GROUNDED ENGINEERING

HYDROGEOLOGICAL ASSESSMENT

PREPARED FOR:
Loon Avenue Lands OP Inc.

ATTENTION:
Colleen Forrest

338 Mapleview Dr | Barrie, Ontario

Grounded Engineering Inc.
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1 Introduction

1.1 Background

Loon Avenue Lands OP Inc. retained Grounded Engineering Inc., to complete a Hydrogeological Assessment for the property located at the municipal address of 338 Mapleview Dr E., Barrie, Ontario (the Subject Lands). The Subject Lands are comprised of what will be referred to as the Development Limit and the Conservation Lands. The Development Limit is the portion that is being developed within the Subject Lands outside of the future Environmental Protection Zone. The Conservation Lands are both the Edge Management Zone and the Wetland Buffer within the Development Limit of the Subject Lands. The site location is presented in Figure 1A. The Subject Lands and Development Limit are presented in Figure 1B.

The proposed project ("the Community") includes constructing twenty (20) new townhome blocks consisting of the following:

- Existing site grades of the Development Limit slopes from northwest to southeast. Existing ground elevations range from Elev. 245.5± m on the west side of the Development Limit to Elev. 242.6± m on the east side. There are also hills up to 5 m high within the development limit (i.e. adjacent to Boreholes 205 and 202). Grade cuts and raises are proposed. Retaining walls will be required in some areas.
- Blocks 1 through 20, each consisting of a collection of 3-storey townhomes with one underground level (basements and walkouts are proposed). Block details, including the assumed lowest Basement Finished Floor Elevation (BFFE), are summarized in the table below.
- Associated surface parking, private roads and site services are proposed.
- General ground floor Finished Floor Elevations (FFEs) were provided by Counterpoint Engineering Inc. per Block.
- Lowest underground BFFEs were assumed at 2.75m below the provided ground floor FFEs, as advised by Counterpoint Engineering Inc.

Block	Unit Type	Number of Units	Number of Storeys	Lowest BFFE (m)
1	Back-to-back Townhomes	Twelve (12)	Three (3)	244.85
2	Back-to-back Townhomes	Sixteen (16)	Three (3)	244.55
3	Back-to-back Townhomes	Sixteen (16)	Three (3)	244.15
4	Back-to-back Townhomes	Eight (8)	Three (3)	244.05
5	Back-to-back Townhomes	Eight (8)	Three (3)	243.85
6	Townhomes with walkouts	Fourteen (14)	Three (3)	244.20
7	Townhomes with walkouts	Six (6)	Three (3)	244.80

Block	Unit Type	Number of Units	Number of Storeys	Lowest BFFE (m)
8	Townhomes with walkouts	Five (5)	Three (3)	244.95
9	Back-to-back Townhomes	Eight (8)	Three (3)	244.15
10	Back-to-back Townhomes	Twelve (12)	Three (3)	243.95
11	Back-to-back Townhomes	Fourteen (14)	Three (3)	243.95
12	Back-to-back Townhomes	Sixteen (16)	Three (3)	244.40
13	Townhomes with walkouts	Eight (8)	Three (3)	244.45
14	Townhomes with walkouts	Eight (8)	Three (3)	244.15
15	Townhomes with walkouts	Eight (8)	Three (3)	243.75
16	Townhomes with walkouts	Two (2)	Three (3)	243.60
17	Townhomes with walkouts	Nine (9)	Three (3)	243.65
18	Townhomes with walkouts	Four (4)	Three (3)	243.55
19	Townhomes with walkouts	Four (4)	Three (3)	243.60
20	Townhomes with walkouts	Eight (8)	Three (3)	243.65

The hydrogeological assessment has been prepared for the purpose of an Official Plan and Zoning Bylaw Amendment application as per the requirement of the Lake Simcoe Region Conservation Authority (LSRCA) and other municipal approval authorities having jurisdiction. The survey plan is provided in Appendix A. The hydrogeological assessment was undertaken to evaluate hydrogeological conditions of the proposed development on the Development Limit and to develop a plan to manage risk of potential impacts associated with activities related to the proposed land use.

1.2 Scope of Work

A summary of the scope of work is provided below:

- Background Information Review: Review of available background geologic and hydrogeological information for the Subject Lands and surrounding areas. This included a review of the Ministry of the Environment, Conservation and Parks (MECP) well records, watershed information by the Lake Simcoe Region Conservation Authority (LSRCA), and results of previous studies and subsurface investigations on neighbouring properties.
- Private Well Survey: A door-to-door well survey was conducted for properties within 500 m of the Subject Lands.

- Groundwater Level Monitoring: Groundwater level monitoring was conducted in order to assess the groundwater flow conditions. The groundwater in the monitoring wells will be monitored for a period of one (1) year to determine seasonally high groundwater levels.
- Hydraulic Conductivity Test: In-situ hydraulic conductivity tests were conducted in select monitoring wells to assess hydraulic conductivity of the strata. The underlying soils were assessed in order to determine potential dewatering requirements.
- Infiltration Tests: In-situ infiltration tests were conducted using a Guelph Permeameter in select areas across the site to assess the infiltration/percolation rates of the strata. The underlying soils were assessed in order to determine the feasibility of any Low Impact Development (LID) measures.
- Water Balance: A water balance and assessment of infiltration rates for existing (pre-development) and post development conditions was completed to determine the feasibility of the proposed development.

2 Site Information

2.1 Site Location and Description

The Subject Lands are L-shaped, with a total area of 11.91 ha. The Development Limit is irregular in shape, with a total area of approximately 3.2 ha. The Development Limit is currently undeveloped. An evaluated wetland, and a regulated woodlot are adjacent to the south of the Development Limit. Lovers Creek is located 174 m to the east of the Subject Lands. It is understood that the Development Limit will be developed with residential townhome buildings with associated internal roads and servicing. The proposed project includes constructing new townhome blocks (Block 1 through 20) consisting of a number of 3-storey back-to-back and conventional townhomes, with basements and walk outs. The general site feature (current and proposed) is presented in Figures 2 and 3.

The townhomes will be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The surrounding properties are predominantly residential and commercial. There is, however, agricultural land use in the south portion of the study area, south of Mapleview Dr E.

The Subject Lands information is provided below:

Municipal Address	338 Mapleview Dr E
Area	Subject Lands - 11.91 ha Development Limit – 2.56 ha
Legal Description	Part S1/2 Lot 11, Concession 12, Innisfil as Pt 1, 51 R4733 except Part 1, Expro. Plan SC944619
UTM Coordinates	E: 606838, N: 4911357 (UTM 17T)

Current Land Use	Undeveloped
Property Owner Information	Loon Avenue Lands BT Inc.
Person who has engaged the Qualified Person to conduct the assessment	Colleen Forrest

2.2 Topography & Drainage

The Ministry of Natural Resources and Forestry (MNRF) and Ministry of Energy, Northern Development and Mines (MENDM) database were searched to obtain topographic and geological maps of Ontario for review. The maps are provided in Appendix B and the information obtained are summarized below:

Records	Information
Topographic Maps	The approximate elevation of the Development Limit ranges from 245.5 masl on the west side of the Development Limit to 242.6 masl on the east side. The Development Limit is sloping towards the south-southeast.
Hydrology	The nearest water body, Lovers Creek is approximately 174 m to the east of the Subject Lands, locally groundwater and surface water are expected to flow to the east towards Lover's Creek which ultimately drains into Kempenfelt Bay, a western arm of Lake Simcoe.
Run Off	It is expected that the majority of storm water run-off will follow site topography and flow to the east towards the adjacent wetland and Lovers Creek, which ultimately drains into Kempenfelt Bay, a western arm of Lake Simcoe.

2.3 Regional Physiography

From a regional perspective, the Subject Lands are situated within a physiographic feature known as the Till Plains characterized by coarse-textured glaciolacustrine deposits consisting of sand, gravel, minor silt and clay.

2.4 Regional Geology and Soils

Based on the published information, the regional geology is described as below.

Records	Information
Geological Maps	Overburden: • The overburden consists primarily of undisturbed glacial till deposits. Bedrock: • Limestone, dolostone, shale, arkose; sandstone of the Ottawa Group; Simcoe Group; Shadow Lake Formation Depth to Bedrock: • Approximately 100 mbgs

It should be noted that the subsurface soil and rock conditions described above represent generalized conditions only and should not be considered site specific. The information is presented in Appendix E.

2.5 Regional Hydrogeology

The Lake Simcoe Region Conservation Authority (LSRCA) has summarized the regional hydrogeologic conditions present within the Barrie Creeks Sub-watershed in the Barrie Creeks, Lovers Creek, and Hewitt's Creek Sub-Watershed Plan (LSRCA, 2012). As per LSRCA (2012), there are four (4) regionally extensive overburden confined aquifers within the sub-watershed (A1-A4). The regional stratigraphy also includes an upper confining layer, three (3) lower confining layers (C1-C3).

Based on the information, the below significant hydrostratigraphic units were defined in the vicinity of the Subject Lands.

Upper Confining Layer - UC (Aquitard):

The upper confining layer is comprised of coarse-grained lacustrine deposits which are part of a regionally extensive sand plain extending west from the City of Barrie to the Town of Angus.

Aquifer 1 – A1 (Aquifer):

The A1 Aquifer is composed of fine to medium grained sand with occasional occurrences of gravel. The A1 aquifer is commonly associated with upland areas. Detailed logging of this unit in the northwest part of the City of Barrie indicates that the A1 aquifer consists of a number of coarsening upward sequences of lacustrine sand with only minor occurrences of silt (LSRCA 2012).

Confining Layer 1 – C1 (Aquitard):

The C1 layer has been cored within the City of Barrie and is described as varved clay and silt.

Aquifer 2 – A2 (Aquifer):

The A2 aquifer is found in the elevation range of approximately 175 to 230 masl within lowland areas but the stratigraphic equivalent extends up to approximately 250 masl to the northeast, under the Oro Moraine. The A2 aquifer can generally be described as being composed of sand, with some clast rich portions. The aquifer is interpreted to extend under Kempenfelt Bay and to the north (towards Midhurst). The lower elevation of the aquifer in the vicinity of Kempenfelt Bay corresponds with the deeper channelized aquifer and suggests that it may represent in-filled former river channels in this area. The A2 aquifer ranges in thickness from approximately 10 to 30 m in most areas. It is regionally extensive but does pinch out in some areas. The aquifer is complex in the central core of Barrie, where it consists of inter-layered sand and silt/clay materials. The eastern part of the A2 aquifer is interpreted to be in direct contact with Kempenfelt

Bay, based on the base elevation of the bay and the interpreted aquifer extents near its shores (LRSCA 2012).

2.6 Regional Climate

The Subject Lands is located in the climatic region of Southern Ontario known as the Simcoe and Kawartha Lakes region. The following general climate data was obtained from Lake Simcoe Climate Data for the Lovers Creek Sub-Watershed, dated April 2017.

Mean annual precipitation (mm/yr.)	914 mm
Mean annual evapotranspiration	545 mm
Mean annual water surplus	369 mm

The precipitation data was based on Lake Simcoe Climate Data. It is noted that the above are average values, which are representative in a regional context. There will be seasonal and annual variations in these values. However, the average values will govern long-term groundwater recharge and discharge rates. Therefore, average values are appropriate for assessment of hydrogeologic conditions at the site.

2.7 Groundwater Resources

The Subject Lands are situated within the Lake Simcoe and Couchiching/Black River Source Protection Area and more specifically within the Lovers Creek Sub watershed which covers an area of approximately 59.9 km^2. The sub watershed has a total watercourse length (including all branches) of 93.1 km which drain into Kempenfelt Bay, a western arm of Lake Simcoe located approximately 3 km northeast of the Subject Lands, which is approximately 37.8 km^2 in size.

The watershed maps are presented in Appendix C.

Well records from the MECP well record database were reviewed for wells located within a 500-m radius of the Development Limit. Eleven (11) well records were retrieved from the well record database. The summary of the MECP well records is presented in Appendix D. A summary of the data obtained is presented in the following table.

Total Number of Wells	**11**
Wells completed in Overburden	11 (100%)
Bedrock	0 (0%)
Unknown	0 (0%)
Depth Ranges	

50 ft. or less	8 (73%)
51 ft. to 100 ft.	1 (9%)
101 to 200 ft.	0 (0%)
201 to 300 ft.	0 (0%)
301 to 400 ft.	2 (18%)
Unknown Depth	0 (0%)

Water Use	
Monitoring/Test Holes	7 (70%)
Commercial/Industrial	0 (0%)
Water Supply (domestic/public/livestock)	1 (9%)
Municipal (Test Hole)	2 (20%)
Unknown/Not Used/Abandoned	1 (9%)

The wells are generally used as test holes or for groundwater monitoring purposes. There was one (1) record of a well used for domestic water supply. The well records with available construction and installation data indicate that the majority of wells in the Study Area were 50 ft deep.

2.8 Private Well Survey

A door-to-door water well survey within 500 m of the Development Limit was completed on March 30, 2021, to characterize the local groundwater use. Based on the private well survey, it was concluded that no sites within a 500 m radius of the Development Limit were on private well water and previous private wells were not found. The results of this inspection are as follows:

- Fire hydrants were observed along Huronia Road to the west and Loon Avenue to the north.
- Residents within residential subdivisions were using municipally supplied water as evidenced by water curb stops in lawns and driveways.
- The one (1) domestic well identified during the MECP well record search was not located during the inspection. This well is likely not in use or has been decommissioned.
- No domestic water wells were observed at the Subject Lands or within the Study Area.

The Subject Lands are located in a developed area of the Barrie, and all properties are municipally serviced. The location of the wells identified within the MECP Well Record Search are presented in Figure 3. A cross section of the wells identified within the search are presented on Figure 4.

2.9 Subsurface Investigation

A subsurface investigation was conducted by Grounded Engineering within the Development Limit from March 29 – June 2, 2021. The field investigation is as below. Borehole logs is presented in Appendix F. The location of the boreholes is shown on Figures 2A and 2B. Cross sections are shown in Figure 7.

Boreholes	BH101 to BH105, BH201 to BH206
Monitoring Wells	BH101 to BH105, MW204 to MW206
Well Depth (mbgs)	5.5 to 9.6 m bgs

The stratigraphy beneath the investigated areas of the Development Limit generally consists of the following:

Geological Units	Description
Topsoil and upper sands	Boreholes 101, 102, and 105, 204 to 206 observed native sands underlying the topsoil. The native sands extended to depths of 0.8 to 3.0 m below grade (Elev. 246.6 to 241.5 ±m). The sands contained a variable amount of silt (ranging from some silt to silty), and trace amounts of gravel, organics and rootlets. The sands generally ranged in colour from dark brown to orangey-brown, and wet.
Native Soils	Underlying the topsoil and surficial sands, the boreholes observed an undisturbed native glacial till deposit. The glacial till had a variable matrix of cohesive clayey silt to cohesionless sandy silt and silty sand, with trace amounts of gravel. This unit was encountered at 0.8 to 3.0 m below grade (Elev. 233.1 to 235.7 ±m) and extended down to targets borehole depths. All boreholes were terminated within the glacial till unit. Borehole 102 observed a cohesionless, coarse sand and gravel at a depth of 9.1 m below grade (Elev. 234.0 ±m). Trace rock fragments were observed (cobbles are inferred). The coarse sand and gravel were grey, wet, and dense.
Bedrock	Bedrock was not encountered during the investigation; however, based on available background information the bedrock consists of limestone, dolostone, shale, arkose, sandstone of the Ottawa Group; Simcoe Group; Shadow Lake Formation.

2.10 Groundwater Level Monitoring

Eight (8) monitoring wells were installed on the Development Limit. To date, groundwater level measurements were taken between April 2021 and May 2022 as part of the hydrogeological

assessment. Grounded advanced three new monitoring wells in February of 2023 and collected water levels from the existing and newly installed wells on March 3, 2023. Water level data is presented in Appendix M.

Observations pertaining to the depth of the water level and caving were made in the open boreholes immediately after completion of drilling and are reported on the borehole logs. The measured water level along with other boreholes detailed are presented in Appendix F. Groundwater levels collected to date are summarized in the following table:

Groundwater levels may be influenced by climatic variations, seasonal fluctuations, and presence of underground services and structures.

The groundwater table within the Development Limit ranges from approximately elev. 242.4 ± masl to elev. 246.8 ± masl. Groundwater at the Development Limit generally follows the topographic contours of the site, flowing eastward towards Lovers Creek.

For design purposes, and to account for seasonal fluctuations in the groundwater table, the design water table is the maximum groundwater levels observed to date in order to represent the seasonally high water table within/near each of the development blocks. The following **design water table elevations** should be assumed:

Block	Relevant Monitoring Wells	Design Groundwater Table (masl)
1	BH101	244.1
2	BH101	244.1
3	BH103	243.1
4	BH102	243.0
5	BH104	242.8
6	BH103	243.1
7	BH206	243.3
8	BH206	243.3
9	BH105	243.1
10	BH105	243.1
11	BH105	243.1
12	BH205	246.8
13	BH205	246.8
14	BH205	246.8
15	BH204	242.4
16	BH204	242.4
17	BH204	242.4

Block	Relevant Monitoring Wells	Design Groundwater Table (masl)
18	BH104	242.8
19	BH104	242.8
20	BH102	243.0

2.11 Groundwater Quality

Groundwater samples were obtained from one monitoring well on-site and submitted for laboratory analysis on September 29, 2021. All the monitoring wells were screened in the overburden materials. Each sample was analyzed with respect to the City of Barrie Sewer Use bylaw. The result of the groundwater testing is presented in Appendix H and summarized below.

City of Barrie Bylaw	Exceedance
Table 1 –Storm Sewer Discharge Criteria	• None
Table 2 - Sanitary Discharge Criteria	• None

2.12 Hydraulic Conductivity

In-situ single well response tests (SWRT) were conducted in five (5) of the monitoring wells (BH101 to BH105) on June 7, 2021 to assess the hydraulic conductivity of the underlying soil. The monitoring wells were installed in the clayey silt and lower sand glacial till. The tests were conducted by drawing down the water levels (rising head test).

Data from the SWRT were analyzed using Bouwer and Rice. The table below summarized the results of the hydraulic conductivity testing. The analysis graphs of the tests are presented in Appendix I.

Monitoring Well	Hydraulic Conductivity (m/sec)	Well Screen Strata
BH101	1.43×10^{-7} m/sec	Lower Silty Sand Glacial Till
BH102	1.42×10^{-8} m/sec	Upper Silty Sand Glacial Till
BH103	4.71×10^{-7} m/sec	Clayey Silt
BH104	3.23×10^{-8} m/sec	Lower Silty Sand Glacial Till
BH105	8.48×10^{-9} m/sec	Lower Silty Sand Glacial Till

Based on the SWRT analysis, the hydraulic conductivity of the underlying soil ranges from 1.43×10^{-7} m/sec to 8.48×10^{-9} m/sec.

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated at the Development Limit are:

- Sands to Sandy Silt: 1×10^{-6} to 1×10^{-7} m/s
- Silty Clay: 1×10^{-7} to 1×10^{-9} m/s
- Glacial Till: 1×10^{-6} to 1×10^{-12} m/s

The hydraulic conductivity field results are relatively consistent with the published values associated with the geological materials which were tested. Based on the in-situ testing, the Development Limit consisted of moderate to low permeability soils and is not considered to be significant in terms of groundwater recharge.

2.13 Surface Water Features

A site inspection was conducted to assess the presence of surface water features on and bounding the Subject Lands. The inspection included the following:

- Inspection of surface and groundwater interactions and associated features
- Inspection of areas of actual and potential groundwater discharge
- Inspection of swales and drainage courses

The site inspection was conducted on March 30, 2021, to assess the presence of any natural environmental features. The topography across the Subject Lands is variable and notable features are summarized as follows:

- The ground slopes from the north to the south-southeast
- Wetlands are present on adjacent lands to the south of the Development Limit
- Lovers Creek is approximately 174 m east of the Subject Lands

During the site visit, the ground surface was covered by significant natural vegetation including grass, trees, and shrubs. Given the sloping topography of the Subject Lands and the Development Limit, the direction of surface runoff is expected to be to the south-southeast.

2.14 Review of Current Regulatory Requirements

Current regulatory requirements associated with water supply and hydrogeology in connection with the proposed development were reviewed. This includes the review of the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan. Relevant information is provided below and presented in Appendix J.

2.14.1 Ministry of Natural Resources and Forestry

The Development Limit is not located within the Niagara Escarpment Plan Area, Oak Ridges Moraine Plan Area, the Greenbelt Protection Act Area, and Natural Heritage Area.

The Development Limit is adjacent to a woodland and Provincially Significant Evaluated Wetland.

2.14.2 Lake Simcoe Region Conservation Authority

According to the Lake Simcoe Region Conservation Authority (LSRCA) website, the Subject Lands/Development Limit is located within an LSRCA regulated area.

2.14.3 Wellhead Protection Areas and Aquifer Vulnerability

Wellhead Protection Area: The Subject Lands/Development Limit is **not** located within a Wellhead Source Protection Area.

Intake Protection Zone**:** The northeast corner of Subject Lands/Development Limit falls within a Zone 2 Intake Protection Area.

Significant Groundwater Recharge Area**:** The Subject Lands/Development Limit is **not** located in a Significant Groundwater Recharge Area.

Highly Vulnerable Aquifers**:** The Subject Lands/Development Limit does **not** fall within a highly vulnerable aquifer area.

Vulnerable Scoring Area – Groundwater: The Subject Lands/Development Limit is **not** located within a Vulnerable Groundwater Scoring Area.

Vulnerable Scoring Area – Groundwater Under Direct Influence**:** The Subject Lands/Development Limit is **not** located within a Vulnerable Groundwater Under Direct Influence Scoring Area.

Vulnerable Scoring Area – Surface Water**:** The Subject Lands/Development Limit **does not** fall within Vulnerable Surface Water Scoring Area.

3 Discussion and Analysis

3.1 Proposed Development Plan

The Development Limit is irregular in shape, with a total area of approximately 3.34 ha. The Development Limit is currently undeveloped. An evaluated wetland, and a regulated woodlot are adjacent to the south of the Development Limit. Lovers Creek is located 174 m to the east of the Subject Lands. It is understood that the Development Limit will be developed with residential townhome buildings with associated internal roads and servicing. The proposed project includes

constructing new townhome blocks (Block 1 through 20) consisting of a number of 3-storey back-to-back and conventional townhomes, with basements and walk outs. The general site feature is presented in Figure 2.

The townhomes will be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The surrounding properties are predominantly residential and commercial. There is, however, agricultural land use in the south portion of the assessment area south of Mapleview Drive East.

The proposed development plan is presented in Figure 3.

The following summarizes the proposed land coverage areas for the development:

Land Coverage Type	Areas
Building Envelope	0.99 ha
Hard Surface Paving	1.30 ha
Landscape areas for infiltration	1.04 ha
Total Area (Development Lands only)	**3.34 ha**

3.2 Summary of Hydrogeologic Conditions

Based on the review of the available site information, the hydrogeologic conditions of the Development Limit is summarized as follows:

- The Development Limit is characterized by an undisturbed native glacial till deposit. This deposit is of moderate to low permeability and provide for low recharge capability and groundwater movement.
- Groundwater was observed at approximately 0.1 – 2.8 m depth (Elev. 242.4 to 246.8 masl) within the monitoring wells. The groundwater table has been observed to be very close to ground surface elevation as noted in BH102 on June 9, 2022 and in BH104 on December 29, 2021. The general direction of groundwater flow at the Development Limit is eastward.
- Based on the highest groundwater levels measured to date, the design groundwater table was established at Elev. 242.4 to 246.8± masl. This translates to about 0.1 to 2.8± m below existing ground surface across the Development Limit.
- Based on the low to moderate permeability of the soils, groundwater transmission is expected to be moderate. A wetland is adjacent to the Development Limit and Lover's Creek is 174 m to the east of the Subject Lands.

- The Subject Lands/Development Limit is not located within a Wellhead Protection Area according to the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan.
- The northeast corner of the Subject Lands/Development Limit falls within a Zone 2 Intake Protection Area. The Subject Lands/Development Limit is not located in a Significant Groundwater Recharge Area. The Subject Lands/Development Limit is not located within a Vulnerable Groundwater Scoring Area and does not fall within a Vulnerable Surface Water Scoring Area.
- MECP well records for wells completed in the vicinity of the Development Limit show that there were eleven (11) wells within 500 m of the Development Limit used for test holes, monitoring, and domestic purposes. The one (1) domestic well identified during the MECP well record search was not located during the private well survey. Well records with available construction method data show that the wells were installed within 15 to 345 ft below grade.

The above hydrogeologic features and functions were considered in assessing the potential impact of the proposed development. This information was used to provide mitigating measures to ensure that hydrogeologic function is not adversely affected during the proposed development.

3.3 Water Balance Analysis

A water balance model was prepared for the Development Limit to assess the distribution of rainfall run-off and infiltration for existing (pre- and post-development) conditions (Appendix L). The model is based on Lake Simcoe Climate Data presented in Section 2.6. The Thornthwaite method was used to evaluate the relative balance between rainfall, evaporation and evapotranspiration in the shallow soil zones. The water balance for pre-and post-development conditions is summarized below:

Pre-Development Water Balance

Pre-Development	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Landscaped Area	33,352	30,484	18,177	4,169	8,138

The post-development water balance accounts for hard surfaced areas created by buildings and pavements and uses the proposed land use statistic information provided by We Merchandise Space Inc, Forrest Group Inc and Counterpoint.

Post-Development Water Balance

Post-Development	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)

Building Envelope	9,935	9,081	-	-	9,081
Hard Surface Paving	13,049	11,927	-	-	11,927
Landscaped Area	10,368	9,476	5,651	1,296	2,530

The volume of surface water run-off available from residential roof tops was calculated to be 9,081 m^3, as noted in the above table. This volume of water will be available as a resource, to maintain groundwater recharge and function. The volume of roof run-off available is compared to the difference in infiltration volume between pre-development and post-development, as noted below:

Potential Post-Development Infiltration Deficit (m^3)	Volume of Roof Run-off Available (m^3)
2,873	9,081

Approximately 32% of roof run-off would be required to match pre-development infiltration rates.

3.4 Infiltration Rates – Guelph Permeameter Tests

Two (2) Guelph Permeameter infiltration tests were completed by Grounded on June 2, 2021. The results of the infiltration tests are presented in Appendix K and summarized below:

Infiltration Location	Approximate Test Depth (mbgs/masl)	Soil Type	Field Saturated K-Value (m/s)	Infiltration Rate* (mm/hr)	Factored Infiltration Rate** (mm/hr)
GP1	0.3 / 245	Silty Sand	NA – Unsuccessful tests due to high groundwater table and saturated conditions within the native silty sand material		
GP2	0.3 / 242.6	Silty Sand			

*Calculated using relationship between infiltration rate and hydraulic conductivity (Figure C11) as defined in the TRCA's Stormwater Management Criteria, Appendix C: Water Balance and Recharge (August 2012)
**Calculated using Table C3: Safety correction factors for calculating design infiltration rates as defined in the TRCA's Stormwater Management Criteria, Appendix C: Water Balance and Recharge (August 2012). Hydraulic conductivity of underlying soil (silty clay till) determined from geomean of SWRTs as per below.

A high groundwater table was observed during the Guelph Permeameter Testing conducted on the Development Limit. The native soils were saturated below grade during the time of testing and on other inspections in dry-weather conditions. The testing in this area was therefore unsuccessful and an infiltration rate for the silty sands could not be determined. Furthermore, the infiltration rate of the underlying silty clay till also could not be tested due to these saturated conditions. The infiltration rate of the underlying strata was calculated using hydraulic conductivities from the in situ single well response tests conducted in the monitoring wells.

Infiltration testing was also attempted in the southern portions of the proposed development and was unsuccessful. If an LID measure is proposed on the Development Limit, the grade will have to be raised to accommodate.

3.5 Groundwater Control Requirements

The proposed project includes constructing new townhouse blocks (Block 1 through 20) consisting of a number of 3-storey back to back and conventional townhomes with basements and walkouts along the perimeter of the development. The footings for the Blocks 1-20 will extend into the groundwater table at the Development Limit. As such, it will be necessary to positively dewater the Development Limit to a minimum of 1.2 m below proposed excavation elevation prior to excavation to preserve the integrity of the native soils during construction. The design considerations for each of the townhome blocks is as follows:

Block	Relevant Borehole	Approx Block Area (m^2)	Borehole Elevations (masl)	Proposed Ground FFE (masl)	Assumed Lowest BFFE (masl)	Assumed Footing Elev. (masl)	Design Groundwater Table Elev. (masl)	Footing Depth Below GWT (m)
1	BH101	960	245.30	247.60	244.85	243.35	244.1	-0.75
2	BH101	1,320	245.30	247.30	244.55	243.05	244.1	-1.05
3	BH103	1,260	243.90	246.90	244.15	242.65	243.1	-0.45
4	BH102	640	243.90	246.80	244.05	242.55	243.0	-0.45
5	BH104	640	243.90	246.60	243.85	242.35	242.8	-0.45
6	BH103	1,120	243.90	246.95	244.20	242.70	243.1	-0.40
7	BH206	800	245.40	247.55	244.80	243.30	243.3	n/a
8	BH206	700	245.40	247.70	244.95	243.45	243.3	n/a
9	BH105	735	243.40	246.90	244.15	242.65	243.1	-0.45
10	BH105	1,000	243.40	246.70	243.95	242.45	243.1	-0.65
11	BH105	1,200	243.60	246.70	243.95	242.45	243.1	-0.65
12	BH205	1,300	243.60	247.15	244.40	242.90	246.8	-3.90
13	BH205	1,000	249.60	247.20	244.45	242.95	246.8	-3.85
14	BH205	1,000	249.60	246.90	244.15	242.65	246.8	-4.15
15	BH204	1,000	243.80	246.50	243.75	242.25	242.4	-0.15
16	BH204	300	243.80	246.35	243.60	242.10	242.4	-0.30
17	BH204	1,100	243.80	246.40	243.65	242.15	242.4	-0.25
18	BH104	600	242.90	246.30	243.55	242.05	242.8	-0.75
19	BH104	500	242.90	246.35	243.60	242.10	242.8	-0.70
20	BH102	500	243.10	246.40	243.65	242.15	243.0	-0.85

*n/a indicates that the footings will not extend below the groundwater table.

Groundwater seepage estimates were conducted for both short-term and long-term dewatering scenarios. The modeling was conducted using an equivalent well radius approximation. The Excel-based calculation for groundwater seepage indicates the short-term (construction) and long-term (permanent) dewatering requirements as provided below.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will be an initial drawdown of the groundwater before a steady state condition is reached. The rate of the initial drawdown, and therefore discharge, is dependent on the dewatering contractor and how the groundwater is being dealt with at the Development Limit.

An estimate of the initial volume of stored groundwater which will require removal before steady state is reached has been provided below.

Please note that if excavation is exposed to the elements, storm water will have to be managed. The short-term control of groundwater should consider stormwater management from rainfall events. A dewatering system should be designed to consider the removal of rainfall from excavation. A design storm of 32 mm has been used in the quantity estimates.

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event (94 mm) is approximately 330,000 L.

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used						
Block	**Groundwater Seepage**		**Design Rainfall Event (32 mm)**		**Total Daily Water Takings**	
	L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
1	10,500	7.3	30,720	21.3	41,220	28.6
2	12,000	8.3	41,590	28.9	53,590	37.2
3	25,500	17.7	41,600	28.9	67,100	46.6
4	13,500	9.4	20,480	14.2	33,980	23.6
5	6,000	4.2	20,480	14.2	26,480	18.4
6	13,500	9.4	35,840	24.9	49,340	34.3
7	15,000	10.4	25,600	17.8	40,600	28.2
8	13,500	9.4	22,400	15.6	35,900	24.9
9	13,500	9.4	23,520	16.3	37,020	25.7
10	21,000	14.6	32,000	22.2	53,000	36.8
11	25,500	17.7	38,400	26.7	63,900	44.4
12	16,500	11.5	41,600	28.9	58,100	40.3
13	15,000	10.4	32,000	22.2	47,000	32.6
14	15,000	10.4	32,000	22.2	47,000	32.6
15	7,500	5.2	32,000	22.2	39,500	27.4

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used						
Block	**Groundwater Seepage**		**Design Rainfall Event (32 mm)**		**Total Daily Water Takings**	
	L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
16	4,500	3.1	9,600	6.7	14,100	9.8
17	7,500	5.2	35,200	24.4	42,700	29.7
18	6,000	4.2	19,200	13.3	25,200	17.5
19	6,000	4.2	16,000	11.1	22,000	15.3
20	7,500	5.2	32,000	22.2	39,500	27.4
Total*	**255,000**	**177**	**582,230**	**404**	**837,230**	**581**
**Totals rounded*						

The groundwater control system is required to be designed by a dewatering contractor. The groundwater must be dewatered prior to excavation to maintain a stable working base in the excavation. Mitigation measures based on dewatering and infiltration requirements as per the MECP are discussed in Section 3.6.

It is possible for townhome structures at this Development Limit to be made as conventional drained structures provided that the underside of the subfloor drainage layer (nominally 0.3 m below BFE) is at least 0.5 m above the groundwater table in each location (i.e., lowest basement FFE is 0.8 m above the groundwater table in each location). The current site grading plan indicates Blocks 3, 4, 6 to 11 and 15 to 17 can be constructed with drained foundations, whereas all other proposed structures be made with fully waterproofed basements.

The long-term discharge estimates were calculated as follows.

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used							
Block	**Groundwater Seepage**		**Infiltration Design Rainfall Event (32 mm)***		**Total Daily Water Takings**		**Recommended Basement Structure**
	L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**	
1	0	0	0	0	0	0	Waterproofed
2	0	0	0	0	0	0	Waterproofed

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used							
Block	**Groundwater Seepage**		**Infiltration Design Rainfall Event (32 mm)***		**Total Daily Water Takings**		**Recommended Basement Structure**
	L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**	
3	N/A**	N/A**	3,300	2.3	3,300	2.3	Drained Foundations
4	N/A**	N/A**	2,000	1.4	2,000	1.4	Drained Foundations
5	0	0	0	0	0	0	Waterproofed
6	N/A**	N/A**	2,918	2.0	2,918	2.0	Drained Foundations
7	N/A**	N/A**	2,304	1.6	2,304	1.6	Drained Foundations
8	N/A**	N/A**	2,112	1.5	2,112	1.5	Drained Foundations
9	N/A**	N/A**	2,150	1.5	2,150	1.5	Drained Foundations
10	N/A**	N/A**	2,688	1.9	2,688	1.9	Drained Foundations
11	N/A**	N/A**	3,702	2.6	3,702	2.6	Drained Foundations
12	0	0	0	0	0	0	Waterproofed
13	0	0	0	0	0	0	Waterproofed
14	0	0	0	0	0	0	Waterproofed
15	N/A**	N/A**	2,688	1.9	2,688	1.9	Drained Foundations
16	N/A**	N/A**	1,344	0.9	1,344	0.9	Drained Foundations
17	N/A**	N/A**	2,880	2.0	2,880	2.0	Drained Foundations
18	0	0	0	0	0	0	Waterproofed
19	0	0	0	0	0	0	Waterproofed
20	0	0	0	0	0	0	Waterproofed
Total*	N/A**	N/A**	**28,086**	**19.5**	**28,086**	**19.5**	

**Total is rounded*

*** N/A indicates underground structures above water table*

The final grading and building configurations have not been advanced to detailed design. To eliminate the requirement for long term discharge due to groundwater seepage, it is recommended that any below grade structures extending into the water table should be waterproofed.

It is noted that permits are required to be submitted for the entire developable area not individual townhouse blocks. The summary below is based on total groundwater takings required, not the groundwater taking required for individual blocks.

Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Not Required
Short Term Permit to Take Water (PTTW)	Required
Long Term Permit to Take Water (PTTW)	Not Required

Long-term discharge into the City of Barrie's municipal sewer system is prohibited. Overland discharge of groundwater and surface water is proposed for the Development Limit. If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6 Assessment of Potential Impact

It is understood that the Development Limit will be developed with townhome buildings, with associated internal roads and servicing. The proposed project includes constructing new townhome blocks (Blocks 1 through 20) with basements and walkouts along the perimeter.

The Development Limit will be serviced with municipal piped water, storm, and sanitary sewers. The proposed nature of the development does not pose any significant concern with respect to potential impact to groundwater quality in the area.

3.6.1 Short Term Discharge (Construction Dewatering)

Groundwater takings of approximately 177 L/min to 501 L/min is possible. The flow of water from the dewatering system must be treated to meet Provincial Water Quality Objectives prior to overland discharge t. Sampling of the discharge water from the dewatering system is required during initial discharge and on an on-going basis as required by the Region during active dewatering. Visual monitoring of the dewatering discharge should be conducted daily. Adjustment to the dewatering system should be made if an increase in turbidity sediment is noted. The above recommendations should be included in a dewatering plan prepared in accordance with regulatory requirements prior to construction.

3.6.2 Long Term Discharge (Post Construction)

A permanent dewatering system would be required if the buildings will be drained structures. Groundwater takings of up to approximately 19.5 L/min are possible. The flow of water from the dewatering system must be treated to meet Provincial Water Quality Objectives prior to overland discharge to meet regulation requirements.

The permanent building drainage system must be properly installed and screened to ensure sediments and fines will not be removed, which is typically a primary cause of dewatering related settlement. The above recommendations should be included in a dewatering plan prepared in accordance with regulatory requirements prior to construction.

If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6.3 Zone of Influence (ZOI)

The Zone of Influence (ZOI) was calculated based on the estimated groundwater taking rate and the average hydraulic conductivity recorded at the Development Limit. The stratigraphy of the relevant native soil (for dewatering purposes) located at the Development Limit generally consists of a cohesionless upper sand deposit underlain by a tight silty clay till. The ZOI calculated for each of the townhouse blocks is as follows:

Equation: $R_0 = 3000*dH*K^{0.5}$ Where R_0 = Radius of Influence (Zone of Influence)
dH = dewatering thickness (m)
K= hydraulic conductivity (m/s)

The representative hydraulic conductivity of the soils used for the ZOI calculations varied by block. As such, the most conservative hydraulic conductivity from the Development Limit was used for the calculations below:

Block	Hydraulic Conductivity (m/s)	dH (m)	ZOI (m)
1	1.43×10^{-7}	1.9	2
2		2.3	3
3		1.7	2
4		1.7	2
5		1.7	2
6		1.6	2
7		1.2	1
8		1.1	1
9		1.7	2

Block	Hydraulic Conductivity (m/s)	dH (m)	ZOI (m)
10		1.9	2
11		0.4	0
12		5.6	6
13		5.1	6
14		5.4	6
15		1.3	1
16		1.3	1
17		1.95	2
18		1.95	2
19		1.95	2
20		1.95	2

The ZOI may reach up to 6± m during construction dewatering. Based on calculated ZOI, -dewatering-induced impacts on the surrounding environment and infrastructure are not anticipated as the ZOI is contained within the area of development and away from watercourses and wetlands.

If long term overland discharge is not feasible, then the buildings must be waterproofed structures.

3.6.4 Geotechnical Considerations

The Subject Lands are bound by residential properties to the north, vacant land to the west, vacant woodland & wetland to the east, and residential and agricultural properties to the south of Mapleview Drive East.

Changes in the groundwater table have the potential to cause settlement based on the change in effective stress. Within the zone of influence, changes in groundwater level have the potential to cause settlement based on the change in effective stresses that will result from dewatering and draining soil (refer to the geotechnical report). It is recommended that a monitoring and mitigation program during dewatering activities be implemented to confirm that there are not potential implications to existing structures on adjacent properties.

3.6.5 Surface Water, Wetlands, and Natural Significance

A tributary of Lovers Creek and a Provincially Significant Evaluated Wetland are located within close proximity to the Development Limit. Groundwater and surface water are expected to flow

towards Lovers Creek, which eventually drains into Kempenfelt Bay (western arm of Lake Simcoe) to the northeast.

3.6.6 Local Wells and Zone of Influence

The Development Limit is in an area that is serviced by the City of Barrie. The townhomes will eventually be serviced with municipal piped water and sewer supply. The surrounding area is currently provided with municipal piped water and sewer supply. The MECP well records were searched through the online Water Well Database for records located on the Development Limit and within a 500 m radius.

Eleven (11) wells were identified within the Study Area, whose uses range from test holes and monitoring wells to domestic wells. The domestic well was not located during the Private Well Survey and surrounding inspection and have likely been decommissioned. Fire hydrants were present throughout the Study Area and the results of the Private Well Survey indicate that the Development Limit and surrounding areas are supplied with water from municipal sources. Dewatering activities at the Development Limit are unlikely to impact any of the wells identified in the Study Area.

3.6.7 Contamination Sources

The Subject Lands and immediate surrounding area currently consist mostly of undeveloped, residential and commercial occupants. These activities are not expected to provide an area of potential environmental concern for the Development Limit.

3.7 Mitigation Measures to Maintain Hydrogeologic Functions

3.7.1 Maintenance of Groundwater Recharge

The existing groundwater recharge rates at the Subject Lands are approximately 125 mm/a. This recharge occurs in a broad diffuse manner over the entire Subject Lands. There are watercourses and wetlands adjacent to the boundaries of the Development Limit. Mitigation measures are available to maintain recharge rates. As there is a surplus of water available following development, it is recommended to consider low-impact development (LID) techniques and/or other forms of water control at the Development Limit to maintain groundwater recharge and function across the site area.

Based on the results of the Guelph Permeameter testing, LID measures that rely on infiltration likely are not feasible due to the high groundwater table at the Development Limit. Ground improvement measures or other forms of groundwater control will be required instead.

There is potential for direct surface runoff from the Development Limit to the watercourses and wetlands. Intercepting overland flow water prior to discharging into these areas and thereby preserving groundwater recharge, groundwater flow pathways, and base flow contribution to existing watercourses must be a primary consideration.

The storm water management measures must specifically address the maintenance of groundwater recharge of the proposed development to preserve the tributary of Lovers Creek and wetland areas located adjacent to the Development Limit.

3.7.2 Maintenance of Groundwater Transmission Pathways

As previously indicated, the soils present on the Development Limit are of moderate to low permeabilities. No significant groundwater flow or transmission zones were encountered on the Development Limit. However, the overall continuity of the groundwater flow at the Development Limit should be maintained, where practical. Generally, the groundwater transmission pathways can be maintained through the following means:

- Bedding materials beneath underground services may serve as a subdrain to collect and convey groundwater. To prevent drainage of groundwater along bedding materials, clay trench plugs should be provided at all manhole locations to cut off the granular bedding.
- The excavation of any underground services or utilities across more permeable layers may interrupt the groundwater flow. It is recommended that trench backfilling be carried out with materials that are similar to the materials that have been excavated. The continuity of any sand or more permeable zones can be maintained by backfilling with the native sandy or more permeable zones as it excavated.

Groundwater flow may occur into the open shallow excavations if more permeable deposits (such as gravelly sand) are encountered. Based on the results of the subsurface investigation, active groundwater control (such as from wells or well points) is not anticipated during construction. Localized groundwater flow into shallow excavations can be controlled by utilizing localized sumps and pumps at the base of the excavations. In addition to this, it is recommended that any excavations should be staged or constructed in such a manner to avoid the collection of overland drainage.

4 Summary

- Overburden soil within the Development Limit is characterized by an undisturbed native glacial deposit. This deposit is of moderate to low permeability and provide for low recharge capability and groundwater movement.
- Groundwater was observed at approximately 0.1 – 2.8 m depth (Elev. 242.4 to 246.8 masl) within the monitoring wells installed in the Development Limit. The groundwater table has

been observed very close to ground surface elevation as noted in BH102 on June 9, 2022 and in BH104 on December 29, 2021. The general direction of groundwater flow at the Development Limit is t eastward.

- Based on the highest groundwater levels measured to date, the design groundwater table was established at Elev. 242.4 to 246.8 ± masl. This translates to about 0.1 to 1.2 ± m below existing ground surface across the Development Limit.
- Based on the low to moderate permeability of the soils, groundwater transmission is expected to be moderate.
- A wetland and tributary of Lovers Creek are present close to the Development Limit.
- The Subject Lands/ Development Limit are not located within a Wellhead Protection Area according to the Lake Simcoe Region Conservation Authority and Lake Simcoe Protection Plan.
- The northeast corner of the Subject Lands/Development Limit fall within a Zone 2 Intake Protection Area. The Subject Lands/ Development Limit are not located in a Significant Groundwater Recharge Area. The Subject Lands/Development Limit are not located within a Vulnerable Groundwater Scoring Area and do not fall within a Vulnerable Surface Water Scoring Area.
- MECP well records for wells completed in the vicinity of the Development Limit show that there were eleven (11) wells within 500 m of the Development Limit used for test holes, monitoring, and domestic purposes. The one (1) domestic well identified during the MECP well record search were not located during the inspection. Well records with available construction method data show that the wells were installed within 15 to 345 ft below grade.
- Based on the results of the Guelph Permeameter testing, LID measures are not likely feasible due to the high groundwater table at the Development Limit.
- There will be a post-development infiltration deficit of approximately 2,873 m^3 for the Development Limit.
- Construction or short-term groundwater control:
    - The footings for the Blocks 1 - 20 will extend into the groundwater table at the Property. As such, it will be necessary to positively dewater the Property to a minimum of 1.2 m below proposed excavation elevation prior to excavation to preserve the integrity of the native soils during construction.
    - Total short-term groundwater takings of approximately 177 to 501 L/min are likely.
    - The flow of water from the dewatering system must be treated to meet Provincial Water Quality Objectives prior to overland discharge.
    - A PTTW and municipal discharge permits will be required prior to any discharge into the municipal sewers.

- Long-term groundwater control:
  - A permanent dewatering system would be required if the buildings will be drained structures. Total long-term groundwater takings of approximately 19.5 L/min are likely.
  - It is recommended that Blocks 1, 2, 5, 12, 13, 14, 18, 19, and 20 will be waterproofed since the basement FFE is in the water table.
  - Blocks 3, 4, 6 to 11 and 15 to 17 can have drained foundations since the basement FFE is sufficiently above the groundwater table.
  - Long-term discharge into the City of Barrie's municipal sewer system is prohibited.
  - Overland discharge of groundwater and surface water is proposed for the Development Limit. If long term overland discharge is not feasible, then the buildings must be waterproofed structures.
  - It is possible for townhome structures at this Development Limit to be made as conventional drained structures provided that the underside of the subfloor drainage layer (nominally 0.3 m below BFE) is at least 0.5 m above the groundwater table in each location (i.e., lowest basement FFE is 0.8 m above the groundwater table in each location).

4.1 Signatures

The Hydrogeological Assessment was conducted by Kim Pickett, C.E.T, LET, QP_{ESA} under the supervision of Bailey Walters, MSc PGeo $QP_{ESA|RA}$.

We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED ENGINEERING

Professional Engineers Ontario
Licensed Engineering Technologist
Name: K. L. PICKETT
Number: 100501338
Limitations: Environmental investigations of soil, groundwater, air and sediment products excluding Records of Site Conditions, soil management plans and completion of Phase I and Phase II Environmental Site Assessments, including design, construction and verification of site remediation.
Association of Professional Engineers of Ontario

Kim Pickett. C.E.T, LET, QP_{ESA}
Intermediate Project Engineer

PROFESSIONAL GEOSCIENTIST
C.W. BAILEY WALTERS
PRACTISING MEMBER
1428
ONTARIO

Bailey Walters, MSc PGeo $QP_{ESA|RA}$
Senior Geoscientist

5 References

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6 Limitations and Restrictions

The assessment should not be considered a comprehensive investigation that eliminates all risks of encountering environmental problems. The information presented in this report is based on information collected during the completion of the Hydrogeological Assessment by Grounded Engineering Inc. It was based on the conditions on the Hydrogeological Assessment at the time of the site inspection supplemented by a review of historical information to assess the environmental conditions regarding the Subject Lands.

There is no warranty expressed or implied by this report regarding the hydrogeologic conditions of the Subject Lands. Professional judgement was exercised in gathering and analysing information collected by our staff, as well as that submitted by others. The conclusions presented are the product of professional care and competence and cannot be construed as an absolute guarantee.

If new information regarding the hydrogeological condition of the Subject Lands is identified during future work, or outstanding responses from regulatory agencies indicate outstanding issues on file with respect to the Subject Lands, Grounded Engineering Inc. should be notified so that we may re-evaluate the findings of this assessment and provide amendments.

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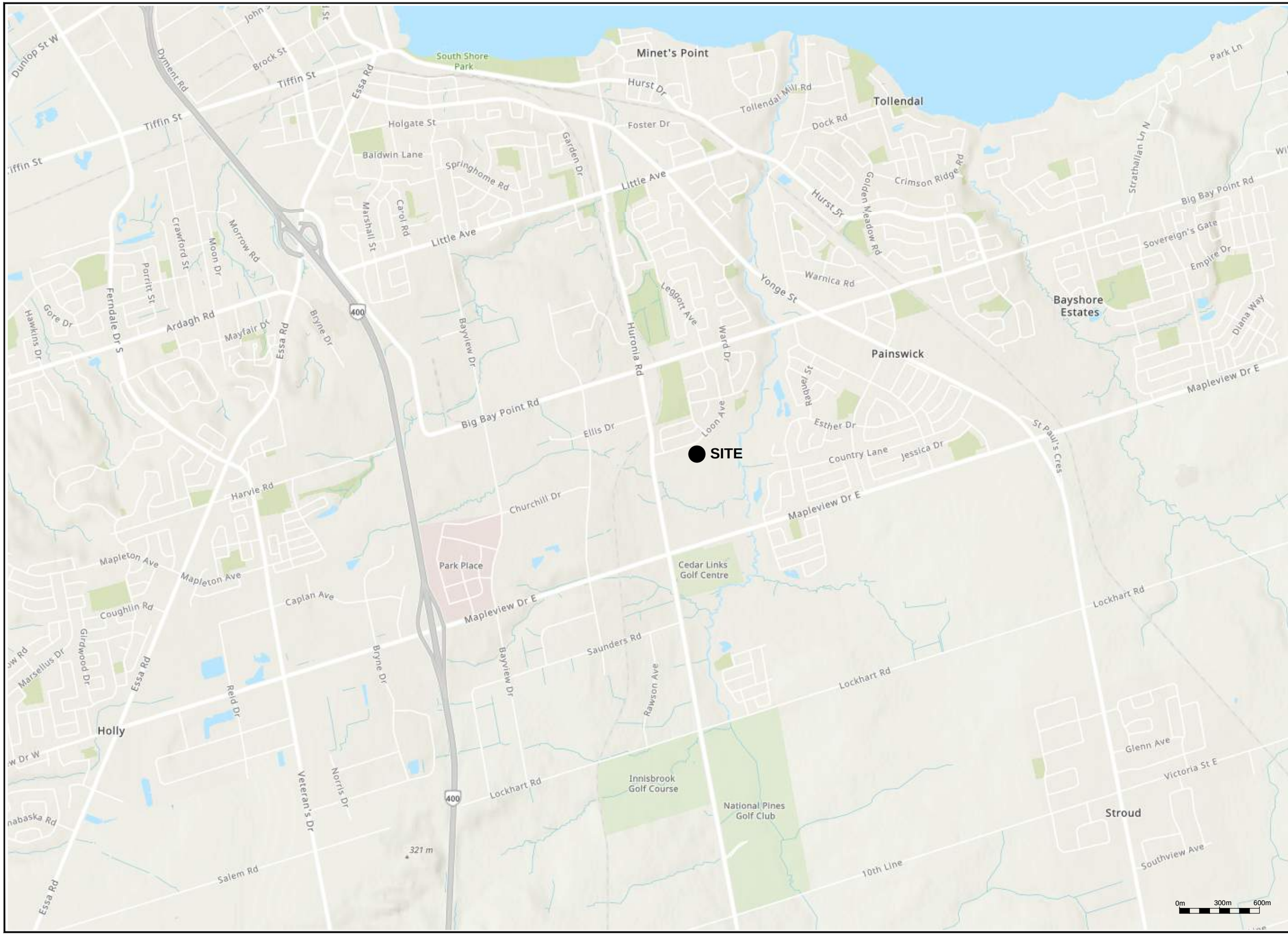
FIGURES



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LEGEND

● APPROXIMATE SITE LOCATION

Note

Reference

ArcGIS Map 2021

Project

338 MAPLEVIEW DR E
BARRIE, ON

Figure Title

SITE LOCATION PLAN

North

TRUE

Date

DECEMBER, 2021

Scale

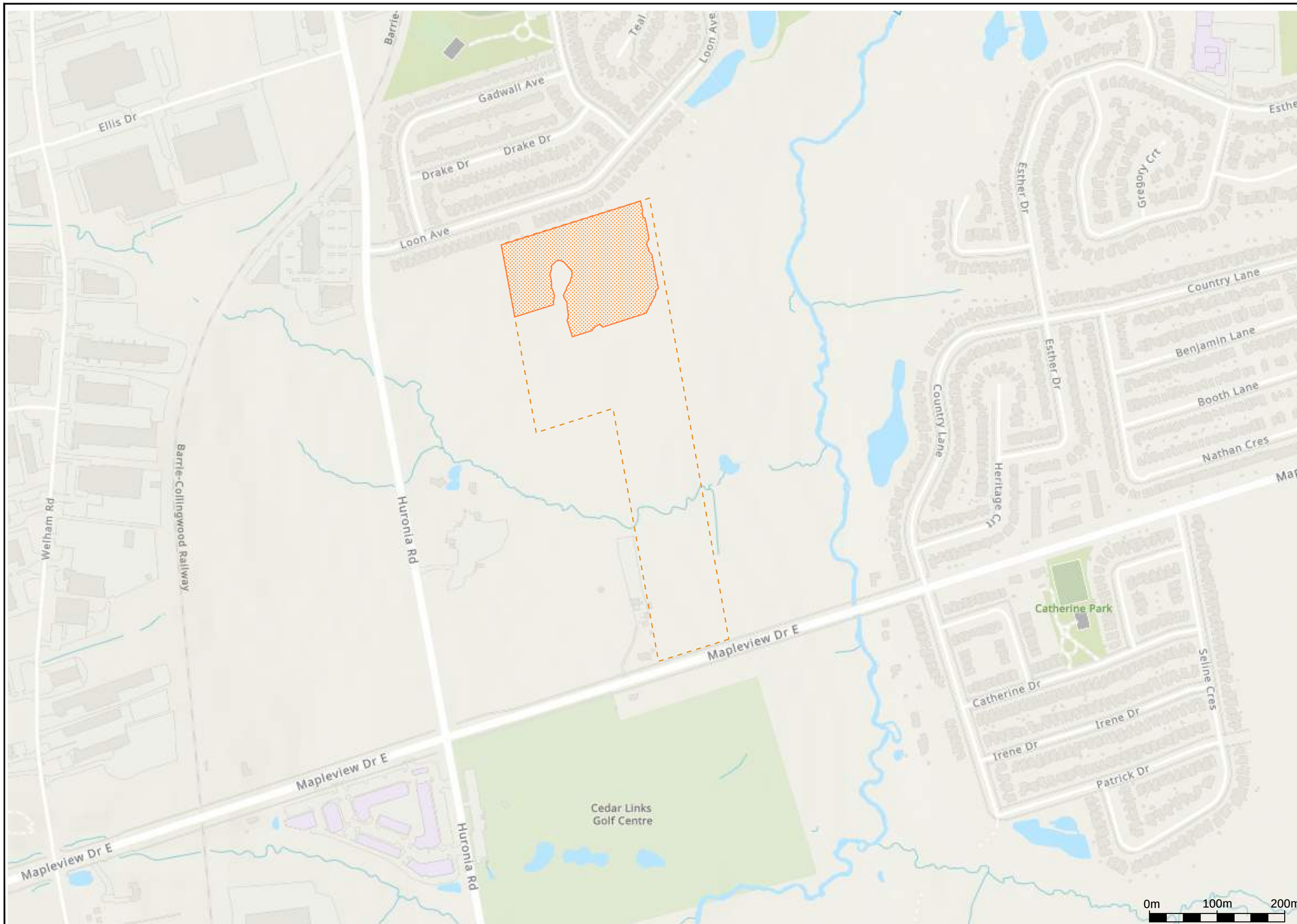
AS INDICATED

Job No

20-295

Figure No

FIGURE 1A



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1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

SUBJECT LANDS

PROPOSED DEVELOPMENT LIMIT

Note

Reference

ArcGIS Map 2023

Project

338 MAPLEVIEW DR E
BARRIE, ON

Figure Title

SUBJECT LANDS AND DEVELOPMENT LIMIT

North

TRUE

Date

APRIL 2023

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 1B

GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT LIMIT
- GROUNDED BOREHOLE / MONITORING WELL
- CROSS SECTION A-A'
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED

Note

Reference

Google Earth Satellite Image 2021

Project

338 MAPLEVIEW DR E BARRIE, ON

Figure Title

BOREHOLE LOCATION PLAN - EXISTING CONDITION

North

TRUE

Date

FEBRUARY 2022

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 2

GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT AREA
- MONITORING WELL/BOREHOLE BY GROUNDED
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED

Note

Reference

Conceptual Grading Plan, dated Feb 28, 2023, Received on April 17, 2023, prepared by Counterpoint Engineering Inc.

Project

338 MAPLEVIEW DR E
BARRIE, ON

Figure Title

BOREHOLE LOCATION PLAN - PROPOSED CONDITIONS

North

TRUE
PROJECT

Date

APRIL 2023

Scale

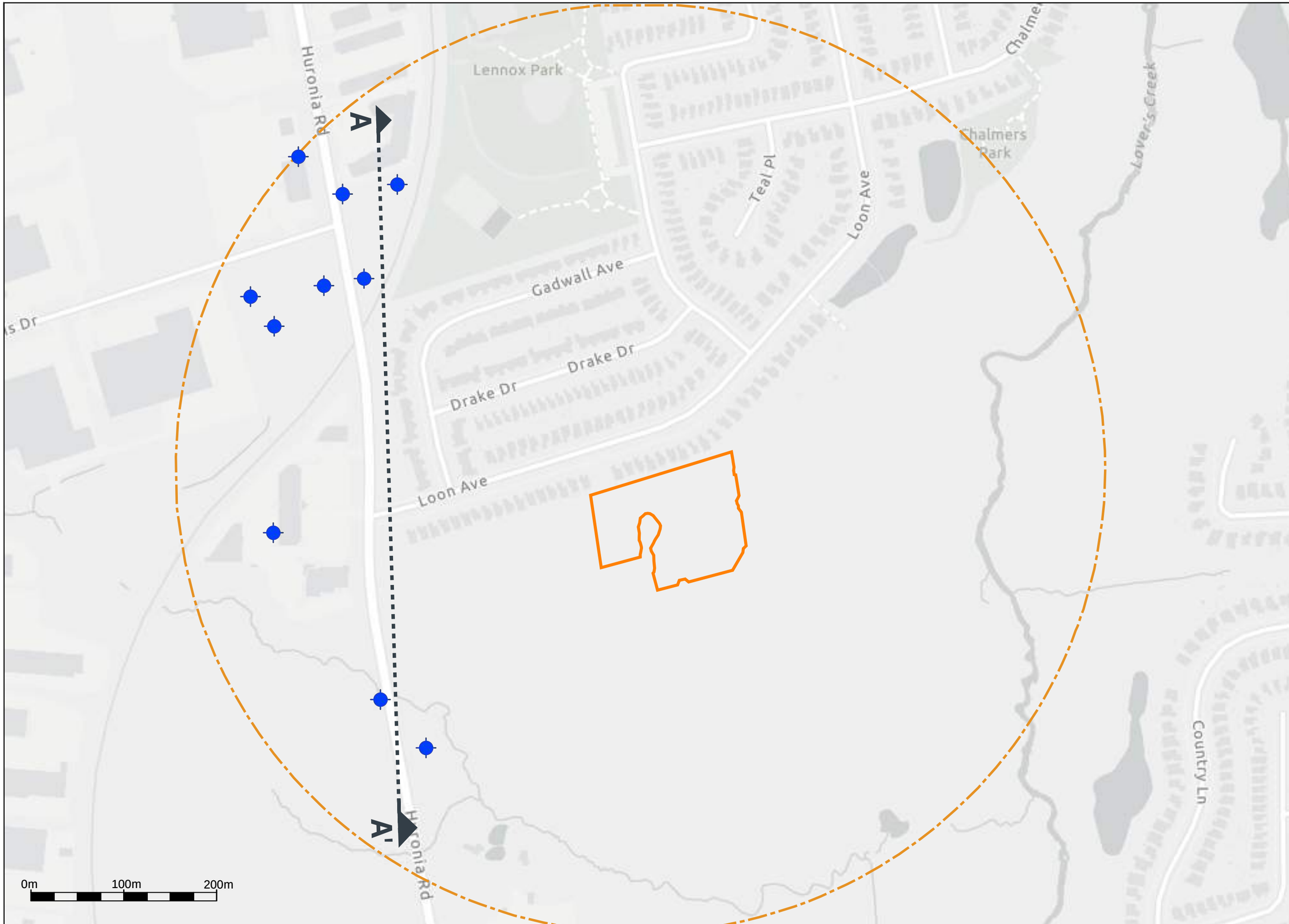
-

Job No

20-295

Figure No

FIGURE 3



GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPED AREA
- 500 m RADIUS
- MECP WELLS
- CROSS SECTION A-A'

Note

Reference

ArcGIS Map 2021

Project

338 MAPLEVIEW DR E BARRIE, ON

Figure Title

MECP WELL LOCATION PLAN

North

TRUE

Date

FEBRUARY 2022

Scale

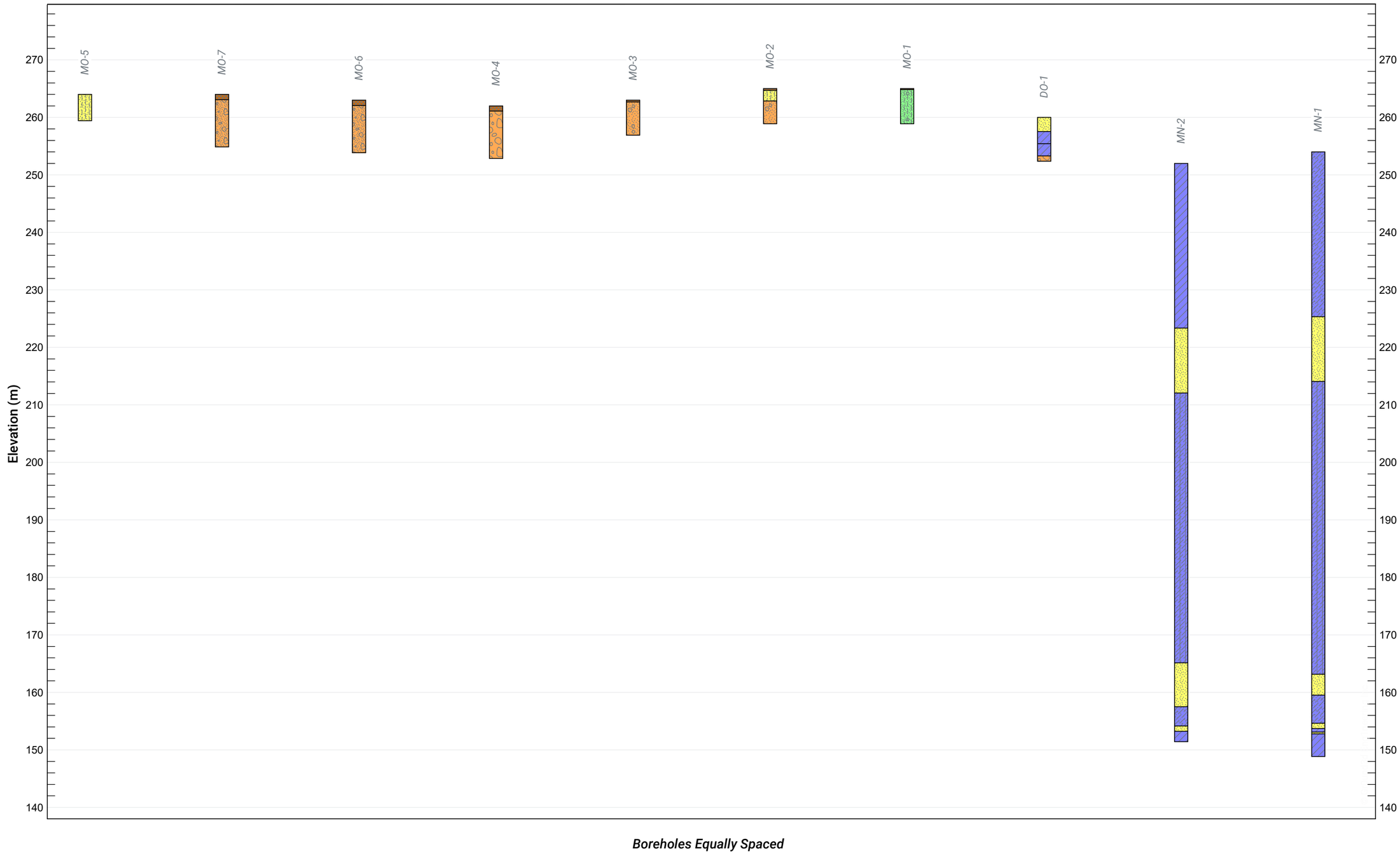
AS INDICATED

Job No

20-295

Figure No

FIGURE 4



GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED SOILS

Note

Reference

Project

338 MAPLEVIEW DR E BARRIE, ON

Figure Title

MECP WELL CROSS SECTION A-A'

North

Date

DECEMBER, 2021

Scale

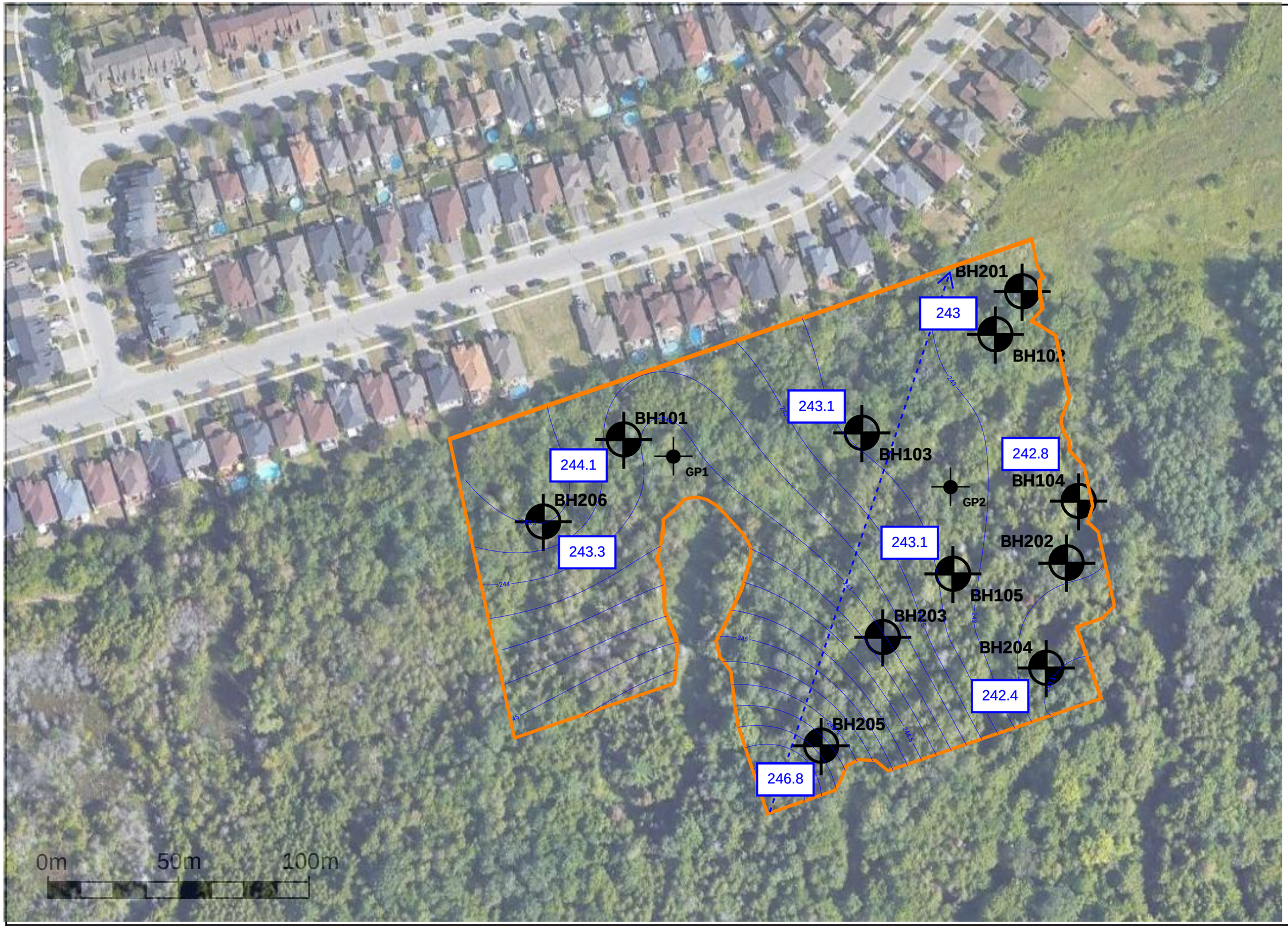
N/A

Job No

20-295

Figure No

FIGURE 5



GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT AREA
- MONITORING WELL/BOREHOLE BY GROUNDED
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED
- 119.4 MARCH 3, 2023 GROUNDWATER ELEVATIONS (masl)
- 119.4 GROUNDWATER CONTOURS (masl)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

Note

Reference

Google Earth Pro 2023

Project

338 MAPLEVIEW DR E BARRIE, ON

Figure Title

GROUNDWATER ELEVATIONS AND GROUNDWATER FLOW DIRECTION

North

TRUE

PROJECT

Date

Scale

AS INDICATED

Job No

20-295

Figure No

FIGURE 6A

GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPOSED DEVELOPMENT LIMIT
- GROUNDED BOREHOLE / MONITORING WELL
- GUELPH PERMEAMETER TESTS COMPLETED BY GROUNDED
- 119.4 MAXIMUM GROUNDWATER ELEVATIONS (masl)
- 119.4 GROUNDWATER CONTOURS (masl)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

Note

Reference

Google Earth Satellite Image 2021

Project

338 MAPLEVIEW DR E BARRIE, ON

Figure Title

MAXIMUM GROUNDWATER ELEVATIONS

North

TRUE

Date

FEBRUARY 2022

Scale

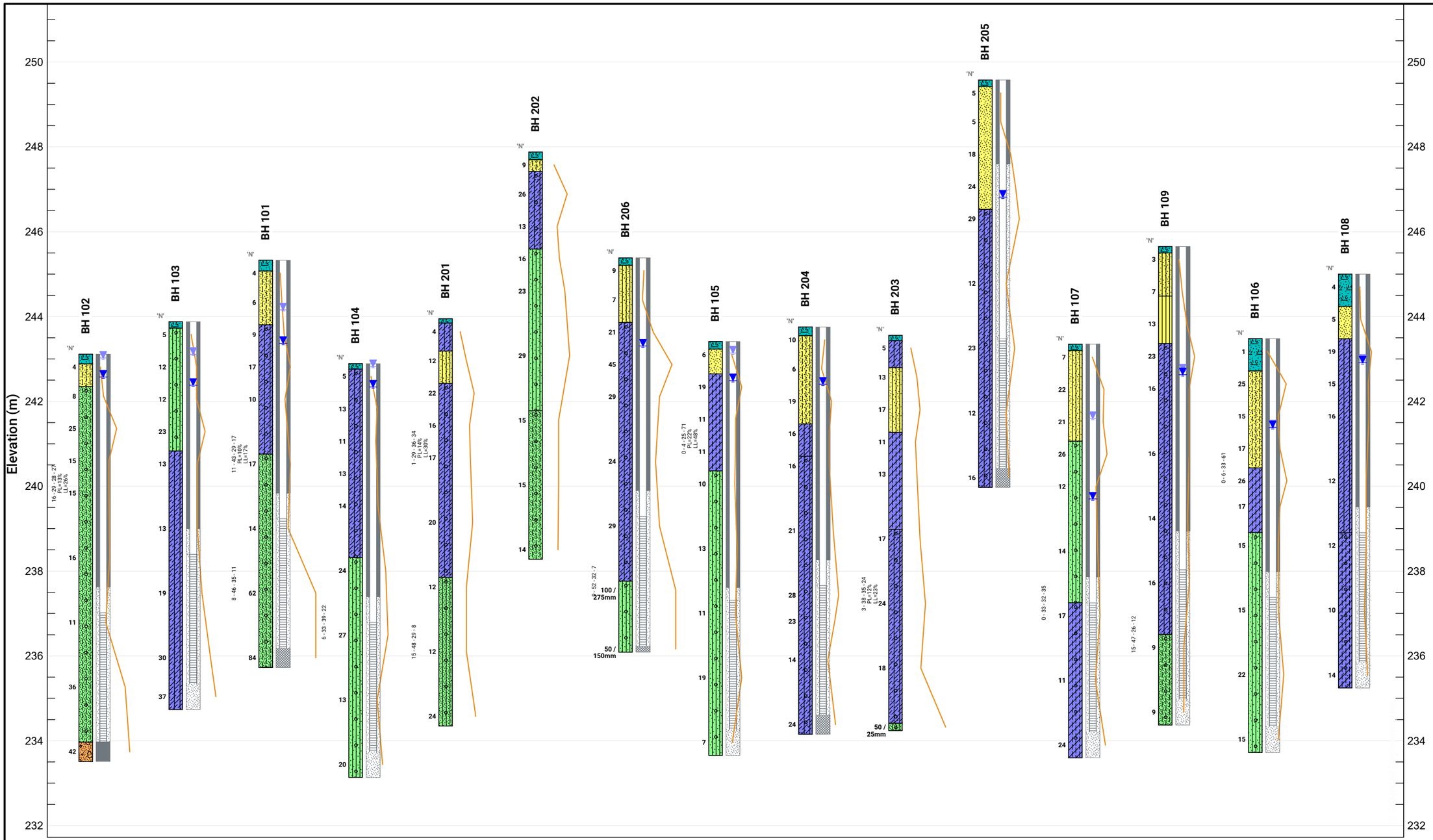
AS INDICATED

Job No

20-295

Figure No

FIGURE 6B



Boreholes Equally Spaced

GROUNDED ENGINEERING

1 Banigan Drive, Toronto, Ont., M4H 1G3
www.groundedeng.ca

LEGEND

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED/ORGANIC

Project
LOON LANDS BARRIE, ON

Figure Title
HYDROGEOLOGIC CROSS SECTION A-A'

Date
APRIL 2023

Scale
AS INDICATED

Job No
20-295

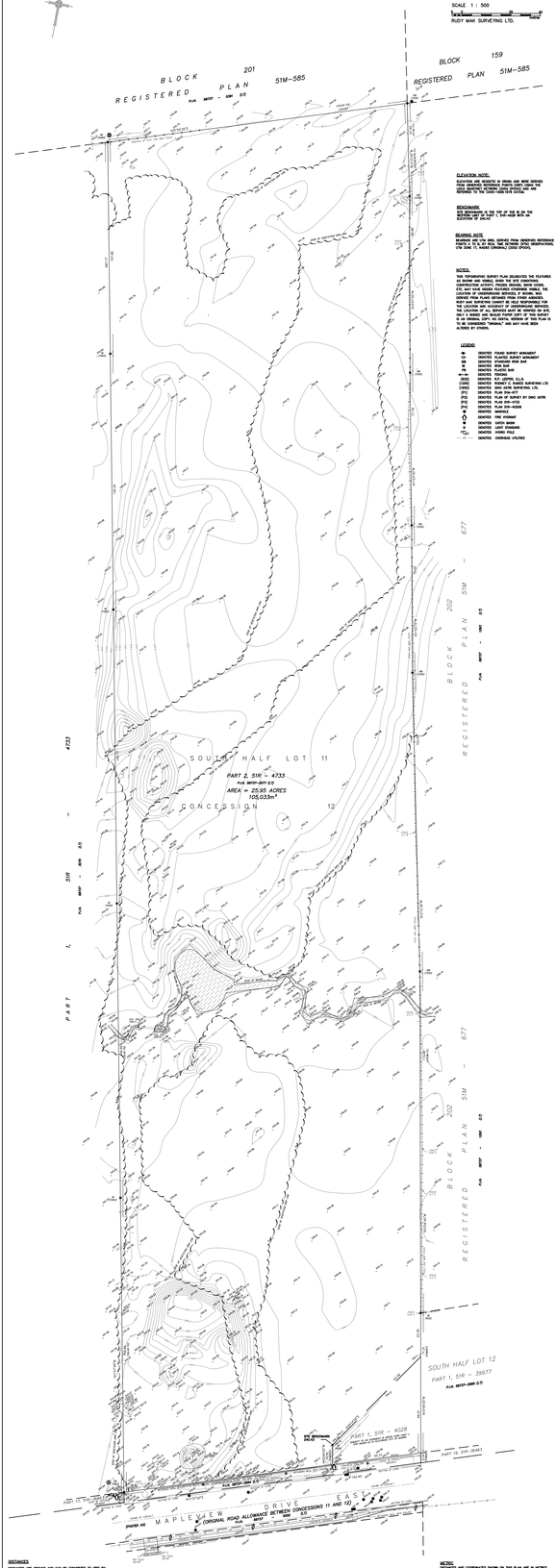
Figure No
FIGURE 7

APPENDIX A

TOPOGRAPHIC SURVEY OF
PART OF SOUTH HALF LOT 11
CONCESSION 12
GEOGRAPHIC TOWNSHIP OF INNISFIL
CITY OF BARRIE
COUNTY OF SIMCOE

SCALE 1 : 500

RUDY MAK SURVEYING LTD.



ELEVATION NOTE:
ELEVATION ARE REFERENCE IN GROWN AND WERE DERIVED FROM GEODETIC NETWORK CONSTRUCTED USING THE CANADIAN BASE NETWORK (CBN) GPS SURVEY. ELEVATIONS REFERENCE TO THE CGVD-1928 DATUM.

BENCHMARK:
SITE BENCHMARK IS THE TOP OF THE BLOCK ON THE NORTHWEST CORNER OF LOT 1, PLAN 51M-585 WITH ELEVATION OF 205.157

BEARING NOTE
BEARINGS ARE U.T.M. GRID, DERIVED FROM REFERENCE MONUMENTS 42F0010 AND 42F0011 HAVING A COMBINED CONSTRUCTIONAL UTM ZONE 17 NAD83 (ORIGINAL) CSRS (POS).

NOTES:
THIS TOPOGRAPHIC SURVEY PLAN DEPICTS THE FEATURES AS SHOWN AND VISIBLE, OVER THE SITE CONSTRUCTION, VEGETATION, FENCES, BUILDINGS, ROADS, UTILITIES, ETC. BUT MAY HAVE HIDDEN FEATURES OVERLOOKED VISIBLE. THE LOCATION OF UNDERGROUND SERVICES, IF SHOWN, WAS OBTAINED FROM THE OWNERS OF THE SERVICES. RUDY MAK SURVEYING CANNOT BE HELD RESPONSIBLE FOR THE LOCATION AND ACCURACY OF UNDERGROUND SERVICES. THE SURVEY PLAN IS THE PROPERTY OF RUDY MAK SURVEYING LTD. ONLY A SIGNED AND SEALED PAPER COPY OF THIS SURVEY PLAN IS TO BE CONSIDERED "ORIGINAL" AND MAY NOT BE ALTERED BY OTHERS.

LEGEND

	DENOTES FOUND SURVEY MONUMENT
	DENOTES PLANTED SURVEY MONUMENT
	DENOTES STANDARD IRON BAR
	DENOTES IRON BAR
	DENOTES PLASTIC BAR
	DENOTES FENCING
	DENOTES RUDY MAK SURVEYING LTD.
	DENOTES RUDOLF E. RAMES SURVEYING LTD
	DENOTES DINO ASTRI SURVEYING LTD.
	DENOTES DINO ASTRI
	DENOTES PLAN OF SURVEY BY DINO ASTRI
	DENOTES PLAN 51R-4733
	DENOTES PLAN 51M-585
	DENOTES MANHOLE
	DENOTES FIRE HYDRANT
	DENOTES CATCH BASIN
	DENOTES LIGHT STANDARD
	DENOTES TREE
	DENOTES HORIZONTAL CONTOURS

DISTANCES
DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.999700.

GEODETIC REFERENCE POINTS (GRID) CHECKED FROM GPS OBSERVATIONS USING THE CSRS NRCAN/EMR NETWORK/PPP (CAN PPP) PRECISE POINT POSITIONING. COORDINATED TO URBAN ACCURACY PER SEC. 14 (2) OF O.REG. 216/10	
POINT ID	NORTHING / EASTING
CBT A	4833785.846 / 587575.571
CBT B	4831686.870 / 589836.003
COORDINATES CANNOT BE TRANSFERRED, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THE PLAN.	

METRIC
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

T:\BLOCK-CAD\BORDER-RUDYMAK\Rudy Mak 4732.wet logo.jpg

89 BIG BAY POINT ROAD
BARRIE, ONTARIO L4N 9A9 (705) 722-3945
E-MAIL: ADA@BARRIESURVEYING.COM

DRAWN BY: AP | CHECK BY: RM | FILE NO. 17475 TOPO

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APPENDIX B

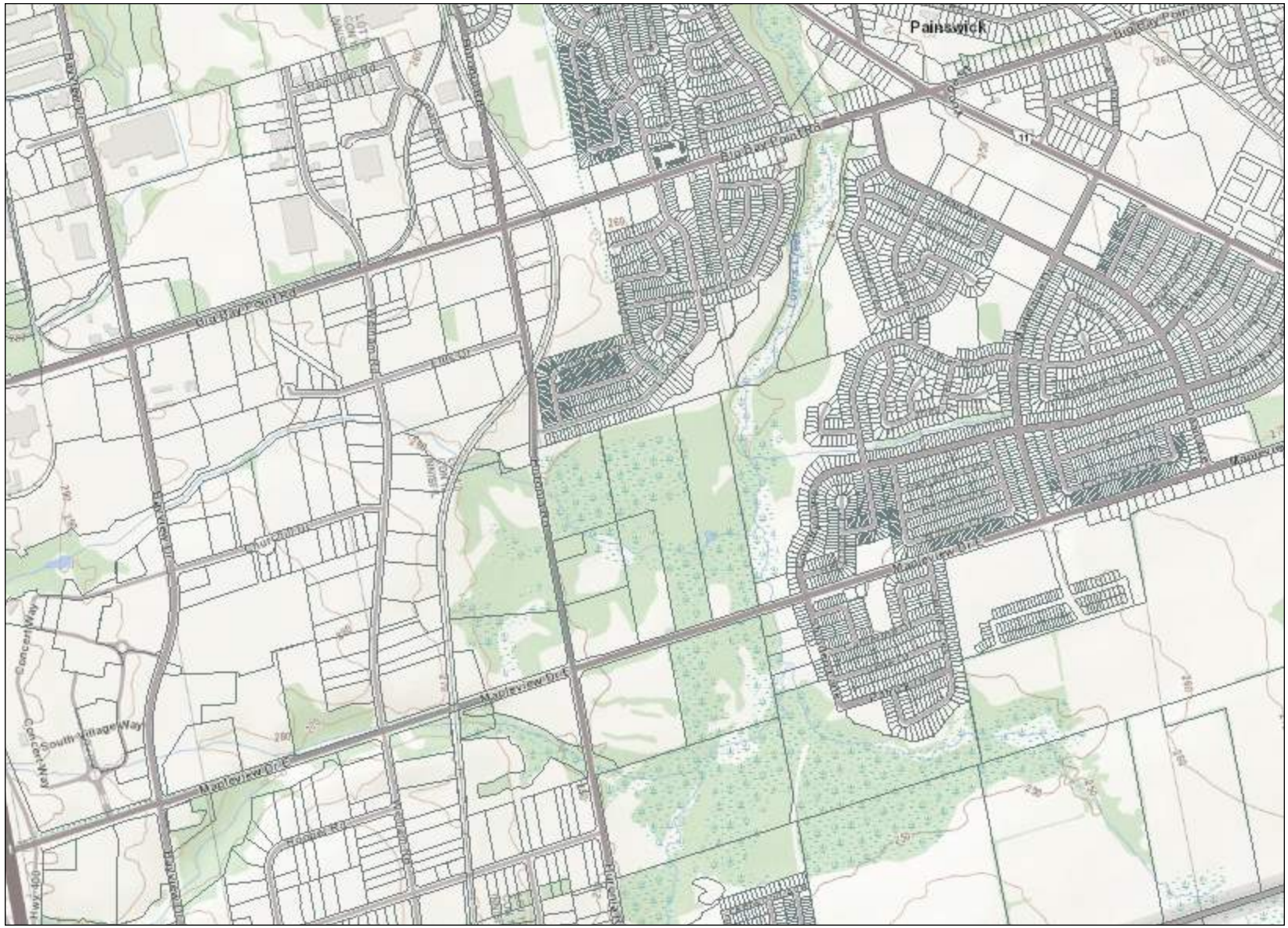
Ontario

MINISTRY OF NATURAL RESOURCES AND FORESTRY

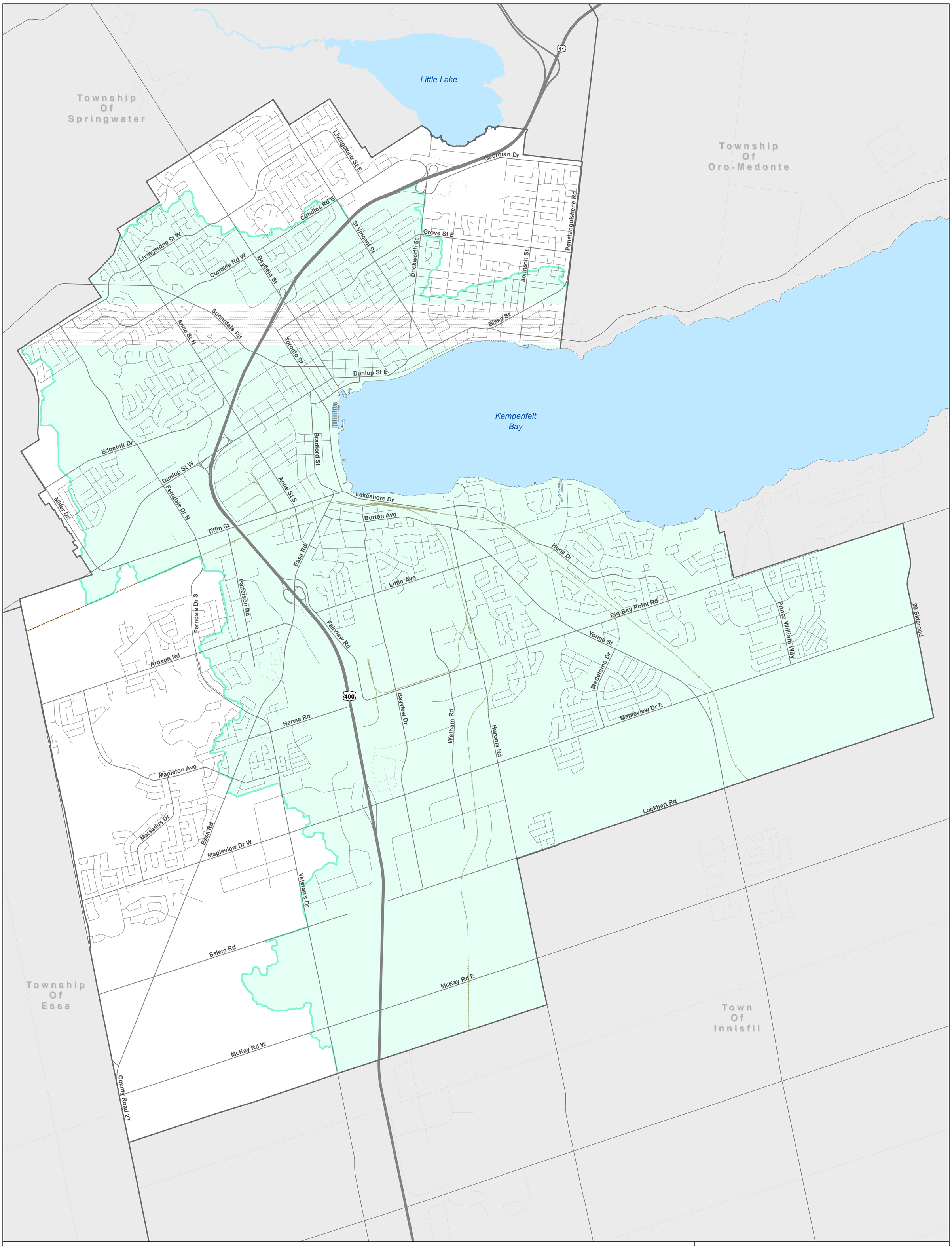
Make a Topographic Map

Topographic Map

Notes:



APPENDIX C



OFFICIAL PLAN

Schedule J
Lake Simcoe Watershed

Office Consolidation
January 2018

Lake Simcoe Watershed Boundary

Barrie

1:20,000

0 0.5 1 2 km

N

The City of Barrie does not warrant the accuracy, completeness, content, or currency of the information provided.
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For information please contact Service Barrie at 705-726-4242 or ServiceBarrie@barrie.ca

GIS Branch 4/26/2018

The Barrie Creeks, Lovers Creek and Hewitt's Creek subwatersheds

Figure 2-4

Legend

- Road
- Municipal Boundary
- Watercourse
- Barrie Creeks
- Hewitts Creeks
- Lovers Creeks

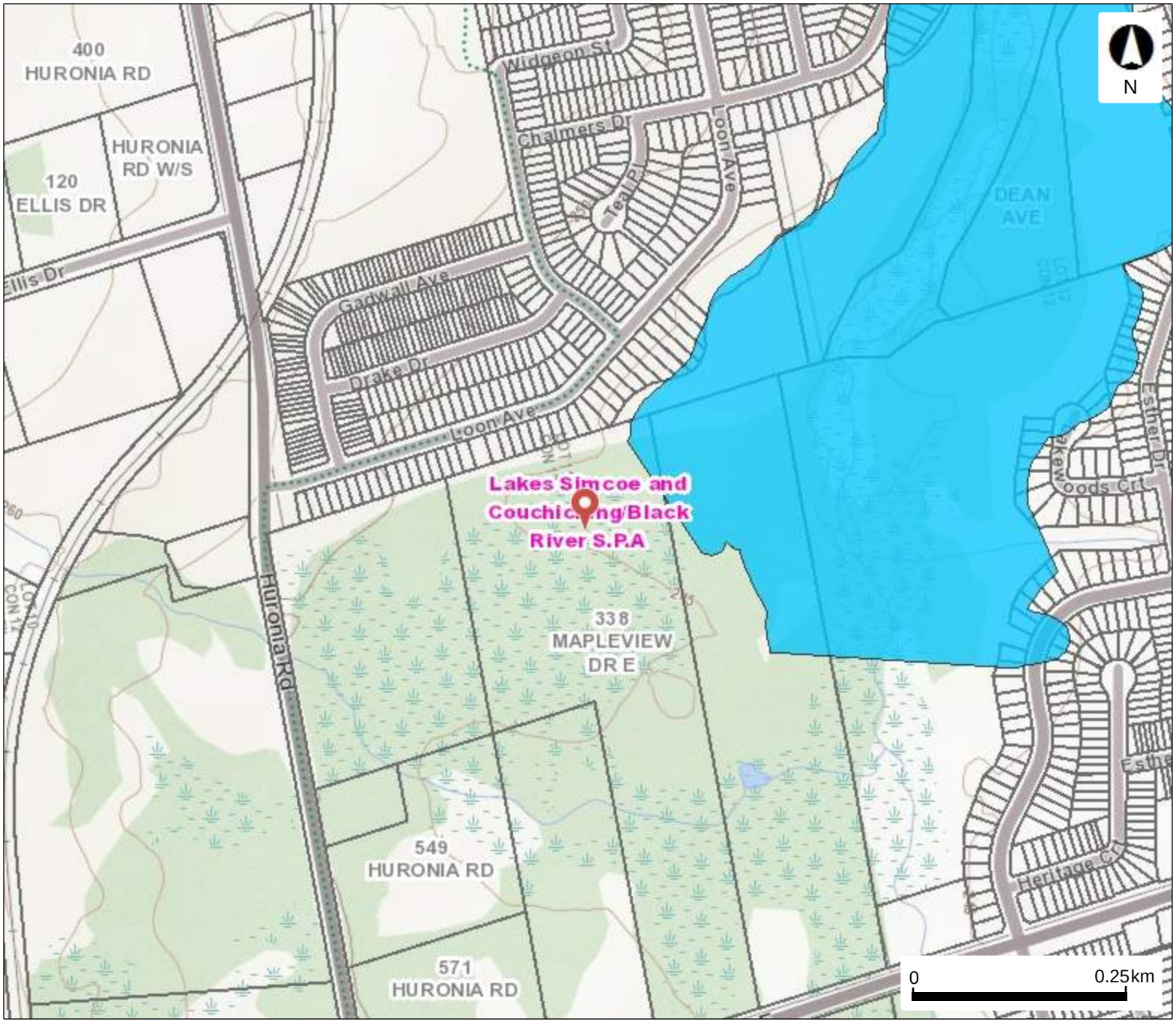
Lake Simcoe Region conservation authority

0 0.5 1 2 3 4 Kilometres

N

This product was produced by the Lake Simcoe Region Conservation Authority and some information depicted on this map may have been compiled from various sources. While every effort has been made to accurately depict the information, data / mapping errors may exist.
This map has been produced for illustrative purposes only.
LSRCA GIS Services DRAFT created July 2010.
© LAKE SIMCOE REGION CONSERVATION AUTHORITY, 2010. All Rights Reserved
The following datasets roads, municipal boundaries and Oak Ridges Moraine are © Queens Printer for Ontario, 2010. Reproduced with Permission

Source Water Protection



Legend

- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel with Addre

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

© Queen's Printer for Ontario, 2021

Map Created: 12/6/2021
Map Center: 44.34708 N, -79.6592 W

APPENDIX D

Water Well Records

December 6, 2021

11:26:03 AM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BARRIE CITY (INNISFI	17 606420 4911700 W	2016-09 7190	0.75	UT		MO	0010 5	7272826 (Z238664) A156794	BRWN SAND SILT 0015
INNISFIL TOWNSHIP	17 606445 4911259 W	1467						7158673 (Z94549) A082330 A	
INNISFIL TOWNSHIP CON 12	17 606524 4911674 W	2019-12 7360	2		///:	MO	0025 5	7353347 (Z328295) A286160	LOAM 0003 GRVL SNDY 0030
INNISFIL TOWNSHIP CON 12	17 606469 4911661 W	2019-12 7360	2		///:	MO	0025 5	7353346 (Z328304) A286176	LOAM 0003 GRVL SNDY 0030
INNISFIL TOWNSHIP CON 12	17 606491 4911571 W	2019-12 7360	2		///:	MO	0025 5	7353345 (Z328293) A286175	LOAM 0003 GRVL 0030
INNISFIL TOWNSHIP CON 12 010	17 606450 4911562 W	2019-04 7190	1.25		///:	MO	0015 5	7333294 (Z309581) A264206	BLCK LOAM LOOS 0001 BRWN SAND TILL GRVL 0020
INNISFIL TOWNSHIP CON 12 010	17 606372 4911550 W	2019-04 7190	1.25		///:	MO	0015 5	7333293 (Z309580) A264205	BLCK LOAM LOOS 0001 BRWN SAND SILT FILL 0007 BRWN SAND TILL GRVL 0020
INNISFIL TOWNSHIP CON 12 010	17 606396 4911519 W	2019-04 7190	1.25		///:	MO	0015 5	7333292 (Z309579) A264034	BLCK LOAM LOOS 0000 BRWN SAND TILL SLTY 0020
INNISFIL TOWNSHIP CON 12 010	17 606398 4911300 W	1967-08 4608	30	FR 0013	13//2/:	DO		5701453 ()	MSND 0008 BRWN CLAY 0015 GREY CLAY 0022 GRVL 0025
INNISFIL TOWNSHIP CON 12 011	17 606564 4911073 W	1974-07 4816	1	FR 0298	2/71//20:0	MN	0305 5	5711981 ()	CLAY SAND GRVL 0094 SAND CMTD 0131 CLAY SILT 0298 MSND FSND 0310 CLAY SAND LYRD 0326 SAND 0329 CLAY 0331 SAND 0332 CLAY DNSE 0345
INNISFIL TOWNSHIP CON 12 011	17 606514 4911123 W	1974-08 4816	2	UK 0285	10/70/37/20:0	MN		5711980 ()	CLAY GRVL 0094 SAND CMTD 0131 CLAY SILT 0285 FSND 0290 MSND 0301 CSND 0310 CLAY SAND LYRD 0321 SAND CMTD 0324 CLAY GRVL 0330

TOWNSHIP	CON	LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code

PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

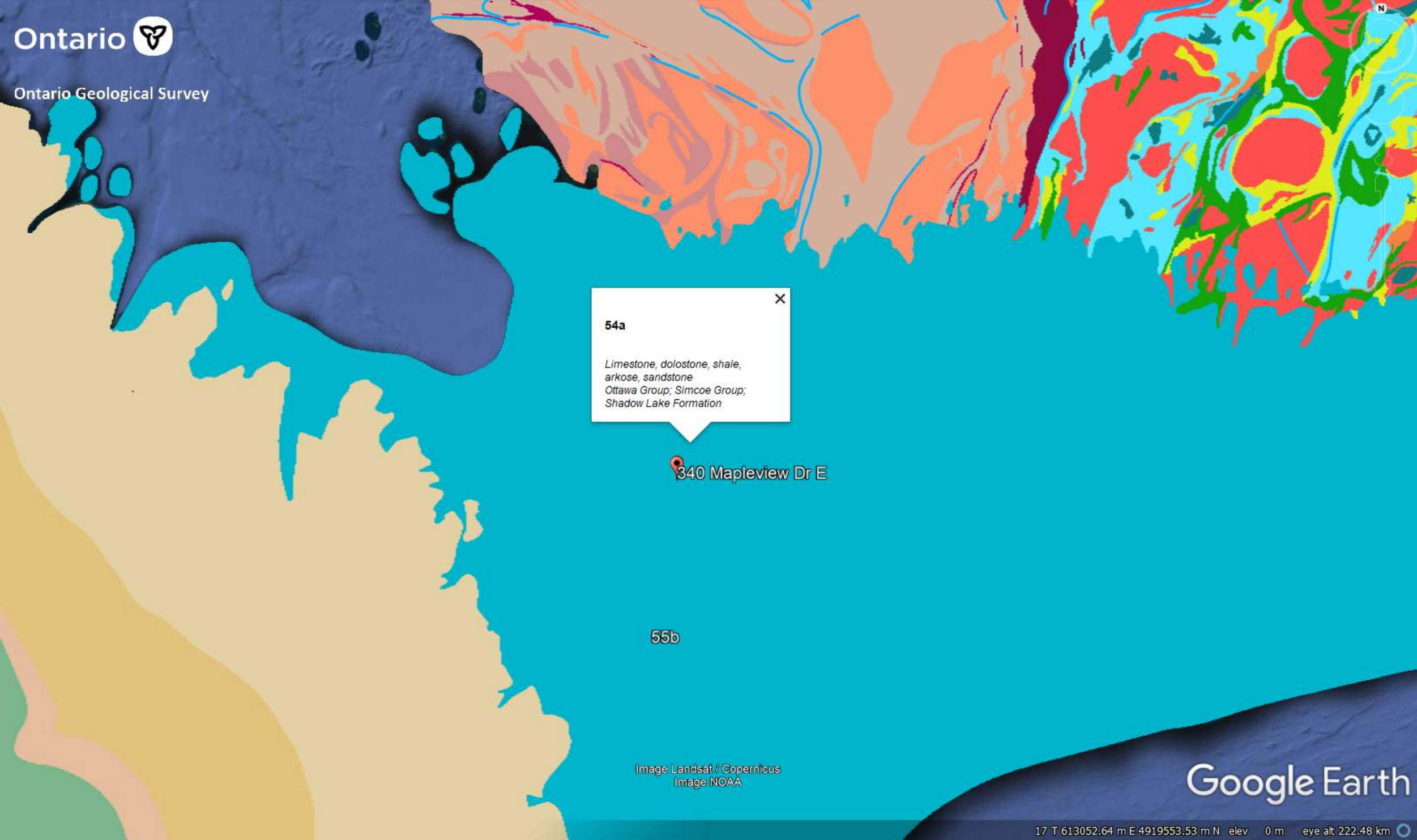
4. Water Detail

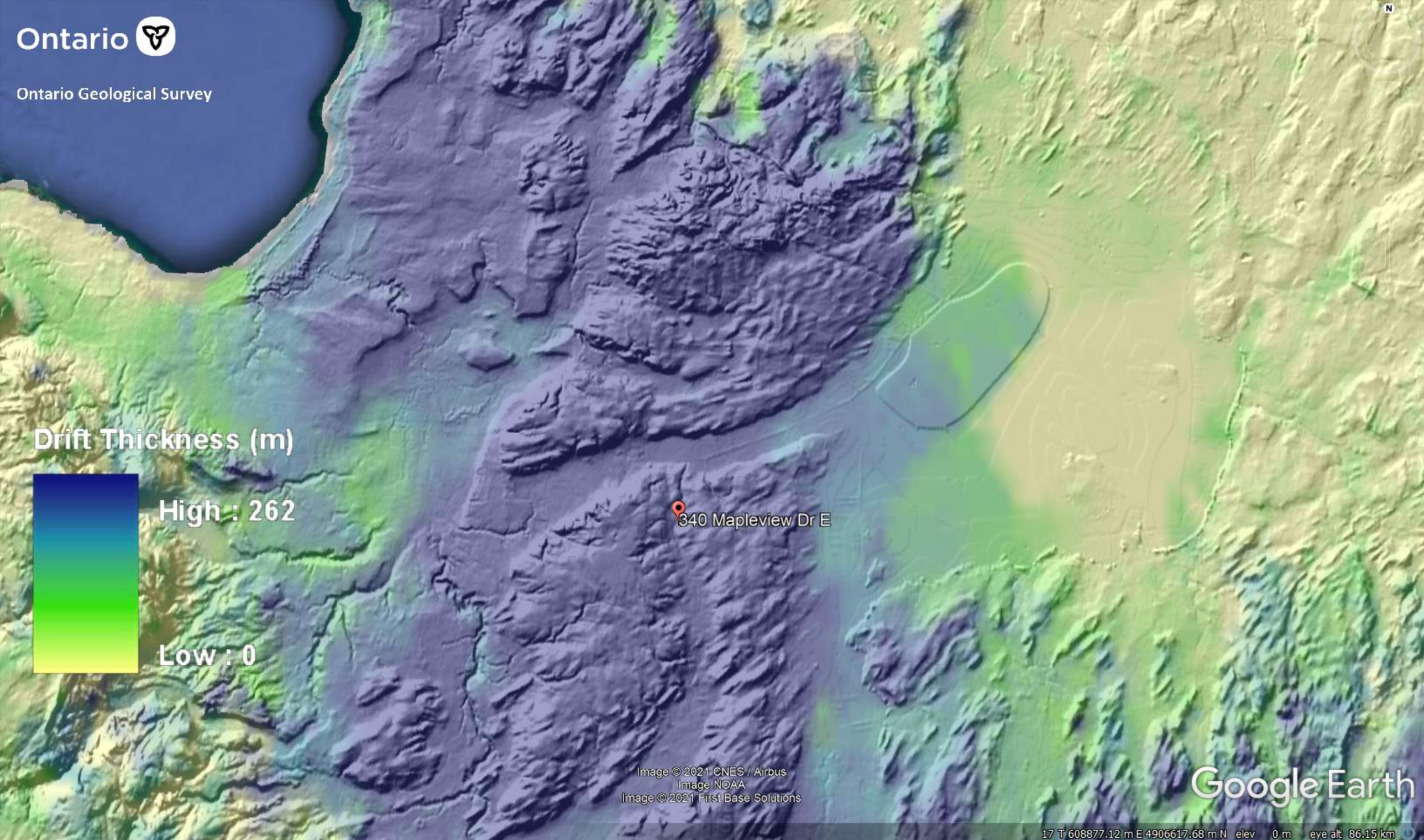
Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

APPENDIX E

Ontario

Ontario Geological Survey


Ontario
Ontario Geological Survey
54a
Limestone, dolostone, shale, arkose, sandstone
Ottawa Group; Simcoe Group; Shadow Lake Formation
340 Mapleview Dr E
55b
Image Landsat / Copernicus
Image NOAA
Google Earth
17 T 613052.64 m E 4919553.53 m N elev 0 m eye alt 222.48 km


Ontario
Ontario Geological Survey
Drift Thickness (m)
High : 262
Low : 0
340 Mapleview Dr E
Image © 2021 CNES / Airbus
Image NOAA
Image © 2021 First Base Solutions
Google Earth
17 T 608877.12 m E 4906617.68 m N elev 0 m eye alt 86.15 km

Ontario
Ontario Geological Survey
19 Modern alluvial deposits
clay, silt, sand, gravel, may contain organic remains
340 Mapleview Dr E
8a Fine-te
Google Earth
1985
17 T 608881.27 m E 4909528.68 m N elev 0 m eye alt 3.25 km

Ontario
Ontario Geological Survey
6 Till Plains (Drumlinized)
Till Plains (Drumlinized)
340 Mapleview Dr E
Google Earth
17 T 626848.16 m E 4902157.39 m N elev 0 m eye alt 37.63 km

APPENDIX F

GROUNDED ENGINEERING

Date Started : Mar 29, 2021
Position : E: 606771, N: 4911332 (UTM 17T)
Elev. Datum : Geodetic

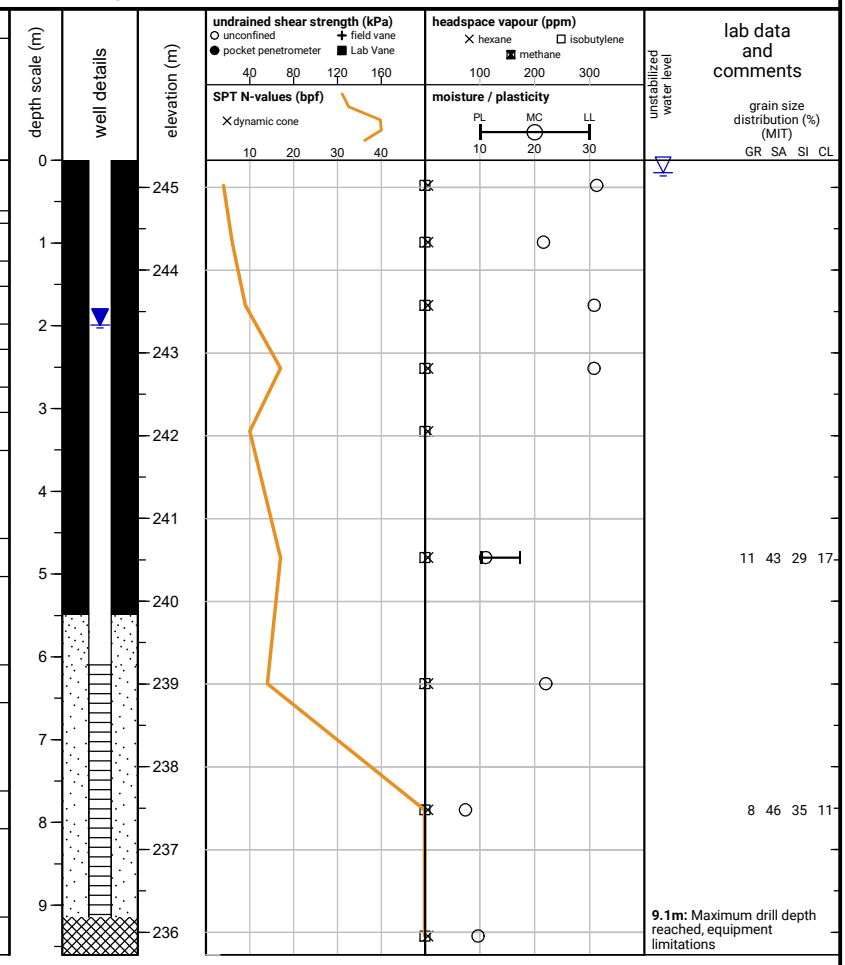
BOREHOLE LOG 101

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description (stratigraphy)	samples: number	type	SPT N-value	lab data and comments: grain size distribution (%) (MIT) GR SA SI CL
245.3	**GROUND SURFACE**				
	250mm **TOPSOIL**				
	SILTY SAND, some clay, trace gravel, trace rootlets, loose, dark brown, moist	1	SS	4	
	...at 0.8 m, orange-brown, trace clay	2	SS	6	
243.8 / 1.5	**CLAYEY SILT**, trace sand, trace gravel, stiff to very stiff, brown, moist (GLACIAL TILL)	3	SS	9	
		4	SS	17	
	...at 3.0 m, grey	5	SS	10	
240.7 / 4.6	**SILTY SAND**, some clay, some gravel, compact, grey, moist (GLACIAL TILL)	6	SS	17	11 43 29 17
		7	SS	14	
	...at 7.6 m, sand and silt, some clay, trace gravel, very dense	8	SS	62	8 46 35 11
	...at 9.1 m, some gravel	9	SS	84	
235.7 / 9.6					



END OF BOREHOLE

Unstabilized water level measured at 0.2 m below ground surface upon completion of drilling.

25 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Apr 1, 2021	1.4	243.9
Jun 7, 2021	2.0	243.3
Jul 25, 2021	1.5	243.8
Sep 10, 2021	1.9	243.4
Nov 11, 2021	1.5	243.8
Dec 29, 2021	1.2	244.1
Jan 28, 2022	1.4	243.9
Mar 3, 2023	2.0	243.3

file: 20-295 gint logs.gpj

 Tech : MC | **PM** : KM | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Mar 30, 2021
Position : E: 606912, N: 4911385 (UTM 17T)
Elev. Datum : Geodetic

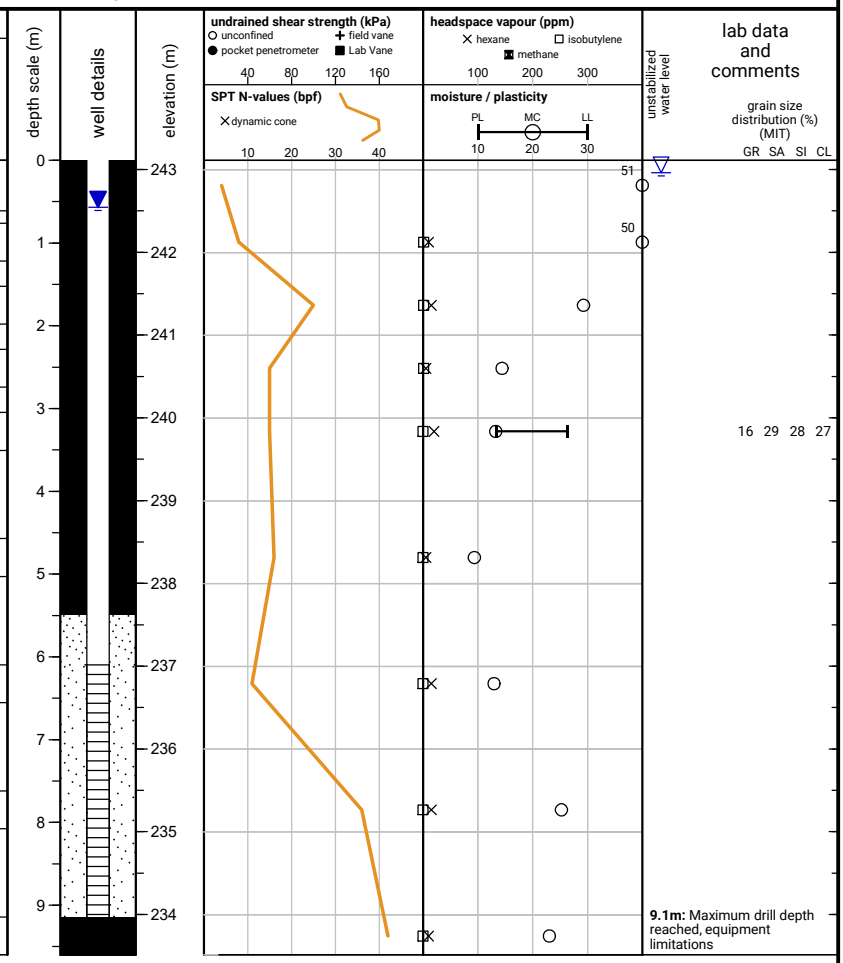
BOREHOLE LOG 102

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

elev / depth (m)	description	graphic log	samples: number	type	SPT N-value
243.1	**GROUND SURFACE**				
	230mm **TOPSOIL**		1	SS	4
242.3 / 0.8	**SILTY SAND**, some clay, trace gravel, trace rootlets, loose, brown, moist				
	SILTY SAND, clayey, trace gravel, loose to compact, brown, moist (GLACIAL TILL)		2	SS	8
			3	SS	25
	...at 2.3 m, grey		4	SS	15
	...at 3.0 m, some gravel, very stiff		5	SS	15
			6	SS	16
	...at 6.1 m, wet		7	SS	11
	...at 7.6 m, dense		8	SS	36
234.0 / 9.1					
233.5 / 9.6	**COARSE SAND and GRAVEL**, trace silt, trace rock fragments, (cobbles inferred), very dense, grey, wet		9	SS	42

solid stem augers OD=150 mm



END OF BOREHOLE

Unstabilized water level measured at 0.2 m below ground surface upon completion of drilling.

25 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Apr 1, 2021	0.2	242.9
Jun 7, 2021	0.5	242.6
Jul 25, 2021	0.1	243.0
Sep 10, 2021	0.5	242.6
Nov 11, 2021	0.2	242.9
Mar 3, 2023	0.6	242.5

file: 20-295 gint logs.gpj

 Tech : MC | **PM** : KM | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Jun 2, 2021
Position : E: 606838, N: 4911357 (UTM 17T)
Elev. Datum : Geodetic

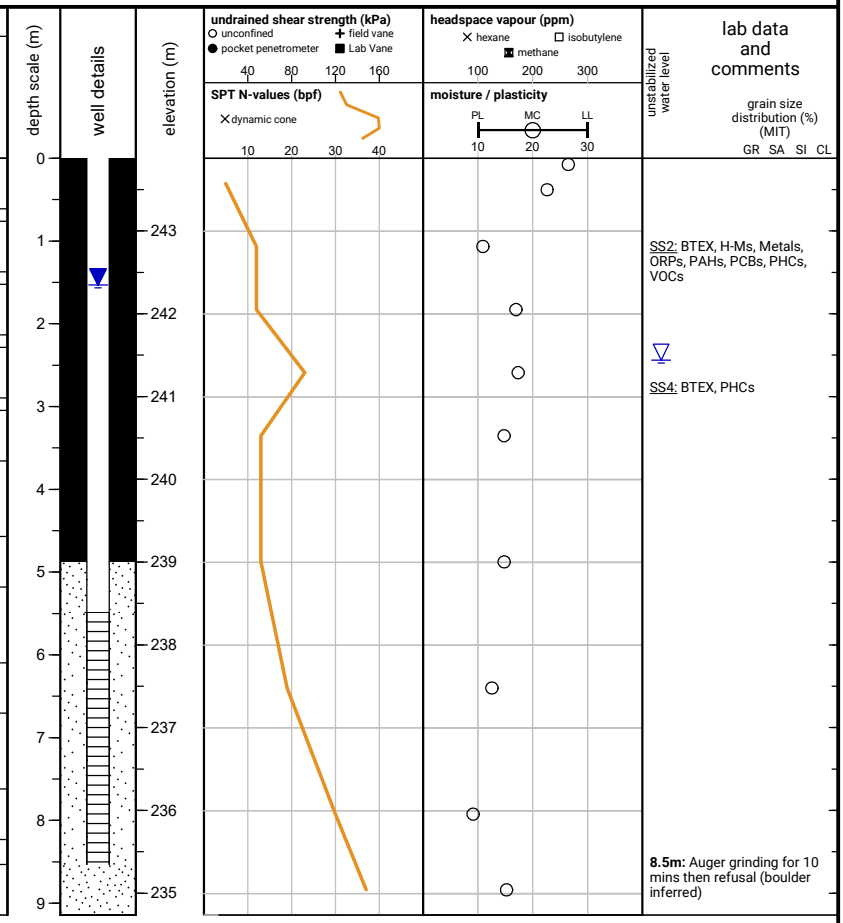
BOREHOLE LOG 103

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

elev depth (m)	description	number	type	SPT N-value	lab data and comments
243.9	**GROUND SURFACE**				
	150mm **TOPSOIL**	1A			
	SANDY SILT, some clay, trace gravel, trace rootlets, loose to compact, brown and grey, moist (GLACIAL TILL)	1B	SS	5	
		2	SS	12	SS2: BTEX, H-Ms, Metals, ORPs, PAHs, PCBs, PHCs, VOCs
	...at 1.5 m, grey	3	SS	12	
		4	SS	23	SS4: BTEX, PHCs
240.9 / 3.0	**CLAYEY SILT**, trace sand, stiff, grey, moist	5	SS	13	
		6	SS	13	
	...at 6.1 m, some sand, very stiff	7	SS	19	
	...at 7.6 m, hard, some gravel (glacial till inferred)	8	SS	30	
234.8 / 9.1		9	SS	37	**8.5m:** Auger grinding for 10 mins then refusal (boulder inferred)

solid stem augers (skinny)



END OF BOREHOLE

Unstabilized water level measured at 2.4 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Jun 3, 2021	1.3	242.6
Jun 7, 2021	1.4	242.5
Jul 25, 2021	1.1	242.8
Sep 10, 2021	1.4	242.5
Nov 11, 2021	1.1	242.8
Dec 29, 2021	0.8	243.1
Jan 28, 2022	1.1	242.8
Mar 3, 2023	1.5	242.4

file: 20-295 gint logs.gpj

 Tech : DI | **PM** : KM | **Rev** : MD

GROUNDED ENGINEERING

Date Started : May 31, 2021
Position : E: 606929, N: 4911327 (UTM 17T)
Elev. Datum : Geodetic

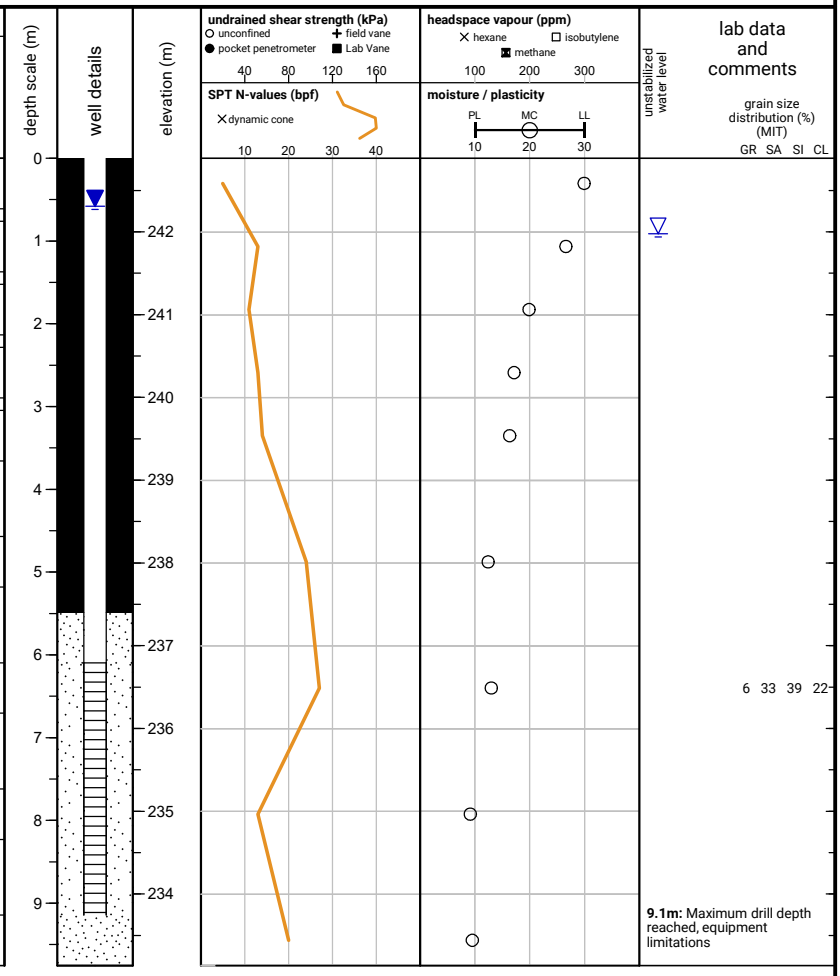
BOREHOLE LOG 104

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers (skinny)

elev / depth (m)	description	graphic log	number	type	SPT N-value
242.9	**GROUND SURFACE**				
	125mm **TOPSOIL**		1	SS	5
	CLAYEY SILT, trace sand, trace gravel, firm to stiff, brown, wet (GLACIAL TILL)		2	SS	13
			3	SS	11
	...at 2.3 m, grey		4	SS	13
			5	SS	14
238.3 / 4.6	**SANDY SILT**, clayey, trace gravel, compact, grey, moist (GLACIAL TILL)		6	SS	24
			7	SS	27
	...at 7.6 m, wet		8	SS	13
233.1 / 9.8			9	SS	20



END OF BOREHOLE

Unstabilized water level measured at 0.9 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Jun 3, 2021	1.3	241.6
Jun 7, 2021	1.1	241.8
Jul 25, 2021	0.4	242.5
Sep 10, 2021	0.6	242.3
Nov 11, 2021	0.3	242.6
Dec 29, 2021	0.1	242.8
Jan 28, 2022	0.4	242.5
Mar 3, 2023	0.6	242.3

file: 20-295 gint logs.gpj

 Tech : DI | **PM** : KM | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Jun 1, 2021
Position : E: 606892, N: 4911293 (UTM 17T)
Elev. Datum : Geodetic

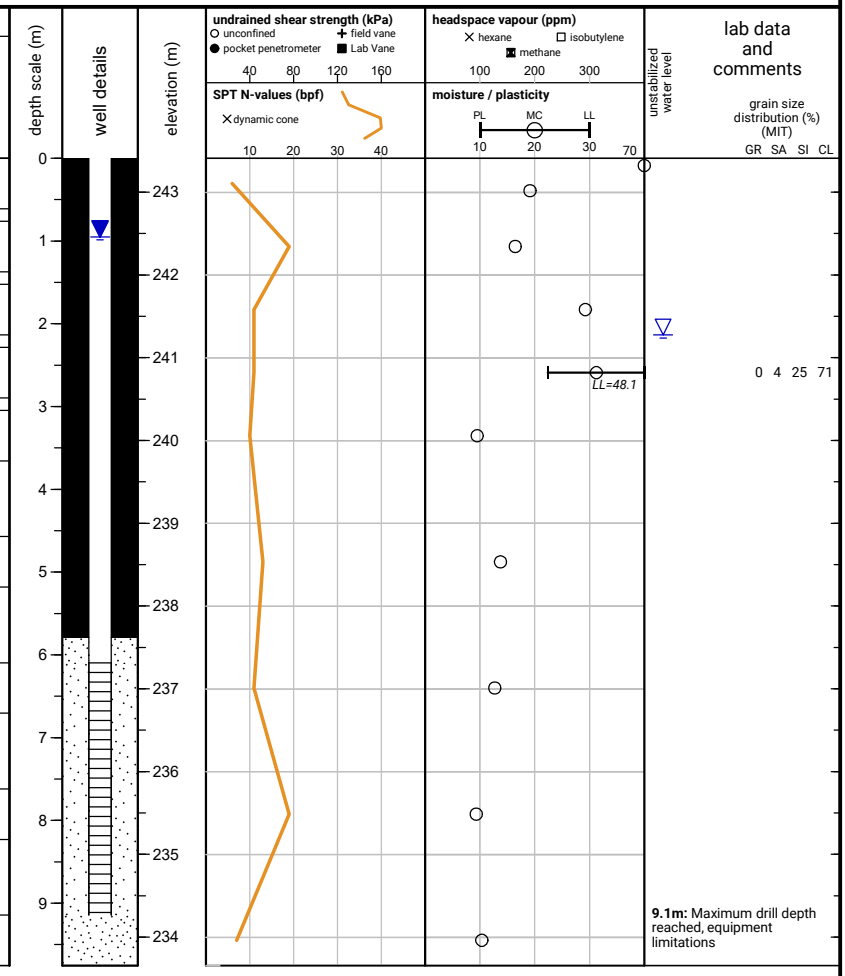
BOREHOLE LOG 105

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers (skinny)

elev / depth (m)	description	number	type	SPT N-value
243.4	**GROUND SURFACE**			
	175mm **TOPSOIL**	1A		
	SAND, some silt, trace clay, trace gravel, trace rootlets, loose, orange - brown, moist	1B	SS	6
242.6 / 0.8	**SILTY CLAY**, trace sand, stiff to very stiff, brown and grey, moist	2	SS	19
	...at 1.5 m, wet	3	SS	11
	...at 2.3 m, grey	4	SS	11
240.4 / 3.0	**SANDY SILT**, clayey, trace gravel, compact, grey, moist (GLACIAL TILL)	5	SS	10
		6	SS	13
		7	SS	11
		8	SS	19
	...at 9.1 m, loose, wet	9	SS	7
233.6 / 9.8				



END OF BOREHOLE

Unstabilized water level measured at 2.1 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Jun 3, 2021	2.9	240.5
Jun 7, 2021	1.7	241.7
Jul 25, 2021	0.7	242.7
Sep 10, 2021	0.9	242.5
Nov 11, 2021	0.6	242.8
Dec 29, 2021	0.3	243.1
Jan 28, 2022	0.6	242.8
Mar 3, 2023	1.0	242.4

file: 20-295 gint logs.gpj

 Tech : DI | **PM** : KM | **Rev** : MD

Date Started : Feb 21, 2023
Position : E: 606859, N: 4911323 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 201

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

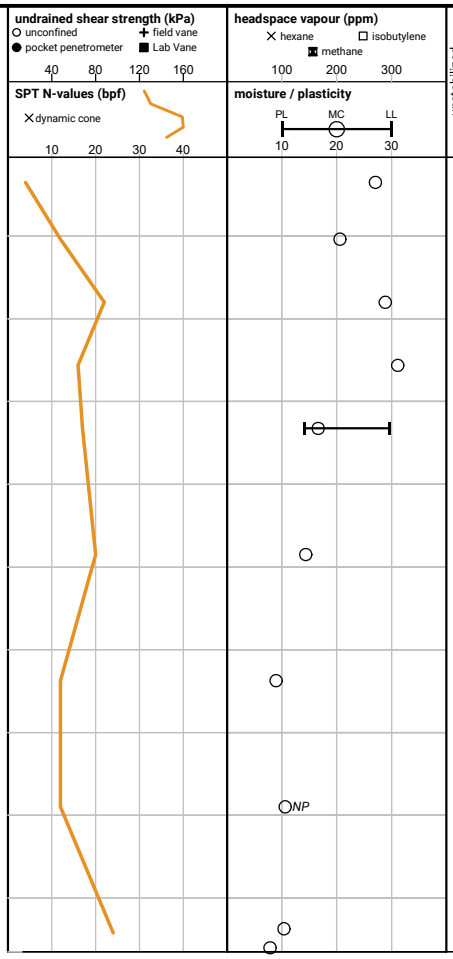
drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description	samples number	type	SPT N-value
243.9	**GROUND SURFACE**			
	100mm **TOPSOIL**	1	SS	4
243.1 / 0.8	**CLAYEY SILT**, some sand, trace gravel, firm, orangey brown, moist to wet			
	SILT AND SAND, trace clay, compact, brown, wet	2	SS	12
242.4 / 1.5	**CLAYEY SILT**, sandy, trace gravel, very stiff, brown, moist (GLACIAL TILL)	3	SS	22
		4	SS	16
		5	SS	17
		6	SS	20
237.8 / 6.1	**SILTY SAND**, some gravel, trace clay, compact, grey, moist to wet (GLACIAL TILL)	7	SS	12
		8	SS	12
		9A	SS	24
234.3 / 9.6		9B	SS	

END OF BOREHOLE

Unstabilized water level measured at 0.5 m below ground surface; caved to 9.1 m below ground surface upon completion of drilling.



unstabilized water level

lab data and comments

2.1m: grinding

grain size distribution (%) (MIT)

	GR	SA	SI	CL
3.1	1	29	36	34
6.1	15	48	29	8

file: 20-295 gint logs.gpj

Tech : CSH | **PM** : AG | **Rev** : MD

Date Started : Feb 15, 2023
Position : E: 606943, N: 4911314 (UTM 17T)
Elev. Datum : Geodetic

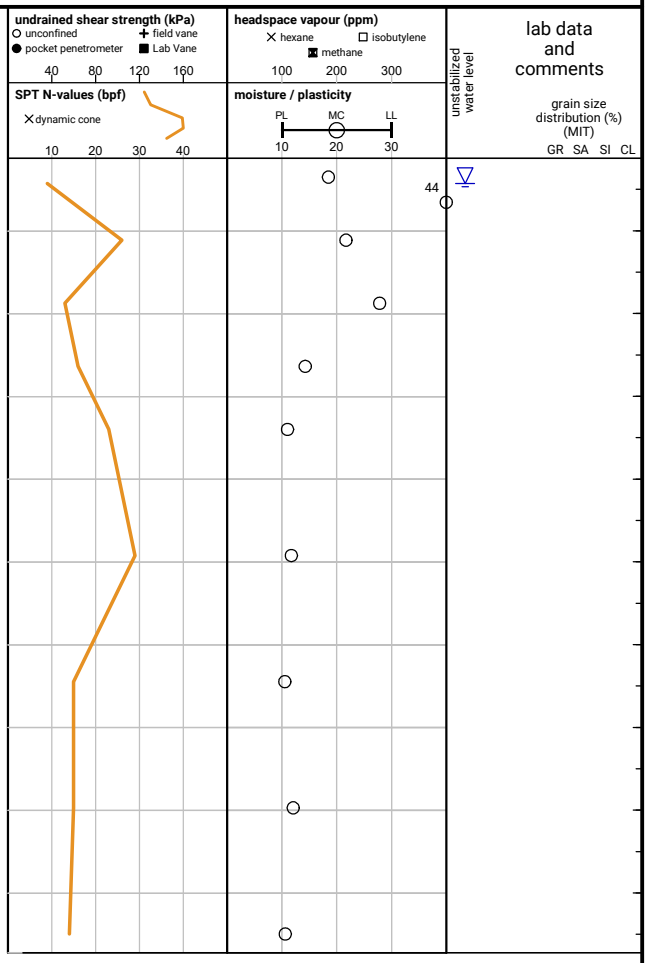
BOREHOLE LOG 202

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description	number	type	SPT N-value
247.9	**GROUND SURFACE**			
247.4 / 0.5	175mm **TOPSOIL**	1A	SS	9
	SILTY SAND, some clay, trace gravel, trace rootlets, brown with orange, wet	1B	SS	
	CLAYEY SILT, trace sand, trace gravel, stiff to very stiff, brown, moist (GLACIAL TILL)	2	SS	26
	...at 1.5 m, wet	3	SS	13
245.6 / 2.3	**SANDY SILT**, some clay, trace gravel, compact, grey, moist to wet (GLACIAL TILL)	4	SS	16
		5	SS	23
	...at 4.6 m, clayey silt, some sand	6	SS	29
241.8 / 6.1	**SILTY SAND**, trace clay, trace gravel, compact, grey, wet (GLACIAL TILL)	7	SS	15
		8	SS	15
238.3 / 9.6		9	SS	14



END OF BOREHOLE

Unstabilized water level measured at 0.3 m below ground surface; caved to 9.1 m below ground surface upon completion of drilling.

file: 20-295 gint logs.gpj

 Tech : CSH | **PM** : AG | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Feb 16, 2023
Position : E: 606881, N: 4911271 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 203

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

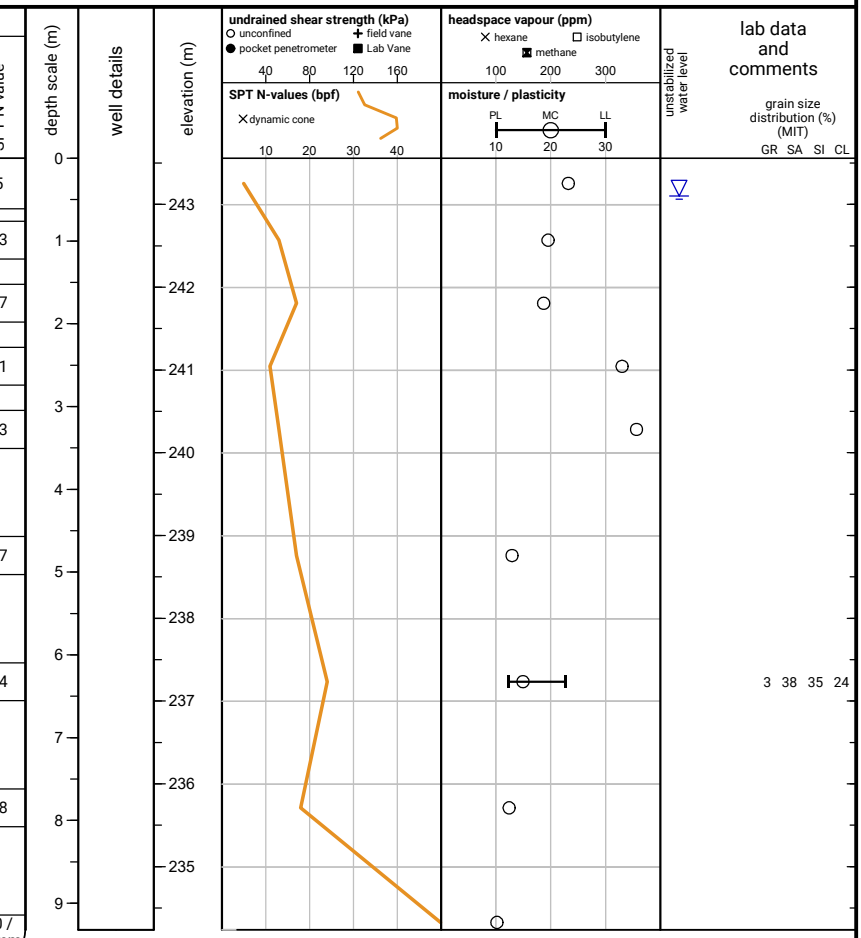
drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description	number	type	SPT N-value
243.6	**GROUND SURFACE**			
	100mm **TOPSOIL**	1	SS	5
242.8 / 0.8	**CLAYEY SILT**, some sand, trace gravel, trace rootlets, firm, orangey brown, moist (WEATHERED)	2	SS	13
	SAND AND SILT, compact, brown, moist	3	SS	17
241.3 / 2.3	**SILTY CLAY**, trace sand, stiff, greyish brown, moist to wet	4	SS	11
		5	SS	13
239.0 / 4.6	**SILTY SAND**, clayey, trace gravel, very stiff, grey, moist (GLACIAL TILL)	6	SS	17
		7	SS	24
	...at 7.6 m, wet	8	SS	18
234.5 / 234.3 / 9.3	**SAND AND SILT**, trace clay, trace gravel, very dense (GLACIAL TILL)	9	SS	50 / 25mm

END OF BOREHOLE

Unstabilized water level measured at 0.5 m below ground surface; caved to 9.1 m below ground surface upon completion of drilling.



Tech : CSH | **PM** : AG | **Rev** : MD

file: 20-295 gint logs.gpj

GROUNDED ENGINEERING

Date Started : Feb 14, 2023
Position : E: 606932, N: 4911275 (UTM 17T)
Elev. Datum : Geodetic

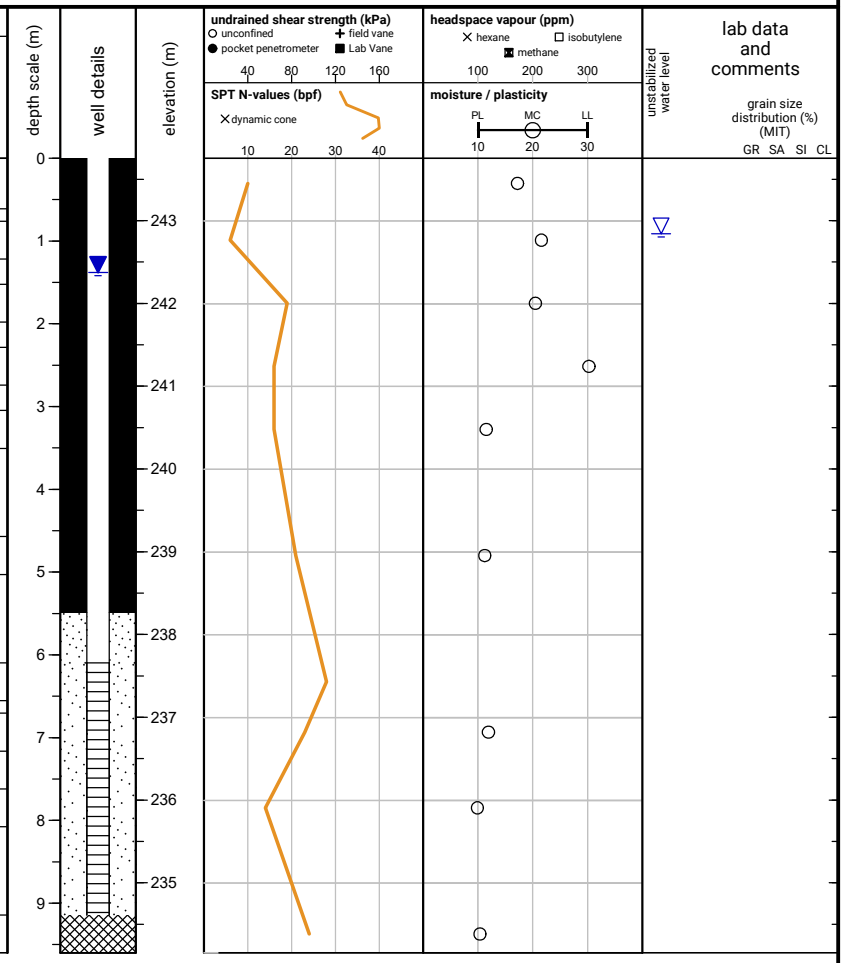
BOREHOLE LOG 204

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description (stratigraphy)	number	type	SPT N-value
243.8	**GROUND SURFACE**			
	200mm **TOPSOIL**	1	SS	10
	SILTY SAND, trace gravel, trace clay, trace rootlets, loose to compact, brown and orange, moist to wet	2	SS	6
	...at 0.8 m, some clay			
	...at 1.5 m, sand and silt, brown	3	SS	19
241.5 / 2.3	**CLAYEY SILT**, trace sand, very stiff, grey, moist	4	SS	16
240.8 / 3.0	**CLAYEY SILT**, sandy, trace gravel, very stiff, grey, moist (GLACIAL TILL)	5	SS	16
		6	SS	21
		7	SS	28
		8	SS	23
	...at 7.6 m, wet	9	SS	14
234.2 / 9.6		10	SS	24



END OF BOREHOLE

Unstabilized water level measured at 0.9 m below ground surface; caved to 9.1 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 3, 2023	1.4	242.4

file: 20-295 gint logs.gpj

Tech : CSH | **PM** : AG | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Feb 21, 2023
Position : E: 606847, N: 4911226 (UTM 17T)
Elev. Datum : Geodetic

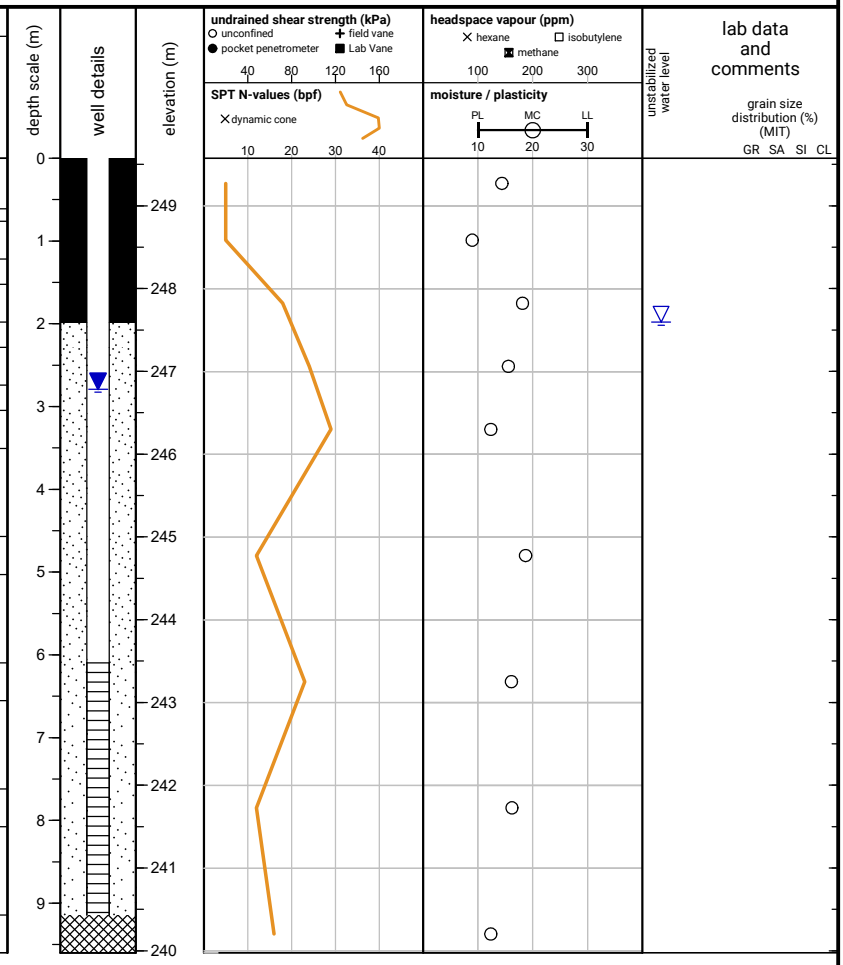
BOREHOLE LOG 205

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description (stratigraphy)	number	type	SPT N-value
249.6	**GROUND SURFACE**			
	150mm **TOPSOIL**			
	SAND, some silt, trace gravel, trace clay, loose to compact, orangey brown, moist	1	SS	5
		2	SS	5
	...at 1.5 m, greyish brown, wet	3	SS	18
		4	SS	24
246.6 / 3.0	**CLAYEY SILT**, sandy, trace gravel, hard, grey, moist (GLACIAL TILL)	5	SS	29
	...at 4.6 m, stiff	6	SS	12
	...at 6.1 m, hard	7	SS	23
	...at 7.6 m, stiff	8	SS	12
	...at 9.1 m, very stiff	9	SS	16
240.0 / 9.6	**END OF BOREHOLE**			



Unstabilized water level measured at 2.0 m below ground surface; caved to 3.7 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 3, 2023	2.8	246.8

file: 20-295 gint logs.gpj

Tech : CSH | **PM** : AG | **Rev** : MD

Date Started : Feb 13, 2023
Position : E: 606739, N: 4911299 (UTM 17T)
Elev. Datum : Geodetic

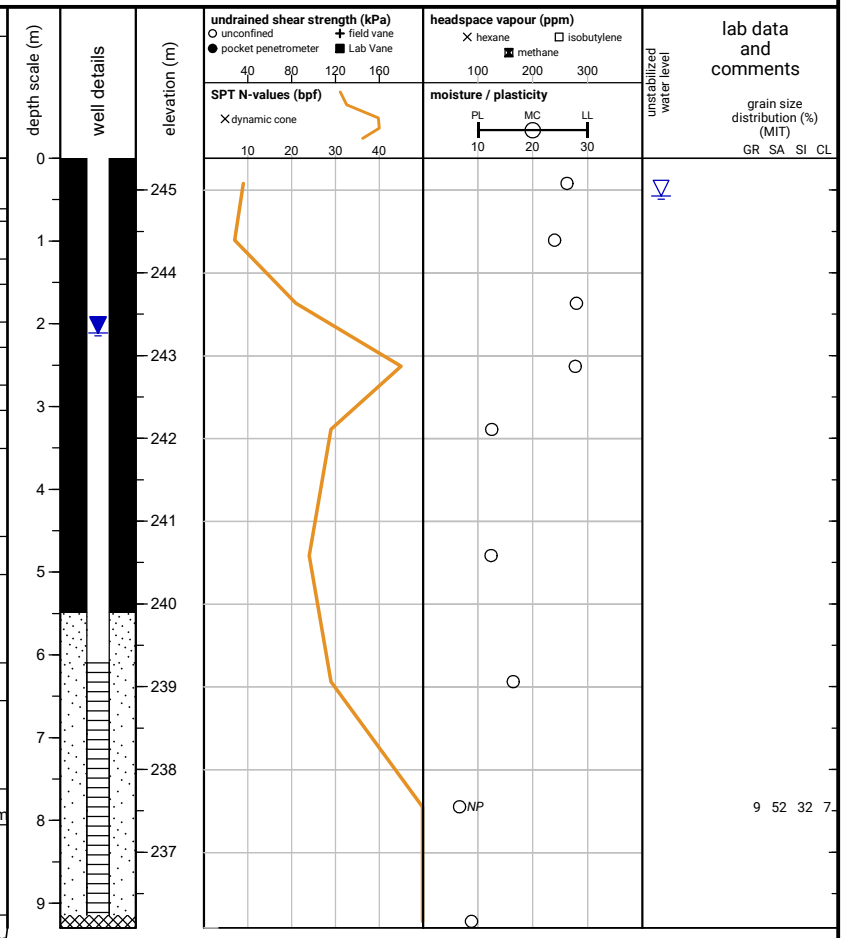
BOREHOLE LOG 206

File No. : 20-295 **Project** : Loon Lands, Barrie, ON **Client** : Loon Avenue Lands OP Inc.

drill method : *Big Beaver*

solid stem augers (sml) OD=112.5 mm

elev / depth (m)	description	number	type	SPT N-value
245.4	**GROUND SURFACE**			
	175mm **TOPSOIL**			
	SANDY SILT, some clay, trace gravel, trace rootlets, loose, orangey brown, wet	1	SS	9
		2	SS	7
243.9 / 1.5	**CLAYEY SILT**, trace sand, trace gravel, compact to dense, brown, moist (GLACIAL TILL)	3	SS	21
		4	SS	45
	...at 3.0 m, sandy	5	SS	29
		6	SS	24
		7	SS	29
237.8 / 7.6	**SILTY SAND**, trace clay, trace gravel, grey, wet (GLACIAL TILL)	8	SS	100 / 275mm
236.1 / 9.3	...at 9.1 m, some gravel, trace clay	9	SS	50 / 150mm



END OF BOREHOLE

Unstabilized water level measured at 0.5 m below ground surface; caved to 9.1 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

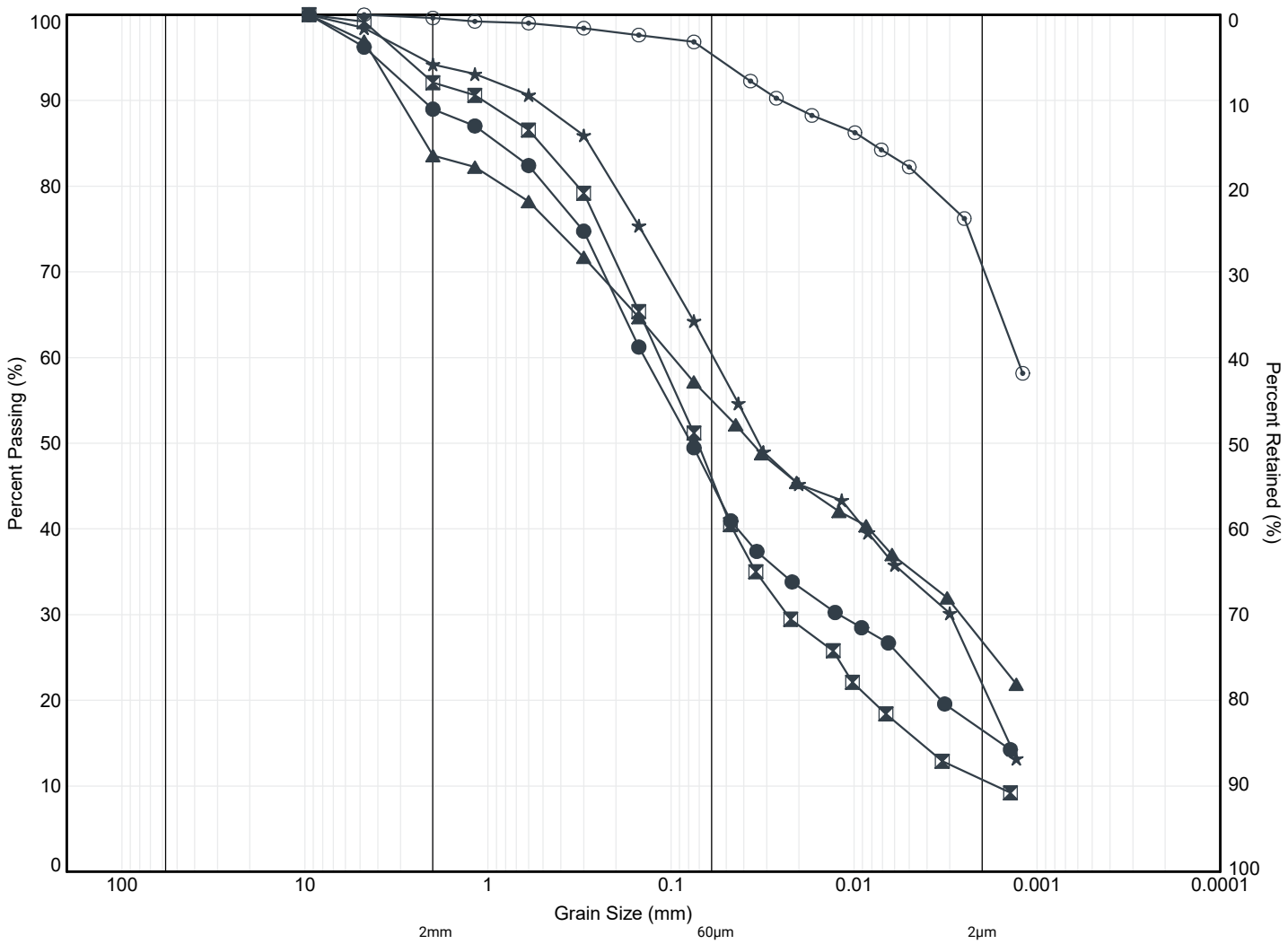
GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 3, 2023	2.1	243.3

file: 20-295 gint logs.gpj

Tech : CSH | **PM** : AG | **Rev** : MD

APPENDIX G



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**101**	SS6	4.8	240.5	11	43	29	17
⊠	**101**	SS8	7.8	237.5	8	46	35	11
▲	**102**	SS5	3.3	239.8	16	29	28	27
★	**104**	SS7	6.4	236.5	6	33	39	22
⊙	**105**	SS4	2.6	240.8	0	4	25	71

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION**

File No.: **20-295-102**

file: 20-295 gint logs.gpj

APPENDIX H

Your Project #: 20-295
Your C.O.C. #: 848089-03-01

Attention: Kimberley Pickett

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2021/11/11
Report #: R6896990
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1S3010
Received: 2021/09/30, 09:32

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Sewer Use By-Law Semivolatile Organics	1	2021/10/02	2021/10/04	CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2021/10/01	2021/10/06	CAM SOP-00427	SM 23 5210B m
1,3-Dichloropropene Sum	1	N/A	2021/10/05		EPA 8260C m
Chromium (VI) in Water	1	N/A	2021/10/04	CAM SOP-00436	EPA 7199 m
Total Cyanide	1	2021/10/01	2021/10/01	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/10/02	2021/10/05	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/10/04	2021/10/04	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2021/10/04	2021/10/05	CAM SOP-00408	EPA 6010D m
Total Metals Analysis by ICPMS	1	N/A	2021/10/13	CAM SOP-00447	EPA 6020B m
Total Nonylphenol in Liquids by HPLC	1	2021/10/04	2021/10/05	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2021/10/04	2021/10/05	CAM SOP-00313	In-house Method
Animal and Vegetable Oil and Grease	1	N/A	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/10/07	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520B m
Polychlorinated Biphenyl in Water	1	2021/10/01	2021/10/01	CAM SOP-00309	EPA 8082A m
pH	1	2021/10/02	2021/10/05	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/10/01	CAM SOP-00444	OMOE E3179 m
Total Kjeldahl Nitrogen in Water	1	2021/10/04	2021/10/05	CAM SOP-00938	OMOE E3516 m
Total PAHs (1)	1	N/A	2021/10/04	CAM SOP - 00301	
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2021/10/07	2021/10/07	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/10/02	2021/10/05	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	2	N/A	2021/10/04	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 Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

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

Your Project #: 20-295
Your C.O.C. #: 848089-03-01

Attention: Kimberley Pickett

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2021/11/11
Report #: R6896990
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C1S3010
Received: 2021/09/30, 09:32

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
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) Total PAHs include only those PAHs specified in the sewer use by-by-law.
(2) 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.
Marijane Cruz, Senior Project Manager
Email: Marijane.Cruz@bureauveritas.com
Phone# (905)817-5756
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

BARRIE SAN. SEWER EXCL. RH (2021-002)

Bureau Veritas ID			QUM030		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	**Criteria**	**BH105**	**RDL**	**QC Batch**
Calculated Parameters					
Total Animal/Vegetable Oil and Grease	mg/L	150	0.80	0.50	7610151
Inorganics					
Fluoride (F-)	mg/L	10	0.19	0.10	7614570
Total Kjeldahl Nitrogen (TKN)	mg/L	100	0.23	0.10	7616650
Phenols-4AAP	mg/L	0.1	0.0018	0.0010	7612017
Total Cyanide (CN)	mg/L	1.2	<0.0050	0.0050	7613230
Petroleum Hydrocarbons					
Total Oil & Grease	mg/L	-	0.80	0.50	7623538
Total Oil & Grease Mineral/Synthetic	mg/L	15	<0.50	0.50	7623539
Metals					
Mercury (Hg)	mg/L	0.01	<0.00010	0.00010	7616090
Volatile Organics					
Acetone (2-Propanone)	mg/L	-	<0.010	0.010	7612867
Benzene	mg/L	0.01	<0.00020	0.00020	7612867
Bromodichloromethane	mg/L	-	<0.00050	0.00050	7612867
Bromoform	mg/L	-	<0.0010	0.0010	7612867
Bromomethane	mg/L	-	<0.00050	0.00050	7612867
Carbon Tetrachloride	mg/L	-	<0.00019	0.00019	7612867
Chlorobenzene	mg/L	-	<0.00020	0.00020	7612867
Chloroform	mg/L	-	<0.00020	0.00020	7612867
Dibromochloromethane	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichlorobenzene	mg/L	0.05	<0.00040	0.00040	7612867
1,3-Dichlorobenzene	mg/L	-	<0.00040	0.00040	7612867
1,4-Dichlorobenzene	mg/L	0.08	<0.00040	0.00040	7612867
Dichlorodifluoromethane (FREON 12)	mg/L	-	<0.0010	0.0010	7612867
1,1-Dichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,2-Dichloroethane	mg/L	-	<0.00049	0.00049	7612867
1,1-Dichloroethylene	mg/L	-	<0.00020	0.00020	7612867
cis-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
trans-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichloropropane	mg/L	-	<0.00020	0.00020	7612867

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 City of Barrie Discharges to Sanitary Sewers By Law 2021-002

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

BARRIE SAN. SEWER EXCL. RH (2021-002)

Bureau Veritas ID			QUM030		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	**Criteria**	**BH105**	**RDL**	**QC Batch**
cis-1,3-Dichloropropene	mg/L	-	<0.00030	0.00030	7612867
trans-1,3-Dichloropropene	mg/L	-	<0.00040	0.00040	7612867
Ethylbenzene	mg/L	0.06	<0.00020	0.00020	7612867
Ethylene Dibromide	mg/L	-	<0.00019	0.00019	7612867
Hexane	mg/L	-	<0.0010	0.0010	7612867
Methylene Chloride(Dichloromethane)	mg/L	0.09	<0.0020	0.0020	7612867
Methyl Ethyl Ketone (2-Butanone)	mg/L	-	<0.010	0.010	7612867
Methyl Isobutyl Ketone	mg/L	-	<0.0050	0.0050	7612867
Methyl t-butyl ether (MTBE)	mg/L	-	<0.00050	0.00050	7612867
Styrene	mg/L	-	<0.00040	0.00040	7612867
1,1,1,2-Tetrachloroethane	mg/L	-	<0.00050	0.00050	7612867
1,1,2,2-Tetrachloroethane	mg/L	0.06	<0.00040	0.00040	7612867
Tetrachloroethylene	mg/L	0.06	<0.00020	0.00020	7612867
Toluene	mg/L	0.02	<0.00020	0.00020	7612867
1,1,1-Trichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,1,2-Trichloroethane	mg/L	-	<0.00040	0.00040	7612867
Trichloroethylene	mg/L	0.05	<0.00020	0.00020	7612867
Trichlorofluoromethane (FREON 11)	mg/L	-	<0.00050	0.00050	7612867
Vinyl Chloride	mg/L	-	<0.00020	0.00020	7612867
p+m-Xylene	mg/L	-	<0.00020	0.00020	7612867
o-Xylene	mg/L	-	<0.00020	0.00020	7612867
Total Xylenes	mg/L	0.3	<0.00020	0.00020	7612867
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	89		7612867
D4-1,2-Dichloroethane	%	-	119		7612867
D8-Toluene	%	-	93		7612867

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 City of Barrie Discharges to Sanitary Sewers By Law 2021-002

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

BARRIE STORM SEWER BYLAW (2021-002)

Bureau Veritas ID				QUM030		
Sampling Date				2021/09/29 12:00		
COC Number				848089-03-01		
	UNITS	**Criteria**	**Criteria-2**	**BH105**	**RDL**	**QC Batch**
Inorganics						
Total BOD	mg/L	15	300	<2	2	7611930
pH	pH	6.0:9.5	6.0:9.5	7.94		7614574
Total Suspended Solids	mg/L	15	350	12	10	7613006
Metals						
Total Aluminum (Al)	mg/L	-	50	<0.1	0.1	7616398
Total Antimony (Sb)	mg/L	-	5	<0.02	0.02	7616398
Total Arsenic (As)	mg/L	-	1	<0.01	0.01	7616398
Total Chromium (Cr)	mg/L	0.08	2	<0.01	0.01	7616398
Total Cobalt (Co)	mg/L	-	5	<0.002	0.002	7616398
Total Copper (Cu)	mg/L	0.01	2	<0.01	0.01	7616398
Total Lead (Pb)	mg/L	0.05	0.7	<0.01	0.01	7616398
Total Manganese (Mn)	mg/L	-	5	0.040	0.001	7616398
Total Molybdenum (Mo)	mg/L	-	5	<0.005	0.005	7616398
Total Nickel (Ni)	mg/L	0.05	2	<0.005	0.005	7616398
Total Phosphorus (P)	mg/L	-	10	<0.05	0.05	7616398
Total Selenium (Se)	mg/L	-	1	<0.02	0.02	7616398
Total Silver (Ag)	mg/L	-	0.4	<0.01	0.01	7616398
Total Tin (Sn)	mg/L	-	5	<0.02	0.02	7616398
Total Titanium (Ti)	mg/L	-	-	<0.005	0.005	7616398
Total Zinc (Zn)	mg/L	0.04	2	<0.005	0.005	7616398
Total Cadmium (Cd)	mg/L	0.001	0.7	<0.000090	0.000090	7630714

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 City of Barrie Discharges to Storm Sewers By Law 2021-002
Criteria-2: The City of Barrie Discharges to Sanitary Sewers By Law 2021-002

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

NONYL PHENOL AND NONYL PHENOL ETHOXYLATE (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	**BH105**	**RDL**	**QC Batch**
Miscellaneous Parameters				
Nonylphenol Ethoxylate (Total)	mg/L	<0.005	0.005	7615731
Nonylphenol (Total)	mg/L	0.002	0.001	7615730

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	**BH105**	**RDL**	**QC Batch**
Metals				
Chromium (VI)	mg/L	0.00085	0.00050	7613594

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		QUM030			QUM030		
Sampling Date		2021/09/29 12:00			2021/09/29 12:00		
COC Number		848089-03-01			848089-03-01		
	UNITS	**BH105**	**RDL**	**QC Batch**	**BH105 Lab-Dup**	**RDL**	**QC Batch**
Semivolatile Organics							
Di-N-butyl phthalate	mg/L	<0.002	0.002	7614554	<0.002	0.002	7614554
Bis(2-ethylhexyl)phthalate	mg/L	<0.002	0.002	7614554	<0.002	0.002	7614554
3,3'-Dichlorobenzidine	mg/L	<0.0008	0.0008	7614554	<0.0008	0.0008	7614554
Pentachlorophenol	mg/L	<0.001	0.001	7614554	<0.001	0.001	7614554
Phenanthrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(a)anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Chrysene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(b/j)fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(k)fluoranthene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(a)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Indeno(1,2,3-cd)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,h)anthracene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(g,h,i)perylene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,i)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Benzo(e)pyrene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Perylene	mg/L	<0.0002	0.0002	7614554	<0.0002	0.0002	7614554
Dibenzo(a,j) acridine	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
7H-Dibenzo(c,g) Carbazole	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,6-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,3-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
1,8-Dinitropyrene	mg/L	<0.0004	0.0004	7614554	<0.0004	0.0004	7614554
Calculated Parameters							
Total PAHs (18 PAHs)	mg/L	<0.001	0.001	7610316			
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	79		7614554	90		7614554
2-Fluorobiphenyl	%	66		7614554	74		7614554
D14-Terphenyl (FS)	%	91		7614554	89		7614554
D5-Nitrobenzene	%	92		7614554	100		7614554

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Bureau Veritas ID		QUM030			QUM030		
Sampling Date		2021/09/29 12:00			2021/09/29 12:00		
COC Number		848089-03-01			848089-03-01		
	UNITS	**BH105**	**RDL**	**QC Batch**	**BH105 Lab-Dup**	**RDL**	**QC Batch**
D8-Acenaphthylene	%	79		7614554	89		7614554

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

VOLATILE ORGANICS BY GC/MS (WATER)

Bureau Veritas ID			QUM031		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	**Criteria**	**TRIP BLANK**	**RDL**	**QC Batch**
Calculated Parameters					
1,3-Dichloropropene (cis+trans)	mg/L	-	<0.00050	0.00050	7611026
Volatile Organics					
Acetone (2-Propanone)	mg/L	-	<0.010	0.010	7612867
Benzene	mg/L	0.01	<0.00020	0.00020	7612867
Bromodichloromethane	mg/L	-	<0.00050	0.00050	7612867
Bromoform	mg/L	-	<0.0010	0.0010	7612867
Bromomethane	mg/L	-	<0.00050	0.00050	7612867
Carbon Tetrachloride	mg/L	-	<0.00019	0.00019	7612867
Chlorobenzene	mg/L	-	<0.00020	0.00020	7612867
Chloroform	mg/L	-	<0.00020	0.00020	7612867
Dibromochloromethane	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichlorobenzene	mg/L	0.05	<0.00040	0.00040	7612867
1,3-Dichlorobenzene	mg/L	-	<0.00040	0.00040	7612867
1,4-Dichlorobenzene	mg/L	0.08	<0.00040	0.00040	7612867
Dichlorodifluoromethane (FREON 12)	mg/L	-	<0.0010	0.0010	7612867
1,1-Dichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,2-Dichloroethane	mg/L	-	<0.00049	0.00049	7612867
1,1-Dichloroethylene	mg/L	-	<0.00020	0.00020	7612867
cis-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
trans-1,2-Dichloroethylene	mg/L	-	<0.00050	0.00050	7612867
1,2-Dichloropropane	mg/L	-	<0.00020	0.00020	7612867
cis-1,3-Dichloropropene	mg/L	-	<0.00030	0.00030	7612867
trans-1,3-Dichloropropene	mg/L	-	<0.00040	0.00040	7612867
Ethylbenzene	mg/L	0.06	<0.00020	0.00020	7612867
Ethylene Dibromide	mg/L	-	<0.00019	0.00019	7612867
Hexane	mg/L	-	<0.0010	0.0010	7612867
Methylene Chloride(Dichloromethane)	mg/L	0.09	<0.0020	0.0020	7612867
Methyl Ethyl Ketone (2-Butanone)	mg/L	-	<0.010	0.010	7612867
Methyl Isobutyl Ketone	mg/L	-	<0.0050	0.0050	7612867
Methyl t-butyl ether (MTBE)	mg/L	-	<0.00050	0.00050	7612867
Styrene	mg/L	-	<0.00040	0.00040	7612867

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 City of Barrie Discharges to Sanitary Sewers By Law 2021-002

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

VOLATILE ORGANICS BY GC/MS (WATER)

Bureau Veritas ID			QUM031		
Sampling Date			2021/09/29 12:00		
COC Number			848089-03-01		
	UNITS	**Criteria**	**TRIP BLANK**	**RDL**	**QC Batch**
1,1,1,2-Tetrachloroethane	mg/L	-	<0.00050	0.00050	7612867
1,1,2,2-Tetrachloroethane	mg/L	0.06	<0.00040	0.00040	7612867
Tetrachloroethylene	mg/L	0.06	<0.00020	0.00020	7612867
Toluene	mg/L	0.02	<0.00020	0.00020	7612867
1,1,1-Trichloroethane	mg/L	-	<0.00020	0.00020	7612867
1,1,2-Trichloroethane	mg/L	-	<0.00040	0.00040	7612867
Trichloroethylene	mg/L	0.05	<0.00020	0.00020	7612867
Trichlorofluoromethane (FREON 11)	mg/L	-	<0.00050	0.00050	7612867
Vinyl Chloride	mg/L	-	<0.00020	0.00020	7612867
p+m-Xylene	mg/L	-	<0.00020	0.00020	7612867
o-Xylene	mg/L	-	<0.00020	0.00020	7612867
Total Xylenes	mg/L	0.3	<0.00020	0.00020	7612867
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	90		7612867
D4-1,2-Dichloroethane	%	-	117		7612867
D8-Toluene	%	-	94		7612867

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 City of Barrie Discharges to Sanitary Sewers By Law 2021-002

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

Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Bureau Veritas ID		QUM030		
Sampling Date		2021/09/29 12:00		
COC Number		848089-03-01		
	UNITS	**BH105**	**RDL**	**QC Batch**
PCBs				
Total PCB	mg/L	<0.00005	0.00005	7611999
Surrogate Recovery (%)				
Decachlorobiphenyl	%	85		7611999

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

TEST SUMMARY

Bureau Veritas ID: QUM030
Sample ID: BH105
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	7614554	2021/10/02	2021/10/04	Adriana Zurita
Biochemical Oxygen Demand (BOD)	DO	7611930	2021/10/01	2021/10/06	Nusrat Naz
Chromium (VI) in Water	IC	7613594	N/A	2021/10/04	Lang Le
Total Cyanide	SKAL/CN	7613230	2021/10/01	2021/10/01	Aditiben Patel
Fluoride	ISE	7614570	2021/10/02	2021/10/05	Surinder Rai
Mercury in Water by CVAA	CV/AA	7616090	2021/10/04	2021/10/04	Gagandeep Rai
Total Metals Analysis by Axial ICP	ICPX	7616398	2021/10/04	2021/10/05	Jolly John
Total Metals Analysis by ICPMS	ICP/MS	7630714	N/A	2021/10/13	Arefa Dabhad
Total Nonylphenol in Liquids by HPLC	LC/FLU	7615730	2021/10/04	2021/10/05	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	7615731	2021/10/04	2021/10/05	Dennis Boodram
Animal and Vegetable Oil and Grease	BAL	7610151	N/A	2021/10/07	Automated Statchk
Total Oil and Grease	BAL	7623538	2021/10/07	2021/10/07	Mitul Patel
Polychlorinated Biphenyl in Water	GC/ECD	7611999	2021/10/01	2021/10/01	Dawn Howard
pH	AT	7614574	2021/10/02	2021/10/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7612017	N/A	2021/10/01	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	7616650	2021/10/04	2021/10/05	Massarat Jan
Total PAHs	CALC	7610316	N/A	2021/10/04	Automated Statchk
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7623539	2021/10/07	2021/10/07	Mitul Patel
Total Suspended Solids	BAL	7613006	2021/10/02	2021/10/05	Sandeep Kaur
Volatile Organic Compounds in Water	GC/MS	7612867	N/A	2021/10/04	Chandni Khawas

Bureau Veritas ID: QUM030 Dup
Sample ID: BH105
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	7614554	2021/10/02	2021/10/04	Adriana Zurita

Bureau Veritas ID: QUM031
Sample ID: TRIP BLANK
Matrix: Water

Collected: 2021/09/29
Shipped:
Received: 2021/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7611026	N/A	2021/10/05	Automated Statchk
Volatile Organic Compounds in Water	GC/MS	7612867	N/A	2021/10/04	Chandni Khawas

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GENERAL COMMENTS

Revised Report (2021/11/11) : City of Barrie Sanitary criteria added per client request.

Revised Report (2021/10/14) : Cadmium repeated.

Revised Report (2021/10/08) : City of Barrie Storm sewer criteria added per client request.

Results relate only to the items tested.

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

Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

			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
7611999	Decachlorobiphenyl	2021/10/01	107	60 - 130	94	60 - 130	100	%				
7612867	4-Bromofluorobenzene	2021/10/04	101	70 - 130	101	70 - 130	95	%				
7612867	D4-1,2-Dichloroethane	2021/10/04	111	70 - 130	106	70 - 130	112	%				
7612867	D8-Toluene	2021/10/04	103	70 - 130	105	70 - 130	95	%				
7614554	2,4,6-Tribromophenol	2021/10/04	82	10 - 130	81	10 - 130	71	%				
7614554	2-Fluorobiphenyl	2021/10/04	63	30 - 130	64	30 - 130	64	%				
7614554	D14-Terphenyl (FS)	2021/10/04	76	30 - 130	80	30 - 130	84	%				
7614554	D5-Nitrobenzene	2021/10/04	75	30 - 130	79	30 - 130	80	%				
7614554	D8-Acenaphthylene	2021/10/04	77	30 - 130	81	30 - 130	80	%				
7611930	Total BOD	2021/10/06					<2	mg/L	1.3	30	96	80 - 120
7611999	Total PCB	2021/10/01	107	60 - 130	107	60 - 130	<0.00005	mg/L	NC	40		
7612017	Phenols-4AAP	2021/10/01	97	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
7612867	1,1,1,2-Tetrachloroethane	2021/10/04	101	70 - 130	103	70 - 130	<0.00050	mg/L	NC	30		
7612867	1,1,1-Trichloroethane	2021/10/04	101	70 - 130	102	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,1,2,2-Tetrachloroethane	2021/10/04	99	70 - 130	99	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,1,2-Trichloroethane	2021/10/04	103	70 - 130	103	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,1-Dichloroethane	2021/10/04	95	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,1-Dichloroethylene	2021/10/04	92	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,2-Dichlorobenzene	2021/10/04	94	70 - 130	97	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,2-Dichloroethane	2021/10/04	99	70 - 130	97	70 - 130	<0.00049	mg/L	NC	30		
7612867	1,2-Dichloropropane	2021/10/04	96	70 - 130	97	70 - 130	<0.00020	mg/L	NC	30		
7612867	1,3-Dichlorobenzene	2021/10/04	91	70 - 130	95	70 - 130	<0.00040	mg/L	NC	30		
7612867	1,4-Dichlorobenzene	2021/10/04	104	70 - 130	110	70 - 130	<0.00040	mg/L	NC	30		
7612867	Acetone (2-Propanone)	2021/10/04	105	60 - 140	101	60 - 140	<0.010	mg/L	NC	30		
7612867	Benzene	2021/10/04	88	70 - 130	90	70 - 130	<0.00020	mg/L	NC	30		
7612867	Bromodichloromethane	2021/10/04	103	70 - 130	103	70 - 130	<0.00050	mg/L	NC	30		
7612867	Bromoform	2021/10/04	103	70 - 130	103	70 - 130	<0.0010	mg/L	NC	30		
7612867	Bromomethane	2021/10/04	100	60 - 140	99	60 - 140	<0.00050	mg/L	NC	30		
7612867	Carbon Tetrachloride	2021/10/04	99	70 - 130	101	70 - 130	<0.00019	mg/L	NC	30		
7612867	Chlorobenzene	2021/10/04	93	70 - 130	96	70 - 130	<0.00020	mg/L	NC	30		
7612867	Chloroform	2021/10/04	98	70 - 130	99	70 - 130	<0.00020	mg/L	NC	30		

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

			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
7612867	cis-1,2-Dichloroethylene	2021/10/04	100	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	cis-1,3-Dichloropropene	2021/10/04	91	70 - 130	90	70 - 130	<0.00030	mg/L	NC	30		
7612867	Dibromochloromethane	2021/10/04	100	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	Dichlorodifluoromethane (FREON 12)	2021/10/04	82	60 - 140	87	60 - 140	<0.0010	mg/L	NC	30		
7612867	Ethylbenzene	2021/10/04	79	70 - 130	85	70 - 130	<0.00020	mg/L	NC	30		
7612867	Ethylene Dibromide	2021/10/04	96	70 - 130	97	70 - 130	<0.00019	mg/L	NC	30		
7612867	Hexane	2021/10/04	90	70 - 130	95	70 - 130	<0.0010	mg/L	NC	30		
7612867	Methyl Ethyl Ketone (2-Butanone)	2021/10/04	102	60 - 140	100	60 - 140	<0.010	mg/L	NC	30		
7612867	Methyl Isobutyl Ketone	2021/10/04	95	70 - 130	96	70 - 130	<0.0050	mg/L	NC	30		
7612867	Methyl t-butyl ether (MTBE)	2021/10/04	84	70 - 130	87	70 - 130	<0.00050	mg/L	NC	30		
7612867	Methylene Chloride(Dichloromethane)	2021/10/04	102	70 - 130	98	70 - 130	<0.0020	mg/L	NC	30		
7612867	o-Xylene	2021/10/04	81	70 - 130	90	70 - 130	<0.00020	mg/L	NC	30		
7612867	p+m-Xylene	2021/10/04	83	70 - 130	89	70 - 130	<0.00020	mg/L	NC	30		
7612867	Styrene	2021/10/04	93	70 - 130	102	70 - 130	<0.00040	mg/L	NC	30		
7612867	Tetrachloroethylene	2021/10/04	92	70 - 130	95	70 - 130	<0.00020	mg/L	NC	30		
7612867	Toluene	2021/10/04	88	70 - 130	92	70 - 130	<0.00020	mg/L	NC	30		
7612867	Total Xylenes	2021/10/04					<0.00020	mg/L	NC	30		
7612867	trans-1,2-Dichloroethylene	2021/10/04	95	70 - 130	97	70 - 130	<0.00050	mg/L	NC	30		
7612867	trans-1,3-Dichloropropene	2021/10/04	103	70 - 130	102	70 - 130	<0.00040	mg/L	NC	30		
7612867	Trichloroethylene	2021/10/04	99	70 - 130	102	70 - 130	<0.00020	mg/L	NC	30		
7612867	Trichlorofluoromethane (FREON 11)	2021/10/04	99	70 - 130	101	70 - 130	<0.00050	mg/L	NC	30		
7612867	Vinyl Chloride	2021/10/04	92	70 - 130	95	70 - 130	<0.00020	mg/L	NC	30		
7613006	Total Suspended Solids	2021/10/05					<10	mg/L	NC	25	98	85 - 115
7613230	Total Cyanide (CN)	2021/10/01	109	80 - 120	106	80 - 120	<0.0050	mg/L	0.22	20		
7613594	Chromium (VI)	2021/10/04	101	80 - 120	102	80 - 120	<0.00050	mg/L	NC	20		
7614554	1,3-Dinitropyrene	2021/10/04	71	30 - 130	124	30 - 130	<0.0004	mg/L	NC	40		
7614554	1,6-Dinitropyrene	2021/10/04	78	30 - 130	116	30 - 130	<0.0004	mg/L	NC	40		
7614554	1,8-Dinitropyrene	2021/10/04	67	30 - 130	102	30 - 130	<0.0004	mg/L	NC	40		
7614554	3,3'-Dichlorobenzidine	2021/10/04	50	30 - 130	85	30 - 130	<0.0008	mg/L	NC	40		
7614554	7H-Dibenzo(c,g) Carbazole	2021/10/04	89	30 - 130	94	30 - 130	<0.0004	mg/L	NC	40		
7614554	Anthracene	2021/10/04	79	30 - 130	84	30 - 130	<0.0002	mg/L	NC	40		

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

Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

			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
7614554	Benzo(a)anthracene	2021/10/04	83	30 - 130	84	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(a)pyrene	2021/10/04	69	30 - 130	74	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(b/j)fluoranthene	2021/10/04	81	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(e)pyrene	2021/10/04	86	30 - 130	92	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(g,h,i)perylene	2021/10/04	96	30 - 130	104	30 - 130	<0.0002	mg/L	NC	40		
7614554	Benzo(k)fluoranthene	2021/10/04	90	30 - 130	92	30 - 130	<0.0002	mg/L	NC	40		
7614554	Bis(2-ethylhexyl)phthalate	2021/10/04	90	30 - 130	92	30 - 130	<0.002	mg/L	NC	40		
7614554	Chrysene	2021/10/04	89	30 - 130	91	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,h)anthracene	2021/10/04	98	30 - 130	103	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,i)pyrene	2021/10/04	71	30 - 130	87	30 - 130	<0.0002	mg/L	NC	40		
7614554	Dibenzo(a,j) acridine	2021/10/04	95	30 - 130	98	30 - 130	<0.0004	mg/L	NC	40		
7614554	Di-N-butyl phthalate	2021/10/04	94	30 - 130	97	30 - 130	<0.002	mg/L	NC	40		
7614554	Fluoranthene	2021/10/04	86	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Indeno(1,2,3-cd)pyrene	2021/10/04	99	30 - 130	108	30 - 130	<0.0002	mg/L	NC	40		
7614554	Pentachlorophenol	2021/10/04	96	30 - 130	52	30 - 130	<0.001	mg/L	NC	40		
7614554	Perylene	2021/10/04	85	30 - 130	89	30 - 130	<0.0002	mg/L	NC	40		
7614554	Phenanthrene	2021/10/04	82	30 - 130	86	30 - 130	<0.0002	mg/L	NC	40		
7614554	Pyrene	2021/10/04	86	30 - 130	88	30 - 130	<0.0002	mg/L	NC	40		
7614570	Fluoride (F-)	2021/10/05	102	80 - 120	99	80 - 120	<0.10	mg/L	11	20		
7614574	pH	2021/10/05			102	98 - 103			0.44	N/A		
7615730	Nonylphenol (Total)	2021/10/05	126	50 - 130	101	50 - 130	<0.001	mg/L	NC	40		
7615731	Nonylphenol Ethoxylate (Total)	2021/10/05	104	50 - 130	107	50 - 130	<0.005	mg/L				
7616090	Mercury (Hg)	2021/10/04	95	75 - 125	98	80 - 120	<0.00010	mg/L	NC	20		
7616398	Total Aluminum (Al)	2021/10/05	NC	80 - 120	103	80 - 120	<0.1	mg/L				
7616398	Total Antimony (Sb)	2021/10/05	109	80 - 120	108	80 - 120	<0.02	mg/L				
7616398	Total Arsenic (As)	2021/10/05	108	80 - 120	105	80 - 120	<0.01	mg/L				
7616398	Total Chromium (Cr)	2021/10/05	103	80 - 120	104	80 - 120	<0.01	mg/L				
7616398	Total Cobalt (Co)	2021/10/05	100	80 - 120	103	80 - 120	<0.002	mg/L				
7616398	Total Copper (Cu)	2021/10/05	105	80 - 120	105	80 - 120	<0.01	mg/L				
7616398	Total Lead (Pb)	2021/10/05	100	80 - 120	104	80 - 120	<0.01	mg/L				
7616398	Total Manganese (Mn)	2021/10/05	102	80 - 120	104	80 - 120	<0.001	mg/L				

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Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

QUALITY ASSURANCE REPORT(CONT'D)

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

			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
7616398	Total Molybdenum (Mo)	2021/10/05	106	80 - 120	106	80 - 120	<0.005	mg/L				
7616398	Total Nickel (Ni)	2021/10/05	100	80 - 120	105	80 - 120	<0.005	mg/L				
7616398	Total Phosphorus (P)	2021/10/05	NC	80 - 120	111	80 - 120	<0.05	mg/L	2.2	20		
7616398	Total Selenium (Se)	2021/10/05	107	80 - 120	105	80 - 120	<0.02	mg/L				
7616398	Total Silver (Ag)	2021/10/05	99	80 - 120	101	80 - 120	<0.01	mg/L				
7616398	Total Tin (Sn)	2021/10/05	102	80 - 120	107	80 - 120	<0.02	mg/L				
7616398	Total Titanium (Ti)	2021/10/05	103	80 - 120	103	80 - 120	<0.005	mg/L				
7616398	Total Zinc (Zn)	2021/10/05	106	80 - 120	108	80 - 120	<0.005	mg/L				
7616650	Total Kjeldahl Nitrogen (TKN)	2021/10/05	110	80 - 120	99	80 - 120	<0.10	mg/L	4.5	20	99	80 - 120
7623538	Total Oil & Grease	2021/10/07			98	85 - 115	<0.50	mg/L	1.0	25		
7623539	Total Oil & Grease Mineral/Synthetic	2021/10/07			95	85 - 115	<0.50	mg/L	1.1	25		
7630714	Total Cadmium (Cd)	2021/10/13	101	80 - 120	101	80 - 120	<0.000090	mg/L	NC	20		

N/A = Not Applicable

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

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

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

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

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

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

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

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

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

Bureau Veritas Job #: C1S3010
Report Date: 2021/11/11

Grounded Engineering Inc.
Client Project #: 20-295
Sampler Initials: VT

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

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

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

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

Marijane Cruz

C1S3010

ries
, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.bvlabs.com

CHAIN OF CUSTODY RECORD

VTN ENV 809

		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#36876 Grounded Engineering Inc.	Company Name:		Quotation #:	C04975	BV Labs Job #:	Bottle Order #: 848089
Attention:	Kimberley Pickett	Attention:	Kimberley Pickett	P.O. #:			
Address:	1 Banigan Drive, Toronto ON M4H 1G3	Address:		Project:	20-295	COC #: C#848089-03-01	Project Manager: Marijane Cruz
Tel:	(647) 265-0915 Fax:	Tel:	(647) 265-0915 Fax:	Project Name:			
Email:	kpickett@groundedeng.ca	Email:	kpickett@groundedeng.ca	Site #:			
				Sampled By:	VT/MC		

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

Regulation 153 (2011)	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 ____	
☐ Table ____	☐ PWQO ☐ Reg 406 Table ____	
	☐ Other ____	

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

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

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

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	~~O-Reg 153 Metals & Inorganics Pkg (Soil)~~	~~O-Reg 153 PHCs, BTEX/F1-F4 (Soil)~~	~~O-Reg 153 VOCs by HS (Soil)~~	~~O-Reg 558 TCLP Inorganics Package~~	~~O-Reg 558 TCLP VOCs by HS~~	~~O-Reg 558 TCLP B(a)P, TCLP PCB~~	~~Toronto Sanitary & Com. Sewer (100-2016)~~	PWQO			# of Bottles	Comments
1		BH105	09/29/21	12:00	GW									X			18	
2		Trip Blank	↓	↓	↓												2	
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
Vivi Tran	21/09/30	9:30		2021/09/30	09:32		Time Sensitive	Temperature (°C) on Recei 9.7	Custody Seal Present	Yes	No ✓
									Intact		

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

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

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

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

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

Exceedance Summary Table – Barrie Storm Sewer

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.						

Exceedance Summary Table – Barrie Sanitary Sewer

Result Exceedances

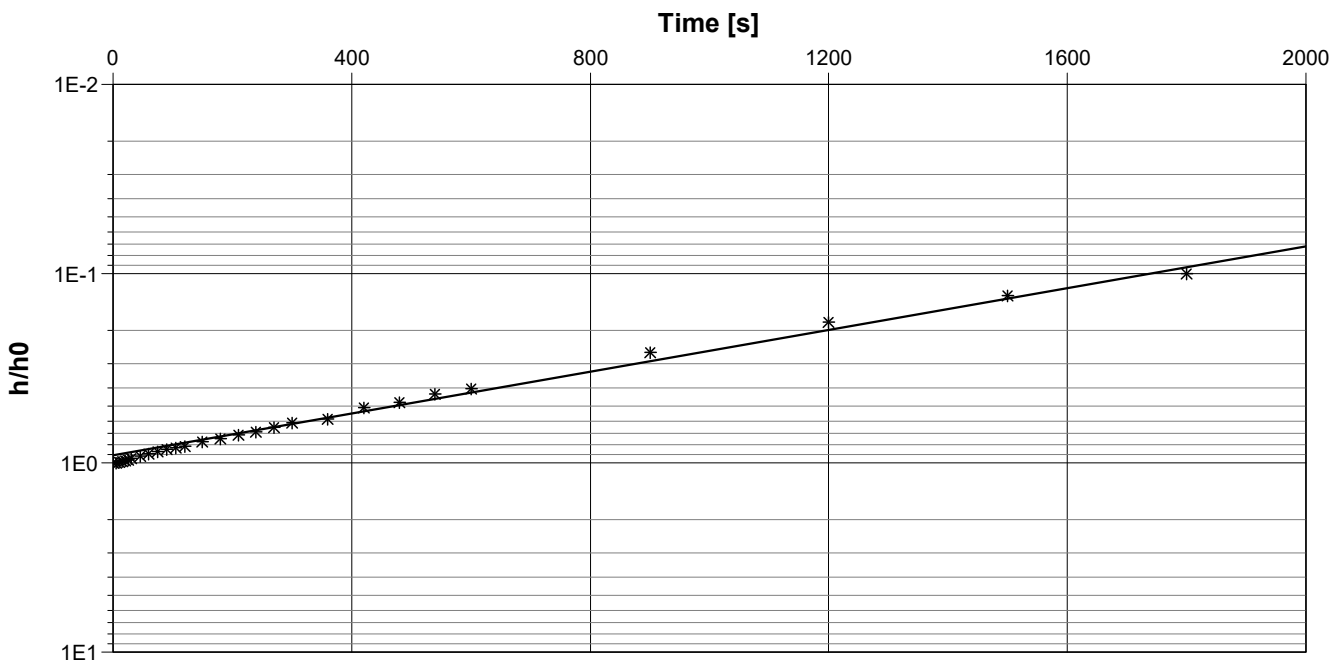
Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						
The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

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

APPENDIX I

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 338 Mapleview Dr E
	Number: 20-295
	Client:

Location: Barrie, ON	Slug Test: BH101	Test Well: BH101
Test Conducted by: VT		Test Date: 2021-06-07
Analysis Performed by: EN	BH101	Analysis Date: 2021-08-18
Aquifer Thickness: 5.00 m		

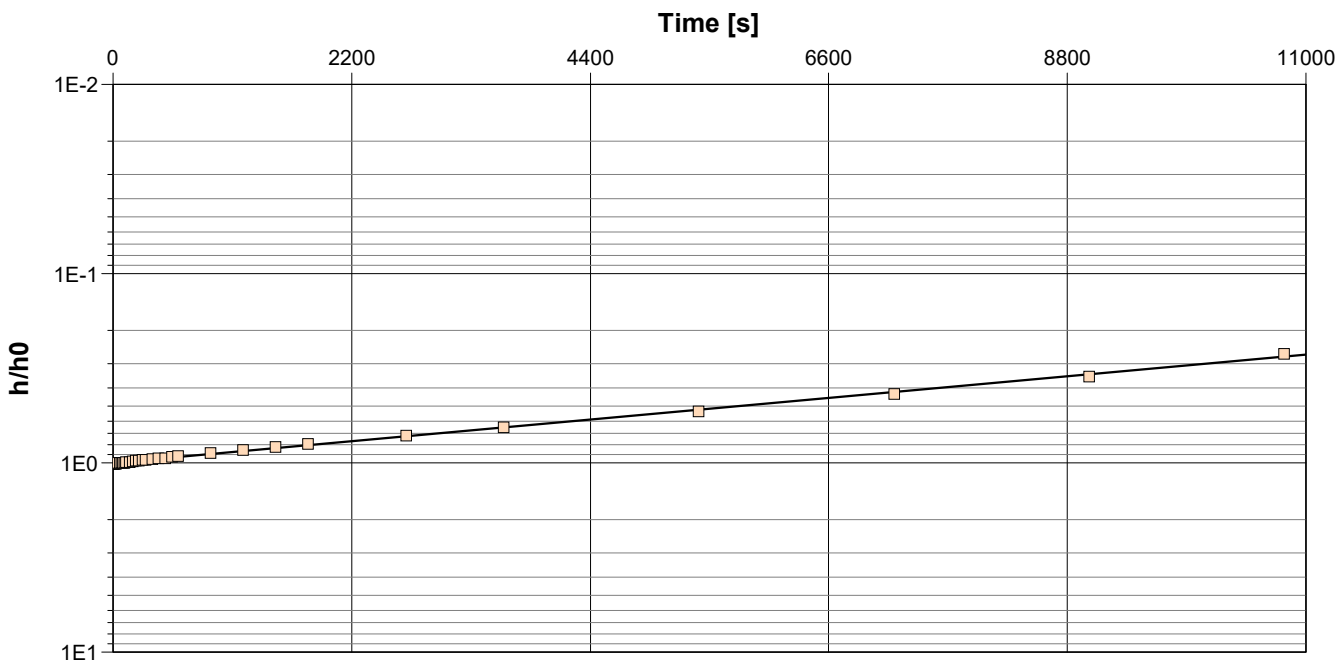


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH101	1.43×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 338 Mapleview Dr E
	Number: 20-295
	Client:

Location: Barrie, ON	Slug Test: BH102	Test Well: BH102
Test Conducted by: VT		Test Date: 2021-06-07
Analysis Performed by: EN	BH102	Analysis Date: 2021-08-18
Aquifer Thickness: 9.60 m		

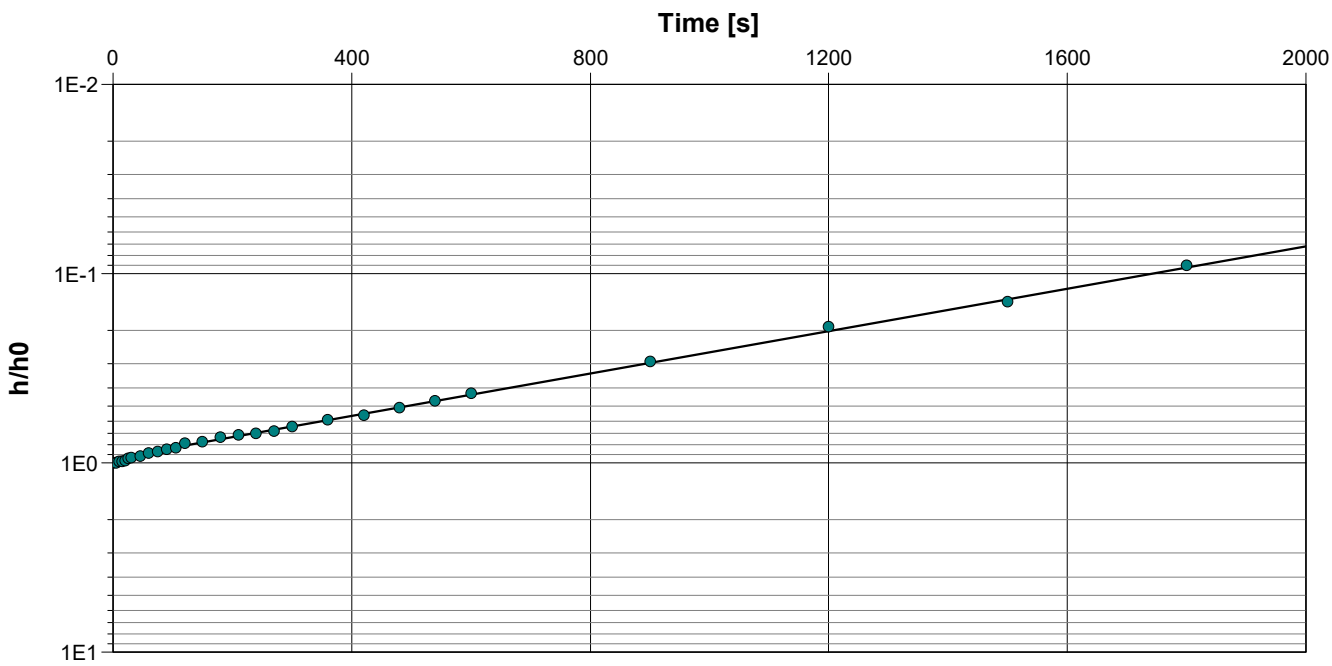


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH102	1.42×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 338 Mapleview Dr E
	Number: 20-295
	Client:

Location: Barrie, ON	Slug Test: BH103	Test Well: BH103
Test Conducted by: VT		Test Date: 2021-06-07
Analysis Performed by: EN	BH103	Analysis Date: 2021-08-18
Aquifer Thickness: 9.10 m		

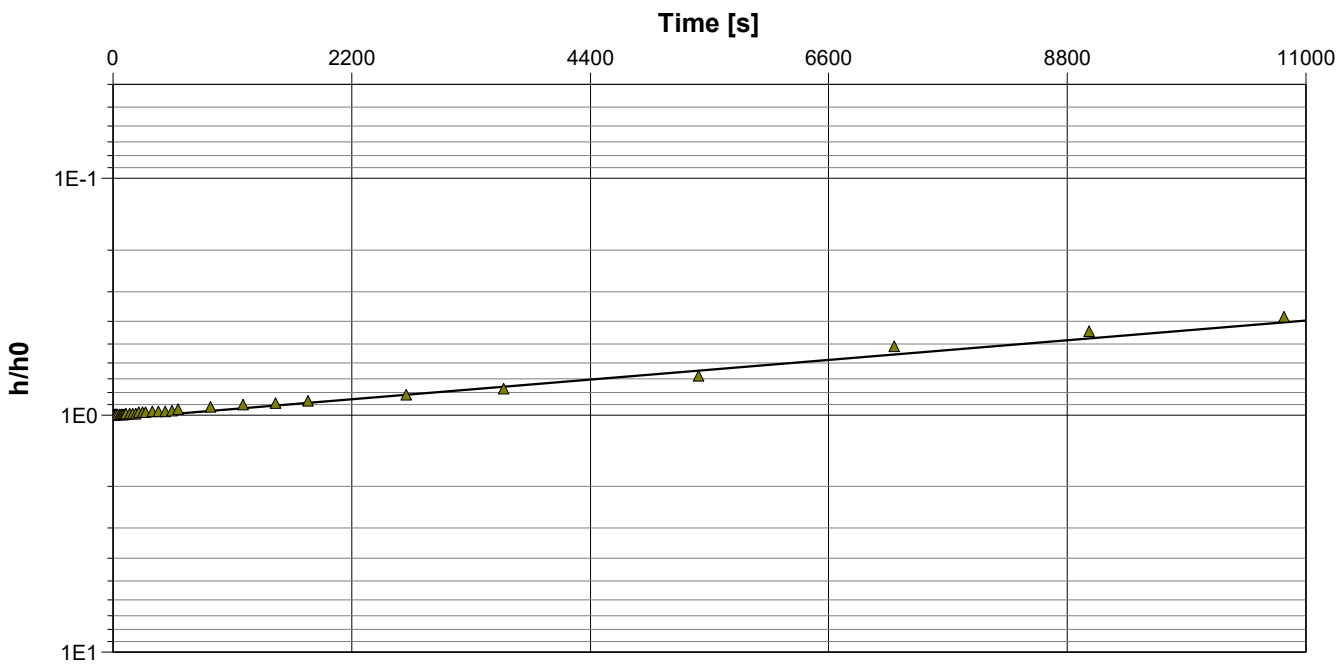


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH103	4.71×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 338 Mapleview Dr E
	Number: 20-295
	Client:

Location: Barrie, ON	Slug Test: BH104	Test Well: BH104
Test Conducted by: VT		Test Date: 2021-06-07
Analysis Performed by: EN	BH104	Analysis Date: 2021-08-18
Aquifer Thickness: 5.20 m		

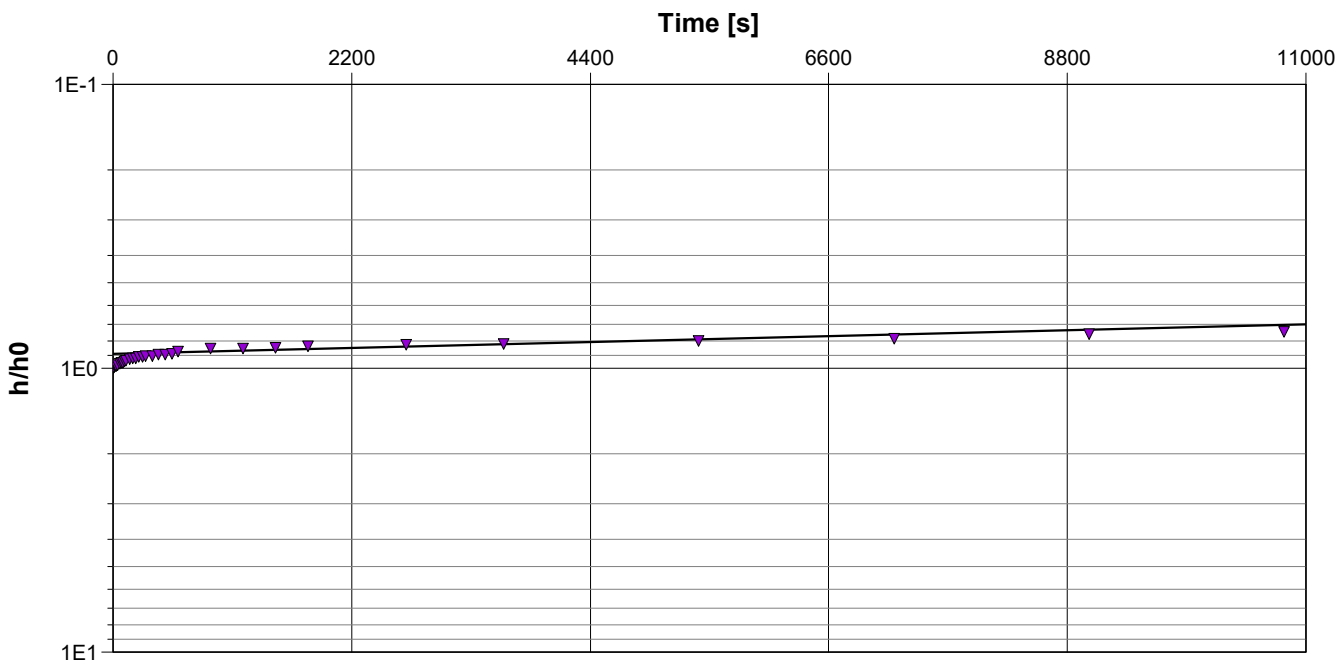


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104	3.23×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 338 Mapleview Dr E
	Number: 20-295
	Client:

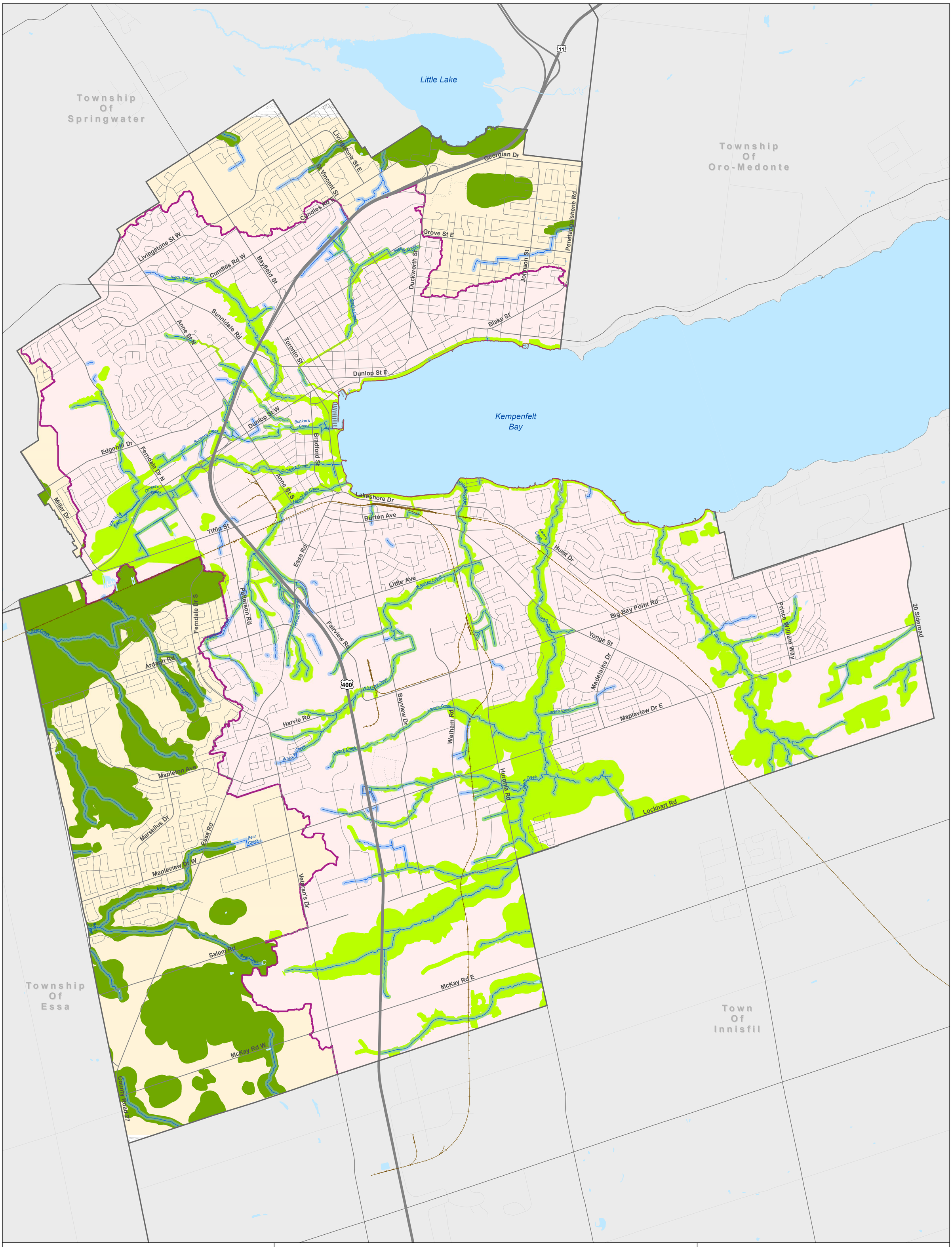
Location: Barrie, ON	Slug Test: BH105	Test Well: BH105
Test Conducted by: VT		Test Date: 2021-06-07
Analysis Performed by: EN	BH105	Analysis Date: 2021-08-18
Aquifer Thickness: 6.80 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH105	8.48×10^{-9}	

APPENDIX J



OFFICIAL PLAN
Schedule F
Conservation Authority Regulation Limits
Office Consolidation
January 2018

- Watercourse
- 30 Metre Watercourse Setback
- Waterbody
- Lake Simcoe Region Conservation Authority Regulation Limits
- Nottawasaga Valley Conservation Authority Regulation Limits
- Lake Simcoe Regional Conservation Authority
- Nottawasaga Valley Conservation Authority

Barrie

1:20,000

0 0.5 1 2 km

N

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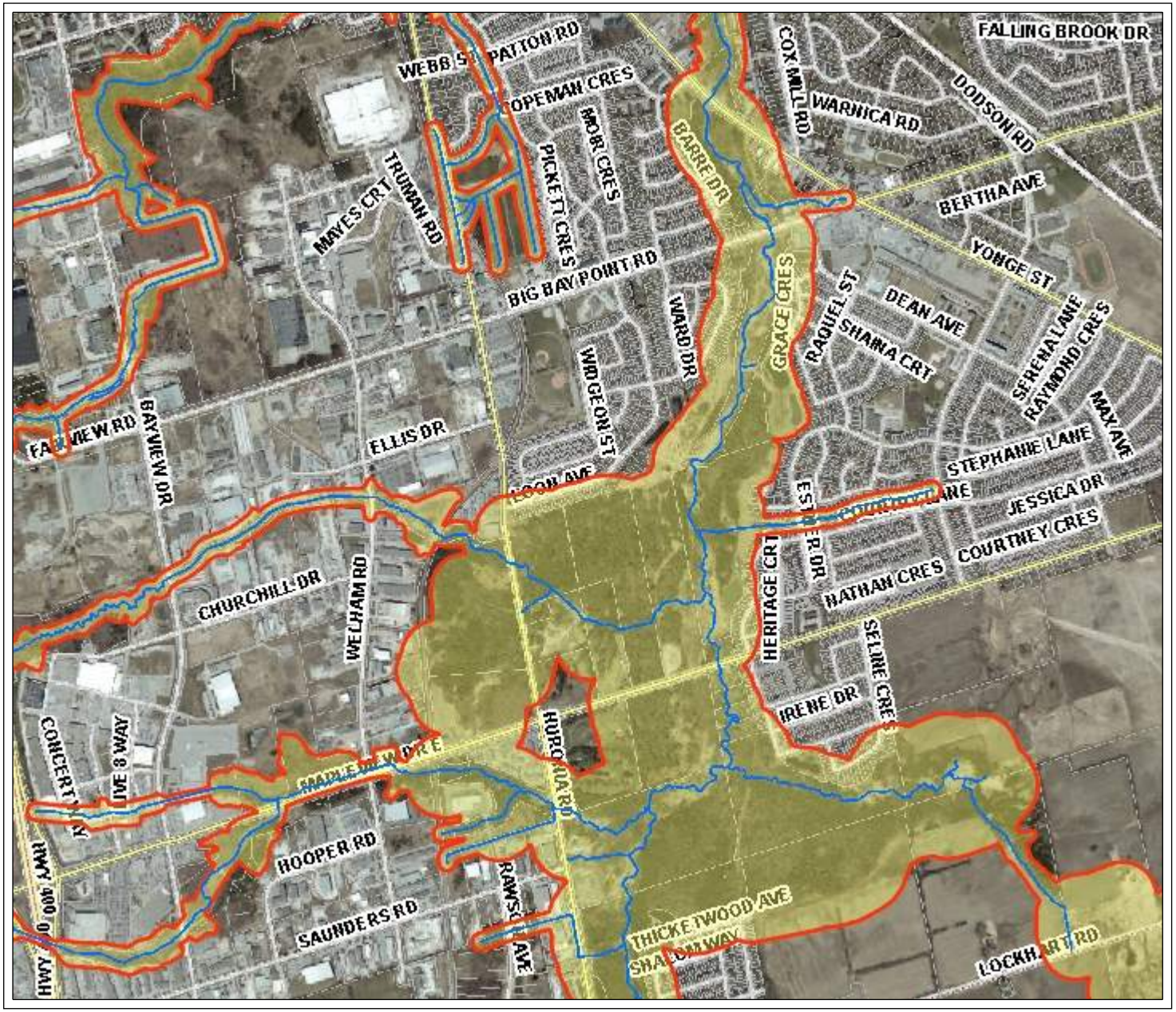
For information please contact Service Barrie at 705-726-4242 or ServiceBarrie@barrie.ca

GIS Branch 4/26/2018

Lake Simcoe Region conservation authority

338 Mapleview Dr- LSRCA Regulated Area



Features

- LSRCA Watershed Boundary
- Lake Simcoe
- Watercourse
- Regulated Area Boundary
- Regulated Area
- Road Labels
- Roads
  - Hwy 400 Series
  - Highway, Arterials
  - Local Road
- Railway

Printed On:
12/7/2021

WGS_1984_Web_Mercator_Auxiliary_Sphere

Mapped By:

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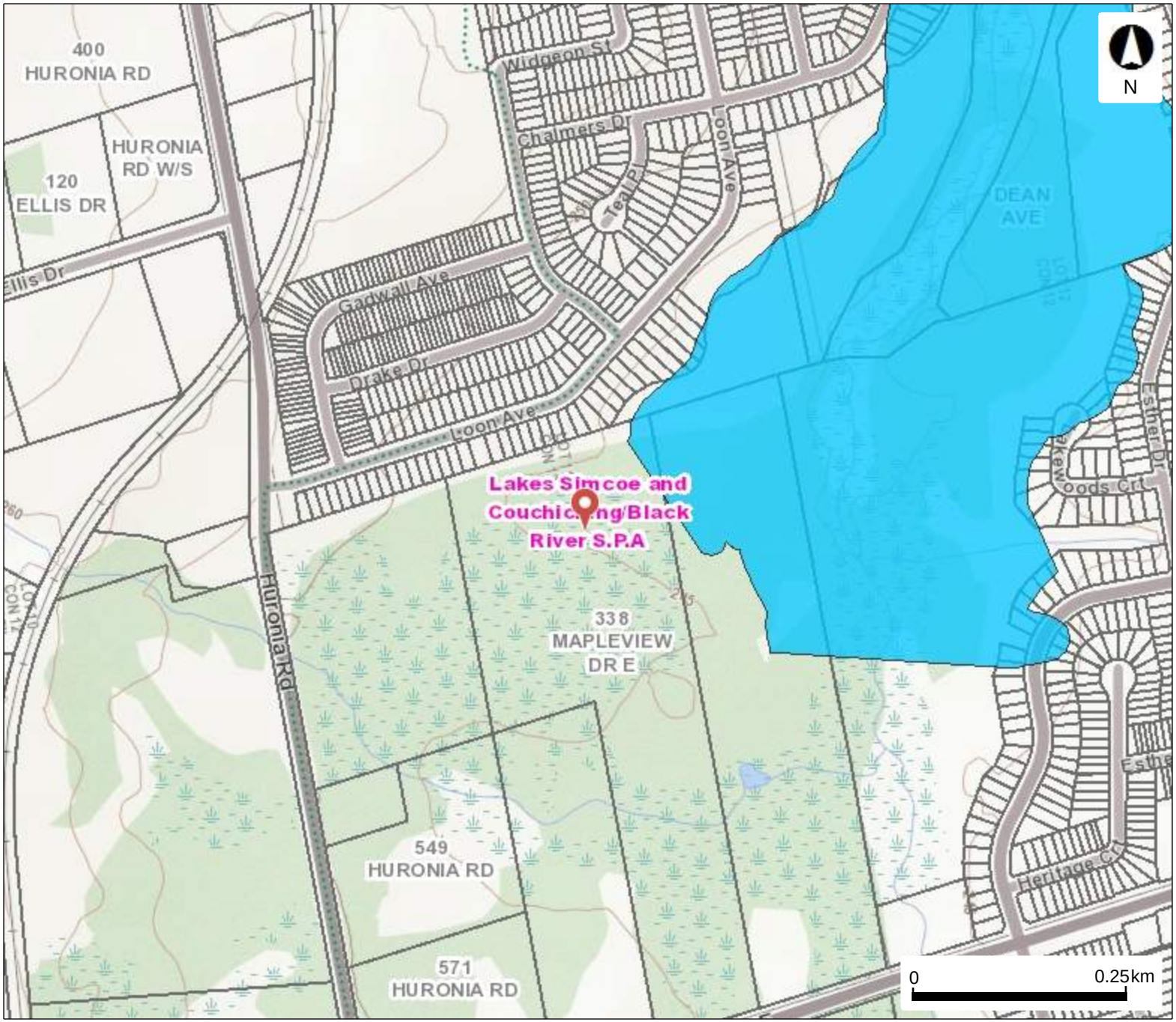
Scale 1: 21,385

Meters

1,086 0 543 1,086

Source Water Protection



Legend

- Source Protection Areas
- Issue Contributing Areas
- WHPA Groundwater Under Direct Influence (WHPA-E)
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Assessment Parcel with Addre

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Ontario

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Map Created: 12/6/2021
Map Center: 44.34708 N, -79.6592 W

Ontario

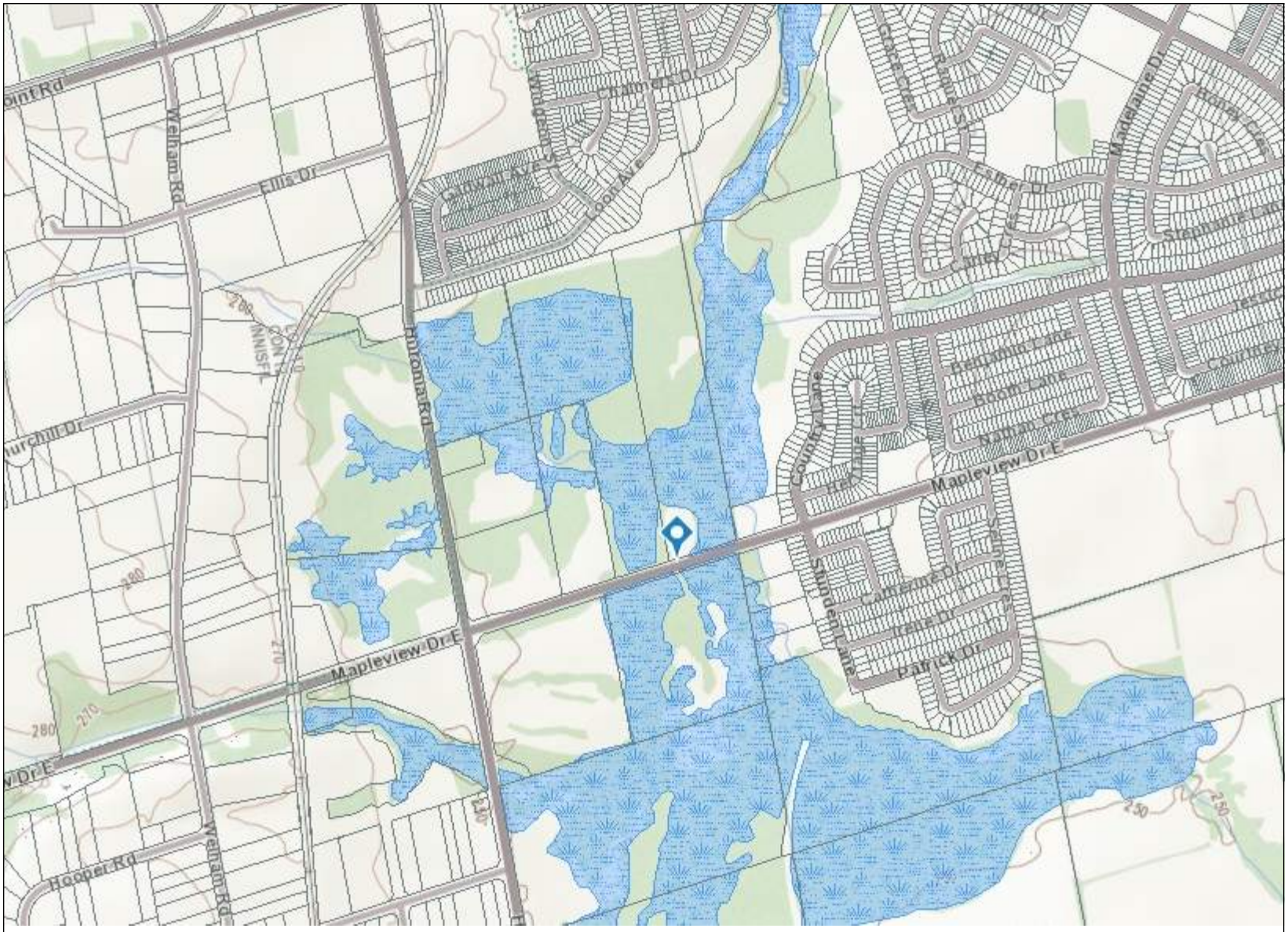
Ministry of Natural Resources and Forestry

Make-a-Map: Natural Heritage Areas

Natural Heritage Areas

Map created: 3/25/2021

Notes: Enter map notes



Legend

- Assessment Parcel
- Woodland
- Conservation Reserve
- Provincial Park
- Natural Heritage System
- Ecoregion

Wetland

- Provincially Significant Wetland Evaluated
- Non - Provincially Significant Wetland Evaluated
- Unevaluated Wetland

Area of Natural Heritage & Scientific Interest (ANSI)

- Provincially Significant Life Science ANSI
- Provincially Significant Earth Science ANSI

Greenbelt Plan

- Boundary
- Greenbelt External Connections

Land Use Designations

- Protected Countryside
- Greenbelt Towns and Villages
- Greenbelt Hamlets
- Urban River Valley
- Greenbelt: Specialty Crop Area

Niagara Escarpment Plan (NEP)

- Boundary
- Parks and Open Space System

Land Use Designations

- Escarpment Natural Area
- Escarpment Protection Area
- Escarpment Rural Area
- Mineral Resource Extraction Area
- Escarpment Recreation Area
- Urban Area
- Minor Urban Centre

Oak Ridges Moraine Conservation Plan (ORM)

- Boundary

Land Use Designations

- Natural Core Area
- Natural Linkage Area
- Countryside Area
- Rural Settlement
- Palgrave Estates Residential Community
- Settlement Area

0.7 0 0.33 0.7 Kilometers

This map may not display all features listed in the legend because the feature layer was not turned on at the time the map was made; the features do not exist in the geographic range; or features have not been mapped. Absence of a feature in the map does not mean they do not exist in this area.

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APPENDIX K

None Available

APPENDIX L

Water Balance

1. Climate Information *(for LSRCA use the rate provided on their website)*

Precipitation	914	mm/a	0.91	m/a
Evapotranspiration	545	mm/a	0.55	m/a
Water Surplus	369	mm/a	0.37	m/a

2. Infiltration Rates

Table 2 Approach - Infiltration Factors

Hilly land, average slope of 28 to 47 m per km	0.1
Open Sandy Loam	0.4
Woodland	0.2
TOTAL:	0.7

Infiltration (Infil. Fac - Water Surplus)	258.3	mm/a	0.2583	m/a
Run-off (Water Surplus - B19)	111	mm/a	0.1107	m/a

Table 3 Approach - Typical Recharge Rates

silty sand to sandy silt	150 - 200	mm/a
silt	125 - 150	mm/a
clayey silt	100 - 125	mm/a

The site development area is underlain by silty sand to silty clay till.

Based on the above, the recharge rate is	125	mm/a	0.125	m/a
with runoff of	244	mm/a	0.244	m/a

Property Statistics

3. Pre- Development Site Coverage

Area Covered by Existing Building	0	m^2	0.00	ha
Area Covered by Existing Hard Surface Paving	0	m^2	0.00	ha
Area Covered by Existing Landscaped area	33,352	m^2	3.34	ha
TOTAL	33,352	m^2	3.34	ha

4. Post-Development Coverage

Area Covered by Building with Additions	9,935	m^2	0.99	ha
Area Covered by Hard Surface Paving	13,049	m^2	1.30	ha
Area Covered by Landscaped Area	10,368	m^2	1.04	ha
TOTAL:	33,352	m^2	3.34	ha

Water Balance

5. Annual Water Balance Before Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	0	0	-	-	-	-
Hard Surface Paving	0	0	-	-	-	-
Landscape Area (entire site)	33,352	30,484	18,177		4,169	8,138
TOTAL	**25,623**	**30,484**	**18,177**	**0**	**4,169**	**8,138**

6. Annual Water Balance After Building Additions

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building (entire site)	9,935	9,081	-	-	-	9,081
Hard Surface Paving	13,049	11,927	-	-	-	11,927
Landscape Area (entire site)	10,368	9,476	5,651	-	1,296	2,530
TOTAL	**33,352**	**30,484**	**5,651**	**0**	**1,296**	**23,537**

7. Comparison of Pre-Development (before buidling additions) and Post-Development (after building additions)

	Precipitation (m^3)	Evapotranspiration (m^3)	Evaporation (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	30,484	18,177	-	4,169	8,138
Post-Development	30,484	5,651	-	1,296	23,537
				2,873	

8. Requirement for Infiltration of Roof Runoff

Volume of roof (building additions) run-off captured (90%)	9,081	m^3
Volume of post-development infiltration without roof run-off	1,296	m^3
Volume of roof run-off required to match pre-development infiltration rates	2,873	m^3
Percentage of roof run-off (building additions roof) required to match pre-development infiltration	32%	

APPENDIX M

TABLE 1
GROUNDWATER LEVEL MONITORING SUMMARY
338 Mapleview Dr E
Barrie, ON
20-295

Well ID	Ground Surface Elevation (masl)	Screen Interval	Screen Interval	Soil Strata	Grounded Engineering																												Minimum Elev. (Lowest)		Maximum Elev. (Highest)		Seasonal Fluctuation
					April 1, 2021		June 7, 2021		July 25, 2021		September 10, 2021		November 11, 2021		December 29, 2021		January 28, 2022		February 23, 2022		March 31, 2022		April 25, 2022		June 9, 2022		July 12, 2022		August 12, 2022		March 3, 2023						
		(mbgs)	(masl)		(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(±m)
BH101	245.3	6.1 - 9.1	239.2 - 236.2	Lower Silty Sand Glacial Till	1.4	243.9	2.0	243.3	1.5	243.8	1.9	243.4	1.5	243.8	1.2	244.1	1.4	244.0	1.6	243.7	1.3	244.0	1.3	244.0	1.5	243.8	1.9	243.4	2.2	243.1	1.99	243.3	2.0	243.3	1.2	244.1	0.4
BH102	243.1	6.1 - 9.1	237.0 - 234.0	Upper Silty Sand Glacial Till	0.2	242.9	0.5	242.6	0.1	243.0	0.5	242.6	0.2	242.9	-	-	-	-	-	-	-	-	-	-	0.1	243.0	0.5	242.6	1.7	241.4	0.57	242.5	0.5	242.6	0.1	243.0	0.2
BH103	243.9	5.5 - 8.5	238.4 - 235.3	Clayey Silt	-	-	1.4	242.5	1.1	242.9	1.4	242.6	1.1	242.9	0.8	243.1	1.1	242.8	1.1	242.8	0.8	243.1	0.8	243.1	1.0	242.9	1.4	242.5	0.8	243.1	1.53	242.4	1.4	242.5	0.8	243.1	0.3
BH104	242.9	6.1 - 9.1	236.8 - 233.7	Lower Silty Sand Glacial Till	-	-	1.1	241.9	0.4	242.5	0.6	242.3	0.3	242.6	0.1	242.8	0.4	242.6	0.3	242.6	0.1	242.8	0.1	242.8	0.3	242.6	0.7	242.2	1.9	241.0	0.58	242.3	1.1	241.9	0.1	242.8	0.5
BH105	243.4	6.1 - 9.1	237.3 - 234.3	Lower Silty Sand Glacial Till	-	-	1.7	241.7	0.7	242.7	0.9	242.5	0.6	242.8	0.3	243.1	0.6	242.8	0.6	242.8	0.4	243.0	0.4	243.0	0.6	242.8	0.7	242.7	1.1	242.3	0.95	242.5	1.7	241.7	0.3	243.1	0.7
BH204	243.8				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.38	242.4	0.0	0.0	1.4	242.4	-0.7
BH205	249.6				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.79	246.8	0.0	0.0	2.8	246.8	-1.4
BH206	245.4				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.11	243.3	0.0	0.0	2.1	243.3	-1.1

mbgs = metres below existing ground surface
masl = metres above sea level
* = unstabilized groundwater level