.

6.4.2 Estimating Infiltration Factors

The infiltration is expected to be controlled by topography and soil cover type. Surplus water is portioned between runoff and infiltration based on the controlling factors provided by MOE (1995). It is noted that the controlling sub-factors provided by the MOE were determined to estimate pre-development infiltration rates.

A total infiltration factor for the Site was estimated using the individual sub-factors representative of the topography, soil type and land cover conditions. The surface geology and soil stratigraphy at the Site are presented in Figures 2 and 5, respectively. The existing land use and topography of the Site are shown on Figures 7 and 8, respectively. The proposed land use map shown on Figure 9 is prepared based on the design drawing (Appendix J). The proposed site grading plan was not available at the time of preparation of this report. As such, a few assumptions were made for the post-development phase.

Considering the topography and soil type for the Site, the total weight infiltration factors for the pre-and post-development phases are estimated to be 0.36 and 0.55, respectively. The estimated pre-and post-development total infiltration factors represent the fraction of the water surplus available for infiltration. Appendix G-5 provides a summary of the sub factors and total weighted infiltration factor based on the Site conditions.

Using the infiltration factor of 0.36 and water surplus rate volume of 218.9 mm/yr for pre-development phase, the infiltration rate for the entire Site is estimated to be 79.88 mm/yr. The fraction of the available water surplus for runoff is 0.64 (= 1.00 – 0.36) and the annual runoff rate is 161.26 mm/yr (Appendix G-6).

Using the infiltration factor of 0.55 and water surplus rate volume of 218.9 mm/yr for post-development phase, the infiltration rate for the entire Site is estimated to be 120.40 mm/yr. The fraction of the available water surplus for runoff is 0.45 (= 1.00 – 0.55) and the annual runoff rate is 139.92 mm/yr (Appendix G-6).

6.5 Pre-Development Water Balance Estimates

6.5.1 Pre-Development Water Balance Analysis

The water balance analysis is based on available information on a regional scale and deemed consistent for the Site. Table 6-5 provides a summary of water balance analysis for the Site.

Table 6-5: Summary of Overall Pre-Development Water Balance Results

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/yr)	Actual Evapo-transpiration (m^3/yr)	Runoff* (m^3/yr)	Infiltration * (m^3/yr)
Total Site	293,900	283,100	231,270	160,801	47,856	22,613
Percentage of Total Precipitation (%)			100.0	69.5	20.7	9.8

The total Site area was used to estimate the total volume of annual precipitation for the Site. As summarized in Table 6-5, the pre-development water balance is as follows: approximately 69.5 % of the total precipitation is subject to evapotranspiration, 20.7 % to runoff and 9.8 % to infiltration.

The pre-development unmitigated water balance, on a weighted average depth basis (in mm/yr) is as follows:

$$P\ (786.90) = ET\ (547.13) + R\ (162.83) + I\ (76.94) + \Delta ST\ (0)$$

6.6 Post-Development Water Balance Estimates

6.6.1 Post-Development Water Balance -Unmitigated

Based on the assumptions made for this assessment, the total area of impervious surfaces under post-development conditions is approximately 232,200 m^2 representing approximately 79.0 % of the Site area (total area: 293,900 m^2) (Table 6-3). The remaining 61,700 m^2 is assumed to be available to contribute to infiltration during post-development stage (21 % of the total land area). The post-development water balance calculations are presented in Appendix G-6. Table 6-6 provides a summary of the water balance assessment.

Table 6-6: Summary of Overall Post-Development Water Balance Forecast-Unmitigated

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/yr)	Evapotranspiration (m^3/yr)	Runoff (m^3/yr)	Infiltration (m^3/yr)
Total Site	293,900	61,700	231,270	35,046	188,796	7,428
Percentage of Total Precipitation (%)			100.0	15.2	81.6	3.2

The un-mitigated post-development water balance, on a weighted average depth basis (in mm/yr) is as follows:

$$P\ (786.9) = ET\ (119.2) + R\ (642.4) + I\ (25.3) + \Delta ST\ (0)$$

6.6.2 Post-Development Water Balance-Mitigated

If no remedial measures are implemented to maintain infiltration, it is expected that infiltration will be reduced from approximately 22,613 m^3/year to 7,428 m^3/year in post-development, resulting in a deficit of 15,185 m^3/yr (Appendix G-6).

To maintain the estimated pre-development infiltration rate of 22,613 m^3/year, mitigation measures should be implemented to maintain the noted infiltration rate volume.

The proposed mitigation measure, known as the Low Impact Development (LID) systems, would consist of but is not limited to infiltration galleries, infiltration trenches, etc. Considering a total deficit of 15,185 m^3/yr and a design infiltration rate of 4 mm/hr, the required area for a proposed LID system is estimated 4,940 m^2. The noted area is anticipated to capture 949 m^3 stormwater volume per a 2-week period from directing roof run-off. Accordingly, the estimated infiltration time for captured water in the proposed LID system is estimated 24 hours (Appendix G-7).

7 Conclusions and Recommendations

Based on the findings of the Preliminary Hydrogeological Investigation and Water Balance Assessment, the following conclusions and recommendations are provided:

Based on the findings of the Preliminary Hydrogeological Investigation and Water Balance Assessment, the following conclusions and recommendations are provided:

- Two (2) rounds of groundwater level measurements have been completed in all monitoring wells. As per the Toronto's Conservation Authority's requirements, a one (1) year groundwater level monitoring program is currently in progress. The water levels will be recorded on a bi-monthly basis. The report will be updated upon the completion of the noted monitoring program.

- When comparing the chemistry of the collected groundwater sample to the Regional Municipality of Peel's Sanitary Sewer Discharge Criteria, there were no parameter exceedances to be reported.

- When comparing the chemistry of the collected groundwater sample to the Regional Municipality of Peel's Storm Sewer Discharge Criteria, the concentrations of both total and dissolved Manganese exceeded the applicable criteria.

- Based on the assumptions outlined in this report, the highest peak dewatering rates for the proposed construction activities is estimated 79,000 L/day. This is the rate which will be required to be discharged to the municipal sewer system.

- The estimated MECP's dewatering rate for proposed construction activities is approximately 63,000 L/day. As the dewatering flow rate estimate is between 50,000 L/day and 400,000 L/day, an EASR will be required to facilitate the construction dewatering program for the Site.

- The estimated construction dewatering volume is based on the assumptions outlined in this report. Any variations in hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the discharge volumes.

- The dewatering rates should be revisited once final design and schedule are available.

- For the short-term dewatering system (construction phase), it is anticipated that TSS levels and some other parameters (for example, Total Metals) in the pumped groundwater may become elevated and exceed both, Sanitary and Storm Sewer Use By-Law limits. To control the concentration of TSS and associated metals, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities to discharge to the applicable sewer system. The specifications of the treatment system will need to be adjusted to the reported water quality results by the treatment contractor/process engineer.

- As per the MECP technical requirement for EASR, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities etc.). A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

- An agreement to discharge into the sewers owned by the Regional Municipality of Peel will be required prior to releasing dewatering effluent.

- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

- Considering a total post development infiltration deficit of 15,185 m^3/yr and an estimated geometric mean of design infiltration rate 4 mm/hr, a minimum total area required for the future LID system to meet the deficit is approximately 4,940 m^2; indicating that any size greater or equal to this area will be sufficient to mitigate the post development infiltration rate. The noted area is anticipated to capture 949 m^3 stormwater volume per a 2-week period from directing roof run-off. Accordingly, the estimated infiltration time for captured water in the proposed LID system is estimated 24 hours.

- A Discharge Plan (dewatering sketch, sewer discharge agreement) must be developed and applied for any discharges from the Site. Monitoring of both water quantity and water quality must be carried out for the entire duration of the construction dewatering phase. During this phase, the Discharge Plan and the daily water taking records must be available onsite. The EASR, Discharge Plan, hydrogeological investigation report, and geotechnical assessment of settlements must also be available at the construction Site during the entire construction dewatering. EXP should be notified immediately about any changes to the construction dewatering schedule or design, since the EASR will need to be updated to reflect these modifications. Altogether, the hydrogeological report, EASR, Discharge Plan and geotechnical assessment constitute the Water Taking Plan which needs to be available onsite during the construction dewatering.

The conclusions and recommendations provided above should be reviewed in conjunction with the entirety of the report. They assume that the present design concept described throughout the report will proceed to construction. This report is solely intended for the construction dewatering assessments. Any changes to the design concept may result in a modification to the recommendations provided in this report.

8 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately, if any unforeseen Site conditions are experienced during construction activities. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

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We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.



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Senior Hydrogeologist
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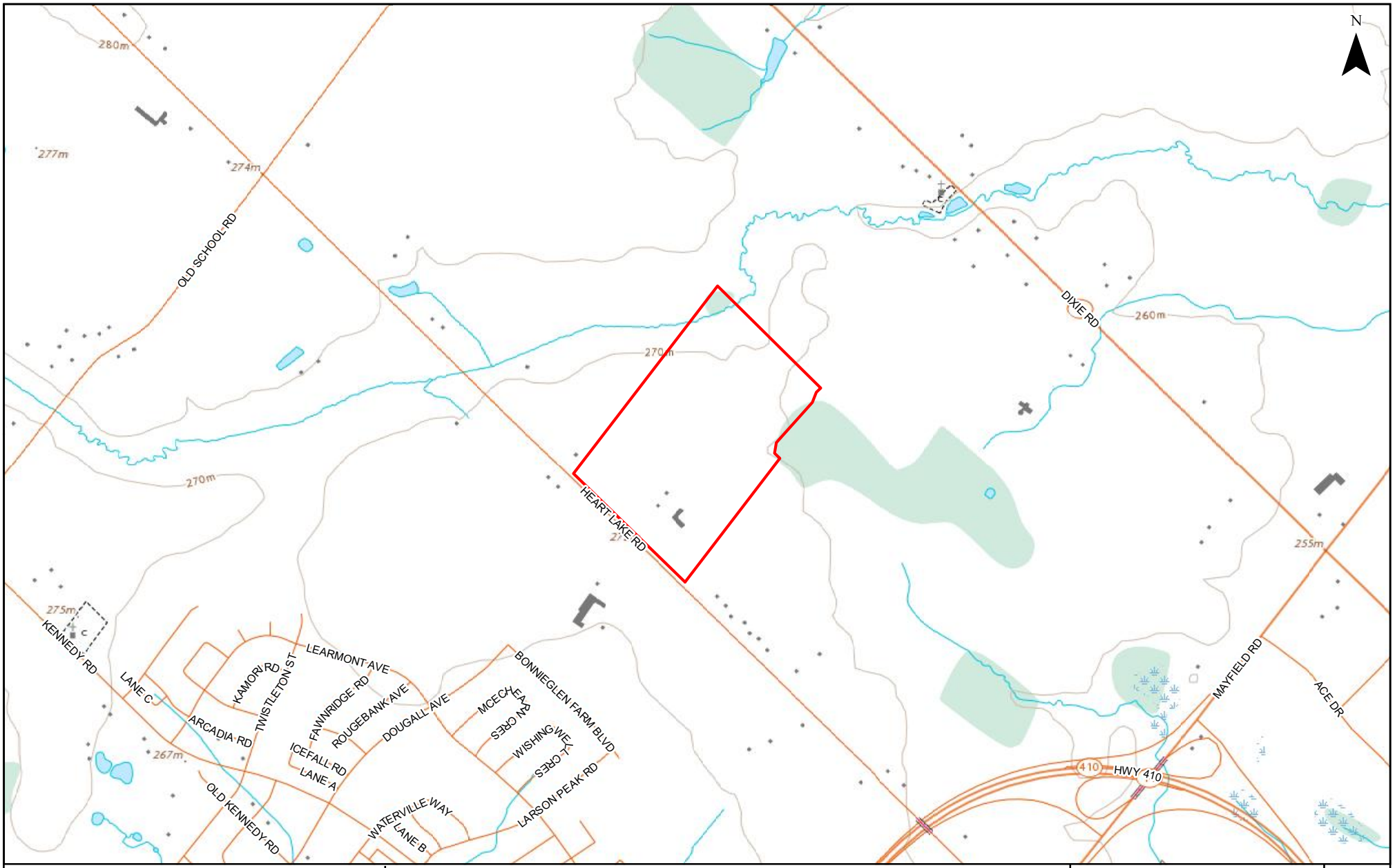


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Environmental Services

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Figures



SCALE:

0 150 300 450 600 750 m

LEGEND:

APPROXIMATE SITE BOUNDARY

SITE LOCATION PLAN

FIGURE: 1

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

DRAWN BY:	CHECKED BY:
AC	FC

PROJECT NUMBER: GTR-22006080-B0 | DATE: MAY 2022



SCALE:
0 200 400 600 800 1,000 m

SOURCE:
BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

exp.

DRAWN BY:	CHECKED BY:
AC	FC

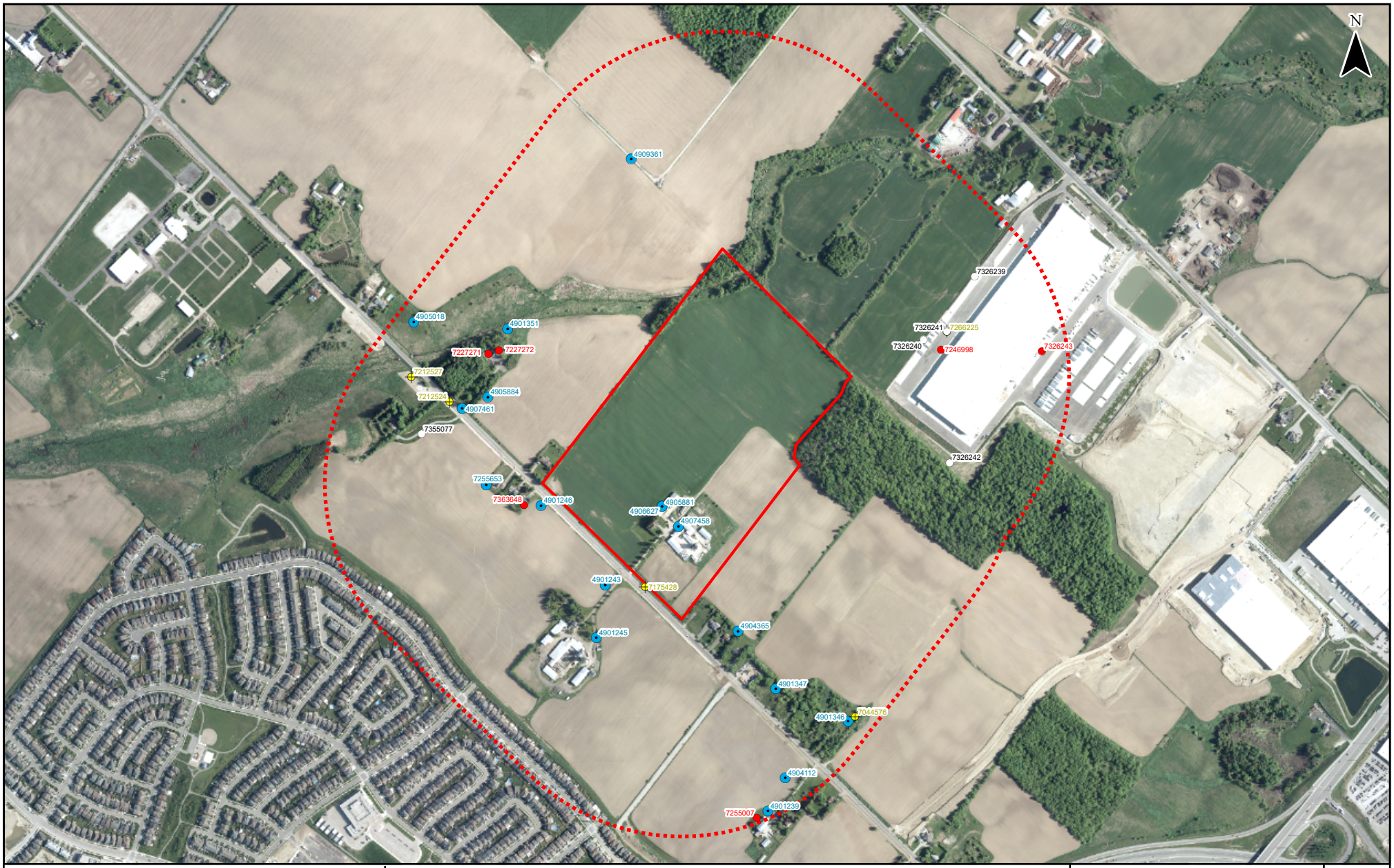
LEGEND:
- APPROXIMATE SITE BOUNDARY
- 19: MODERN ALLUVIAL DEPOSITS
- 9C: COARSE-TEXTURED (FORESHORE-BASINAL) GLACIOLACUSTRINE DEPOSITS
- 5D: GLACIOLACUSTRINE-DERIVED SILTY TO CLAYEY TILL

SURFICIAL GEOLOGY

FIGURE: 2

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0 | DATE: MAY 2022



SCALE:

0 150 300 450 600 750 m

SOURCE:

BASED ON GOOGLE EARTH IMAGERY DATED 2020,
AVAILABLE WELL RECORD INFORMATION AS OF MARCH 2021

exp.

DRAWN BY:	CHECKED BY:
AC	FC

LEGEND:

- MONITORING WELL / TEST HOLE
- WATER SUPPLY WELL
- ABANDONED WELL
- UNCLASSIFIED / UNFINISHED WELL
- APPROXIMATE SITE BOUNDARY
- 500 m ZONE

MECP WATER WELL RECORDS MAP

FIGURE: 3

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0

DATE: MAY 2022



SCALE:

0 50 100 150 200 250 m

exp.

DRAWN BY:	CHECKED BY:
AC	FC

LEGEND:

- BOREHOLE (EXP, 2021 - 2022)
- BOREHOLE / MONITORING WELL (EXP, 2021 - 2022)
- INFILTRATION TEST LOCATION (EXP, 2022)
- MINI-PIEZOMETER (EXP, 2022)
- STAFF GAUGE (EXP, 2022)
- CROSS SECTION AXIS
- APPROXIMATE SITE BOUNDARY

BOREHOLE / MONITORING WELL LOCATION PLAN

FIGURE: 4

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

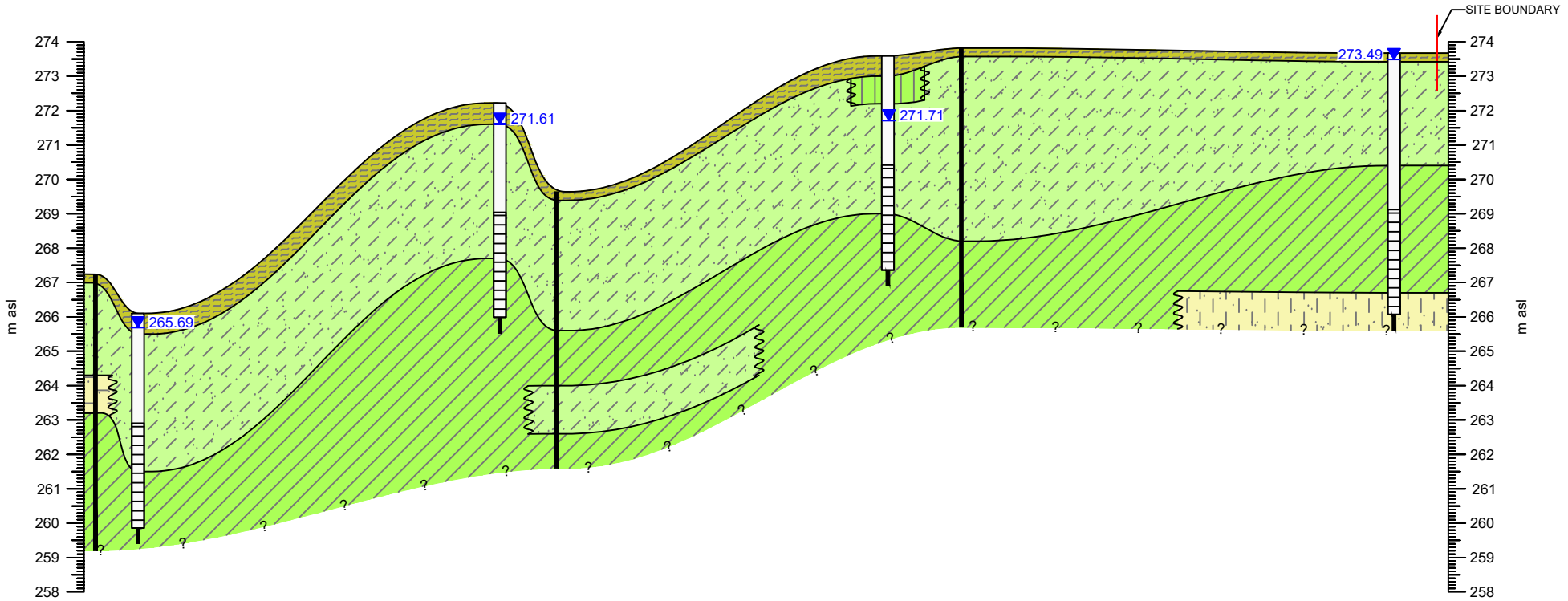
PROJECT NUMBER: GTR-22006080-B0

DATE: MAY 2022

A
NORTH

A'
SOUTH

BH4 EL:267.24
BH/MW104 EL:266.10
BH/MW103 EL:272.22
BH7 EL:269.64
BH/MW102 EL:273.59
BH6 EL:273.82
BH9 EL:273.67



VERTICAL SCALE: AS SHOWN

HORIZONTAL SCALE: 0 40 80 120 160 200 m

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LEGEND:

- TOPSOIL
- SILTY SAND
- SILTY CLAY
- SILTY SAND TILL
- SILTY CLAY TILL / CLAYEY SILT TILL
- SANDY SILT TILL
- GROUNDWATER ELEVATION (masl) AS MEASURED ON MAY 6, 2022

TITLE AND LOCATION:

CROSS SECTION A-A'
HYDROGEOLOGICAL INVESTIGATION AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
GTR-22006080-B0	JA
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
MAY 2022	5

\\exp\data\BRM\GTR-22006080-B0\60 Execution\65 Drawings\CAD\HG\GTR-22006080-B0.dwg



SCALE:

0 50 100 150 200 250 m

LEGEND:

- BOREHOLE / MONITORING WELL (EXP, 2021 - 2022)
- xx.xx GROUNDWATER ELEVATION (m asl) AS MEASURED ON MAY 6, 2022
- GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER DIVIDE
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	FC

GROUNDWATER CONTOUR PLAN

FIGURE: 6

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0

DATE: MAY 2022



SCALE:

0 50 100 150 200 250 m

LEGEND:

- AGRICULTURAL / LANDSCAPE
- BUILDING
- PAVED SURFACE
- WOODLOT
- APPROXIMATE SITE BOUNDARY

exp.

DRAWN BY:	CHECKED BY:
AC	FC

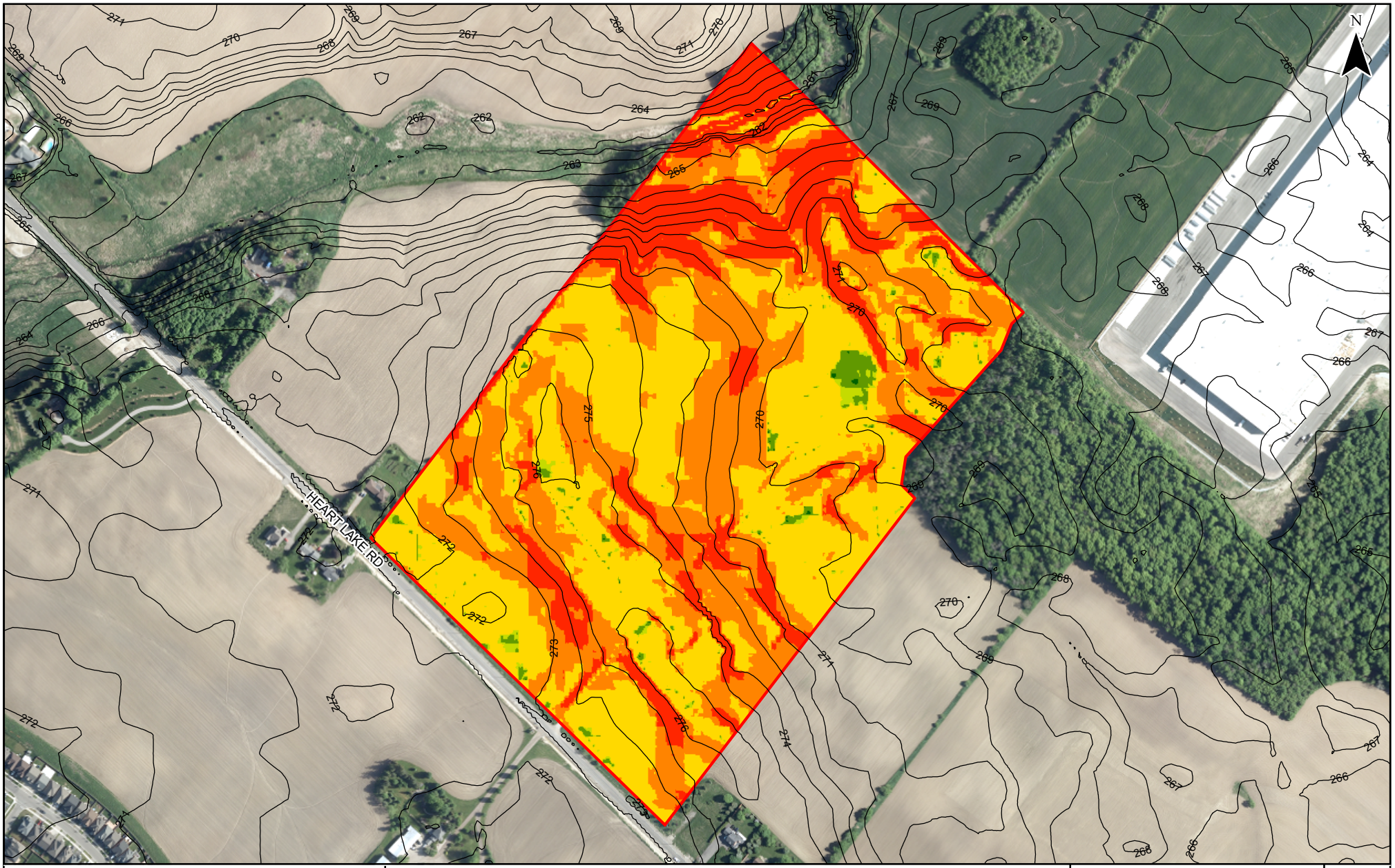
EXISTING LAND USE

FIGURE: 7

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0

DATE: MAY 2022



SCALE:

0 50 100 150 200 250 m

SOURCE:

TOPOGRAPHIC CONTOURS (2013) BASED ON
PROVINCIAL DIGITAL ELEVATION MODEL.
MINISTRY OF NATURAL RESOURCES AND FORESTRY, 2013.

exp.

DRAWN BY:	CHECKED BY:
AC	FC

LEGEND:

TOPOGRAPHIC CONTOUR (m asl)

APPROXIMATE SITE BOUNDARY

EXISTING SLOPE (INFILTRATION FACTOR):

- <0.06% (0.30)
- 0.06 - 0.28% (0.25)
- 0.28 - 0.38% (0.20)
- 0.38 - 2.8% (0.15)
- 2.8 - 4.7% (0.10)
- >4.7% (0.05)

EXISTING SLOPE

FIGURE: 8

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0

DATE: MAY 2022



SCALE:

0 50 100 150 200 250 m

SOURCE:

SCHEME 05 - CONCEPTUAL SITE PLAN - HEARTLAKE ROAD.
WARE MALCOMB, NOVEMBER 2021

exp.

DRAWN BY:	CHECKED BY:
AC	FC

LEGEND:

- APPROXIMATE SITE BOUNDARY
- BUILDING
- LANDSCAPE
- PAVED SURFACE
- WOODLOT

PROPOSED LAND USE

FIGURE: 9

HYDROGEOLOGICAL INVESTIGATION
AND WATER BALANCE ASSESSMENT
12505 HEART LAKE ROAD
CALEDON, ONTARIO

PROJECT NUMBER: GTR-22006080-B0 | DATE: MAY 2022

Appendix A – MECP WWR Summary Table

On-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10320555	4905881	11/20/1981	595315	4846373	275.4	margin of error : 100 m - 300 m				Rotary (Convent.)	55.2	53.6	12.7	Livestock	Domestic	Water Supply
10321191	4906627	3/31/1987	595315	4846371	275.4	margin of error : 100 m - 300 m				Rotary (Convent.)	50.6	49.1	12.7	Domestic	Livestock	Water Supply
10322017	4907458	6/27/1990	595352	4846326	276.1	margin of error : 3 - 10 m				Rotary (Convent.)	61.3	60.4	12.7	Domestic	Livestock	Water Supply

Off-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE FROM SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10316085	4901239	7/24/1965	595558	4845671	272.9	margin of error : 100 m - 300 m			484	Cable Tool	39.0	38.1	17.8	Livestock	Domestic	Water Supply
10316089	4901243	12/19/1961	595184	4846190	271.3	margin of error : 100 m - 300 m			67	Boring	16.2	12.2	76.2	Livestock		Water Supply
10316091	4901245	8/18/1966	595164	4846070	271.4	margin of error : 100 m - 300 m			167	Cable Tool	39.0	36.9	17.8	Livestock	Domestic	Water Supply
10316092	4901246	3/2/1966	595037	4846374	271.0	margin of error : 100 m - 300 m			38	Cable Tool	17.1	14.6	10.2	Domestic		Water Supply
10316192	4901346	12/7/1962	595742	4845878	273.1	margin of error : 100 m - 300 m			446	Cable Tool	54.9	52.4	15.2	Livestock	Domestic	Water Supply
10316193	4901347	3/27/1965	595576	4845952	275.0	margin of error : 100 m - 300 m			269	Cable Tool	54.9	51.2	17.8	Domestic		Water Supply
10316197	4901351	8/22/1967	594960	4846780	262.3	margin of error : 100 m - 300 m			280	Boring	12.2	8.5	76.2	Livestock	Domestic	Water Supply
10318900	4904112	7/16/1973	595598	4845747	272.7	margin of error : 30 m - 100 m			436	Rotary (Convent.)	53.6	50.6	12.7	Domestic		Water Supply
10319150	4904365	6/14/1974	595489	4846085	275.7	margin of error : 30 m - 100 m			119	Rotary (Convent.)	27.4	24.4	12.7	Domestic		Water Supply
10319783	4905018	4/12/1976	594744	4846796	264.3	margin of error : 30 m - 100 m			461	Boring	9.8	9.1	76.2	Domestic		Water Supply
10320558	4905884	5/27/1981	594915	4846623	270.2	margin of error : 100 m - 300 m			220	Boring	20.7	15.2	76.2	Domestic		Water Supply
10322020	4907461	8/8/1990	594855	4846597	270.0	margin of error : 3 - 10 m			252	Rotary (Convent.)	52.4	50.9	12.7	Domestic		Water Supply
11099354	4909361	2/18/2004	595244	4847171	269.2	UTM very unreliable			294	Cable Tool	17.4	17.4	20.3	Domestic		Water Supply
1003636975	7175428	12/22/2011	595275	4846187	272.8	margin of error : 30 m - 100 m	50 SOUTH OF 12506 HEART LAKE ROAD	Brampton	5	Rotary (Convent.)	7.6	4.6	5.1	Monitoring and Test Hole		Observation Wells
1004663358	7212524	11/28/2013	594826	4846613	268.9	margin of error : 30 m - 100 m	HEART LAKE RD.	Caledon	284	Rotary (Convent.)	27.4		5.1	Monitoring		Observation Wells
1004663367	7212527	11/13/2013	594738	4846669	265.6	margin of error : 30 m - 100 m	HEART LAKE RD.	Caledon	388	Boring	20.4		3.2	Monitoring		Observation Wells
1005123356	7227271	8/28/2014	594916	4846722	267.7	margin of error : 30 m - 100 m	12679 HEART LAKE RD.	CALEDON	280			12.2	10.0			Abandoned-Other
1005123359	7227272	8/28/2014	594940	4846730	267.5	margin of error : 30 m - 100 m	12679 HEART LAKE RD.	CALEDON	266			4.6	90.0			Abandoned-Other
11766997	7044576	5/15/2007	595757	4845889	271.4	margin of error : 10 - 30 m	HEART LAKE RD AT MAYFIELD RD	CALEDON	451	Boring	6.1		5.0	Not Used		Observation Wells
1005635266	7246998	7/15/2015	595955	4846732	265.8	margin of error : 30 m - 100 m	130 SANDALWOOD PKWY WEST	Brampton	215	Direct Push				Monitoring and Test Hole		Abandoned Monitoring and Test Hole
1005846795	7255007	11/26/2015	595532	4845655	273.9	margin of error : 30 m - 100 m	12304 HEART LAKE RD.	CALEDON	489			7.9				Abandoned-Other
1005862979	7255653	12/8/2015	594911	4846421	271.2	margin of error : 30 m - 100 m			129	Rotary (Convent.)	53.6			Domestic		Water Supply
1006122730	7266225	4/13/2016	595968	4846774	266.1	margin of error : 100 m - 300 m	DIXIE RD. W. + MAYFIELD RD.	BRAMPTON	242	Rotary (Convent.)	7.6			Monitoring and Test Hole		Monitoring and Test Hole
1007357211	7326239	12/6/2018	596032	4846900	265.9	margin of error : 30 m - 100 m	DIXIE ROAD	CALEDON	364							
1007357214	7326240	12/6/2018	595915	4846755	267.2	margin of error : 30 m - 100 m	DIXIE ROAD	CALEDON	186							
1007357217	7326241	12/6/2018	595968	4846774	266.1	margin of error : 30 m - 100 m	DIXIE ROAD	CALEDON	242							
1007357220	7326242	12/6/2018	595975	4846472	266.6	margin of error : 30 m - 100 m	DIXIE ROAD	CALEDON	301							
1007357223	7326243	12/6/2018	596186	4846728	263.9	margin of error : 30 m - 100 m	DIXIE ROAD	Caledon	441							Abandoned-Other
1008372687	7363648	7/17/2020	594998	4846375	271.0	margin of error : 30 m - 100 m	12600 Heart Lake Road	Caledon	65			7.0				Abandoned-Other
1008207922	7355077		594762	4846538	270.7	margin of error : 30 m - 100 m			300							

Appendix B – Borehole Logs

Log of Borehole 1

Project No. BRM-21011099-B0 | Drawing No. 2

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

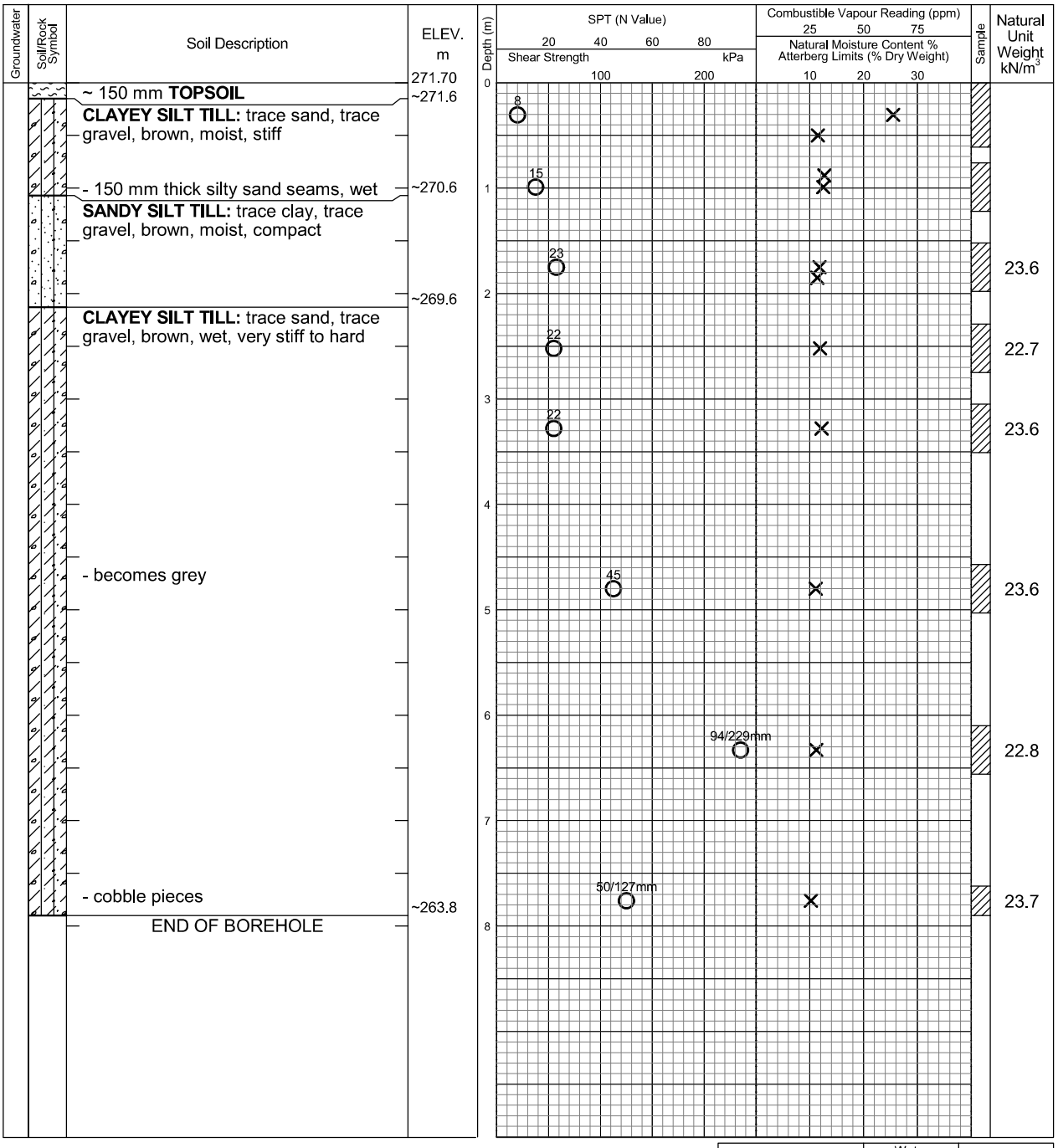
Date Drilled: June 3, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Date	Water Level (m)	Hole Open to (m)
On completion	1.22	Open

Log of Borehole 2

Project No. BRM-21011099-B0 | Drawing No. 3

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 3, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
	274.95
~ 150 mm **TOPSOIL**	~274.8
CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, firm	~274.3
SANDY SILT TILL: trace clay, trace gravel, brown, moist, compact	~272.8
CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, stiff to hard - cobble pieces - becomes grey - becomes wet	~266.9
END OF BOREHOLE	

SPT (N Value): 7, 18, 23, 53, 19, 13, 15, 22

Shear Strength (kPa)

Natural Moisture Content % / Atterberg Limits (% Dry Weight)

Combustible Vapour Reading (ppm)

Depth (m)	Natural Unit Weight kN/m³
1	22.3
2	22.3
3	22.6
4	22.6
5	23.9
6	23.5

Date	Water Level (m)	Hole Open to (m)
On completion	7.32	Well
June 25, 2021	1.39	Well

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 3

Project No. BRM-21011099-B0 | Drawing No. 4

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 3, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL**	271.75	0	4		
SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to compact	~271.5	1	10		20.9
		2	25		21.9
			27		22.7
	~268.9	3			22.6
CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, very stiff - becomes wet - 150 mm thick silty sand seam			24		
		4			
- becomes grey		5	15		23.1
		6	19		23.5
		7			
	~263.7	8	22		
END OF BOREHOLE					

Date	Water Level (m)	Hole Open to (m)
On completion	6.10	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 4

Project No. BRM-21011099-B0 | Drawing No. 5

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 3, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL**	267.24	0		
SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to compact	~267.0	0	6	
		1	16	22.1
		2	23	22.5
		2	21	
	~264.3	3	23	
SILTY SAND: trace clay, brown, wet, compact				
	~263.2	4		
CLAYEY SILT TILL: trace sand, trace gravel, grey, moist, stiff to very stiff		5	13	23.6
- cobble pieces		6	19	23.7
		7		
	~259.2	8	18	23.4
END OF BOREHOLE				

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30
Sample

Date	Water Level (m)	Hole Open to (m)
On completion	Dry	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 5

Project No. BRM-21011099-B0

Drawing No. 6

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 3, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m
~ 400 mm **TOPSOIL**	272.20
	~271.8
SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to very dense	
- 100 mm thick silty sand seam	
- becomes wet	
- becomes grey	
	~266.6
CLAYEY SILT TILL: trace sand, trace gravel, grey, wet, very stiff to hard	
	~264.1
END OF BOREHOLE	

SPT (N Value) 20 40 60 80

Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m) 0 1 2 3 4 5 6 7 8

SPT N values: 9, 11, 19, 19, 50, 26, 29, 35

Natural Unit Weight kN/m³: 20.8, 21.9, 23.5, 24.0, 22.6

Date	Water Level (m)	Hole Open to (m)
On completion	1.52	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 6

Project No. BRM-21011099-B0

Drawing No. 7

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 1, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test (S)

Combustible Vapour Reading

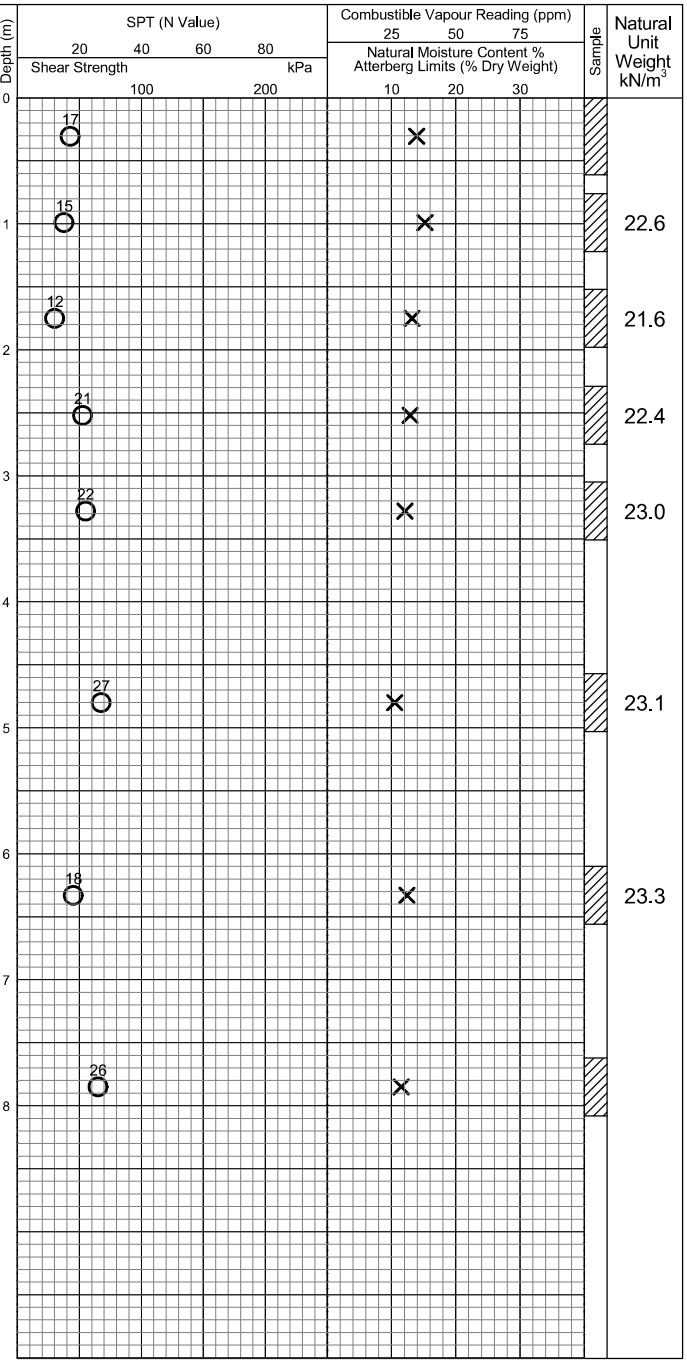
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m
SANDY SILT TILL: trace clay, trace gravel, brown, moist, compact to dense	273.82
- cobble pieces	
	~268.2
CLAYEY SILT TILL: trace sand, trace gravel, grey, moist, very stiff	
	~265.7
END OF BOREHOLE	



Date	Water Level (m)	Hole Open to (m)
On completion	Dry	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 7

Project No. BRM-21011099-B0

Drawing No. 8

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 2, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

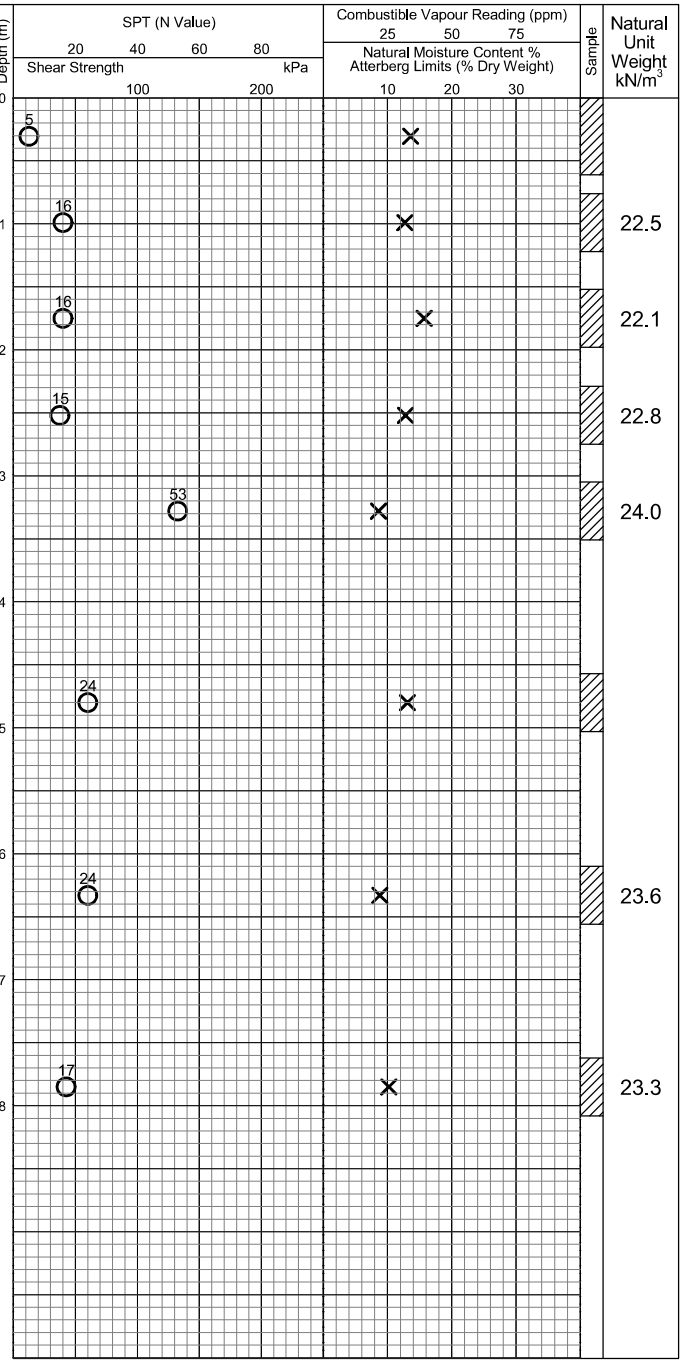
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~ 250 mm **TOPSOIL**	269.64
		SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to very dense	~269.4
		SILTY CLAY TILL: trace sand, trace gravel, grey, wet, very stiff	~265.6
		SANDY SILT TILL: trace clay, trace gravel, grey, wet, compact	~264.0
		CLAYEY SILT TILL: trace clay, trace gravel, grey, moist, very stiff	~262.6
		END OF BOREHOLE	~261.6



Date	Water Level (m)	Hole Open to (m)
On completion	Dry	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 8

Project No. BRM-21011099-B0

Drawing No. 9

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 2, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

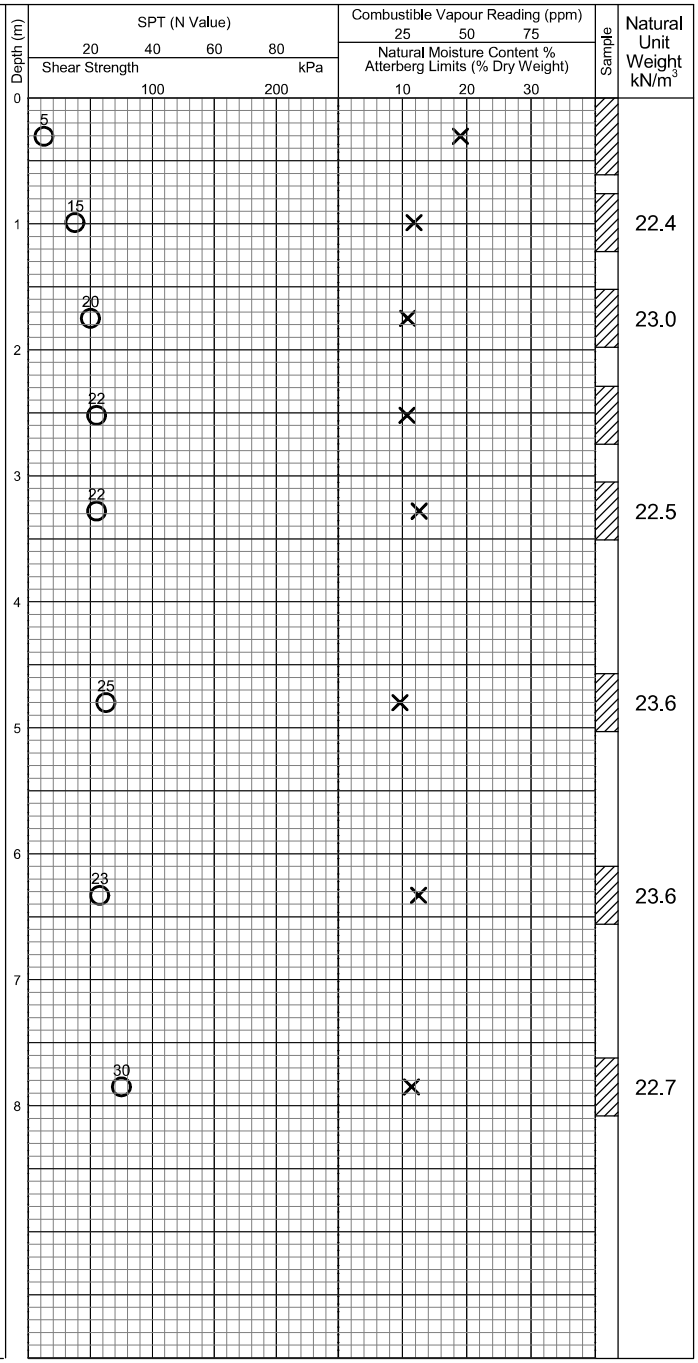
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~ 250 mm **TOPSOIL**	269.47
		CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, firm	~269.2
		SANDY SILT TILL: trace clay, trace gravel, brown, moist, compact	~268.8
		CLAYEY SILT TILL: trace sand, trace gravel, grey, wet, very stiff	~265.5
		END OF BOREHOLE	~261.4



Date	Water Level (m)	Hole Open to (m)
On completion	3.05	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 9

Project No. BRM-21011099-B0

Drawing No. 10

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 1, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)
~ 250 mm **TOPSOIL**	273.67	0
	~273.4	
SANDY SILT TILL: trace clay, trace gravel, brown, moist, compact		1
		2
	~270.4	3
CLAYEY SILT TILL: trace sand, trace gravel, grey, moist, very stiff		4
- becomes wet		5
	~266.7	6
SILTY SAND TILL: trace clay, trace gravel, grey, wet, dense		7
	~265.6	8
END OF BOREHOLE		

SPT (N Value): 6, 14, 22, 22, 17, 28, 23, 41

Shear Strength kPa: 20 40 60 80 / 100 200

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Natural Unit Weight kN/m³: 22.6, 22.4, 22.0, 22.3, 23.5, 21.1

Date	Water Level (m)	Hole Open to (m)
On completion	4.88	Well
June 25, 2021	1.12	Well

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 10

Project No. BRM-21011099-B0

Drawing No. 11

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 1, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m
~ 250 mm **TOPSOIL**	275.50
SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to compact	~275.3
- cobble pieces	
	~271.5
CLAYEY SILT TILL: trace sand, trace gravel, grey, moist, stiff to very stiff	
	~267.4
END OF BOREHOLE	

SPT (N Value) 20 40 60 80

Shear Strength kPa 100 200

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m)	SPT (N)	Sample	Natural Unit Weight kN/m³
0	7		
1	22		
2	23		22.7
	21		22.8
3	29		22.9
4			
5	13		23.3
6	14		23.5
7			
8	26		24.0

Date	Water Level (m)	Hole Open to (m)
On completion	3.66	7.01

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 11

Project No. BRM-21011099-B0 | Drawing No. 12

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 1, 2021

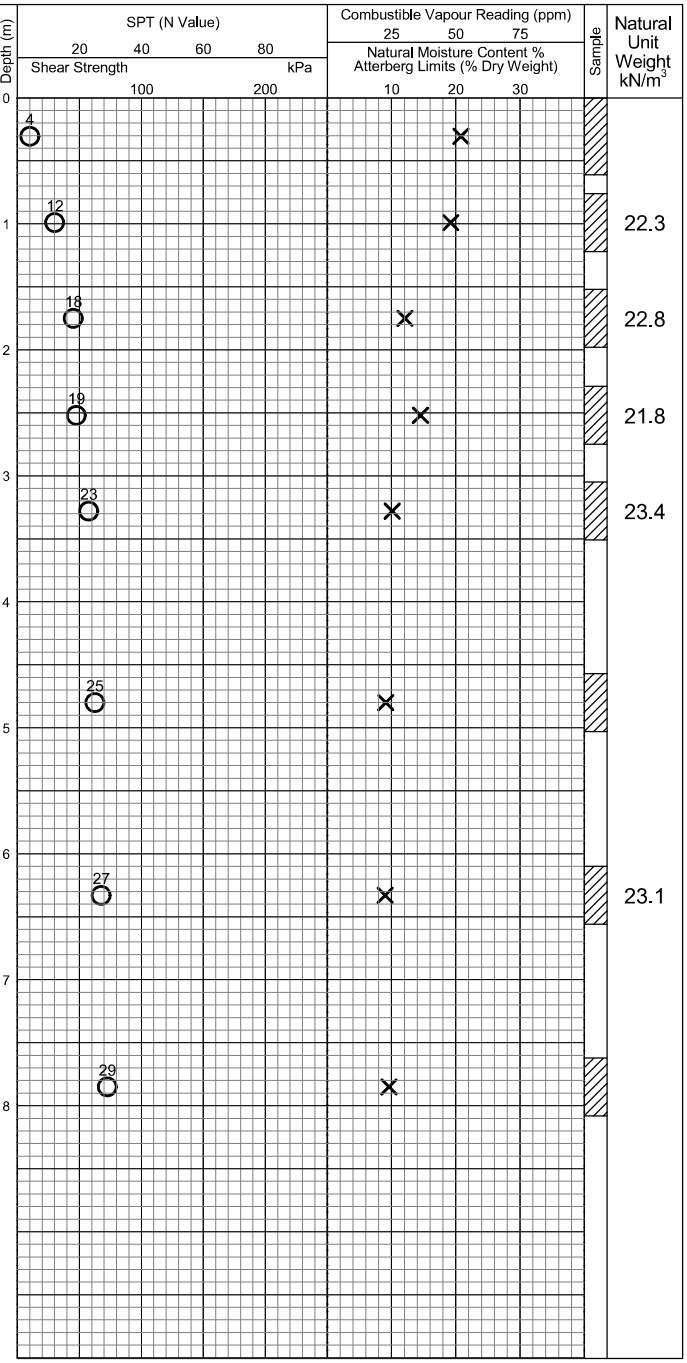
Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~ 250 mm **TOPSOIL**	269.98	
SANDY SILT TILL: trace clay, trace gravel, brown, moist, loose to compact	~269.7	
		22.3
		22.8
		21.8
	~267.1	
SILTY SAND TILL: trace clay, trace gravel, brown, moist, compact		23.4
- becomes wet		
	~264.4	
CLAYEY SILT TILL: trace sand, trace gravel, grey, wet, very stiff		23.1
	~261.9	
END OF BOREHOLE		



Date	Water Level (m)	Hole Open to (m)
On completion	5.79	6.71

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 12

Project No. BRM-21011099-B0

Drawing No. 13

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 2, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m
~ 250 mm **TOPSOIL**	268.52
SANDY SILT TILL: trace clay, trace gravel, brown, moist, losoe to very dense	~268.3
- cobble pieces	
- becomes wet	
CLAYEY SILT TILL: trace sand, trace gravel, grey, wet, very stiff to hard	~264.5
END OF BOREHOLE	~260.4

SPT (N Value): 7, 12, 24, 33, 51, 31, 22, 28

Shear Strength (kPa)

Natural Moisture Content % / Atterberg Limits (% Dry Weight)

Natural Unit Weight kN/m³: 22.9, 22.8, 23.9, 22.5, 22.6

Date	Water Level (m)	Hole Open to (m)
On completion	6.10	Well
June 25, 2021	0.73	Well

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/5/21

Log of Borehole 13

Project No. BRM-21011099-B0

Drawing No. 14

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: 12505 Heartlake Road, Caledon ON

12505 Heartlake Rd, Caledon

Date Drilled: June 4, 2021

Drill Type: Solid Auger Bomb

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test (S)

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		~ 125 mm **CONCRETE SLAB** over ~ 50 mm **GRANULAR BASE** over		0	7			
		FILL: clayey silt, trace sand, trace gravel, red brick fragments, brown to dark brown, moist, no staining, no odour		1	10			
		CLAYEY SILT TILL: fine sand seams, trace gravel, brown, oxidized partings, moist, very stiff, no staining, no odour		2	23			
		END OF BOREHOLE						

Date	Water Level (m)	Hole Open to (m)
On completion	Dry	Open

EXPLOGBRAMPTON 12505 HEARTLAKE.GPJ NEW.GDT 7/7/21

Log of Borehole BH101

Project No. GTR-22006080-B0 | Drawing No. 1

Project: Hydrogeological Investigation | Sheet No. 1 of 1

Location: 12505 Heart Lake Rd.
Caledon, Ontario

Date Drilled: April 4 2022

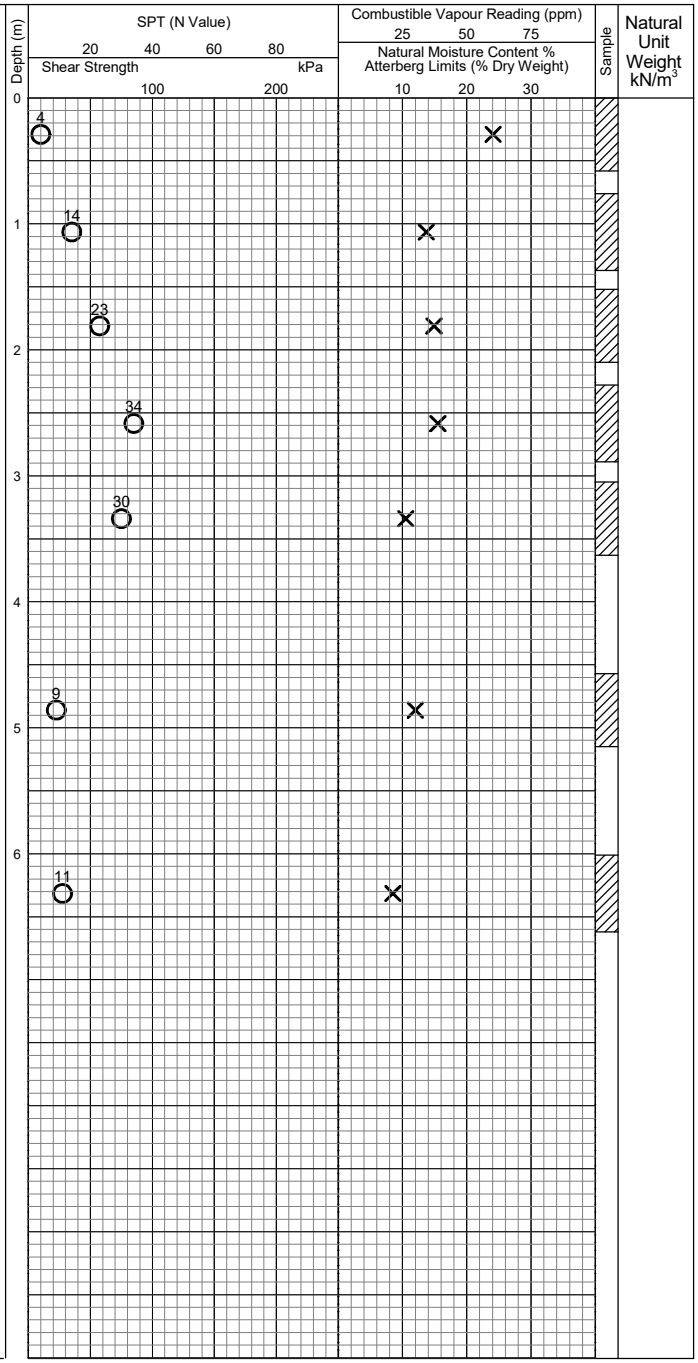
Drill Type: Hollow Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL topsoil, silty clay, some organic material, brown, trace of gravel	272.29
	~271.7
SANDY SILT TILL brown, trace of clay and gravel,	
	~270.8
CLAYEY SILT TILL brown, trace of pebbles	
	~265.6
END OF BOREHOLE at 6.7 m Monitoring well installed at 6.06 m	



Date	Water Level (m)	Hole Open to (m)
4/11/2022	DRY	Upon Completion
4/28/2022	0.99	
6/5/2022	0.66	

EXPLOGBRAMPTON 12505 HEART LAKE DRAFT_YR.GPJ NEW.GDT 5/20/22

Log of Borehole BH102

Project No. GTR-22006080-B0 | Drawing No. 2

Project: Hydrogeological Investigation | Sheet No. 1 of 1

Location: 12505 Heart Lake Rd.
Caledon, Ontario

Date Drilled: April 4 2022

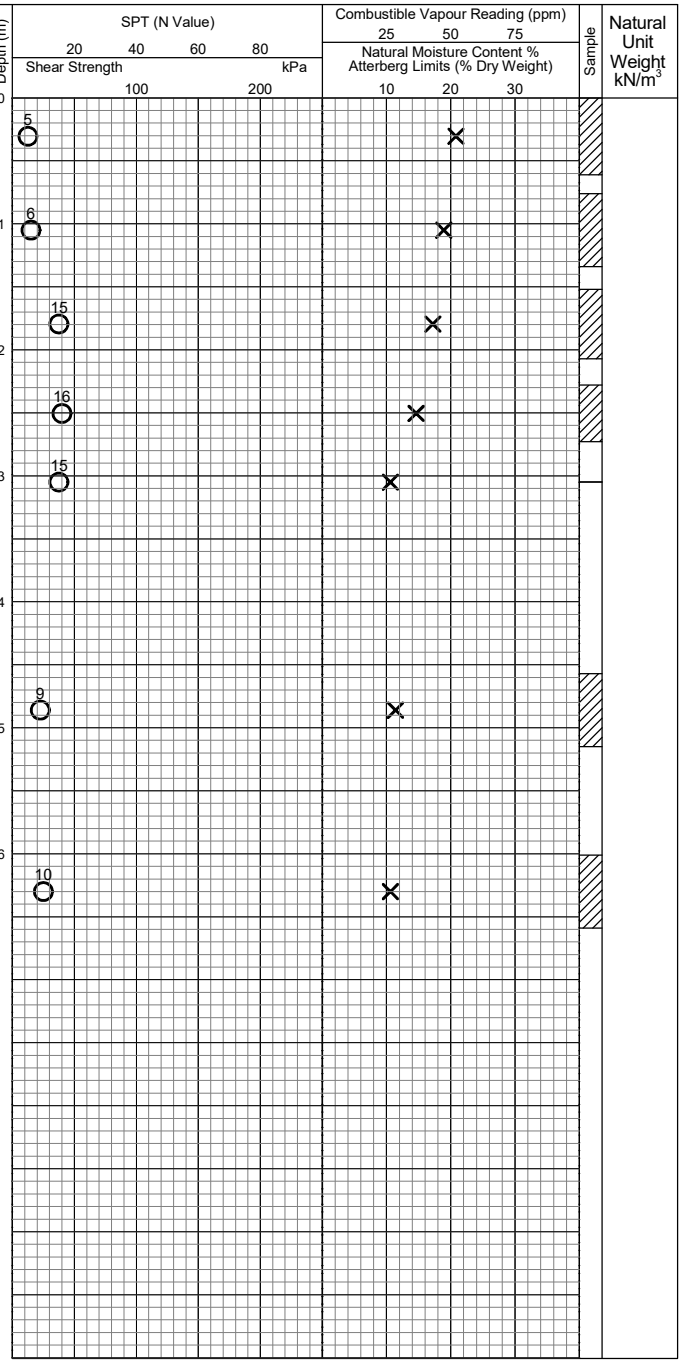
Drill Type: Hollow Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL topsoil, silty clay with some organic material	273.59
	~273.0
SILTY CLAY	
	~272.2
SANDY SILT TILL brown, some to trace of clay, trace of gravels	
	~269.0
CLAYEY SILT TILL grey, moist some sand trace of gravels	
	~266.9
END OF BOREHOLE at 6.7 m Monitoring well installed at 6.19 m	



Date	Water Level (m)	Hole Open to (m)
4/11/2022	5.6	Upon Completion
4/28/2022	1.97	
6/5/2022	1.88	

EXPLOGBRAMPTON 12505 HEART LAKE DRAFT_YR.GPJ NEW.GDT 5/20/22

Log of Borehole BH103

Project No. GTR-22006080-B0 | Drawing No. 3

Project: Hydrogeological Investigation | Sheet No. 1 of 1

Location: 12505 Heart Lake Rd.
Caledon, Ontario

Date Drilled: April 4 2022

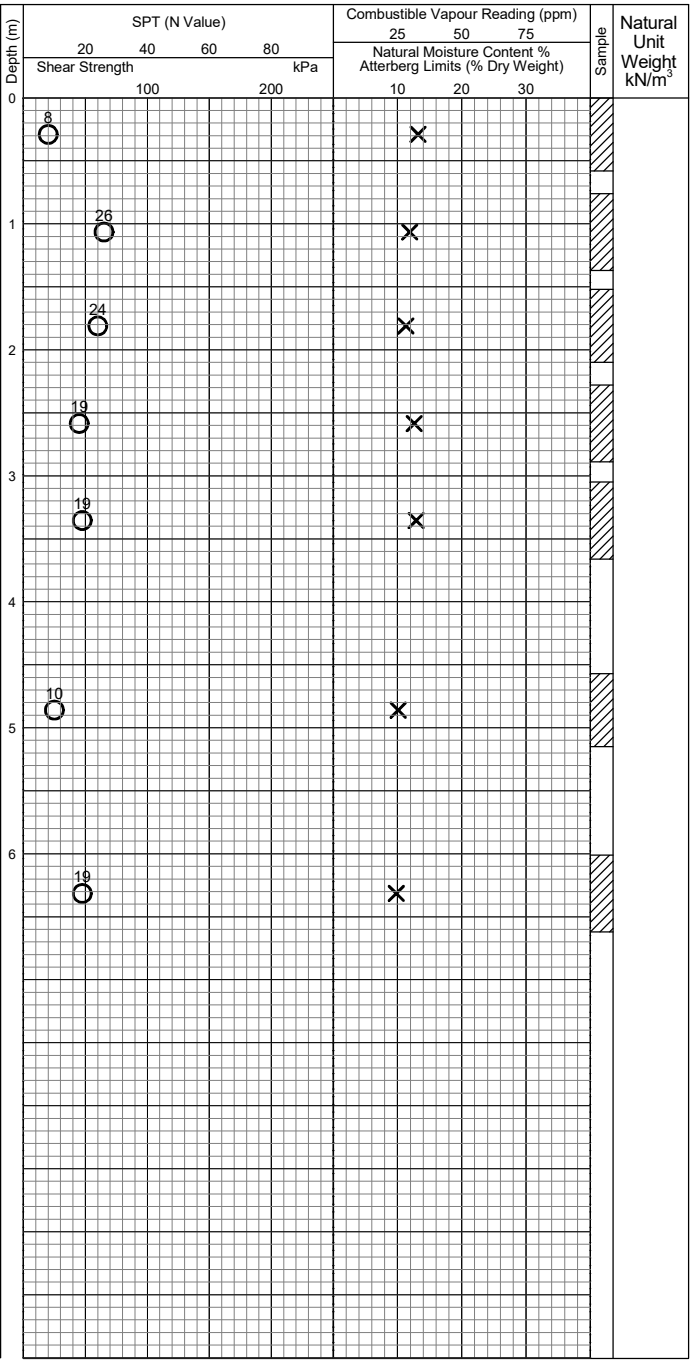
Drill Type: Hollow Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL topsoil, some organic material	272.22
	~271.6
SANDY SILT TILL brown trace of clay, gravel, and pebbles	
	~267.7
SILTY CLAY TILL grey trace of sand and gravels	
	~265.5
END OF BOREHOLE at 6.7 m Monitoring well installed at 6.24 m	



Date	Water Level (m)	Hole Open to (m)
4/11/2022	DRY	Upon Completion
4/28/2022	0.76	
6/5/2022	0.61	

EXPLOGBRAMPTON 12505 HEART LAKE DRAFT_YR.GPJ NEW.GDT 5/20/22

Log of Borehole BH104

Project No. GTR-22006080-B0 | Drawing No. 4

Project: Hydrogeological Investigation | Sheet No. 1 of 1

Location: 12505 Heart Lake Rd.
Caledon, Ontario

Date Drilled: April 4 2022

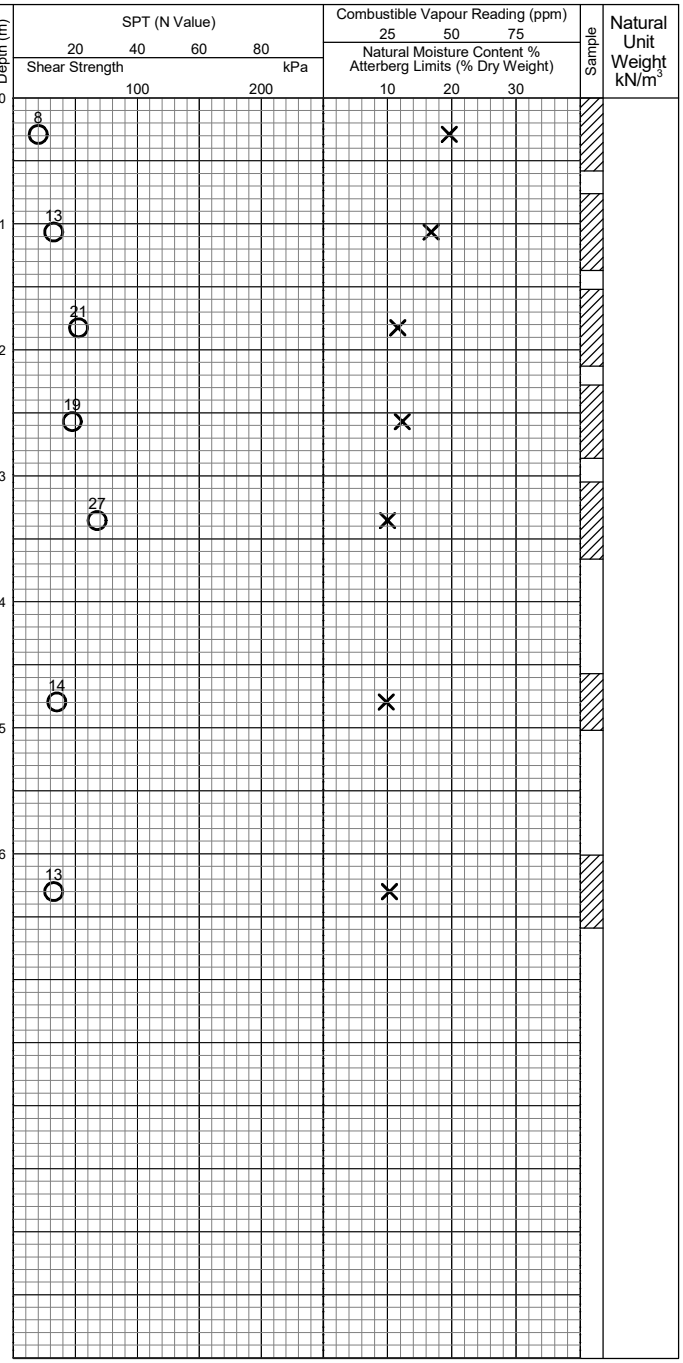
Drill Type: Hollow Stem Auger

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL topsoil, silty clay, some organic material, brown trace of gravel	266.10
	~265.5
SANDY SILT TILL brown trace of clay, gravel and pebbles	
	~261.5
CLAYEY SILT TILL grey, moist trace of gravels and pebbles	
	~259.4
END OF BOREHOLE at 6.7 m Monitoring well installed at 6.16 m.	



Date	Water Level (m)	Hole Open to (m)
4/11/2022	4.06	Upon Completion
4/28/2022	0.50	
6/5/2022	0.41	

EXPLOGBRAMPTON 12505 HEART LAKE DRAFT_YR.GPJ NEW.GDT 5/20/22

Appendix C – Groundwater and Surface Water Summary Table

Appendix C: Groundwater and Surface Water Elevations Summary

12505 Heart Lake Rd, Caledon

GTR-22006080-B0

Monitoring Well ID	Investigation/Year	Ground Surface Elevation (masl)	Stick Up (m)	Approximate Full Well Depth (mbTOP)	Approximate Full Well Depth (mbgs)	Minimum GW Elevation (masl)	Maximum GW Elevation (masl)	Depth	28-Apr-22	6-May-22
Monitoring Wells										
BH 2 *	**Geotechnical / 2021**	274.95	1.00	8.68	7.68	267.27	274.38	mbTOP	1.57	1.60
								mbgs	0.57	0.60
								masl	274.38	274.35
BH 9 *	**Geotechnical / 2021**	273.67	0.90	7.94	7.04	266.63	273.49	mbTOP	1.16	1.08
								mbgs	0.26	0.18
								masl	273.41	273.49
BH 12 *	**Geotechnical / 2021**	268.52	0.89	7.09	6.20	262.32	268.12	mbTOP	1.45	1.29
								mbgs	0.56	0.40
								masl	267.96	268.12
BH 101	**Hydrogeological / 2022**	272.29	0.75	6.81	6.06	266.23	271.63	mbTOP	1.74	1.41
								mbgs	0.99	0.66
								masl	271.30	271.63
BH 102	**Hydrogeological / 2022**	273.59	1.05	7.24	6.19	267.40	271.71	mbTOP	3.02	2.93
								mbgs	1.97	1.88
								masl	271.62	271.71
BH 103	**Hydrogeological / 2022**	272.22	1.06	7.30	6.24	265.98	271.61	mbTOP	1.82	1.67
								mbgs	0.76	0.61
								masl	271.46	271.61
BH 104	**Hydrogeological / 2022**	266.10	1.18	7.34	6.16	259.94	265.69	mbTOP	1.68	1.59
								mbgs	0.50	0.41
								masl	265.60	265.69
Mini-Piezometers and Staff-Gauges										
MP 1	**Hydrogeological / 2022**	262.07	0.66	1.82	1.16	261.63	261.69	mbTOP	1.10	1.04
								mbgs	0.44	0.38
								masl	261.63	261.69
SG 1	**Hydrogeological / 2022**	261.48	-	-	-	261.35	261.35	-	-	-
								mags	0.13	-
								masl	261.35	-
MP 2	**Hydrogeological / 2022**	261.86	0.80	1.81	1.01	261.70	261.76	mbTOP	0.96	0.90
								mbgs	0.16	0.10
								masl	261.70	261.76

Notes:

* Survey data are based on the geotechnical borehole logs (EXP, 2021)

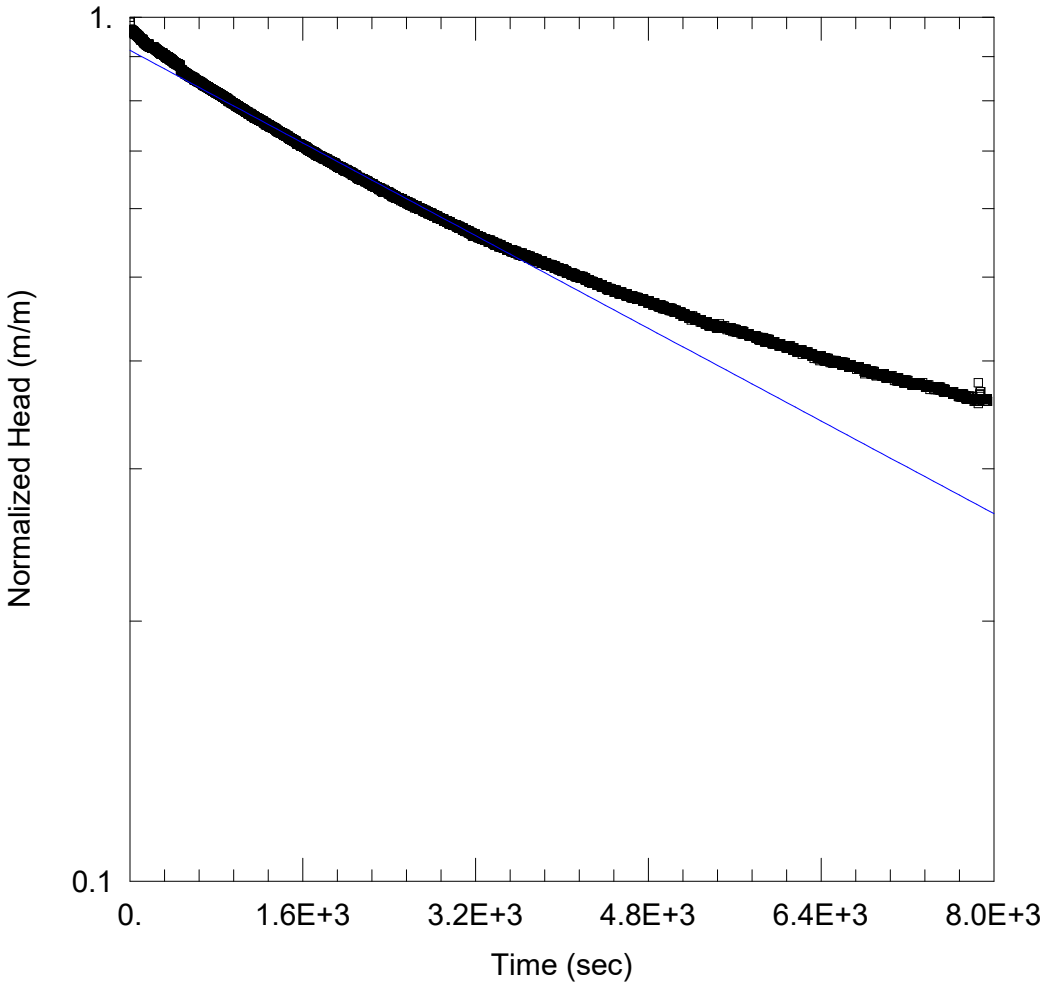
mbTOP - meters below top of the pipe

mbgs - meters below ground surface

mags - meters above ground surface

masl - meters above mean sea level

Appendix D – Laboratory's Certificates of Analysis



BH 2 FALLING HEAD

Data Set: C:\...\BH 2.aqt
Date: 05/08/22 Time: 09:37:31

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 2 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

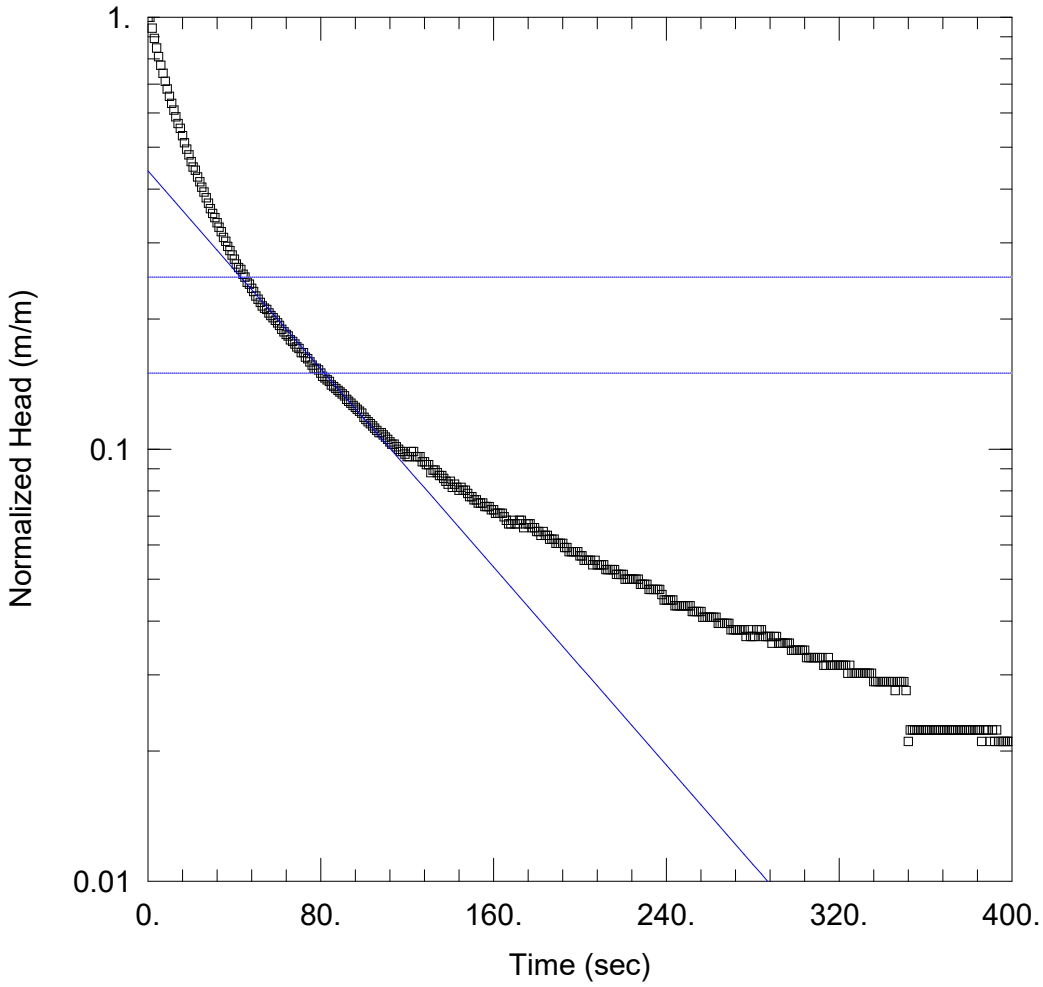
Saturated Thickness: 7.08 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 2 Falling Head)

Initial Displacement: 0.437 m
Total Well Penetration Depth: 7.08 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.08 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 7.247E-8 m/sec
y0 = 0.4 m



BH 9 FALLING HEAD

Data Set: \...\BH 9.aqt
Date: 05/12/22 Time: 15:17:42

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 9 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

Saturated Thickness: 6.86 m Anisotropy Ratio (Kz/Kr): 1.

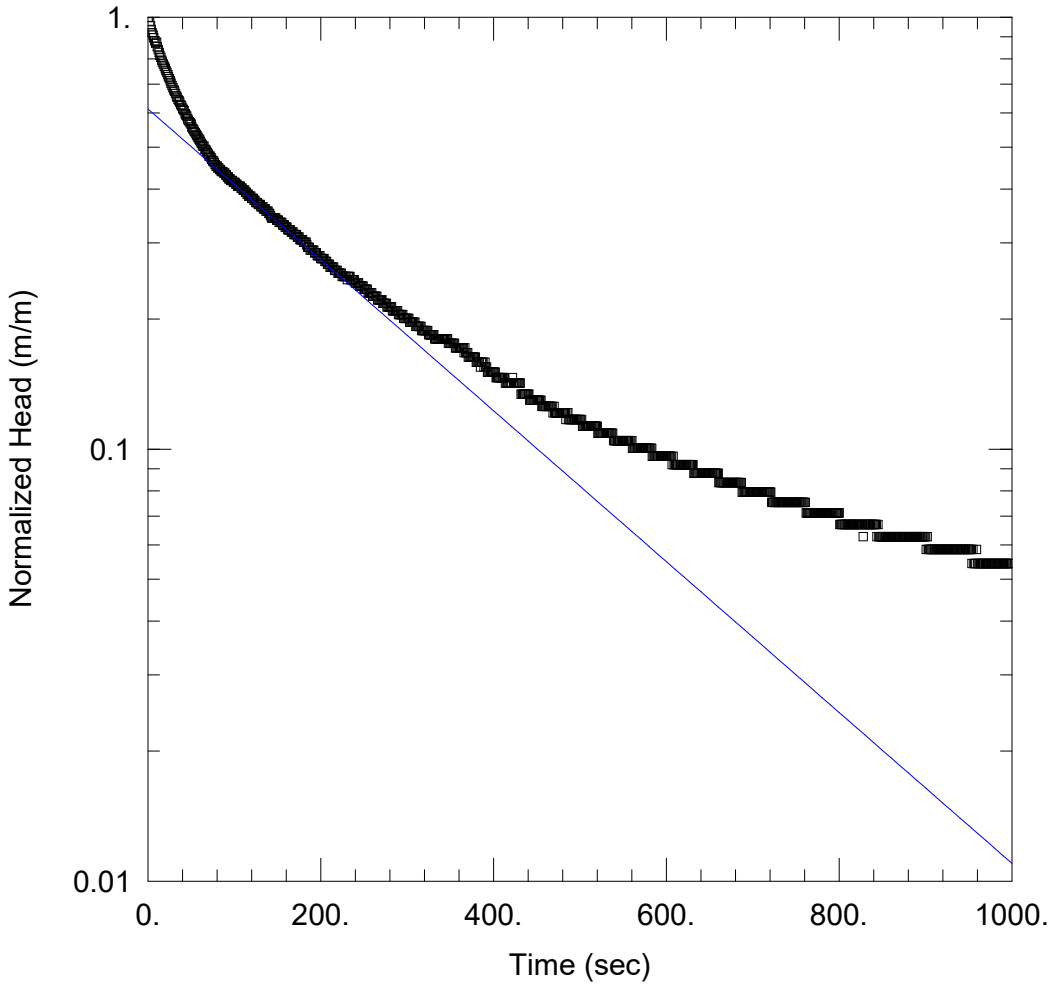
WELL DATA (BH 9 Falling Head)

Initial Displacement: 0.76 m
Total Well Penetration Depth: 6.86 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.86 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 5.213E-6 m/sec y0 = 0.3348 m



BH 12 FALLING HEAD

Data Set: \...\BH 12.aqt
Date: 05/12/22 Time: 15:20:56

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 12 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

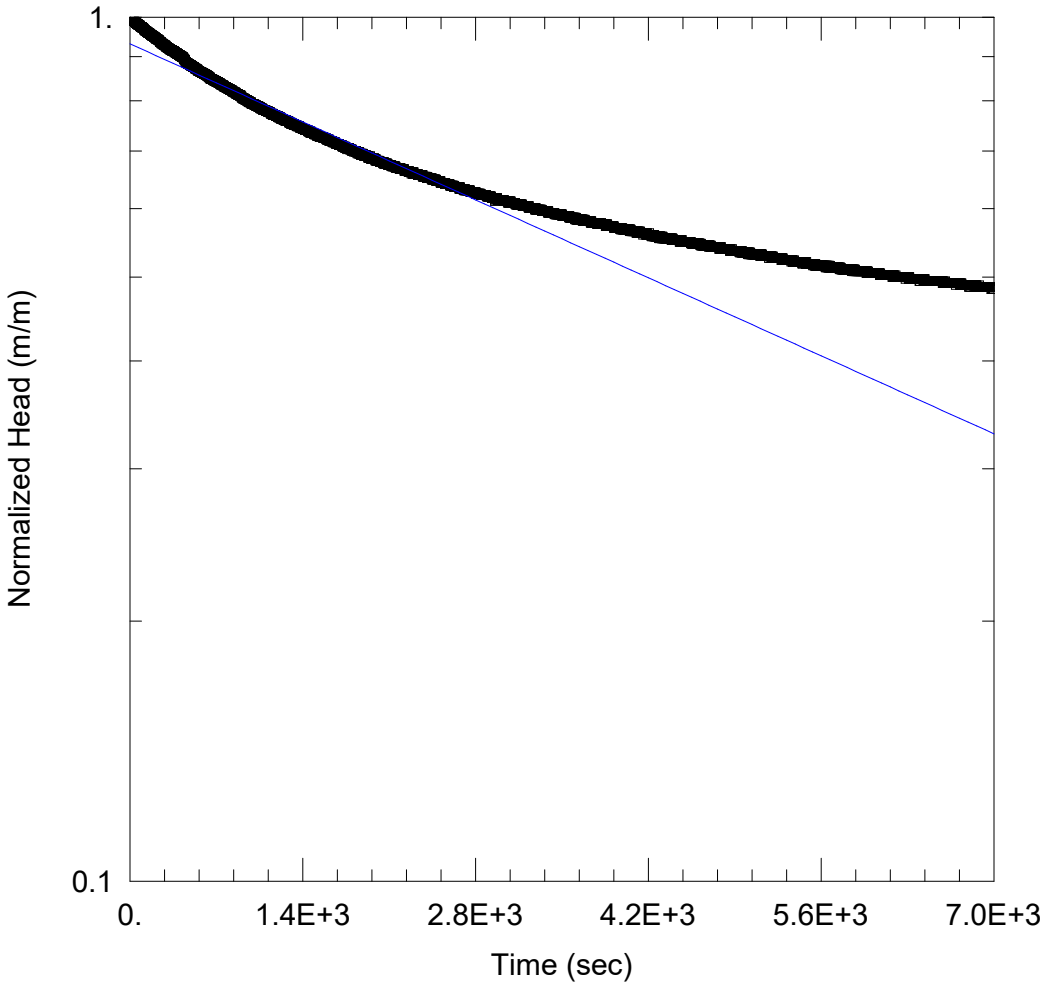
Saturated Thickness: 5.796 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 12 Falling Head)

Initial Displacement: 0.717 m
Total Well Penetration Depth: 5.796 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.796 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.588E-6 m/sec
y0 = 0.4394 m



BH 101 FALLING HEAD

Data Set: \...\BH 101.aqt
Date: 05/12/22 Time: 15:27:16

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 101 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

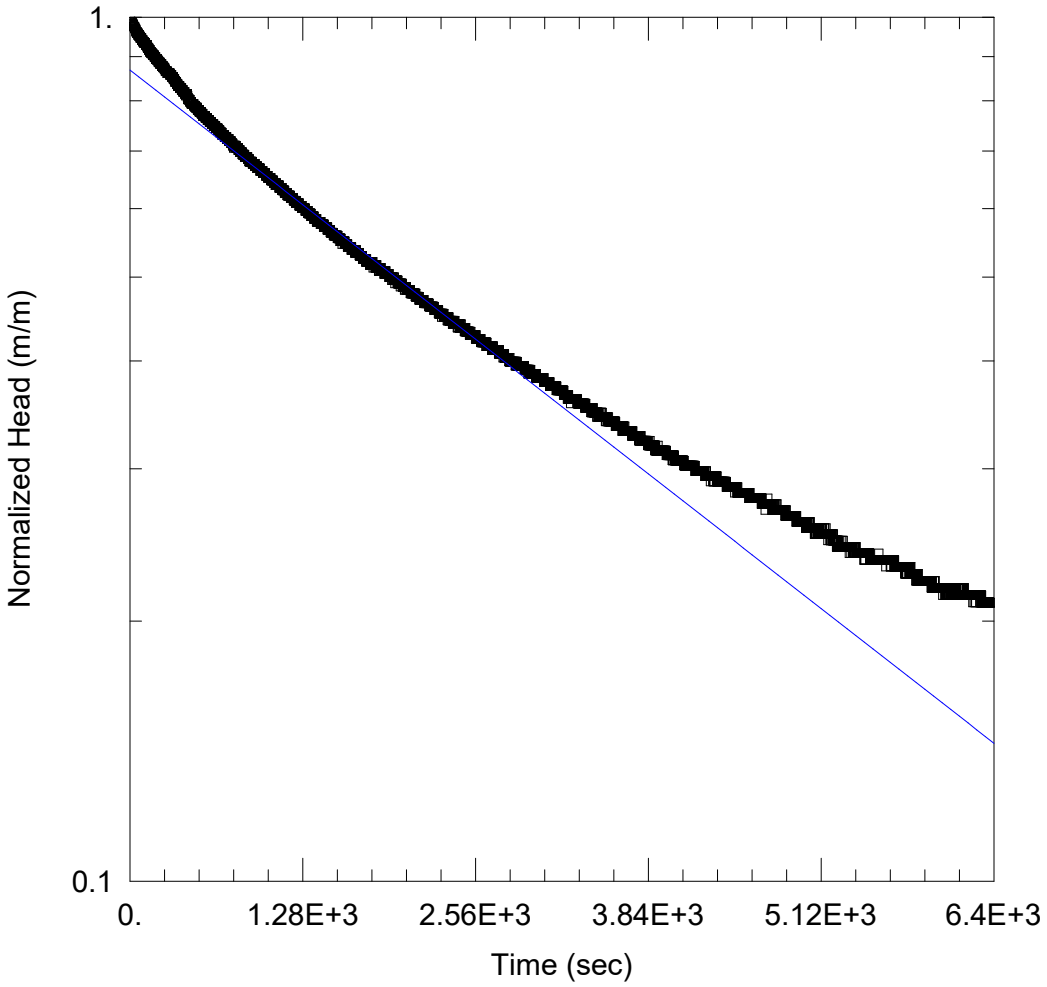
Saturated Thickness: 5.396 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 101 Falling Head)

Initial Displacement: 1.152 m
Total Well Penetration Depth: 5.396 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.396 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 6.97E-8 m/sec
y0 = 1.073 m



BH 102 FALLING HEAD

Data Set: \...\BH 102.aqt
Date: 05/12/22 Time: 15:28:26

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 102 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

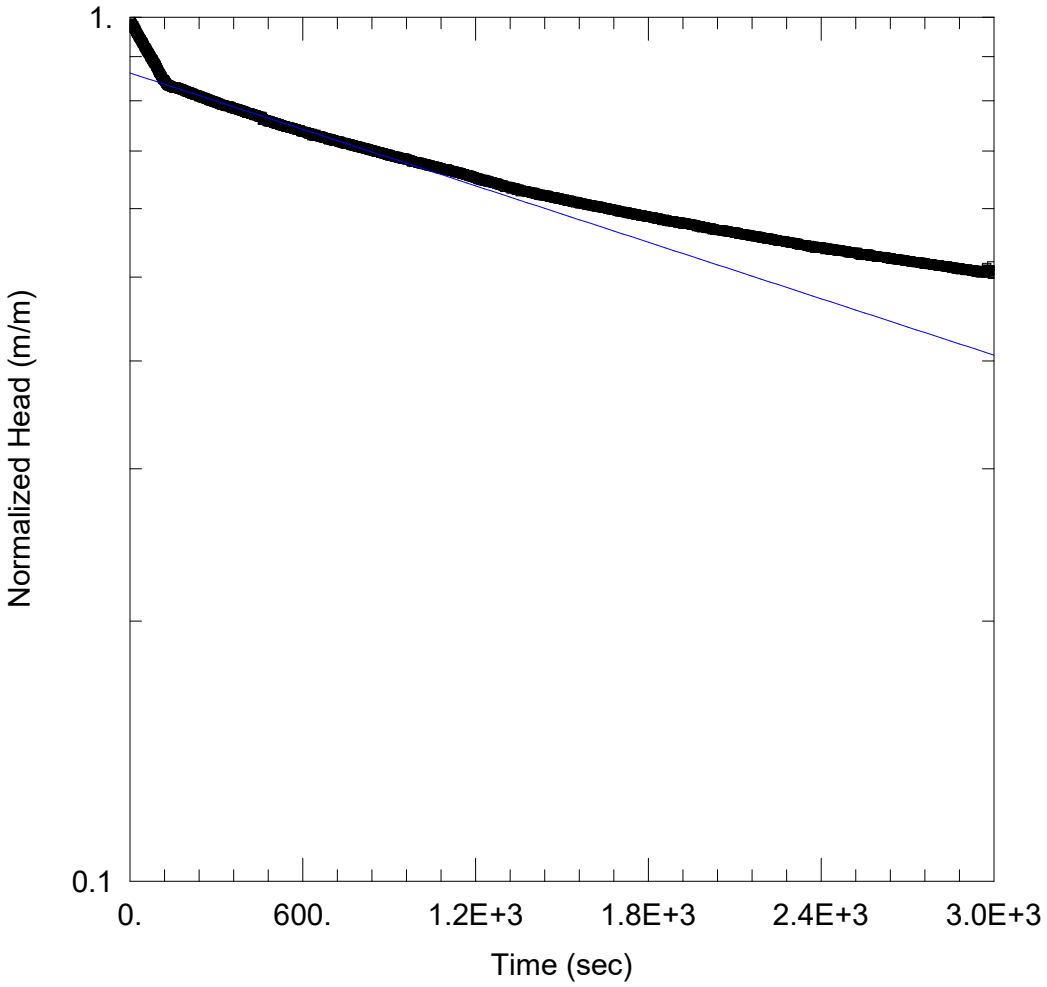
Saturated Thickness: 4.31 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 102 Falling Head)

Initial Displacement: 0.714 m
Total Well Penetration Depth: 4.31 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.31 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.316E-7 m/sec
y0 = 0.6201 m



BH 103 FALLING HEAD

Data Set: \...\BH 103.aqt
Date: 05/12/22 Time: 15:29:47

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 103 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

Saturated Thickness: 5.29 m Anisotropy Ratio (Kz/Kr): 1.

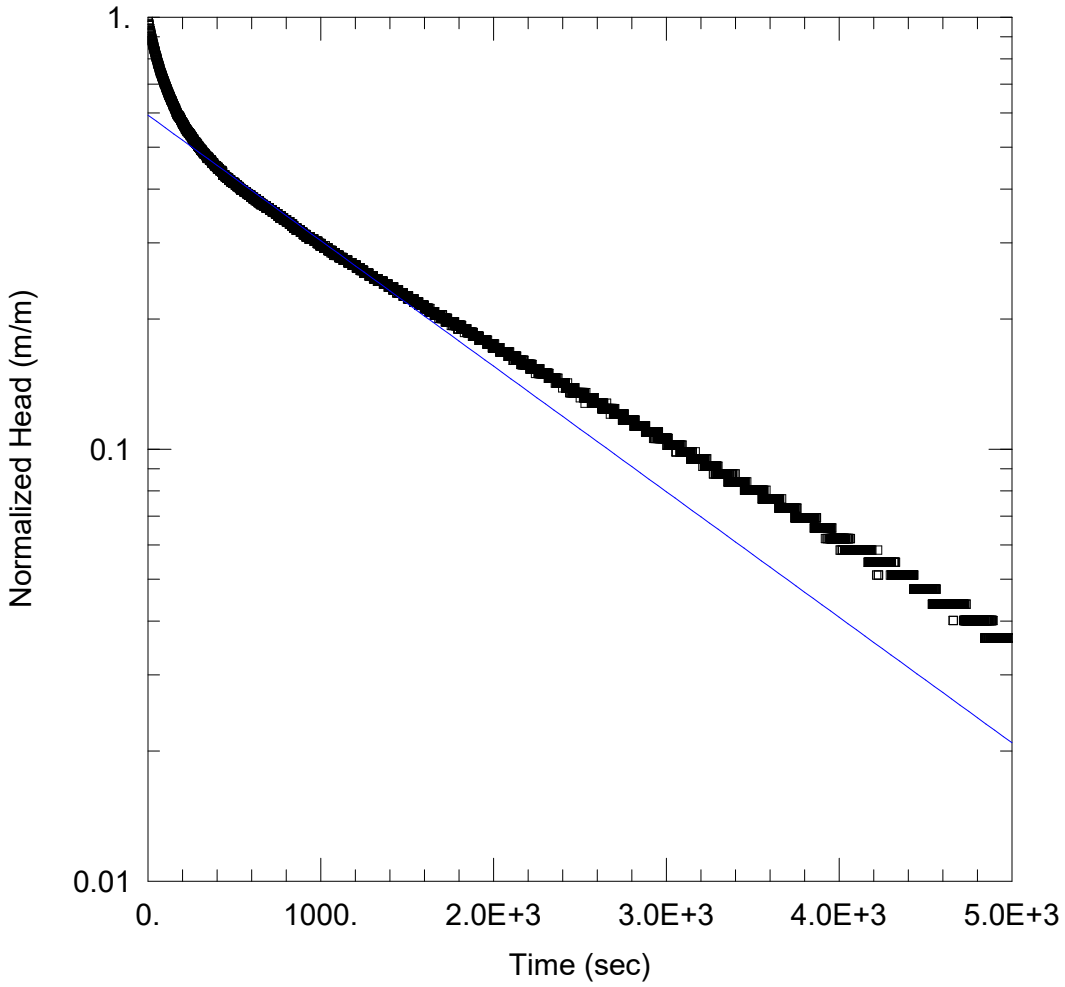
WELL DATA (BH 103 Falling Head)

Initial Displacement: 0.994 m
Total Well Penetration Depth: 5.29 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.29 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.177E-7 m/sec y0 = 0.8566 m



BH 104 FALLING HEAD

Data Set: \...\BH 104.aqt
Date: 05/12/22 Time: 15:31:37

PROJECT INFORMATION

Company: EXP Services Inc
Client: Berkshire Axis Development
Project: GTR-22006080-B0
Location: 12505 Heart Lake Road, Caledon
Test Well: BH 104 Falling Head
Test Date: 6 May, 2022

AQUIFER DATA

Saturated Thickness: 5.75 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 104 Falling Head)

Initial Displacement: 0.822 m
Total Well Penetration Depth: 5.75 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.75 m
Screen Length: 3. m
Well Radius: 0.0762 m

SOLUTION

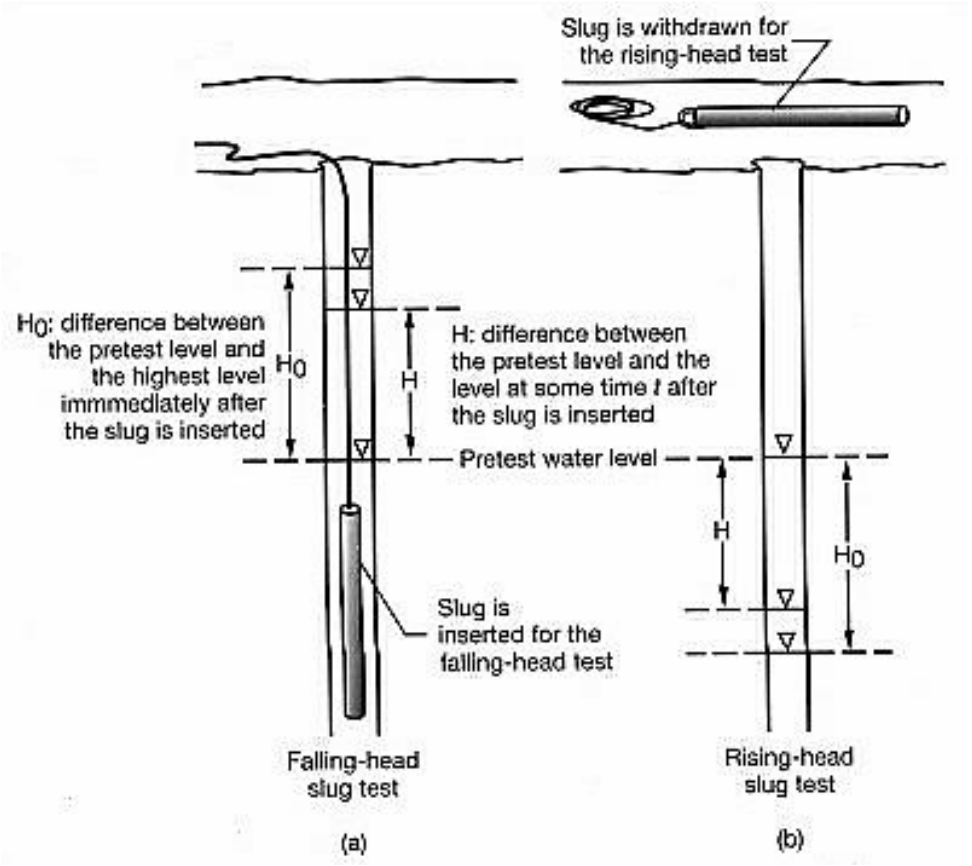
Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.142E-7 m/sec
y0 = 0.4875 m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.



Initials ___

Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.

   (Static Water Level – Dynamic Water Level).95 + Static Water Level = 95% Recovery Value
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.

Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
    a. Affix the rope to the bailer.
    b. Remove the waterra tubing and place in garbage bag
    c. Record static water level measurement again.
    d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
    e. Quickly lower the bailer into the well and remove.
    f. Continue this process until the water level will reduce no further.
    g. Record the dynamic water level.
3. If using **waterra** to bail the water:
    a. Pump the water into graduated bucket until the water level will reduce no further.
    b. Record how much water has been removed.
    c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix E – Construction Dewatering Estimations (Short-Term)

Your P.O. #: ENV-BRM
Your Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your C.O.C. #: 877551-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
CANADA L6T 4V1

Report Date: 2022/05/16
Report #: R7126564
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2C2964
Received: 2022/05/06, 18:31

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
ABN Compounds in Water by GC/MS	1	2022/05/09	2022/05/09	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	1	2022/05/09	2022/05/14	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2022/05/09	2022/05/09	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2022/05/07	2022/05/09	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2022/05/09	2022/05/09	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	1	N/A	2022/05/09	CAM SOP-00447	EPA 6020B m
Total Metals Analysis by ICPMS	1	N/A	2022/05/12	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2022/05/06	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2022/05/10	2022/05/12	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2022/05/10	2022/05/12	CAM SOP-00313	BV Labs Method
Animal and Vegetable Oil and Grease	1	N/A	2022/05/14	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2022/05/13	2022/05/13	CAM SOP-00326	EPA1664B m,SM5520B m
Polychlorinated Biphenyl in Water	1	2022/05/10	2022/05/11	CAM SOP-00309	EPA 8082A m
pH	1	2022/05/07	2022/05/09	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2022/05/11	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2022/05/12	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2022/05/10	2022/05/12	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2022/05/13	2022/05/13	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2022/05/11	2022/05/12	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2022/05/11	CAM SOP-00228	EPA 8260C m

Remarks:

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

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

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Your P.O. #: ENV-BRM
Your Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your C.O.C. #: 877551-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
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CERTIFICATE OF ANALYSIS

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Received: 2022/05/06, 18:31

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.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Patricia Legette, Project Manager
Email: Patricia.Legette@bureauveritas.com
Phone# (905)817-5799
==========
This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				SOE064			SOE064		
Sampling Date				2022/05/06 13:00			2022/05/06 13:00		
COC Number				877551-01-01			877551-01-01		
	UNITS	Criteria	Criteria-2	BH103	RDL	QC Batch	BH103 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Total Animal/Vegetable Oil and Grease	mg/L	-	150	ND	0.50	7981889			
Inorganics									
Total Carbonaceous BOD	mg/L	15	300	ND	2	7984457	ND	2	7984457
Fluoride (F-)	mg/L	-	10	0.10	0.10	7982601			
Total Kjeldahl Nitrogen (TKN)	mg/L	1	100	ND (1)	1.0	7986241			
pH	pH	6.0:9.0	5.5:10.0	7.77		7982607			
Phenols-4AAP	mg/L	0.008	1	ND	0.0010	7986301			
Total Suspended Solids	mg/L	15	350	ND	10	7989104			
Dissolved Sulphate (SO4)	mg/L	-	1500	110	1.0	7982779			
Total Cyanide (CN)	mg/L	0.02	2	ND	0.0050	7983422			
Petroleum Hydrocarbons									
Total Oil & Grease	mg/L	-	-	1.0	0.50	7994482			
Total Oil & Grease Mineral/Synthetic	mg/L	-	15	0.80	0.50	7994449			
Miscellaneous Parameters									
Nonylphenol Ethoxylate (Total)	mg/L	-	0.2	ND	0.025	7987023			
Nonylphenol (Total)	mg/L	-	0.02	ND	0.001	7987002			
Metals									
Mercury (Hg)	mg/L	0.0004	0.01	ND	0.00010	7983812			
Total Aluminum (Al)	ug/L	-	50000	150	4.9	7989562			
Total Antimony (Sb)	ug/L	-	5000	ND	0.50	7989562			
Total Arsenic (As)	ug/L	20	1000	ND	1.0	7989562			
Total Cadmium (Cd)	ug/L	8	700	ND	0.090	7989562			
Total Chromium (Cr)	ug/L	80	5000	ND	5.0	7989562			
Total Cobalt (Co)	ug/L	-	5000	ND	0.50	7989562			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				SOE064			SOE064		
Sampling Date				2022/05/06 13:00			2022/05/06 13:00		
COC Number				877551-01-01			877551-01-01		
	UNITS	Criteria	Criteria-2	BH103	RDL	QC Batch	BH103 Lab-Dup	RDL	QC Batch
Total Copper (Cu)	ug/L	50	3000	ND	0.90	7989562			
Total Lead (Pb)	ug/L	120	3000	ND	0.50	7989562			
Total Manganese (Mn)	ug/L	50	5000	**71**	2.0	7989562			
Total Molybdenum (Mo)	ug/L	-	5000	3.3	0.50	7989562			
Total Nickel (Ni)	ug/L	80	3000	1.0	1.0	7989562			
Total Phosphorus (P)	ug/L	-	10000	ND	100	7989562			
Total Selenium (Se)	ug/L	20	1000	ND	2.0	7989562			
Total Silver (Ag)	ug/L	120	5000	ND	0.090	7989562			
Total Tin (Sn)	ug/L	-	5000	ND	1.0	7989562			
Total Titanium (Ti)	ug/L	-	5000	ND	5.0	7989562			
Total Zinc (Zn)	ug/L	40	3000	ND	5.0	7989562			
Semivolatile Organics									
Bis(2-ethylhexyl)phthalate	ug/L	8.8	12	ND	2.0	7983288			
Di-N-butyl phthalate	ug/L	15	80	ND	2.0	7983288			
Volatile Organics									
Benzene	ug/L	2	10	ND	0.40	7982605			
Chloroform	ug/L	2	40	ND	0.40	7982605			
1,2-Dichlorobenzene	ug/L	5.6	50	ND	0.80	7982605			
1,4-Dichlorobenzene	ug/L	6.8	80	ND	0.80	7982605			
cis-1,2-Dichloroethylene	ug/L	5.6	4000	ND	1.0	7982605			
trans-1,3-Dichloropropene	ug/L	5.6	140	ND	0.80	7982605			
Ethylbenzene	ug/L	2	160	ND	0.40	7982605			
Methylene Chloride(Dichloromethane)	ug/L	5.2	2000	ND	4.0	7982605			
Methyl Ethyl Ketone (2-Butanone)	ug/L	-	8000	ND	20	7982605			
Styrene	ug/L	-	200	ND	0.80	7982605			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
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Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

PEEL SANITARY & STORM SEWER (53-2010)

Bureau Veritas ID				SOE064			SOE064		
Sampling Date				2022/05/06 13:00			2022/05/06 13:00		
COC Number				877551-01-01			877551-01-01		
	UNITS	Criteria	Criteria-2	BH103	RDL	QC Batch	BH103 Lab-Dup	RDL	QC Batch
1,1,2,2-Tetrachloroethane	ug/L	17	1400	ND	0.80	7982605			
Tetrachloroethylene	ug/L	4.4	1000	ND	0.40	7982605			
Toluene	ug/L	2	270	ND	0.40	7982605			
Trichloroethylene	ug/L	8	400	ND	0.40	7982605			
p+m-Xylene	ug/L	-	-	ND	0.40	7982605			
o-Xylene	ug/L	-	-	ND	0.40	7982605			
Total Xylenes	ug/L	4.4	1400	ND	0.40	7982605			
PCBs									
Total PCB	ug/L	0.4	1	ND	0.05	7986811			
Microbiological									
Escherichia coli	CFU/100mL	200	-	<10	10	7982030			
Surrogate Recovery (%)									
2,4,6-Tribromophenol	%	-	-	63		7983288			
2-Fluorobiphenyl	%	-	-	54		7983288			
2-Fluorophenol	%	-	-	28		7983288			
D14-Terphenyl	%	-	-	99		7983288			
D5-Nitrobenzene	%	-	-	53		7983288			
D5-Phenol	%	-	-	20		7983288			
Decachlorobiphenyl	%	-	-	75		7986811			
4-Bromofluorobenzene	%	-	-	100		7982605			
D4-1,2-Dichloroethane	%	-	-	102		7982605			
D8-Toluene	%	-	-	94		7982605			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID				SOE065		
Sampling Date				2022/05/06 13:00		
COC Number				877551-01-01		
	UNITS	Criteria	Criteria-2	BH103	RDL	QC Batch
Metals						
Dissolved Aluminum (Al)	ug/L	-	50000	5.1	4.9	7983451
Dissolved Antimony (Sb)	ug/L	-	5000	ND	0.50	7983451
Dissolved Arsenic (As)	ug/L	20	1000	ND	1.0	7983451
Dissolved Cadmium (Cd)	ug/L	8	700	ND	0.090	7983451
Dissolved Chromium (Cr)	ug/L	80	5000	ND	5.0	7983451
Dissolved Cobalt (Co)	ug/L	-	5000	ND	0.50	7983451
Dissolved Copper (Cu)	ug/L	50	3000	3.0	0.90	7983451
Dissolved Lead (Pb)	ug/L	120	3000	ND	0.50	7983451
Dissolved Manganese (Mn)	ug/L	50	5000	**65**	2.0	7983451
Dissolved Molybdenum (Mo)	ug/L	-	5000	3.0	0.50	7983451
Dissolved Nickel (Ni)	ug/L	80	3000	ND	1.0	7983451
Dissolved Phosphorus (P)	ug/L	-	10000	ND	100	7983451
Dissolved Selenium (Se)	ug/L	20	1000	ND	2.0	7983451
Dissolved Silver (Ag)	ug/L	120	5000	ND	0.090	7983451
Dissolved Tin (Sn)	ug/L	-	5000	ND	1.0	7983451
Dissolved Titanium (Ti)	ug/L	-	5000	ND	5.0	7983451
Dissolved Zinc (Zn)	ug/L	40	3000	ND	5.0	7983451

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: The Regional Municipality of Peel Storm Sewer Discharge.
By-Law Number 53-2010.

Criteria-2: The Regional Municipality of Peel Sanitary Sewer Discharge.
By-Law Number 53-2010.

ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

TEST SUMMARY

Bureau Veritas ID: SOE064
Sample ID: BH103
Matrix: Water

Collected: 2022/05/06
Shipped:
Received: 2022/05/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	7983288	2022/05/09	2022/05/09	Milijana Avramovic
Carbonaceous BOD	DO	7984457	2022/05/09	2022/05/14	Frank Zhang
Total Cyanide	SKAL/CN	7983422	2022/05/09	2022/05/09	Nimarta Singh
Fluoride	ISE	7982601	2022/05/07	2022/05/09	Yogesh Patel
Mercury in Water by CVAA	CV/AA	7983812	2022/05/09	2022/05/09	Jaswinder Kaur
Total Metals Analysis by ICPMS	ICP/MS	7989562	N/A	2022/05/12	Nan Raykha
E.coli, (CFU/100mL)	PL	7982030	N/A	2022/05/06	Sonja Elavinamannil
Total Nonylphenol in Liquids by HPLC	LC/FLU	7987002	2022/05/10	2022/05/12	Furneesh Kumar
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7987023	2022/05/10	2022/05/12	Furneesh Kumar
Animal and Vegetable Oil and Grease	BAL	7981889	N/A	2022/05/14	Automated Statchk
Total Oil and Grease	BAL	7994482	2022/05/13	2022/05/13	Navjot Kaur
Polychlorinated Biphenyl in Water	GC/ECD	7986811	2022/05/10	2022/05/11	Farag Mansour
pH	AT	7982607	2022/05/07	2022/05/09	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	7986301	N/A	2022/05/11	Louise Harding
Sulphate by Automated Colourimetry	KONE	7982779	N/A	2022/05/12	Chandra Nandlal
Total Kjeldahl Nitrogen in Water	SKAL	7986241	2022/05/10	2022/05/12	Massarat Jan
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7994449	2022/05/13	2022/05/13	Navjot Kaur
Total Suspended Solids	BAL	7989104	2022/05/11	2022/05/12	Shaneil Hall
Volatile Organic Compounds in Water	GC/MS	7982605	N/A	2022/05/11	Gladys Guerrero

Bureau Veritas ID: SOE064 Dup
Sample ID: BH103
Matrix: Water

Collected: 2022/05/06
Shipped:
Received: 2022/05/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	7984457	2022/05/09	2022/05/14	Frank Zhang

Bureau Veritas ID: SOE065
Sample ID: BH103
Matrix: Water

Collected: 2022/05/06
Shipped:
Received: 2022/05/06

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	7983451	N/A	2022/05/09	Nan Raykha

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

GENERAL COMMENTS

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

Package 1	6.7°C

Sample SOE064 [BH103] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

			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
7982605	4-Bromofluorobenzene	2022/05/11	102	70 - 130	102	70 - 130	99	%				
7982605	D4-1,2-Dichloroethane	2022/05/11	100	70 - 130	98	70 - 130	100	%				
7982605	D8-Toluene	2022/05/11	99	70 - 130	102	70 - 130	96	%				
7983288	2,4,6-Tribromophenol	2022/05/09	79	10 - 130	102	10 - 130	87	%				
7983288	2-Fluorobiphenyl	2022/05/09	45	30 - 130	74	30 - 130	85	%				
7983288	2-Fluorophenol	2022/05/09	29	10 - 130	55	10 - 130	52	%				
7983288	D14-Terphenyl	2022/05/09	102	30 - 130	116	30 - 130	107	%				
7983288	D5-Nitrobenzene	2022/05/09	48	30 - 130	84	30 - 130	87	%				
7983288	D5-Phenol	2022/05/09	20	10 - 130	36	10 - 130	34	%				
7986811	Decachlorobiphenyl	2022/05/11	76	60 - 130	68	60 - 130	78	%				
7982601	Fluoride (F-)	2022/05/09	107	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	0.93	20		
7982605	1,1,2,2-Tetrachloroethane	2022/05/11	91	70 - 130	90	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7982605	1,2-Dichlorobenzene	2022/05/11	93	70 - 130	94	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7982605	1,4-Dichlorobenzene	2022/05/11	107	70 - 130	108	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7982605	Benzene	2022/05/11	94	70 - 130	93	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	Chloroform	2022/05/11	102	70 - 130	101	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	cis-1,2-Dichloroethylene	2022/05/11	104	70 - 130	103	70 - 130	ND, RDL=0.50	ug/L	2.2	30		
7982605	Ethylbenzene	2022/05/11	92	70 - 130	93	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	Methyl Ethyl Ketone (2-Butanone)	2022/05/11	102	60 - 140	98	60 - 140	ND, RDL=10	ug/L	NC	30		
7982605	Methylene Chloride(Dichloromethane)	2022/05/11	102	70 - 130	100	70 - 130	ND, RDL=2.0	ug/L	NC	30		
7982605	o-Xylene	2022/05/11	90	70 - 130	93	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	p+m-Xylene	2022/05/11	95	70 - 130	96	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	Styrene	2022/05/11	100	70 - 130	102	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7982605	Tetrachloroethylene	2022/05/11	96	70 - 130	97	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	Toluene	2022/05/11	91	70 - 130	92	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982605	Total Xylenes	2022/05/11					ND, RDL=0.20	ug/L	NC	30		
7982605	trans-1,3-Dichloropropene	2022/05/11	93	70 - 130	86	70 - 130	ND, RDL=0.40	ug/L	NC	30		
7982605	Trichloroethylene	2022/05/11	108	70 - 130	108	70 - 130	ND, RDL=0.20	ug/L	NC	30		
7982607	pH	2022/05/09			102	98 - 103			1.1	N/A		
7982779	Dissolved Sulphate (SO4)	2022/05/12	91	75 - 125	97	80 - 120	ND, RDL=1.0	mg/L	3.1	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
7983288	Bis(2-ethylhexyl)phthalate	2022/05/09	102	30 - 130	111	30 - 130	ND, RDL=2.0	ug/L	NC	40		
7983288	Di-N-butyl phthalate	2022/05/09	107	30 - 130	117	30 - 130	ND, RDL=2.0	ug/L	NC	40		
7983422	Total Cyanide (CN)	2022/05/09	97	80 - 120	96	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
7983451	Dissolved Aluminum (Al)	2022/05/09	100	80 - 120	98	80 - 120	ND, RDL=4.9	ug/L	NC	20		
7983451	Dissolved Antimony (Sb)	2022/05/09	104	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L	NC	20		
7983451	Dissolved Arsenic (As)	2022/05/09	104	80 - 120	102	80 - 120	ND, RDL=1.0	ug/L	NC	20		
7983451	Dissolved Cadmium (Cd)	2022/05/09	98	80 - 120	97	80 - 120	ND, RDL=0.090	ug/L	NC	20		
7983451	Dissolved Chromium (Cr)	2022/05/09	101	80 - 120	99	80 - 120	ND, RDL=5.0	ug/L	NC	20		
7983451	Dissolved Cobalt (Co)	2022/05/09	99	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	6.5	20		
7983451	Dissolved Copper (Cu)	2022/05/09	102	80 - 120	98	80 - 120	ND, RDL=0.90	ug/L	NC	20		
7983451	Dissolved Lead (Pb)	2022/05/09	98	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20		
7983451	Dissolved Manganese (Mn)	2022/05/09	99	80 - 120	100	80 - 120	ND, RDL=2.0	ug/L	0.34	20		
7983451	Dissolved Molybdenum (Mo)	2022/05/09	110	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	3.8	20		
7983451	Dissolved Nickel (Ni)	2022/05/09	95	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L	2.3	20		
7983451	Dissolved Phosphorus (P)	2022/05/09	101	80 - 120	106	80 - 120	ND, RDL=100	ug/L	NC	20		
7983451	Dissolved Selenium (Se)	2022/05/09	98	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	NC	20		
7983451	Dissolved Silver (Ag)	2022/05/09	99	80 - 120	99	80 - 120	ND, RDL=0.090	ug/L	NC	20		
7983451	Dissolved Tin (Sn)	2022/05/09	103	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L	NC	20		
7983451	Dissolved Titanium (Ti)	2022/05/09	98	80 - 120	94	80 - 120	ND, RDL=5.0	ug/L	NC	20		
7983451	Dissolved Zinc (Zn)	2022/05/09	97	80 - 120	99	80 - 120	ND, RDL=5.0	ug/L	NC	20		
7983812	Mercury (Hg)	2022/05/09	90	75 - 125	89	80 - 120	ND, RDL=0.00010	mg/L	NC	20		
7984457	Total Carbonaceous BOD	2022/05/14					ND,RDL=2	mg/L	NC	30	109	85 - 115
7986241	Total Kjeldahl Nitrogen (TKN)	2022/05/11	98	80 - 120	108	80 - 120	ND, RDL=0.10	mg/L	1.2	20	103	80 - 120
7986301	Phenols-4AAP	2022/05/11	106	80 - 120	101	80 - 120	ND, RDL=0.0010	mg/L	NC	20		
7986811	Total PCB	2022/05/11	88	60 - 130	73	60 - 130	ND, RDL=0.05	ug/L	NC	40		

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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
7987002	Nonylphenol (Total)	2022/05/12	95	50 - 130	98	50 - 130	ND, RDL=0.001	mg/L	NC	40		
7987023	Nonylphenol Ethoxylate (Total)	2022/05/12	85	50 - 130	85	50 - 130	ND, RDL=0.025	mg/L	NC	40		
7989104	Total Suspended Solids	2022/05/12					ND, RDL=10	mg/L	3.0	25	97	85 - 115
7989562	Total Aluminum (Al)	2022/05/12	92	80 - 120	95	80 - 120	ND, RDL=4.9	ug/L				
7989562	Total Antimony (Sb)	2022/05/12	103	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L				
7989562	Total Arsenic (As)	2022/05/12	98	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L	NC	20		
7989562	Total Cadmium (Cd)	2022/05/12	99	80 - 120	98	80 - 120	ND, RDL=0.090	ug/L				
7989562	Total Chromium (Cr)	2022/05/12	96	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L	NC	20		
7989562	Total Cobalt (Co)	2022/05/12	96	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L				
7989562	Total Copper (Cu)	2022/05/12	104	80 - 120	99	80 - 120	ND, RDL=0.90	ug/L	0.14	20		
7989562	Total Lead (Pb)	2022/05/12	95	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L				
7989562	Total Manganese (Mn)	2022/05/12	98	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L				
7989562	Total Molybdenum (Mo)	2022/05/12	103	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L				
7989562	Total Nickel (Ni)	2022/05/12	94	80 - 120	96	80 - 120	ND, RDL=1.0	ug/L				
7989562	Total Phosphorus (P)	2022/05/12	101	80 - 120	110	80 - 120	ND, RDL=100	ug/L				
7989562	Total Selenium (Se)	2022/05/12	95	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L				
7989562	Total Silver (Ag)	2022/05/12	101	80 - 120	101	80 - 120	ND, RDL=0.090	ug/L				
7989562	Total Tin (Sn)	2022/05/12	102	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L				
7989562	Total Titanium (Ti)	2022/05/12	91	80 - 120	94	80 - 120	ND, RDL=5.0	ug/L				
7989562	Total Zinc (Zn)	2022/05/12	98	80 - 120	101	80 - 120	ND, RDL=5.0	ug/L				
7994449	Total Oil & Grease Mineral/Synthetic	2022/05/13			97	85 - 115	ND, RDL=0.50	mg/L	0.52	25		

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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
7994482	Total Oil & Grease	2022/05/13			99	85 - 115	ND, RDL=0.50	mg/L	2.1	25		

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 (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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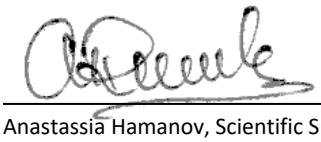
Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

VALIDATION SIGNATURE PAGE

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



Anastassia Hamanov, Scientific Specialist



Sonja Elavinamannil, Master of Biochemistry, Team Lead

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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MICRO

Bureau Veritas
5740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvna.com

Page 1 of 1

CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#30554 exp Services Inc	Company Name:	EXP Services Inc	Quotation #:	C20374	Bureau Veritas Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Francois Chartier	P.O. #:	ENV – BRM STREAM 2		877551
Address:	1595 Clark Blvd	Address:	Jeffrey.Leon@exp.com	Project:	GTR-22006080-B0	COC #:	Project Manager:
	Brampton ON L6T 4V1		Thabiso.Modise@exp.com	Project Name:		C#877551-01-01	Patricia Legette
Tel:	(905) 793-9800 Fax: (905) 793-0641	Tel:	(905) 793-9800 Ext: 2523 Fax:	Site #:	12505 Heart Lake Road, ON		
Email:	AP@exp.com; Karen.Burke@exp.com	Email:	Francois.Chartier@exp.com	Sampled By:	Thabiso Modise		

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

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine	☐ CCME ☑ Sanitary Sewer Bylaw	
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ Reg 558. ☑ Storm Sewer Bylaw	
☐ Table 3 ☐ Agri/Other ☐ For RSC	☐ MISA Municipality Peel	
☐ Table ___	☐ PWQO ☐ Reg 406 Table	
	☐ Other	

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

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 #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Peel Sanitary & Storm Sewer (53-2010)	Dissolved metals (Field Filtered)	# of Bottles	Comments
1		BH 103	22/05/06	13:00	GW	X	✓		18	PLEASE MEET 5 DAY TAT
2		BH 103	22/05/06	13:00	GW	✓		✓	1	PLEASE INCLUDE COC IN CERTIFICATE OF ANALYSIS
3										
4										
5										
6										
7										
8										
9										
10										

06-May-22 18:31
Patricia Legette
C2C2964
DSG ENV-1594

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Thabiso Modise	22/05/06	18:30	[illegible]	20220506	18:31	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	7.1 5.8	Present		
		Intact		✓

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S 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.BVNA.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.BVNA.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

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

White: Bureau Veritas Yellow: Client

Bureau Veritas Canada (2019) Inc.

Bureau Veritas Job #: C2C2964
Report Date: 2022/05/16

exp Services Inc
Client Project #: GTR-22006080-B0
Site Location: 12505 Heart Lake Road, ON
Your P.O. #: ENV-BRM
Sampler Initials: TM

Exceedance Summary Table – Peel Region Storm 2010

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
BH103	SOE064-09	Total Manganese (Mn)	50	71	2.0	ug/L
BH103	SOE065-01	Dissolved Manganese (Mn)	50	65	2.0	ug/L

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedance Summary Table – Peel Region Sanitary 2010

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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Appendix F – Water Balance Calculations

APPENDIX F: Construction Dewatering Calculations

12505 Heart Lake Rd, Caledon
GTR-22006080-B0

Table F-1: Flow all Sides of the Excavation

Parameters	Symbols	Unit	Foundation	Underground Utilities
Ground Elevation	-	mASL		
Highest Groundwater Elevation	-	mASL	**274.95**	**274.95**
Lowest Excavation Elevation		mASL	**274.30**	**271.95**
Dewatered Elevation Target	-	mASL	273.30	270.95
Top of the Water-Bearing Zone	-	mASL	274.95	274.95
Base of the Water-Bearing Zone	-	mASL	**269.30**	**266.95**
Height of Water Table Above the Base of Water-Bearing Zone	**H**	m	5.65	8.00
Height of Dewatering Target Above the Base of Water-Bearing Zone	**h_w**	m	4.00	4.00
Hydraulic Conductivity	**K**	m/s	**3.10E-06**	**3.10E-06**
Length of Excavation	-	m	**30.00**	**30.00**
Width of Excavation	-	m	**2.00**	**2.00**
Method to Calculate Radius of Influence	-	-	**Sichardt**	**Sichardt**
Radius of Influence from Sides of Excavation	**Ro**	m	8.72	21.13
Distance to Linear Source from Sides of excavation	**Lo=Ro/2**	m	4.36	10.56
Dewatering Flow Rate (unconfined linear flow component)	**Q**	m^3/day	31	39
Factor of Safety	**FS**	-	2.00	2.00
Dewatering Flow Rate (multiplied by factor of safety)	**Q.FS**	m^3/day	63	78
Precipitation Event	-	mm/day	15	15
Volume from Precipitation	-	m^3/day	0.9	0.9
Dewatering Flow Rate **Without Safety Factor** (including rainwater collection)	-	m^3/day	32	40
Dewatering Flow Rate **With Safety Factor** (including rainwater collection)	-	m^3/day	64	79

Precipitation Event 2 year storm	-	mm/day	53.7
Volume from Precipitation	-	m^3/event	3
Precipitation Event 100 year storm	-	mm/day	125.2
Volume from Precipitation	-	m^3/event	8

Notes:

mASL - meters above sea level

Analytical Solution for Estimating Plane Flow from an Unconfined Aquifer to a Fully-Penetrating Excavation

$$Q_w = Kx\frac{H^2 - {h_w}^2}{L_o}$$

(Based on the Dupuit Equation)

Where:

Q_w = Flow rate per unit length of excavation (m^3/s)

K = Hydraulic conductivity (m/s)

H = Height of static water table above base of water-bearing zone (m)

h_w = Height of target water level above the base of water-bearing zone (m)

L_o=Distance of Influence (m)

x=Length of excavation (m)

Appendix G – Toronto and Region Conservation Authority (TRCA)

Appendix G-1: Infiltration Testing Results
12505 Heart Lake, Caledon, ON
GTR-22006080-B0

Location:	12505 Heart Lake, Caledon, ON
Date:	April 29 and May 6, 2022
Weather:	
Analyst:	TM

Borehole radius (cm):	2.5
Soil class:	Default

Measurement	Start depth of water (cm)	End depth of water (cm)	Start time (*decimal min)	End time (*decimal min)	Change in head (cm)	Perc test result (min/cm)	Perc test (hr/mm)	mean head (m)	K_{fs} (mm/hr)	Kfs (cm/sec)	Kfs (m/sec)
IT 1	68.1	65.4	0.0	225.2	2.7	83.4	0.1390	0.668	0.0	4.7E-07	4.7E-09
IT 2	63.0	54.6	0.0	54.9	8.4	6.5	0.0109	0.588	0.26	7.3E-06	7.3E-08
IT 3	50.7	50.4	0.0	59.0	0.3	196.8	0.3279	0.506	0.0	3.0E-07	3.0E-09
IT 4	78.0	71.1	0.0	55.5	6.9	8.0	0.0134	0.746	0.15	4.1E-06	4.1E-08

Appendix G-2: Low Impact Design (LID) Calculations for Infiltration Gallery
12505 Heart Lake, Caledon, ON
GTR-22006080-B0

Test Location	Hydraulic Conductivity (K_{fs}) (cm/s)	Infiltration Rate (IR) (mm/hr)	Discrete Design Infiltration Rate(DIR) (mm/hr)	Percolation Time (min/cm)
IT 1	5E-07	11	3	190
IT 2	7E-06	23	7	91
IT 3	3E-07	10	3	214
IT 4	4E-06	20	6	107

Geology Units	Geometric Mean of K_{fs} (cm/s)	Infiltration Rate (I) (mm/hr)*	Ratio of Mean Measured Infiltration Rates	Safety Correction Factor (SCF)
Overlying Geology Unit	1.44E-06	15	1.5	3.5
Underlying Geology Unit (1.5 m below the bottom of trench)	1.44E-06	10		

Design Infiltration Rate(DIR) (mm/hr)	Minimum	3	**Percolation Time (min/cm)**	91
	Maximum	7		214
	Geometric Mean	**4**		**141**

Note:
Analytical Solutions (CVC and TRCA 2010)

$$Infiltration\ Rate\ (IR) = \left(\frac{K_{fs}}{6x10^{-11}}\right)^{\frac{1}{3.7363}}$$
$$Design\ Infiltration\ Rate\ (DIR) = \frac{IR}{SCF}$$

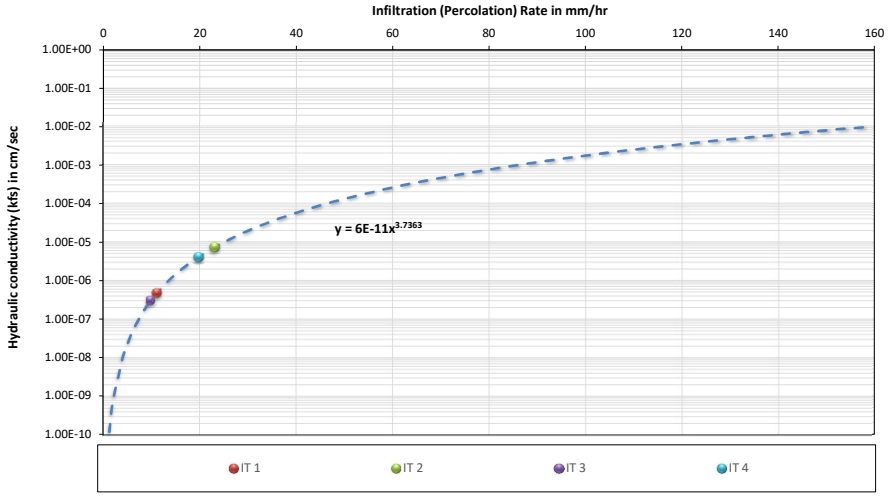
Kfs: hydraulic conductivity (cm/sec)

IR: infiltration rate (mm/hr)

DIR: design infiltration rate (mm/hr)

SCF: Safety Correction Factor (based on the chart recommended by CVC and TRCA, 2010)

Figure : Approximate relationship between infiltration rate and hydraulic conductivity (LID SWM planning and Design Guide, Appendix C1)



Appendix G-3: Model Input

12505 Heart Lake, Caledon, ON

GTR-22006080-B0

Year	Month	Ave. T (^{0}C)	Ave P (mm)
1983-2012	1	-5.1	52.8
1983-2012	2	-4.4	47.0
1983-2012	3	0.3	50.7
1983-2012	4	7.1	70.1
1983-2012	5	13.3	77.1
1983-2012	6	18.8	70.2
1983-2012	7	21.7	76.9
1983-2012	8	20.8	73.9
1983-2012	9	16.4	73.6
1983-2012	10	9.7	63.3
1983-2012	11	3.8	73.6
1983-2012	12	-2.1	57.7

Note:

TORONTO LESTER B. PEARSON INT'L A

Climate Station ID: 6158733

Appendix G-4: Model Output

12505 Heart Lake, Caledon, ON

GTR-22006080-B0

Month	PET	P	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus
January	9.2	52.8	23.5	190.9	9.2	0.0	31.9	15.8
February	10.9	47.0	30.4	196.6	10.9	0.0	37.5	24.7
March	21.0	50.7	49.1	199.5	21.0	0.0	18.2	46.1
April	39.6	70.1	46.2	199.6	39.6	0.0	2.4	46.1
May	72.5	77.1	7.1	190.0	72.4	0.1	0.0	16.7
June	108.2	70.2	-38.0	149.7	105.7	2.5	0.0	4.8
July	127.9	76.9	-51.0	112.3	112.1	15.8	0.0	2.2
August	102.6	73.9	-28.7	99.0	84.6	18.0	0.0	2.7
September	59.8	73.6	13.9	108.1	55.7	4.1	0.0	8.8
October	31.2	63.3	32.2	135.6	30.5	0.7	0.0	5.3
November	16.2	73.6	57.3	170.9	16.2	0.0	0.2	22.1
December	10.2	57.7	36.0	184.8	10.2	0.0	11.7	22.1
Annual Rate (mm/yr)	609.1	786.9	177.8	161.4	568.0	41.2	101.9	217.3

Note:

TORONTO LESTER B. PEARSON INT'L A

Climate Station ID: 6158733

Appendix G-5: Lot-Level Average Infiltration Factors
12505 Heart Lake, Caledon, ON
GTR-22006080-B0

1. Average Infiltration Factor – Pre Development Conditions

Category	Weighted Infiltration Factor
Topography/Slope	0.11
%94 Glaciolacustrine-Derived Silty to Clayey Till, 6% Modern Alluvial Deposits	0.15
Landscaped Area	0.10
Total weighted Infiltration factor	**0.36**

2. Average Infiltration Factor – Post Development Conditions

Unmitigated

Category	Weighted Infiltration Factor
Topography/Slope	0.30
%94 Glaciolacustrine-Derived Silty to Clayey Till, 6% Modern Alluvial Deposits	0.15
Landscaped Area	0.10
Total weighted Infiltration factor	**0.55**

Notes:

Landscaped area considered equivalent to Cultivated Cover

Appendix G-6: Summary of Pre and Post-Development Water Balance (Unmitigated)
12505 Heart Lake, Caledon, ON
GTR-22006080-B0

1. Climate Data

	Pre-Development mm/a		Post-Development Un-Mitigated mm/a
Precipitation	786.90		786.90
Evapotranspiration	568.00		568.00
Water Surplus	218.90		218.90
Infiltration Rate	79.88		120.40
Runoff	139.02		98.51

2. Pre-Developed Study Area Statistics

Landscaped Areas	283,100	sq.m.
Existing Buildings	3,600	sq.m.
Roads, Sidewalks, Parking Areas (Paved Areas)	7,200	sq.m.
TOTAL	293,900	sq.m.

3. Proposed Lot Coverage -
Mixed-Used Development

Building Roofs	95,000	sq.m.
Roads, Sidewalks, Parking Areas (Paved Areas)	137,200	sq.m.
Landscaped Areas	61,700	sq.m.
TOTAL	293,900	sq.m.

4. Annual Pre-Development Water Balance

Land Use	**Area (sq.m.)**	**Precipitation (cu.m.)**	**Actual Evapotranspiration (cu.m.)**	**Infiltration Rate (cu.m.)**	**Run-off (cu.m.)**
Total Impervious	10,800	8,499	0	0	8,499
Undeveloped	283,100	222,771	160,801	22,613	39,357
Total	293,900	231,270	160,801	22,613	47,856
	Pre-development Rates in mm/year		**547.13**	**76.94**	**162.83**

5. Annual Post-Development Water Balance Un-Mitigated

Land Use	**Area (sq.m.)**	**Precipitation (cu.m.)**	**Actual Evapotranspiration (cu.m.)**	**Infiltration Rate (cu.m.)**	**Run-off (cu.m.)**
Lots					
Roofs	95,000	74,756	0	0	74,756
Roads, Sidewalks, Parking Areas	137,200	107,963	0	0	107,963
Landscaped Areas	61,700	48,552	35,046	7,428	6,078
TOTAL	293,900	231,270	35,046	7,428	188,796
	Post-development Rates in mm/year		**119.2**	**25.3**	**642.4**

6. Comparison of Pre-Development and Post-Development Un-Mitigated

	Precipitation (cu.m.)	**Actual Evapotranspiration (cu.m.)**	**Run-off (cu.m.)**	**Infiltration Rate for Areas with Shallow Groundwater Table (cu.m.)**
Pre-Development	231,270	160,801	47,856	22,613
Post Development	231,270	35,046	188,796	7,428
			Pre-development Infiltration Rate	**76.9**
			Post-development Infiltration Rate Un-Mitigated	**25.3**
			Deficit Post Development Un-Mitigated	**-15,185**

Appendix G-7: Estimate of Infiltration Area of LID System
12505 Heart Lake, Caledon, ON
GTR-22006080-B0

1. Design Infiltration Rate

Item	Value	Unit
Geometric mean of design infiltration rates	4.00	mm/h
	96.00	mm/day
	0.10	m/day/m^2
	0.10	m/24 hrs/m^2

2. Climate Data

Total precipitation based on weather station records	786.90	mm/yr
Total rain in an eight (8) month precipitation period	524.60	mm/yr
Based on a 32-week precipitation period	32.79	mm/week
	0.033	m/2 week/m2

3. Roof and Resulted Runoff Volume

Total roof area	95,000	m^2
Rooftop runoff volume in an eight (8) month precipitation perio	49,837	m^3/yr
Total rooftop runoff volume per 2 week	3,115	m^3/2 week

4. Estimated Deficit Volume

Estimated deficit based on water balance calculations	15,185	m^3/yr
Deficit over available water (roof runoff) for infiltration	30%	-
Storage to infiltrate to meet deficit	949	m^3/2 week

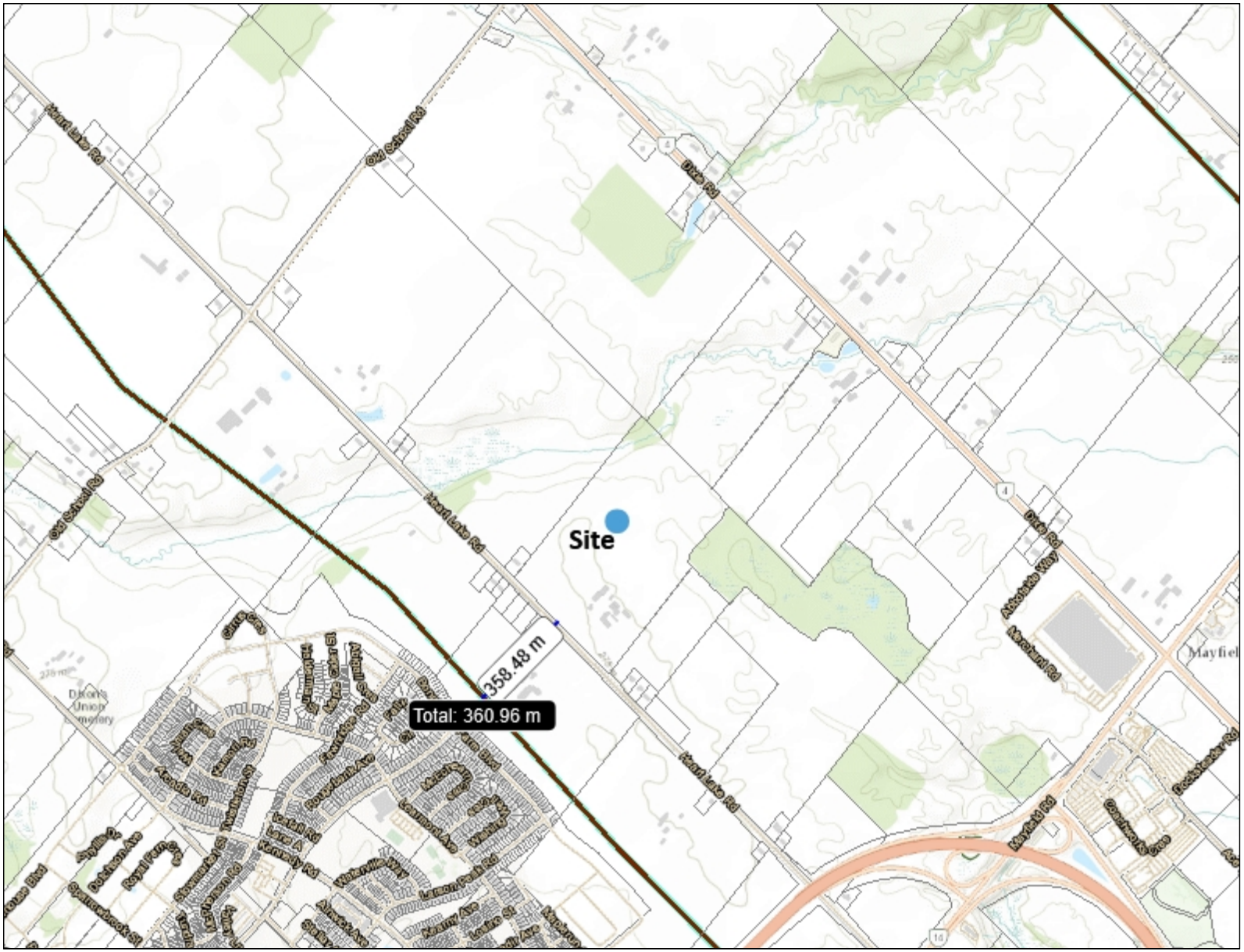
5. LID Area

Area of infiltration system required to mitigate infiltrate deficit (rounded)	**9,890**	m^2
mm of Rain per 2 week per m^2 of LID to be infiltrated	96	mm/2 week/m^2 of LID
Drawdown time in hours	24	hrs

Note: only roof water to be infiltrated (clean water)

Appendix H – Engineering Drawings

Bedrock Thalweg_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Bedrock Thalweg

York Region

1.4 0 0.69 1.4 Km

1: 27,016

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DATE PRINTED: May 5, 2022

Thickness of Overburden_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Quaternary Sediment Thickness (all cont
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Quaternary Sediment Thickness (Depth t (ORMGP)

York Region

0.7 0 0.34 0.7 Km

1: 13,508

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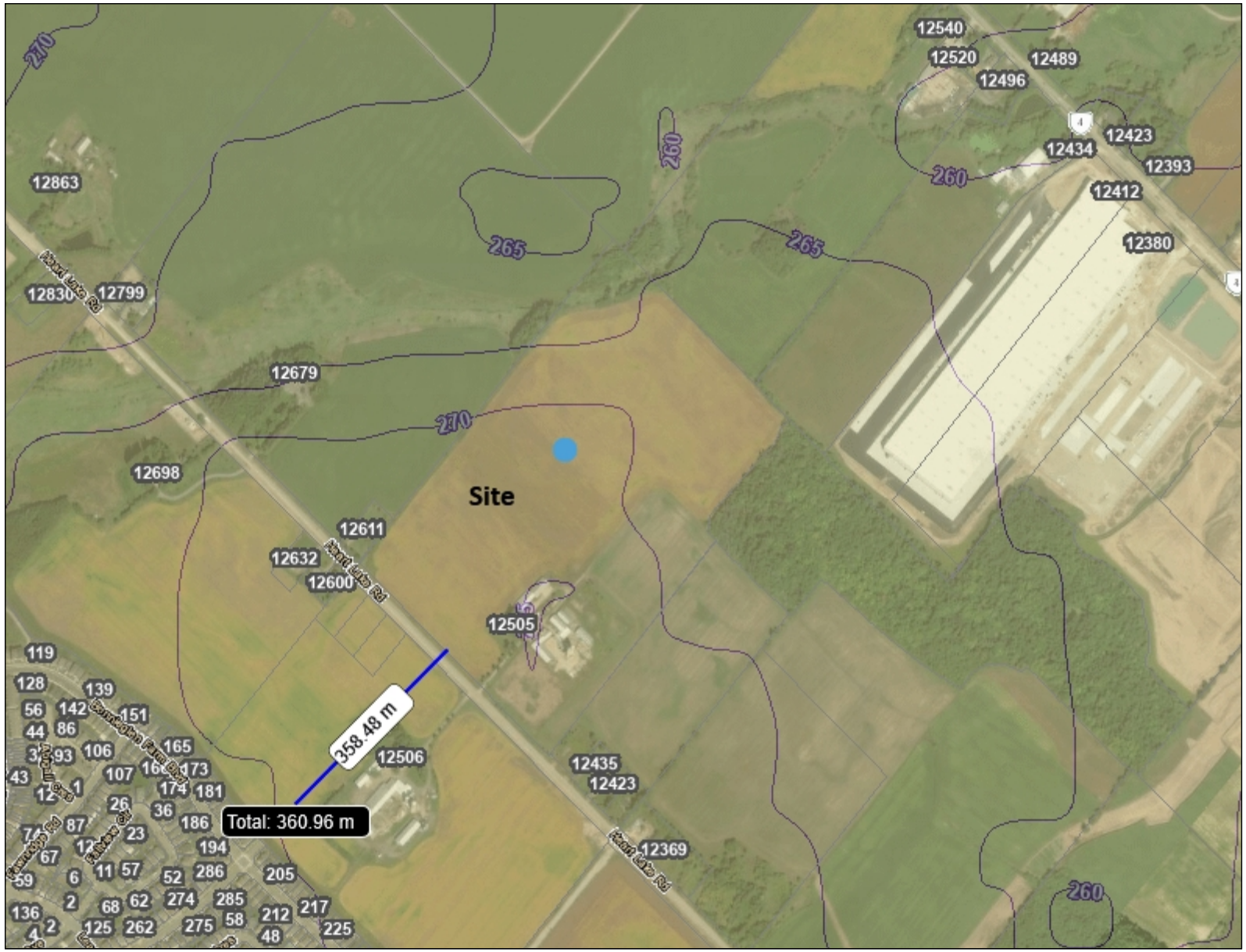
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Top of Halton_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Halton Till (or equiv.) Contour (all contou
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Top of Halton Till (or equiv.) (mASL)

0.7 0 0.34 0.7 Km

1: 13,508

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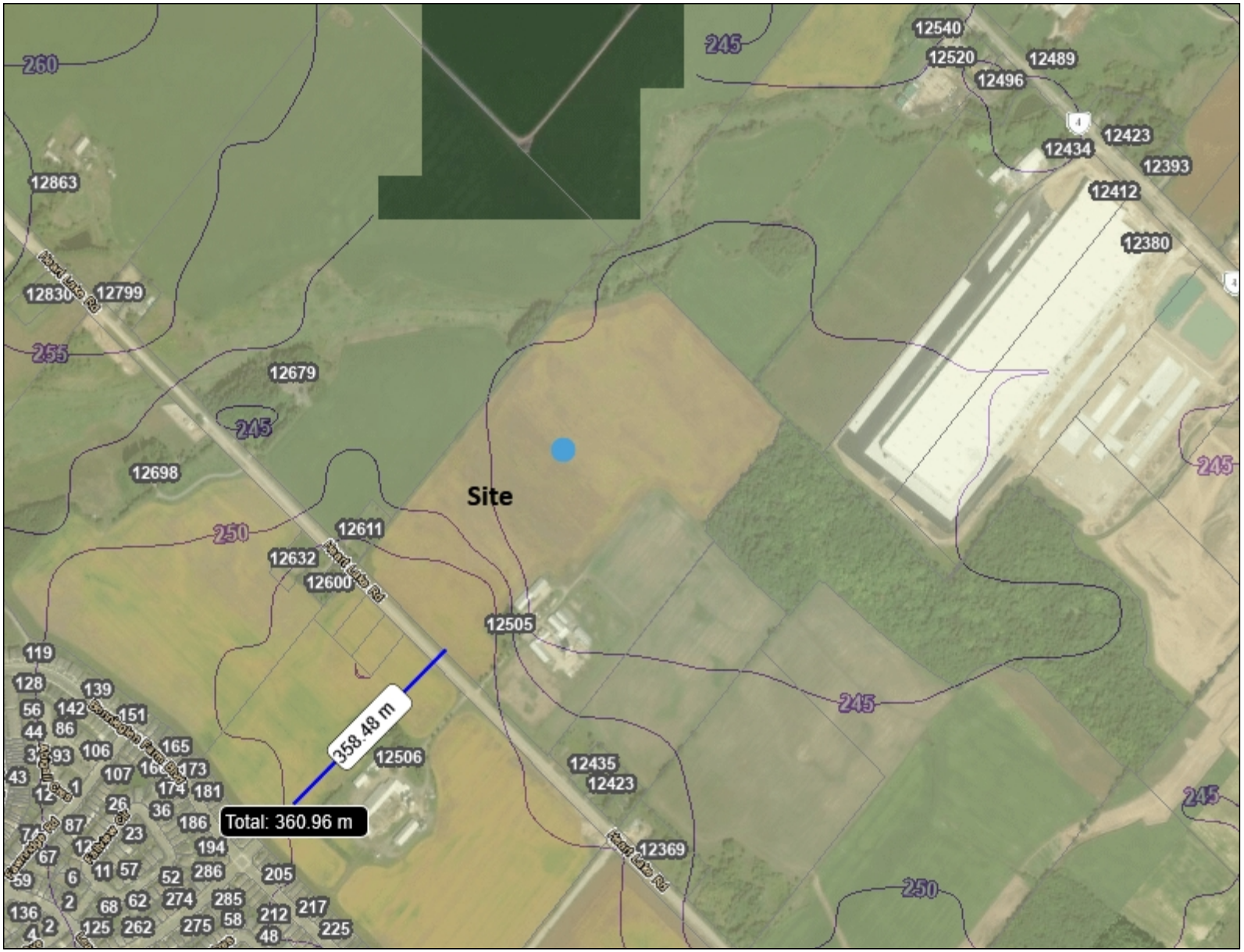
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Top of ORAC_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Oak Ridges (or equiv.) Contour (all conto
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Top of Oak Ridges (or equiv.) (mASL)

0.7 0 0.34 0.7 Km

1: 13,508

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DATE PRINTED: May 5, 2022

Top of Thorncliffe_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Thorncliffe Fm. Contour (all contours)
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Thorncliffe Fm. Contour (1m)
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Top of Thorncliffe Fm. (mASL)

0.7 0 0.34 0.7 Km

1: 13,508

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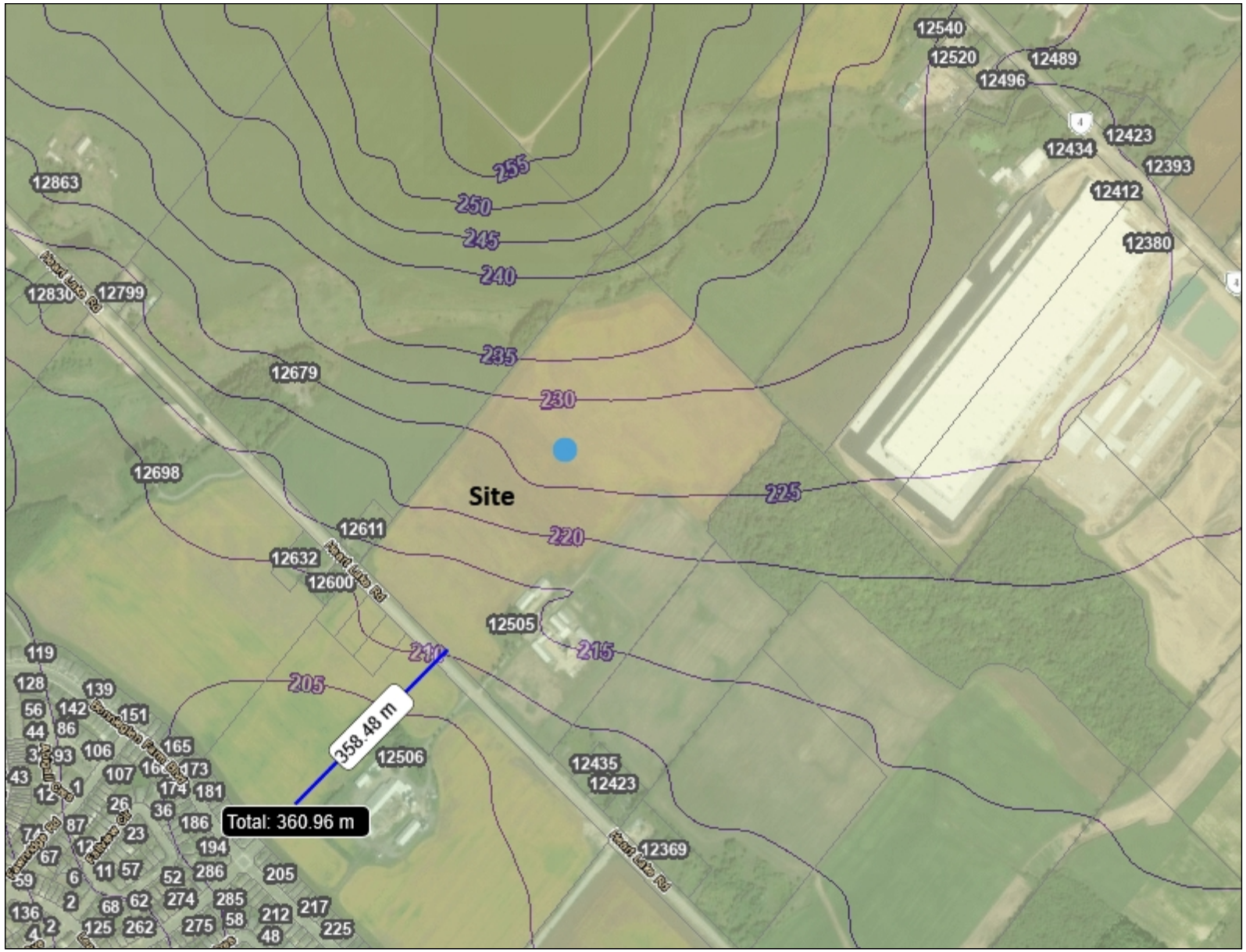
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Top of Bedrock_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Bedrock Contour (all contours)
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Bedrock (mASL)

York Region

0.7 0 0.34 0.7 Km

1: 13,508

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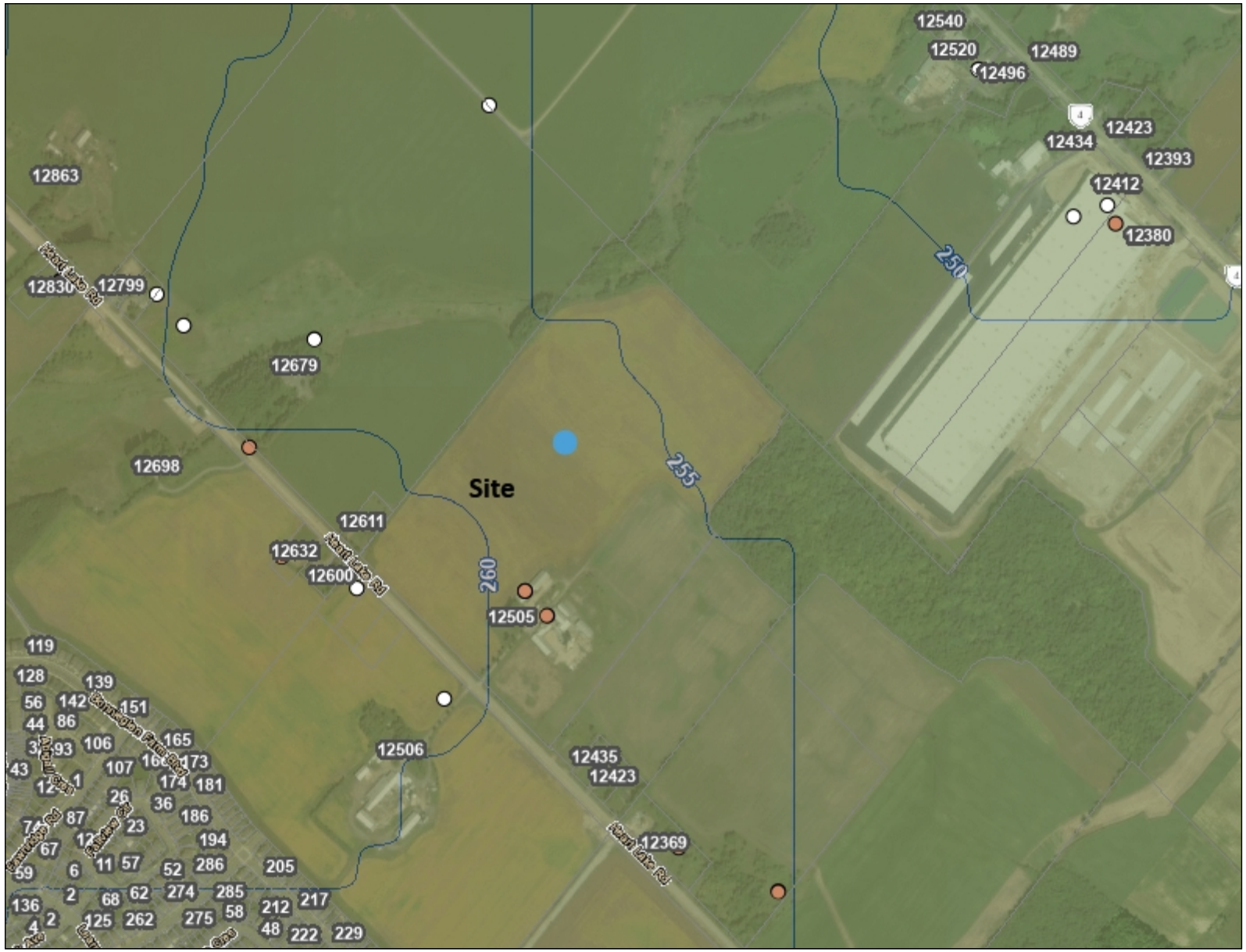
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Groundwater Contours_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Shallow Wells (<20 m deep)
- Deep Wells (>40 m deep)
- Water Bodies
- Streams (Strahler > Class 3)
- Water Table Contour (all contours)
- Contour (1m)
- Contour (2m)
- Contour (5m)
- Contour (10m)
- Contour (25m)
- Contour (50m)
- Water Table 0 (WT0) (mASL)

York Region

0.7 0 0.34 0.7 Km

1: 13,508

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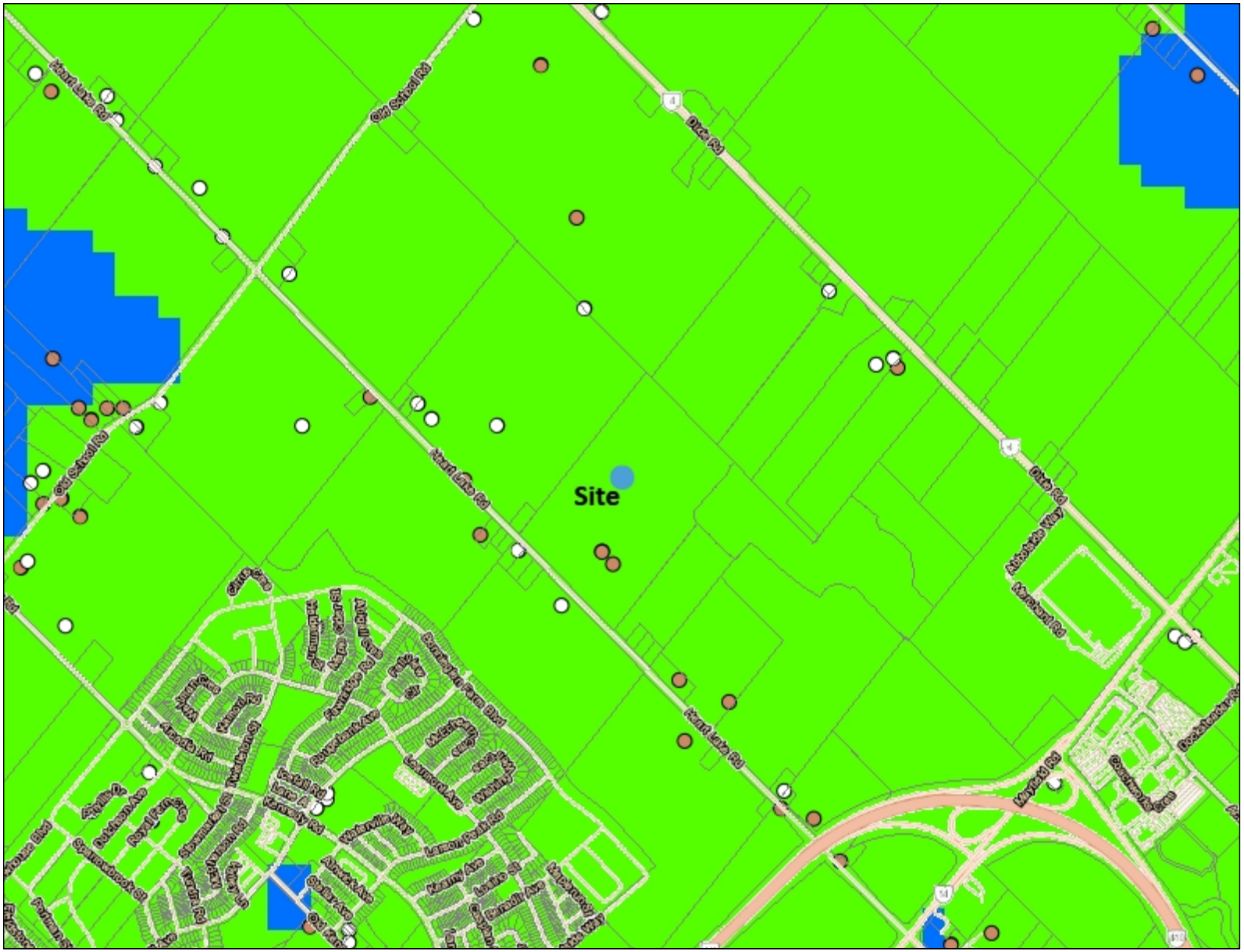
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Groundwater Gradient_12505 Heart Lake, Caledon, ON



Legend

- Address Points - City of Peterborough
- Address Points - York
- Address Points - City of Barrie
- Address Points - Peel
- Address Points - Durham
- Address Points - Hastings County
- Address Points - City of Toronto
- Assessment Parcel Partners
- Shallow Wells (<20 m deep)
- Deep Wells (>40 m deep)
- Water Bodies
- Streams (Strahler > Class 3)
- Vertical Gradient (WT1 minus PS0)
- Upward Gradient (PS0>WT1)
- Downward Gradient (WT1 > PS0)

York Region

1.4 0 0.69 1.4 Km

1: 27,016

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