



**HYDROGEOLOGICAL ASSESSMENT
PROPOSED MIXED-USE DEVELOPMENT
642 DUNLOP STREET WEST,
BARRIE, ONTARIO**

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1.0 INTRODUCTION

Terraprobe Inc. was retained by 25707517 Ontario Inc c/o Innovative Planning Solutions to conduct a hydrogeological assessment for the property with municipal address 642 Dunlop Street West, Barrie, Ontario, hereinafter referred to as the Property or Site. The Property is located northeast quadrant of the intersection of Dunlop Street West and Miller Road in the City of Barrie. The general location of the Site is shown on **Figure 1**.

The Site is currently developed with two low-rise commercial structures. It is proposed to demolish the existing structures and construct a new 5-storey mixed-use building with slab-on-grade construction (no basement), commercial use and covered parking/driveway at ground level and residential use above. There will also be at-grade exterior parking and a driveway. The proposed development will be municipally serviced for water and sewer.

The purpose of this report is to assess local and regional hydrogeological conditions and the potential impacts of the proposed development on the groundwater system.

2.0 SCOPE OF WORK

The scope of work for the study consisted of the following:

- **Review of available background information:** Available background information for the Site and the project was reviewed. This included the results of geotechnical and environmental investigations of the property and available information regarding the proposed design and construction concepts for the development. In addition, information from public sources, including geologic mapping and MECP well record.
- **Detailed Site Inspection:** An inspection of the property was conducted to review existing Site conditions, including identification of any hydrogeological features such as significant areas of potential groundwater recharge or areas of groundwater discharge. The topographic survey of the Site provided to Terraprobe was reviewed in order to provide a discussion regarding drainage conditions.
- **Private Well Survey:** Due to the current COVID-19 work restrictions that have been imposed by the provincial government and to ensure health and safety, the private well survey has been put on hold.
- **Borehole Drilling:** Prior to the commencement of drilling, the locations of underground utilities, including telephone, natural gas and electrical lines, were marked out by local locating companies, and individual borehole locations were cleared by private utility locating service providers. The field investigation was conducted on January 18 to 20, 2022 and consisted of drilling and sampling a total of nine (9) boreholes ((eight (8) boreholes were advanced with regular sampling and one (1) borehole was augered without sampling for installation of a groundwater monitoring well)). The boreholes extended to depths varying from about 1.8 to 12.6 m below the existing ground surface.
- **Well Installation:** To measure the groundwater level and investigate the quality of groundwater, six (6) boreholes (BH1 to BH5 and BH9) were instrumented with a monitoring well. The

monitoring well consisted of a 50 mm diameter PVC screen with a length of PVC riser pipe and a 10-ft slotted screen. Upon installation, an elevation survey of the monitoring wells, relative to a local datum, was completed so that relative groundwater flow direction can be assessed. The information obtained from the boreholes was used for the hydrogeological assessment.

- **Completion of hydraulic conductivity testing:** Single well response tests (slug tests) were conducted in the selected four (4) monitoring wells (BH2 to BH5) to assess the hydraulic conductivity of the screened strata.
- **Water Balance Analysis:** Pre- and post-development water balance calculations will be conducted to assess infiltration rates and determine the requirements to maintain recharge at the Property.
- **Analysis of potential impacts of groundwater control:** Analysis was conducted to assess the potential impacts of groundwater control on local structures, water wells, and surface water features. This also includes providing recommendations on any requirements for applying for a Permit to Take Water (PTTW) or Environmental Activity and Sector Registry (EASR) posting with the Ministry of the Environment, Conservation and Parks (MECP).
- **Hydrogeology Report:** Following the completion of the above-noted study, a detailed engineering report was prepared regarding the Site hydrogeology. The report provides the following information:
 - Presentation of all the factual information gathered during the study, including the background information and results of site subsurface investigation;
 - Provision of a conceptual site model for local and regional hydrogeologic conditions. The conceptual site model will be used as a basis to assess impacts to local surface and groundwater features;
 - Calculations of water balance for existing (pre-development) and post-development conditions and assessment of infiltration rates to establish the requirements for maintaining groundwater recharge at the property;
 - Develop a Source Water Impact Assessment and Mitigation Plan regarding potential threats to the local water supply aquifer and municipal water supply wells;
 - Impact assessment and mitigation measures to maintain the hydrogeological functions;

3.0 APPLICABLE REGULATIONS AND POLICIES

3.1 Lake Simcoe Region Conservation Authority (LSRCA) Policies and Regulations (O. Reg. 179/06)

Under Section 28 of the Conservation Authorities Act, local conservation authorities are mandated to protect the health and integrity of the regional greenspace system and to maintain or improve the hydrological and ecological functions performed by valley and stream corridors. The LSRCA, through its regulatory mandate, is responsible for issuing permits under Ontario Regulation (**Ont. Reg. 179/06**), *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* for development proposal or Site alteration work to shorelines and watercourses within the regulated areas.

LSRCA Regulated Area online mapping and pre-consultation comments were reviewed. It is our understanding that the property is partially located within an LSRCA Regulated Area due to the presence of wetland features in the north and the associated minimum vegetation protection zone. As such, it is anticipated that a permit from the LSRCA under Ont. Reg. 179/06 will be required for the proposed development

Refer to **Appendix A** for associated regulatory mapping details.

3.2 Clean Water Act 2006

The MECP mandates the protection of existing and future sources of drinking water under the Clean Water Act, 2006 (CWA). Initiatives under the CWA include the delineation of Wellhead Protection Areas (WHPAs), Significant Groundwater Recharge Areas (SGRAs) and Highly Vulnerable Aquifers (HVAs), as well as the assessment of drinking water quality and quantity threats within Source Protection Regions. Source Protection Plans are developed under the CWA and include the restriction and prohibition of certain types of activities and land uses within WHPAs. This plan dictates that any site within the Lake Simcoe Watershed of South Georgian Bay (SGBLS) region can be rated in terms of score indicating vulnerability to drinking water quality and quantity threats. Based on the review of MECP's Source Protection Information Atlas, County of Simcoe interactive mapping and Lake Simcoe Region Conservation Authority (LSRCA) regulated area mapping, the following information was obtained related to the subject property:

Associated Policy Area	Applicability
Conservation Authority	Lake Simcoe Region and Conservation Authority
Source Protection Area	Lake Simcoe and Couchiching/Black River Source Protection Area
Watershed	Lake Simcoe Watershed
Subwatershed	Barrie Creeks
LSRCA Regulated Area	Yes
Wellhead Protection Area (WHPA)	WHPA-B (2-Year Capture Zone), Intrinsic Vulnerability Score: 6 (Barre Well No: 3A, 4, 5, 7, 17, 18, 19)
Significant Groundwater Recharge Area (SGRA).	No
Highly Vulnerable Aquifer (HVA)	Yes; Intrinsic Vulnerability Score: 6

Wellhead Protection Areas (WHPA - Q) or Recharge Management Area	Wellhead Protection Area Q1: Yes Stress: Low Wellhead Protection Area Q2: Yes Stress: Low
Intake Protection Zone	Intake Protection Zone: 3
Intake Protection Zone Q	No
Issue Contributing Area:	Yes, Contaminant: Chloride
Oak Ridges Moraine (ORM)	The area of proposed development is not located within the Oak Ridges Moraine (ORM)
Niagara Escarpment Plan Area	The area of proposed development is not located within the Niagara Escarpment Plan Area
Greenbelt Protection Act Area	The area of proposed development is not located within the Greenbelt Protection Act Area

Refer to **Appendix A** for associated regulatory mapping details.

3.3 Hydrogeological Assessment Submission Guidelines 2013

The Conservation Authority Guidelines for Development Applications (June 2013) was reviewed as a part of this assessment. This guidance document provides a list of recommended requirements for hydrogeological investigations. Lake Simcoe Region and Conservation Authority (LSRCA) has adopted these guidelines for hydrogeological assessments. The hydrogeology report is completed as per the guidelines provided in the document.

4.0 DESCRIPTION OF SITE CONDITIONS

4.1 Site Location and Description

The Property is located northeast quadrant of the intersection of Dunlop Street West and Miller Road. The general location of the Site is shown on **Figure 1**. The Site is currently developed with two low-rise commercial structures. It is proposed to demolish the existing structures and construct a new 5-storey mixed-use building with slab-on-grade construction (no basement), commercial use and covered parking/driveway at ground level and residential use above. There will also be at-grade exterior parking and a driveway. The proposed development will be municipally serviced for water and sewer.

4.2 Site Topography and Drainage

Based on the boreholes advanced, the Site elevation varies from approximately $234.3 \pm$ masl to $235.7 \pm$ masl (meters above sea level) with an approximate existing grade elevation of $235.0 \pm$ masl. The majority of the Site drains to north/ northwest towards the wetland feature and Miller Drive. **Figure 5** further indicates the topography of the Site.

The nearest surface water feature is the tributary of Dyments Creek, located approximately 50 m south of the proposed development. Dyments Creeks flow northeast, following local topography towards Kempenfelt's Bay/Lake Simcoe. The regional groundwater flow direction is expected to flow east/northeast towards Kempenfelt's Bay/Lake Simcoe, located approximately 3.6 km east.

4.3 Regional Geology and Physiography

The surficial geology of the area is representative of coarse-textured glaciolacustrine deposits in the eastern portion of the Property, consisting of sand, gravel, minor silt and clay of Foreshore and basinal deposits (9c). The northeastern part is recent organic deposits consisting of peat, muck and marl (20). **Figure 3** illustrates the mapped surficial geology for the Site and the surrounding area.

From a regional perspective, the Site is situated within the physiographic feature known as the Sand Plains (11) and within the physiographic landform known as the Simcoe Lowlands (35). The Sand Plains is a narrow stretch of land along the shoreline of Kempenfelt Bay. It also continues from the shoreline through the centre of the Barrie Creeks subwatershed from the lakeshore to the low-lying area to the west of the subwatershed. The physiographic region is typically characterized by having lower elevations, with flat-floored valley features that generally correspond to current river systems (LSRCA, 2012). The lowlands were flooded by glacial Lake Algonquin and, as a result, are floored by sand, silt and clay (Chapman and Putnam, 1984). **Figure 4** shows the location of the Site within the regional physiography map.

4.4 Regional Hydrogeology

The stratigraphy of the surficial deposits within the Barrie Creeks subwatershed is complex as a result of the glacial history. Based on the review of the Barrie Creeks Subwatershed Plan (LSRCA 2012); the subsurface hydrostratigraphy within the Barrie Creeks sub-watershed comprises of the following units.

Geological Unit	Brief Description
Recent Glaciolacustrine Deposits	Recent glaciolacustrine deposits are present at the ground surface, which comprise of sandy silt to silt matrix, moderate to high matrix carbonate content, clast content moderate to high Pleistocene deposits. These surficial deposits generally have low to moderate permeabilities and function as an aquitard.
Halton/Kettleby Till	Underlying the recent glaciolacustrine deposits is the Halton/ Kettleby Till which comprises of sandy silt to clayey silt till. The Halton/ Kettleby Till has low permeabilities and functions as an aquitard.
Oak Ridges Aquifer Complex (ORAC) - Regional Aquifer	Underlying the Halton/Kettleby Till is the ORAC, the shallowest aquifer in the region. It predominantly comprises of granular sediments with interlaid finer materials. The ORAC is generally comprised of soils with medium to high permeabilities.
Upper Newmarket Till	Underlying the ORAC is the Newmarket Till, which acts as an aquitard. The Newmarket till comprises of dense sandy silt to clayey silt and generally has a low permeability.
Sunnybrook Drift	The Sunnybrook Drift underlies the TAC and acts as a regional aquitard in the sub-watershed. The Sunnybrook Drift comprises of silt and clays with low permeabilities and functions as an aquitard.
Scarborough Aquifer Complex (SAC) - Regional Aquifer	The SAC is the third regional aquifer in the area underlying the Sunnybrook Drift. The SAC comprises sands, silt and clays with varying permeabilities.

Bedrock was not contacted over the current subsurface investigation. Bedrock in the area is middle Ordovician Verulam (54a) formation consisting of limestone, dolostone, shale, arkose, sandstone of the Simcoe Group. The Verulam Formation occurs along the shoreline of Kempenfelt Bay and expands west of the City of Barrie. The Verulam Formation ranges from 32 to 65 m thick and is rich in fossiliferous limestone with inter-beds of calcareous shale, which indicates that the depositional environment was a was open marine shelf environment. Based on the review of the Oak Ridges Moraine Groundwater Program (OGRMP) cross-section tool, bedrock lies at an elevation of approximately 120 masl, and depth to bedrock at the Site is approximately 115 m below ground surface.

4.5 Watershed Setting

The Barrie Creeks subwatershed is one of six (6) subwatersheds that drain into Lake Simcoe. The subwatershed's streams empty into Kempenfelt Bay. The Barrie Creeks subwatershed is located almost entirely within the Town of Barrie, with a small portion falling into the Oro-Medonte in the northeast and Springwater to the northwest, accounting for the remaining area at 5% and 2%, respectively. The Barrie Creeks subwatershed is a densely populated subwatersheds and has a total area of approximately 37.5 km² and accounts for 1.4% of Lake Simcoe's total watershed area, with a total watercourse length of 53.8 km (including all branches), or about 1.3% of the total combined watercourse length of the entire Lake Simcoe watershed (LSRCA 2012).

4.6 Local Surface Water and Natural Heritage Features

Mapping from the Ontario Ministry of Natural Resources and Forestry (MNR) was to determine if water bodies, wetland and woodland features were present on the Property and within the Study Area. The Ontario Ministry of Natural Resources National Heritage Information Centre database for listings of Areas of Natural or Scientific Interest (ANSIs) was reviewed. The natural heritage map is presented in **Figure 6**. The information is summarized below.

Water Bodies	Property	No water bodies are present on the Property
	Study Area	The nearest surface water feature is a tributary of Dyments Creek (a tributary of Barrie Creeks), located approximately 50 m south of the proposed development.
Wetlands	Property	<u>Provincially Significant Evaluated Wetland</u> - No Provincially Significant wetlands are present on the Property <u>Non- Provincially Significant Evaluated Wetland</u> - No Non-Provincially Significant wetlands are present on the Property. <u>Unevaluated Wetland</u> - Unevaluated wetland feature is present in the north portion of the Property
	Study Area	<u>Provincially Significant Evaluated Wetland</u> - The closest Provincially Significant Evaluated Wetland is present approximately 180 m southwest from the Property. <u>Non- Provincially Significant Evaluated Wetland</u> - No Non- Provincially Significant wetlands are present in the Study area. <u>Unevaluated Wetland</u> - Unevaluated wetland feature is present approximately 60 m south of the Property.
Woodlands	Property	Woodland areas are identified on the Property in the northern portion of the Property
	Study Area	The closest woodland area was identified in close proximity of the Property along the north and south perimeter.
ANSIs	Property	<u>Provincially Significant Life Science ANSI</u> - No Life Science ANSIs were identified on the Property. <u>Provincially Significant Earth Science ANSI</u> - No Earth Science ANSIs were identified on the Property.
	Study Area	<u>Provincially Significant Life Science ANSI</u> - The closest Life Science ANSIs is located approximately 1.8 km south of the Property <u>Provincially Significant Earth Science ANSI</u> - No Provincially Significant Earth Science ANSIs were identified in the Study Area

4.7 Local Groundwater Resources

MECP Water Well Records (WWRs) were reviewed for the registered wells located at the Site and within a 500 m radius of the Site boundaries (study area). Information contained in these records provides data for determining the nature and use of local groundwater resources. A total of 28 well records were found. The locations of the well records in the Study Area are presented on **Figure 7**, with the details for each well summarized in **Appendix B**. A summary of data obtained from these MECP records is presented in the Table below:

Total Number of Wells	28
Depth Ranges	
50 ft. or less	7 (25%)
51 ft. to 100 ft.	6 (21%)
Greater than 100 ft.	7 (25%)
Unknown	8 (29%)
Water Use	
Domestic Water Supply	11 (39%)
Public/ Municipal Water Supply	1 (4%)
Commercial/ Industrial Water Supply	3 (11%)
Monitoring/Test Holes	9 (32%)
Not Used/ Abandoned	3 (11%)
Unknown	1 (4%)

Based on the review of the well records, it is indicated that fifteen (15) active water supply wells were found within a 500 m radius of the area of the Site constructed in the year 1959 - 2007, with depths ranging from 4.3 mbgs to 96.3 mbgs. The locations of the well records in the Study Area are presented on **Figure 7**. The water supply well record is summarized in the table below:

Map ID	MECP Well ID	Well Depth (m)	Well Use	Construction Date	Approx. Distance from the Site (m)
1	5704843	20.4	Domestic	May 6, 1959	285
2	5704844	75.3	Domestic	October 21, 1964	410
3	5704866	29.0	Domestic	September 18, 1958	220
4	5704867	4.3	Domestic	June 2, 1967	410
5	5709133	34.1	Commercial	April 21, 1972	365
6	5711998	7.0	Domestic	July 5, 1974	260
9	5716164	22.6	Commercial	July 12, 1979	200
10	5716689	79.9	Industrial	June 8, 1979	415
11	5718060	25.3	Domestic	April 23, 1982	390
12	5718624	15.2	Commercial	August 3, 1983	15
13	5718988	19.8	Domestic	January 26, 1984	285
14	5719487	12.2	Domestic	November 7, 1984	205
15	5728600	73.2	Domestic	October 18, 1991	195
19	5739405	27.7	Domestic	November 12, 2004	170
22	7114203	95.7	Municipal	December 7, 2007	440

Based on the review of Risk Management comments dated: January 13, 2021, it is indicated that two (2) potential wells are located on the site (Map ID: 12 and 27). The Well ID 5718624 (Map ID: 12) is registered for commercial use and constructed in 1983. However, the Well ID 7260721 (Map ID: 27) is registered as a test hole for 636 Dunlop St West, Barrie.

Moreover, one (1) active Barrie municipal production well PW-19 (Well ID: 7114203, Map ID: 22) is located within 500 m of the Site under permit number P-300-6139583233 (Issue date: 2022-01-20) with a maximum allowed groundwater taking of 7,862,400 L/day screened in lower A3/A4 aquifer. The details of the Barrie well supply system is provided below.

4.8 Barrie Well Supply

Based on the review of *Lakes Simcoe and Couchiching-Black River SPA Part 1 2014 Updated Assessment Report, Chapter 8, City of Barrie*, it is indicated that the aquifers underlying the City of Barrie are part of a regionally extensive and complex aquifer system, within which four major sand and gravel aquifer units have been identified. Locally, these are referred to as the upper (Aquifer A1), intermediate (Aquifer A2) and lower (Aquifer A3 and A4) aquifers.

Aquifer A1 is largely unconfined under all of the central and most other parts of the City and is, therefore, susceptible to contamination from surface activities. The portions of the upper aquifer identified in the Oro-Medonte and upland areas immediately west of the City correspond to the regional Aquifer A1, which is mapped as ice contact stratified drift. Aquifer A2 is regionally extensive. The aquifer is complex within the central core area of Barrie, where it consists of inter-layered sand and silt/clay materials. The aquifer is overlain by 5 to 20 or more metres of confining materials in most areas, reported to consist of clayey and silty sediments. The lower aquifers, A3 and A4, are extensive sand and gravel aquifers, which form the source of the majority of Barrie's groundwater supply. These aquifers are in direct contact with one another under the central Barrie area, as well as further to the west. Based on the base elevation of the Kempenfelt Bay and the known elevation of the upper surface of Aquifer A3, it is interpreted that the aquifer is in contact with Kempenfelt Bay in areas to the east. Wells 3A, 5, and 12 are all constructed in the deeper Aquifer A4. Wells 7, 9, 11, 13, 14, 15, 17, and 18 are located approximately in the centre of the combined A3/A4 aquifer, whereas the remaining wells (Wells 4 and 16) are located in the upper part of the Aquifer 3.

4.9 Results of Door-to-Door Survey

The private well survey requires to contact residents within the study area to collect information and water samples from private wells to assess groundwater uses in the area. Due to the current COVID-19 restrictions that have been imposed by the provincial government and to ensure health and safety, the private well survey has been placed on hold.

5.0 RESULTS OF SUBSURFACE INVESTIGATION

The field investigation was conducted between January 18 and 20, 2022 and consisted of drilling and sampling a total of nine (9) boreholes ((eight (8) boreholes were advanced with regular sampling and one (1) borehole was augered without sampling for installation of a groundwater monitoring well)) extending to depths varying from about 1.8 to 12.6 m below existing ground surface.

To measure the groundwater level and investigate the quality of groundwater, six (6) boreholes (BH1 to BH5 and BH9) were instrumented with a monitoring well. The locations of boreholes and monitoring wells are shown on the attached **Figure 2**.

The boreholes were drilled by a specialist drilling contractor using truck/track-mounted drilling rigs equipped with power augers. The borings were advanced using continuous flights of solid stem augers and were sampled at 0.75 m intervals with conventional 50 mm diameter split barrel samplers. The drilling was conducted under the full-time supervision of a member of our field staff, who logged the borings and examined the samples as they were obtained. All samples obtained during the investigation were sealed into plastic jars and transported to our geotechnical testing laboratory for detailed inspection and testing.

5.1 Local Site Setting

Based on the review of the geotechnical report **File No. 3-21-0182-01**; the subsurface soil stratigraphy is indicated below. The following stratigraphy is based on the borehole findings, as well as the geotechnical laboratory testing conducted on selected representative soil samples. The stratigraphic boundaries indicated on the Borehole Logs are inferred from non-continuous samples and observations of drilling resistance and typically represent a transition from one soil type to another. These boundaries should not be interpreted to represent exact planes of geological change. The subsurface conditions have been confirmed in a series of widely spaced boreholes and will vary between and beyond the borehole locations.

5.1.1 Surficial Topsoil/ Earth Fill Material/Organic Deposits

A surficial pavement structure consisting of 50 mm to 230 mm of asphaltic concrete was encountered at the surface of Boreholes 1, 3, 5, 6 and 8. The asphaltic concrete was found underlain by 130 mm to 370 mm of granular fill at Boreholes 1, 3, 5 and 6. **Topsoil** was encountered at Boreholes 2, 4 and 7, and its thickness ranged from 140 to 150 mm. A zone of earth fill materials was encountered in boreholes 2, 4, 7 and 8 and extended to the depths of 0.6 m below grade. The earth fill materials consisted of sand to sandy silt to with organics, peat and some gravel. The fill material indicated a loose to compact relative density with the moist condition. A layer of **Peat**, with some sand seams, was encountered in Boreholes 1, 3, 5 and 6 beneath the pavement structure/ earth fill zone and extended to a depth ranging from 0.8 to 1.5 m (Elev. 232.9 m to 234.5 m) m below grade indicating a moist condition.

5.1.2 Native Soils

Undisturbed native soil deposits underlie the topsoil/earth fill/organic deposits, which extended to the full depth of investigation are as follows:

- **Sand**, with trace amounts of silt, clay and gravel, was encountered beneath the surficial pavement/topsoil layer in all boreholes and extended to the full depth of the investigation (about 12.6 m depth below grade), indicating a wet condition. The sand generally became water-bearing below about 1.5 ±m depth below grade.

The detailed stratigraphic conditions are presented on the accompanying borehole logs provided in **Appendix C**. A subsurface profile of Site is provided in **Figure 8**. Geotechnical characterization of the various soil types, including grain size analysis, was conducted and is presented in **Appendix D**. Additional information pertaining to soil stratigraphy is discussed in the geotechnical report by Terraprobe under a separate cover (**File No. 3-21-0182-01**).

5.2 Monitoring Well Installation

Monitoring wells were installed in six (6) boreholes (BH1 to BH5 and BH9) for groundwater monitoring and to investigate groundwater quality. The monitoring wells were constructed using 50-mm diameter PVC riser pipes and screens, which were installed in each of the selected geotechnical boreholes in accordance with Ontario Regulation (O. Reg.) 903. Filter sand was placed around the well screen to approximately 0.6 m above the top of the screen. The wells were then backfilled with bentonite to approximately 0.3 m below the ground surface. All monitoring wells were surveyed using an R10 Trimble GPS relative to a geodetic datum. The details are provided below:

Well ID	Well Diameter (mm)	Ground Surface Elevation (masl)	Top of Screen		Bottom of Screen		Screened Geological Units
			Depth (mbgs)	Elev. (masl)	Depth (mbgs)	Elev. (masl)	
BH 1	50	235.5	4.6	230.9	7.6	227.9	Sand
BH 2	50	234.5	8.5	226.0	11.6	222.9	Sand
BH 3	50	235.3	4.6	230.7	7.6	227.7	Sand
BH 4	50	235.4	9.1	226.3	12.2	223.2	Sand
BH 5	50	235.2	1.5	233.7	4.6	230.6	Sand
BH 9	50	234.4	1.5	232.9	4.6	229.8	Sand

Note: masl: meters above sea level, mbgs: meters below ground surface

Additional details of the monitoring well installation is presented on the enclosed borehole logs provided in **Appendix C**.

5.3 Groundwater Monitoring Program

It is noted that there is a requirement for long-term monitoring of groundwater levels to assess seasonal variations for the period of one year (12 months). The groundwater monitoring program is ongoing. Monthly manual groundwater level observations will be noted in the installed monitoring wells over the period of one year. The first reading was measured at the event of hydrogeological testing on February 01, 2022 as indicated below:

Monitoring Well	Ground Surface Elevation (masl)	February 01, 2022	
		Groundwater Depth (mbgs)	Groundwater Elevation (masl)
BH 1	235.5	*	*
BH 2	234.5	1.7	232.8
BH 3	235.3	1.8	233.5
BH 4	235.4	1.9	233.5
BH 5	235.2	1.5	233.7
BH 9	234.4	1.7	232.7

Note: masl: meters above sea level, mbgs: meters below ground surface

*non-accessible due to snow cover

Based on the available water level recordings till date from February 2022 to December 2022, it is noted that the groundwater level in the overburden varies from 232.2 ± masl to 234.4 ± masl. Local groundwater flow direction in the area expected to mimic the surface topography appears to be in the north towards the adjacent wetland area. However, the regional groundwater flow direction is expected to flow east/northeast towards Kempenfelt's Bay/Lake Simcoe, located approximately 3.6 km east. The groundwater flow direction is shown in **Figure 9**. However, this pattern does not take into account the water level observed at monitoring well BH1 and should be revised later based on the groundwater monitoring data.

It should be noted that the groundwater levels noted above may fluctuate seasonally depending on the amount of precipitation and surface runoff. Further, long-term groundwater monitoring will be required to capture the seasonal groundwater flow fluctuations. Upon completion of the ongoing long-term monitoring, an addendum report will be issued incorporating the hydrographs representing the seasonal groundwater fluctuations at the Site.

The monitoring wells installed at the Site need to be maintained in accordance with Ontario Water Resources Act, O. Reg. 903/90. When the wells are no longer required for monitoring or sampling purposes, these wells will need to be appropriately decommissioned by a licensed well contractor as outlined in the Regulation.

Please note: the results of the groundwater measurement at the property between February 2022 to December 2022 is attached.

5.4 Estimation of Hydraulic Conductivity

5.4.1 Estimation from Grain Size

The Allen Hazen equation estimation method was also used to estimate the hydraulic conductivity (K) for saturated subsoils at selected depths beneath the water table below the subject site. The Hazen Equation method was adopted to estimate the hydraulic conductivity (K) for different soil layers which may contain groundwater during the seasonal high-water table (spring) period or if they are not encountered within the screen intervals. The Allen Hazen Equation method relies on the interrelationship between hydraulic conductivity and effective grain size, d_{10} , in the soil media. This empirical relation predicts a power-law relation with K, as follow:

$$K = Cd_{10}^2$$

where;

- d_{10} : Value of the soil grain size gradation curve as determined by sieve analysis, whereby 10% by weight of the soil particles are finer, and 90% by weight of the soil particles are coarser.
- C: Coefficient; it is equal to 1 when K in cm/sec and d_{10} is in mm
- K: Estimated hydraulic conductivity in cm/s

The Allen Hazen Equation estimation provides an indication of the groundwater yield capacity for saturated soil strata at the depths where soils samples were selected for grain size analysis. The grain size distribution graphs prepared for the geotechnical investigation were used to estimate the hydraulic conductivity. The grain size analysis results are provided in **Appendix D**. The results of the Hazen equation are summarized below:

Borehole No./Sample ID	Sampling Depth (mbgs)	Sampling Elevation (masl)	D ₁₀ Grain Size (mm)	Soil Description (Native)	Estimated Hydraulic Conductivity (m/s)
Borehole 1 Sample 5	3.3	232.2	0.122	SAND, trace gravel, trace silt, trace clay	1.5×10^{-4}
Borehole 2 Sample 4	2.5	232	0.119	SAND Trace silt, trace clay	1.4×10^{-4}
Borehole 3 Sample 7	6.3	229	0.120	SAND Trace silt, trace clay	1.5×10^{-4}
Borehole 4 Sample 10	10.9	224.5	0.129	SAND, trace gravel, trace silt, trace clay	1.7×10^{-4}

Note: masl: meters above sea level, mbgs: meters below ground surface

Based on the Allen Hazen method, the hydraulic conductivity of the native sand deposit is estimated in the order of 10^{-4} m/s, indicating a higher permeability of the native soils.

5.4.2 Estimation from In-situ Hydraulic Testing

The hydraulic conductivity was also determined based on single well response tests (Slug Tests)

performed on the selected four (4) monitoring wells (BH2 to BH5). The monitoring wells were developed in advance. Well development involves the purging and removal of groundwater from the monitoring wells to remove remnants of clay, silt and other debris introduced into the monitoring well during construction and to induce the flow of formation groundwater through the well screens, thereby improving the transmissivity of the subsoil strata formation at the well screen depths.

The static water level was measured prior to the test. The Solinst Datalogger was programmed to record the water levels at one (1) second of the interval throughout each test. The data from the tests were analysed using Bouwer and Rice method (1967) included in the Aquifer Test V.7 software Package. The results of the analysis are presented in **Appendix E**. The hydraulic properties of the strata applicable to the Site are as follows:

Monitoring Well ID	Top of Well Screen Elevation (masl)	Bottom of Well Screen Elevation (masl)	Screened Geological Units	Hydraulic Conductivity (m/s)
BH 2	226.0	222.9	Sand	4.1×10^{-6}
BH 3	230.7	227.7	Sand	5.8×10^{-6}
BH 4	226.3	223.2	Sand	2.2×10^{-6}
BH 5	233.7	230.6	Sand	6.1×10^{-6}

Note: masl: meters above sea level, mbgs: meters below ground surface

Based on the in-situ hydraulic testing, the hydraulic conductivity of the native sand deposit is estimated in the order of 10^{-6} m/s, indicating a higher permeability of the native soils.

5.4.3 Estimation from Literature

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

Soil Unit	Estimated Hydraulic Conductivity Range (m/s)
Earth Fill	10^{-6}
Sand (Native)	$10^{-2} - 10^{-6}$

Based on the analyses, the hydraulic conductivity calculated from the single well response testing and grain size analyses are consistent with the published values associated with the geological material tested.

5.5 Assessment of Groundwater Quality

One (1) unfiltered groundwater sample was collected by Terraprobe and analyzed by a Canadian laboratory accredited and licensed by the Standards Council of Canada and or Canadian Association for Laboratory Accreditation. The sample was collected directly from monitoring well BH2 on February 01, 2022. The monitoring well BH2 was developed and purged prior to sample collection.

Upon sampling, all of the bottles were placed in ice and packed in a cooler for shipment to the analytical laboratory. Sample analysis was performed by AGAT Laboratories, a laboratory accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA). The filtration for aluminum dissolved and mercury was performed in the lab. The sample was compared with Water Quality Assessment - Provincial Water Quality Objectives (PWQO) Standards.

In summary, the results indicate the following:

- The groundwater sample meets the permissible limits for Provincial Water Quality Objectives (PWQO) for all the parameters analyzed except the following parameter.

Parameter	BH 2 Groundwater Quality Results (mg/L)	PWQO Guideline Limits (mg/L)	Reported Detection Limit (RDL)
Total Iron	1.48	0.3	0.010

The groundwater quality test results and the certificate of analysis are presented in **Appendix F**.

6.0 IMPACT ASSESSMENT

The impact assessment details that are applicable to the Property are discussed below:

6.1 Impact Assessment of Water Quantity Threats

The Site is located in the Recharge Management Area - Well Head Protection Area WHPA-Q1 and Q2. WHPA Q1- Refers to the area where activities that take water without returning it to the same source may be a threat, and WHPA Q2- refers to the area where activities that reduce recharge may be a threat. The Clean Water Act, 2006 identifies two activities that are prescribed to be drinking water quantity threats. The activities prescribed to be drinking water threats under the Clean Water Act, 2006 are those considered to be manmade. These activities, as listed in the Act, are provided below. Activities 19 and 20 are potential threats to water quantity as indicated below:

Threat #	Drinking Water Threat (Description)	Vulnerable Area	Applicable Circumstance	Risk
19	An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body (dewatering requirements)	WHPA-Q1	An existing taking, an increase to an existing taking or a new taking. The water is or would be taken from within a WHPA-Q1.	Low
20	An activity that reduces recharge to an aquifer (Paving of driveways and increased roof area in post-development)	WHPA-Q2	An existing activity, a modified activity or a new activity. The activity is or would be wholly or partly located within a WHPA-Q2	Low

6.1.1 Water Balance Methodology and Assessment

It is common practice and an accepted method to provide estimates of surplus using a Thornthwaite and Mather approach, where surplus is estimated based on precipitation minus evapotranspiration. With the recent completion of technical studies required under The Clean Water Act 2006, numerical models were utilized to estimate interception, evaporation, potential and actual evapotranspiration, snowmelt, runoff, infiltration, interflow, and groundwater recharge. Many of these model estimates are based on soils, surficial geology and land use mapping products but may also consider detailed vegetation attributes as well as hydrological cycle functions. These modelling output data are available, and consultants are encouraged to use them to complete site-specific water balance assessments.

A water balance for the Site was prepared to assess the distribution of rainfall, runoff, and infiltration for pre-development and post-development conditions based on the "Lake Simcoe Climate Data Reference Document to Support the Completion of Water Balance Assessment Version 1.0 (April 2017)". The water balance tables provided in this document are average values obtained from the numerical modelling undertaken by Earthfx (2010) required under the Clean Water Act, 2006. The resulting water balance parameters are categorized by various vegetation covers in different soil types for each

subwatershed within the Lake Simcoe Basin. Infiltration factors can then be applied based on specific site conditions – vegetation, soil and topography, per the above-mentioned MOE methodology. When applied to an appropriate catchment area, they can provide reasonable estimates of infiltration for comparison purposes

Based on the Barrie Creeks Subwatershed climate data, the mean annual **precipitation** is considered as 952 mm/yr., and the **mean annual actual evapotranspiration** is considered as 446 mm/yr. The volume of surplus water, i.e. $952 \text{ mm/yr.} - 446 \text{ mm/yr.} = 506 \text{ mm/yr.}$ that infiltrates into the soil was determined by applying an infiltration factor to the surplus volume based on topography, soil type and land cover as per Table 2 approach in the *Technical Information Requirements for Land Development Applications* (1995). Based on the Table 2 approach, the **infiltration factor** is estimated as 0.5, considering the topography as flat topography (0.2), soil type as clay and loam (0.2) and cover as cultivated (0.1). The infiltration factors for the post-development conditions were considered the same as the pre-development conditions. The rate of infiltration was based on the Table 2 approach in the *Technical Information Requirements for Land Development Applications* (1995) and is considered as 278 mm/yr.

Based on the above information, a conceptual model of groundwater flow and water balance was developed. A water balance was conducted for the post-development conditions for the entire Site and the feature-based water balance for the wetland north of the site, using the proposed land use statistics information and property development plan. The post-development water balance accounts for hard-surfaced areas created by buildings and pavements. The post-development conditions will result in a surplus of water available from run-off.

The following assumptions were applied for the pre-and post-development water balance:

- No infiltration will occur beneath the hard surface areas, including asphalt/concrete surfaced parking areas and walkways or driveways.
- It is assumed that there will be 10% of evaporation in hard-surface areas/impervious surfaces, and the remaining will contribute to run-off.
- Run-off from parking areas will be directed towards storm sewers and is not included in the infiltration calculations.
- Infiltration rates in open areas of the property (landscaped areas) will occur at rates similar to those for pre-development conditions.
- There will be no infiltration beneath hard-surface areas, including buildings, pavements, and walkways.

Based on the land use statistic information provided in Stormwater Management Report prepared by WMI & Associate Limited for the site File # 21-710 dated March 2023. To calculate the water balance for the property and the feature-based water balance of the wetland north of the property. The site is divided into two catchment/ drainage areas (**Drainage area A and Drainage Area B**). The proposed development statistics of each of the wetland is summarized below:

6.1.1.1 DrianageA (Catchment Area 0.6 ha):

The drainage area of approximately 0.6 ha, and proposed development of approximately 0.14 ha (building and hard surface area).

Drainage A (Catchment Area 0.6 ha)-Summary of Site Statistics (Pre-development)

Land Use	Area (ha)	Area (m ²)
Building Footprint/Envelope	0.02	200
Hardscape/Impervious	0.12	1, 200
Softscape/Pervious (Undeveloped Area)	0.46	4,600
Total	0.60	6,000

Pre- Development Water Balance (Entire Site)

	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Existing	6,000	5,712	1,932	133	1,835	1,811

Please note: the pre-development run-off from drainage A- catchment area support the adjacent north wetland, it is proposed to be marcthed in the post-development condition by conveying the captured building roof run-off to mitigate the post-development condition.

6.1.1.2 Drainage B (Catchment Area 0.21ha):

The drainage area of approximately 0.21 ha, and proposed development of approximately 0.16 ha (hard surface area).

Drainage B (Catchment Area 0.21 ha)-Summary of Site Statistics (Pre-development)

Land Use	Area (ha)	Area (m ²)
Building Footprint/Envelope	0	0
Hardscape/Impervious	0.016	1,600
Softscape/Pervious (Undeveloped Area)	0.05	500
Total	0.21	2,100

Pre- Development Water Balance (Entire Site)

	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Existing	2,100	1,999	210	152	200	1,437

Please note: the pre-development run-off from drainage B- catchment area drain to sewer systems located to the south of the site and this is proposed to be maintained in the post-development condition.

6.1.1.3 Entire Site Water Balance

The water balance for pre-development conditions for the entire Site is summarized in the Table below:

Entire Site- Summary of Site Statistics (Pre-development)

Land Use	Area (ha)	Area (m ²)
Building Footprint/Envelope	0.02	200
Hardscape/Impervious	0.28	2,800
Softscape/Pervious (Undeveloped Area)	0.51	5,100
Total	0.81	8,100

Entire Site- Pre- Development Water Balance (Entire Site)

	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Existing	8,100	7,711	2,142	286	2,035	3,249

Development of an area affects the natural water balance of the Site. The most significant difference is the addition of impervious surfaces as a type of surface cover. Impervious surfaces prevent the infiltration of water into the soils. Net effect of the construction of impervious surfaces is that most of the precipitation that falls onto the impervious surfaces becomes surplus water and direct runoff. The natural permeability of the ground surface changes by reducing the current undeveloped land/ open space and vegetation at the Site and replacing part of these areas with less permeable/ impervious surfaces such as building roofs, roads, and driveways. The development will result in an increased volume of runoff and a reduction in infiltration. Pre-development conditions result in approximately 2,035 m³ of water available for infiltration to the groundwater system, as mentioned in the above table.

Based on the post-development plan, a summary of proposed land use and water balance calculations for the post-development are provided below:

Entire Site- Summary of Site Statistics (Post-development)

Land Use	Area (ha)	Area (m ²)
Building Footprint/Envelope	0.24	2,400
Hardscape/Impervious (Roads)	0.30	3,000
Softscape/Pervious (Undeveloped Area)	0.27	2,700
Total	0.81	8,100

Post- Development Water Balance without Mitigation (Entire Site)

	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Proposed Development	8,100	7,711	1,134	514	1077	4,986

Comparison of Pre-Development & Post-Development Water Balance Over (Entire Site)

	Precipitation(m ³)	Evapotranspiration Losses (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-off to Wetland (m ³)
Pre-Development	7,711	2,142	286	2,035	3,249
Post-Development	7,711	1,134	514	1,077	4,986
Difference	0	-1,008	228	-958	1,737

In the post-development, the water balance calculations show that development has the potential to reduce the natural infiltration by **958 m³/yr.** and to increase the runoff by 1,737 m³/yr. Conservation Ontario Guidelines (Conservation Ontario, 2013) suggest a target of 80 % of the predevelopment infiltration being maintained in the post-development conditions. Calculations for the Site are indicative of the post-development infiltration being at a level of about 53 % of the pre-development infiltration. As such, opportunities to capture run-off and provide secondary infiltration in greenspace areas will be required to increase post-development infiltration. This indicates that with proper stormwater management and mitigation measures are required to maintain the overall infiltration rates at the property. The low-impact development (LID) techniques that are being considered as part of the post-development design proposed in the stormwater management report will mitigate the infiltration deficit.

Roof runoff Infiltration Deficit (Entire Site)

	Potential Post-Development Infiltration Deficit (m ³) with mitigation
Proposed Development	958

Post-Development- Available Roof Run-off

The rooftop runoff water will be re-infiltrated through stormwater management features, a total of 2,056 m³/yr. of water could be available for infiltration/compensation of the adjacent wetland north of the site under post-development conditions (assuming 90% available of the roof run-off captured).

The volume of roof run-off available post-development, as noted in the Table below:

Roof Run-off Volume of Available (Entire Site)

	Volume of Roof Run-off Available (m ³)
Proposed Development	1,851

The water balance calculations are provided in **Appendix G.**

Post-development Condition-Feature-Based Water Balance (Wetland North of the Site) :

In the post-development, it is expected that available run-off to the wetland should match the pre-development run-off volume of **1, 811 m³/yr.**

As noted above, the total volume of rooftop runoff water available to compensate/mitigate the post-development wetland runoff and the site infiltration is **1 851 m³/yr.**

It is proposed in the Storm Water management LID report prepared by WMI & Associates Limited to channel the run-off to the wetland adjacent north of the site.

Post-development Roof runoff Compensation (Wetland North of the Site & Site Infiltration Deficit)

Available Roof Run-Off (m ³)	Runoff Available to Compensate Adjacent Wetland to the North (m ³)	Volume of Roof Run-off for Site Infiltration deficit(m ³)
1,851	1,811	40

In summary, the pre-development run-off (**1, 811 m³/yr.**), can be fully mitigated in the post-development condition, while the post-development infiltration deficit for the site can be reduced from (**958 m³/yr.** to **(918 m³/yr.)**) based on the available roof runoff. The infiltration deficit (**918 m³/yr.**) for the site will remain unmitigated.

Drainage from the building rooftop will drain northward via a separate storm sewer towards the adjacent north wetland.

It should be noted that the single rooftop outlet serving the entire roof was identified as the appropriate solution. Infiltration is not proposed within the swale.

Further details on the design and implementation of the LID techniques are described in the “ Stormwater Management Report, 642 Dunlop Street West, City of Barrie, dated March 2023, File # 21-710, prepared by WMI & Associates Limited. The information in this report describes the best management practice to mitigate and compensate for the post-development hydrogeological condition.

7.0 Groundwater Control and Dewatering Requirements

7.1 Construction Requirements and Methodology

Current Development:

The Site is currently developed with two low-rise commercial structures.

Proposed Development:

It is proposed to demolish the existing structures and construct a new 5-storey mixed-use building with slab-on-grade construction (no basement), commercial use and covered parking/driveway at ground level and residential use above. There will also be at-grade exterior parking and driveway. The proposed development will be municipally serviced for water and sewer.

Based on the design information provided by the client, Terraprobe identified the following details related to the proposed development:

Proposed Development					
Development Phase	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor (FFE)		Approximate Foundation Elevation (masl)
			Depth (m)	Elevation (masl)	
- Five-story slab-on-grade building	5	0	Slab-on-Grade Structure	±236.0	± 234.5* (Spread footing resting on Engineered Fill)

* 1.5 m of earth cover or equivalent insulation for frost protection

In general, the stratigraphic units that were encountered at the Property are summarized below:

A surficial pavement structure consisting of 50 mm to 230 mm of asphaltic concrete was encountered at the surface of Boreholes 1, 3, 5, 6 and 8. The asphaltic concrete was found underlain by 130 mm to 370 mm of granular fill at Boreholes 1, 3, 5 and 6. **Topsoil** was encountered at Borehole 2, 4 and 7, and its thickness ranged from 140 to 150 mm. A zone of earth fill materials was encountered in boreholes 2, 4, 7 and 8 and extended to the depths of 0.6 m below grade. The earth fill materials consisted of sand to sandy silt to with organics, peat and some gravel. The fill material indicated a loose to compact relative density with the moist condition. A layer of **Peat**, with some sand seams, was encountered in Borehole 1, 3, 5 and 6 beneath the pavement structure/ earth fill zone and extended to a depth ranging from 0.8 to 1.5 m (Elev. 232.9 m to 234.5 m) m below grade indicating a moist condition.

Undisturbed native soil deposits underlie the topsoil/earth fill/organic deposits, which extended to the full depth of investigation are as follows:

Sand, with trace amounts of silt, clay and gravel, was encountered beneath the surficial pavement/topsoil layer in all boreholes and extended to the full depth of the investigation (about 12.6 m depth below grade), indicating a wet condition. The groundwater conditions at the Property are summarized below:

Monitoring Well	Ground Surface Elevation (masl)	February 01, 2022	
		Groundwater Depth (mbgs)	Groundwater Elevation (masl)
BH 1	235.5	*	*
BH 2	234.5	1.7	232.8
BH 3	235.3	1.8	233.5
BH 4	235.4	1.9	233.5
BH 5	235.2	1.5	233.7
BH 9	234.4	1.7	232.7

Note: masl: meters above sea level, mbgs: meters below ground surface
*non-accessible due to snow cover

Based on the in-situ hydraulic testing, the hydraulic conductivity of the native sand deposit is estimated in the order of 10^{-6} m/s, indicating a higher permeability of the native soils. The results are shown below:

Monitoring Well ID	Top of Well Screen Elevation (masl)	Bottom of Well Screen Elevation (masl)	Screened Geological Units	Hydraulic Conductivity (m/s)
BH 2	226.0	222.9	Sand	4.1×10^{-6}
BH 3	230.7	227.7	Sand	5.8×10^{-6}
BH 4	226.3	223.2	Sand	2.2×10^{-6}
BH 5	233.7	230.6	Sand	6.1×10^{-6}

Note: masl: meters above sea level, mbgs: meters below ground surface

The prevailing ground water conditions at the Property are as follows:

Ground Water Conditions	
Highest Ground Water Elevation (masl)	±234.4 masl

Ground Water Control

The water taking requirements for ground water control at the Property are established only from rainfall events since there is no groundwater seepage. The results are shown below:

* Rainfall event data obtained from Ministry of Transportation IDF Curve

Ground Water Quantity: Short Term (Construction) – S.F. 2.0 Used						
Location	Ground Water Seepage		26.9 mm Design Rainfall Event*		Total Volume	
	L/day	L/min	L/day	L/min	L/day	L/min
<i>Five-story slab-on-grade building</i>	0	0	1,000	0.7	1,000	0.7
Regulatory Requirements						
Environmental Activity and Sector Registry (EASR) Posting			Not Required			
Short Term Permit to Take Water (PTTW)			Not Required			
Long Term Permit to Take Water (PTTW)			Not Required			

Note: For further details on the geotechnical design considerations and constructability, please refer to the geotechnical report prepared by Terraprobe under a separate cover (**File No. 3-21-0182-01**)

7.2 Impact Assessment of Water Quality Threats

A drinking water threat is defined in the Clean Water Act as “an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water.” The Clean Water Act, 2006 prescribes a number of land use that are considered to be drinking water threats. Based on the **web-based Threats Analysis Tool** developed by The Upper Thames River Conservation Authority following prescribed threats could be significant:

Threat #	Threat Sub Category	Risk	Vulnerable Area / Score	Circumstance	Parameter of Concern
16	Handling and Storage of a Dense Non-Aqueous Phase Liquid (DNAPL)	Significant	WHPA-B (6)	- The below-grade handling of a DNAPL in relation to its storage (Any Quantity) - The handling of a DNAPL at or above grade, in relation to its storage (Any Quantity) - The storage of a DNAPL at or above grade (Any Quantity) - The storage of a DNAPL completely below grade (Any Quantity) - The storage of a DNAPL partially below grade (Any Quantity)	Chemical

The Ministry of Environment Tables of Drinking Water Threats identifies five (5) types of dense non-aqueous phase liquids that could make their way into surface and groundwater as a result of a spill from

the handling or storage of these chemicals. The following chemicals could threaten the safety of drinking water sources in certain situations:

- 1,4-Dioxane
- Tetrachloroethylene (Perchloroethylene [PCE])
- Trichloroethylene [TCE]
- Vinyl Chloride [VC]
- Polycyclic Aromatic Hydrocarbons [PAHs]

As required under the Clean Water Act, any use or storage of Dense Non-Aqueous Phase Liquids (DNAPLs) will be prohibited within WHPA-A and WHPA-B zones across the Site as these are considered to be significant drinking water threats. Any amount of dense non-aqueous phase liquids is considered a significant threat within a WHPA-A, B, C or C1 (where the vulnerability score is greater than or equal to 2). Based on the nature of the proposed development, the use or storage of DNAPLs is not anticipated at the Site

Handling and storage of household hazardous waste disposal, maintaining fuel oil tanks and septic systems, maintaining or decommissioning a well increases the risk for contaminating the aquifer; however, the proposed development will be serviced by the City of Barrie water supply and sanitary sewer systems. Therefore, none of the above-mentioned concerns applies to the Site.

7.3 Groundwater and Surface Water Quality Impact

The area of the proposed development is located in the Highly Vulnerable Aquifer (HVA). HVAs are those areas where an aquifer may be more prone to contamination. These areas have been identified where there is little or no protection from an overlying aquitard (a protective layer of low permeability materials). The Property is also mapped under Issue Contributing Area for Chloride. Best management practices for the use of salt for winter driveways maintenance should be adopted that will reduce the potential to affect underlying ground water resources. The risk management plan for water quality threat management is provided under Section 7.0.

Based on the review of Risk Management comments dated: January 13, 2021, it is indicated that infiltration of rooftop runoff and vegetated surfaces may be permitted if current site conditions demonstrate no existing contamination. Depending on the land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, bacteria and viruses. For groundwater, generally with the exception of the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater flow through the soils. Under the proposed development, the quality of water directed to pervious areas for infiltration is not expected to contain any contaminant of concerns. Considering the nature of the proposed development, it is anticipated that there will not be any contributing contaminants that may affect the background ground water quality in the area.

The nearest surface water features are a tributary of Dyments Creek located approximately 50 m south. Any groundwater that will be taken from the site will be discharged (if required) into the City's sewer systems and not into any natural water body. As such, there will be no impact to surface water features as

a result of the proposed development.

Furthermore, at the time of preparation of this report, Terraprobe is not aware of any Environmental Site Assessments (ESAs) conducted at the Property.

7.4 Anthropogenic Transport Pathways

No significant anthropogenic transport pathways were identified during investigations conducted on the Property. Six (6) monitoring wells were installed during the site investigation conducted by Terraprobe to gather information regarding the groundwater quality and elevation at the Property. The well depths range from 4.6 mbgs to 12.2 mbgs installed in the shallow groundwater and are therefore not considered to be a risk to the groundwater resource. The monitoring wells installed at the Site need to be maintained in accordance with Ontario Water Resources Act, O. Reg. 903/90. When the wells are no longer required for monitoring or sampling, these wells will need to be appropriately decommissioned by a licensed well contractor as outlined in the Regulation. Based on the nature of the proposed development and structure, the excavation works will not present a transport pathway to the municipal groundwater aquifer.

Based on the review of Risk Management comments dated: January 13, 2021, it is indicated that two (2) potential wells are located on the site (Map ID: 12 and 27). The Well ID 5718624 (Map ID: 12) is registered for commercial use constructed in 1983. However, the Well ID 7260721 (Map ID: 27) is registered as a test hole for 636 Dunlop St West, Barrie. Therefore, the applicant is required to maintain or decommission the well located on the Site in accordance with O.Reg. 903 and Ministry of the Environment, Conservation and Parks (MECP) standards to ensure the structural integrity of the wells and to prevent them from becoming a transport pathway for any possible contamination.

7.5 Impact to Local Groundwater Resources

The proposed development will be municipally serviced, and there is no proposed on-site groundwater use for the development. Based on the review of Risk Management comments dated: January 13, 2021, it is indicated that building supports are not permitted to be constructed within the municipal supply aquifer.

As indicated earlier, one (1) active Barrie municipal production well (PW-19, Well ID: 7114203, Map ID: 22) is located within 500 m of the Site screened in lower A3/A4 aquifer. Based on the review of Oak Ridges Moraine Groundwater Program (OGRMP) cross-section tool and source water comments, it is noted that the confined municipal aquifer is found at approximately ± 75 meters below grade. The proposed development scheme will be a slab-on-grade structure. The excavation activities will not extend to the underneath confined municipal aquifer. Moreover, the zone of influence during any dewatering activities (if applicable) will be limited in its lateral extent and will not extend horizontally to the location of the municipal production wellhead.

Based on the well record review and nature of the proposed development, it is unlikely that impacts from the proposed development will affect municipal water-taking resources in the study area.

8.0 RISK MANAGEMENT PLAN AND MITIGATING MEASURES

8.1 Water Quality Threat Management

8.1.1 Groundwater Recharge Threat Management

The existing groundwater recharge rates at the Site are approximated as 278 mm/yr. These recharge rates are based on the property-specific conditions. This recharge occurs in a broad diffuse manner over the entire Site. Based on the borehole findings, below any surficial materials (topsoil or pavement structure), the subsurface conditions generally consist of loose sand fill with peat organics and or loose an organic peat layer extending to a depth of up to 1.5 m below grade. These materials are underlain by the native sand deposit with permeability estimated in the order of 10^{-4} m/s to 10^{-6} m/s, indicating higher permeabilities which indicates a possible contribution to the groundwater recharge to shallow groundwater zone. Therefore, management of groundwater recharge at the Site following development is recommended where it is feasible and should be designed using a Best Management Practice approach.

It is anticipated that groundwater recharge at the Site can be maintained through the use of appropriate low-impact development (LID) techniques. Appropriate stormwater control measures would be required to prevent erosion due to increased runoff, for slow and delayed-release to promote infiltration and prevent flooding. The implementation of these measures at the Site will assist in maintaining the shallow groundwater recharge and replicate the existing surface drainage. Runoff from the proposed development will conform to the stormwater management report for the Site.

As per CVC-TRCA (2010), the recommended vertical separation between the base of the given infiltration augmentation option and the high groundwater table is at least one meter; however, distances of less than one meter of separation in soils having higher infiltration potential may still be effective. Based on the available water level recordings till date, it is noted that groundwater level in the overburden varies from $232.7 \pm \text{masl}$ to $233.7 \pm \text{masl}$ (1.5 mbgs to 1.9 mbgs). The suitability of using the proper infiltration options within the Site will be provided in the Stormwater Management Report/Functional Servicing Report. Final design of the LID measures should be reviewed in conjunction with the stormwater management plan for the Site.

Furthermore, as indicated earlier, the water balance calculations show that development has the potential to reduce the natural infiltration by $668 \text{ m}^3/\text{yr}$. Conservation Ontario Guidelines (Conservation Ontario, 2013) suggest a target of 80% of the predevelopment infiltration being maintained in the post-development conditions. Final design of the infiltration measures provided in the FSR report should address these infiltration targets estimated in water balance calculations.

Furthermore, the soils present on the property are of higher permeabilities which would provide potential pathways for groundwater discharge. The future development will also be connected to municipal servicing through underground utility lines. The future development may disrupt the shallow groundwater flow, and its continuity should be maintained where practical. However, it is recommended that the excavation of the building foundation and any underground services or utilities across the site must be backfilled using material of similar permeabilities.

8.1.2 Groundwater Taking Threat Management

The construction dewatering rate and duration is typically governed by the PTTW or EASR. If a PTTW or EASR is required, a monitoring plan will be prepared as part of an Environmental Management Plan (EMP) and implemented during dewatering to track the zone of influence and manage dewatering discharge quality and quantity. Monitoring programs generally involve a combination of: Installation of dedicated monitoring wells; Pre, during, and post-construction water level monitoring and groundwater quality sampling and testing; and dewatering discharge quality sampling and testing

8.2 Water Quality Threat Management

8.2.1 Prohibited Uses

Since the Property is located in a WHPA-B, the handling and storage of a dense non-aqueous phase liquid (DNAPL) (for example, paints, paint-thinners, degreasers, solvents, etc.) as listed in the *Tables of Drinking Water Threats, Clean Water Act, 2006, Ontario Ministry of the Environment (as amended Nov 16, 2009)* is prohibited at the Property.

Future tenants will need to be aware of these requirements, the Property owner will be required to have a sale and purchase agreement clause and/or a lease clause that informs future purchasers or leases that the property is within a wellhead protection area and subject to source protection policies under the Clean Water Act, 2006.

8.2.2 Application of Road Salt

8.2.2.1 Preventive/Mitigation/Management Measures – Road Salt

All salt stored at the Site for later application shall be stored in water-impermeable containers and in roofed areas of the Property that either are asphalt-paved or have a poured concrete floor to minimize entry into the subsurface. Stormwater runoff at the impermeable surfaces, roadways, walkways, and driveways on the Site will drain to catch basins at the public roadways. This will preclude downward migration into the aquifer.

The Transportation Association of Canada (TAC) has produced a document titled *Syntheses of Best Practices – Road Salt Management (2013)*. The Best Management Practices should be generally followed at the Site unless prohibited. In addition, best management practices for contractors, residents, and the community are provided by the not-for-profit organization Smart About Salt Council, and their recommendations may be of benefit in reducing salt loads. Some items recommended include maintaining health and safety as a top priority, training and education for road salt management, salt application rates, and monitoring of releases from the salt application. It is recommended that a Contractor who is certified by Smart About Salt be retained.

Practices of road salt management to be considered so as to reduce the amount of salt needed and minimize associated groundwater and surface water impacts include (TAC, 2013):

- The 4 R's of snow and ice control:
 1. Right Material – the right material will depend on the conditions being treated. In situations where the pavement temperature is extremely cold, chemicals with lower working temperatures and sand/salt mixtures may be warranted.
 2. Right Amount – The right amount of material is dependent upon the type of slippery condition being treated, the amount of residual chemical on the pavement surface, the expected pavement temperature and the amount of precipitation that is expected.
 3. Right Place – Precise placement of materials is important to keep it in the right place to do the job rather than waste the environment. Proper material placement requires the right equipment and skilled operators.
 4. Right Timing – The timing of salt placement is important to minimizing waste and maximizing chemical effectiveness. There are times when the pavement temperature is, and is expected to remain, above freezing and therefore may not warrant salt application. Proactive anti-icing is key to achieving safer conditions quickly with less salt.

Application of a Road Salt Alternative - Calcium Magnesium Acetate: Calcium Magnesium Acetate has a low environmental impact but can contribute to biochemical oxygen demand (BOD). It also has a high purchase cost relative to NaCl. In addition, Potassium acetate (KA) is often used as a base for commercial chloride-free liquid de-icer formulations as a road salt alternative, having low corrosion, relatively high performance, and a low environmental impact. The above risk management and risk mitigation measures should be considered for the proposed development.

- The mechanical removal of snow from the treatment area prior to the application of a freeze point depressant (e.g., salt) to minimize the amount of material needed and the potential for dilution and re-freeze.
- The application of freeze point depressants after plowing only when pavement temperatures are below freezing, and the remaining snow/ice that could not be removed by mechanical means presents a hazard.
- The use of liquid rather than solid salt in the right conditions to speed up the melting process.
- The application of only enough material to do the job.
- The location of snow storage such that meltwater that may contain salt is not directed towards salt vulnerable areas.
- The understanding is that salt should not be used to promote the rapid melting of stockpiled snow.

8.2.2.2 Monitoring, Emergency Response, Financial Assurance and Communication and Implementation Plan – Road Salt

The threats to drinking water quality after the development is completed primarily involve the use of road salt. Given that road salt is typically applied in a solid form, immediate clean-up should be conducted by Site maintenance staff in the event of a spill. Based on the negligible threat posed to water quality in the nearby

municipal wells by application of road salt at the Property, monitoring, emergency response, financial assurance and a communication and implementation plan are not considered to be necessary for this prescribed threat.

8.2.3 Storage of Fuels and Chemicals - Temporary

During construction of the proposed building, it may be necessary to temporarily store fuels and/or chemicals at the Site. This represents a potential threat to groundwater quality, as a spill of significant size may potentially impact the local water supply. The fuel will be stored in a small quantity after construction for the on-site standby generator.

8.2.3.1 Preventive/Mitigation/Management Measures – Temporary Storage of Fuels and Chemicals (During and Post Construction)

The fuels will only be stored (maximum size of 2500L is assumed) as part of the construction activities and will be removed once the construction is completed. During construction, it is expected that fuels such as gasoline and diesel, and other chemicals may be temporarily stored on Site for construction. There is no significant downward pathway into the underlying deep aquifer. This is a result of the hydraulic isolation of the shallow groundwater from the deep aquifer in which municipal wells are installed.

To further prevent and mitigate any spills at the Site, it is recommended to place temporary fuel and chemical storage containers of significant size into secondary containment such that a leak can be contained. The temporary fuel and chemical storage containers should also be protected from vehicle strikes. Appropriate spill kits should be maintained at various locations throughout the Site, and an emergency spill response plan should be developed to outline actions to be taken in case of a spill or leak. Best Management Practices should be used during and post-construction when handling these items.

The fuel will also be stored in a small quantity after construction for the on-site standby generator. Given the small quantity of fuel storage in the post-construction period, it does not pose any threat to groundwater quality. Please refer to the Sections below for details related to mitigation, monitoring and emergency responses.

8.2.3.2 Monitoring, Emergency Response, Financial Assurance and Communication and Implementation Plan – Temporary Storage of Fuels and Chemicals (During and Post Construction)

The monitoring and emergency response measures recommended to be implemented at the Property include the following:

Monitoring

- Prior to beginning construction, spill kits should be available on the Site with absorbent material for spills containment. Contractors should be properly trained in the use of the spill kit materials. Equipment and materials to handle spills should be properly maintained at all times.
- It is recommended that temporary fuel and chemical storage locations be inspected on a regular basis to ensure the integrity of storage containers.

Emergency Response

For the fuel spills, the following steps can be taken:

- If a spill occurs, it should be reported to the contractor's onsite supervisor. The contractor should assess if the spill could be of environmental significance (based on material, quantity, spill-receiving body, and potential sensitive receptors).
- If there is an injury on-site, a 911 call should be made in addition to notifying any Site-emergency personnel.
- All steps should be taken to contain the liquid at the source. If it has already entered (or has the potential to enter) any existing ditch, the ditch should be blocked further downstream to contain the spill and ensure it does not migrate offsite.
- The MECP Spills Action Centre SAC (1-800-268-6060) should be contacted immediately.
- Contact a remediation company to clean up the spill. The remediation contractor will also be responsible for the removal and disposal of hazardous materials from the Site.

For further information related to environmental spills, please visit:

<https://www.barrie.ca/Living/Environment/Pages/EnvironmentalSpills.aspx>

9.0 CLOSURE

We trust this report meets with your requirements. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Yours truly,



Syed Ali, EIT
Project Manager



Samuel Oyedokun, P. Eng., PMP., QP_{ESA}
Team Lead - Environment - GTA



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11. Lake Simcoe Regional and Conservation Authority (LSRCA), 2017. Lake Simcoe Climate Data, Barrie Creeks Subwatershed, Lake Simcoe Conservation Authority.
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14. Source Water Protection Atlas interactive mapping: <https://www.gisapplication.lrc.gov.on.ca/SourceWaterProtection/>
15. Terraprobe Inc., Geotechnical Investigation and Engineering Report Proposed Mixed-Use Development, 642 Dunlop Street West, Barrie, Ontario, File No, 3-21-0182-01
16. The Upper Thames River Conservation Authority, Web-Based Threats Analysis Tool, <http://maps.thamesriver.on.ca/swpCAMaps/threatslookup/default.aspx>
17. Transportation Association of Canada (TAC) (2013), Syntheses of Best Practices – Road Salt Management

LIMITATIONS

This report was prepared by Englobe Corp. for the use of **25707517 Ontario Inc.**, and is intended to provide an assessment of the hydrogeological condition on the property located at **642 Dunlop Street West, Barrie, ON**. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Terraprobe accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report, including consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

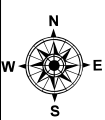
The assessment should not be considered a comprehensive audit that eliminates all risks. The information presented in this report is based on information collected during the completion of the subsurface investigation conducted by Englobe Corp. It is based on conditions at the property at the time of the site inspection. The subsurface conditions were assessed based on information collected at specific borehole and monitoring well locations. The actual subsurface conditions between the sampling points may vary.

There is no warranty expressed or implied by this report regarding the condition of the property. Professional judgment was exercised in gathering and analyzing 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.

In the event that during future work new information regarding the condition of the property is encountered, or the proposed development is changed from that which was provided to Englobe with respect to the property, Englobe should be notified in order that we may re-evaluate the findings of this assessment and provide amendments, as required.

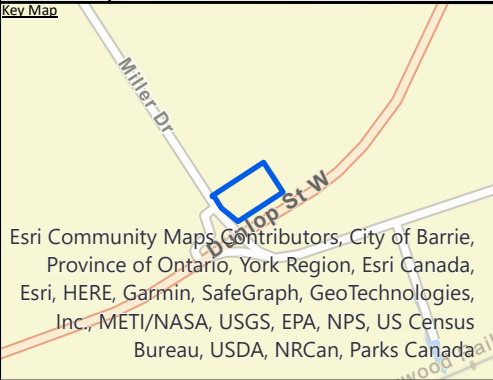
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FIGURES



References:
ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus Ds, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Basemaps

Key Map



Esri Community Maps Contributors, City of Barrie, Province of Ontario, York Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Notes:

Legend:

 Approximate Site Boundary

Project Title:
Hydrogeological Assessment

Site Location:
642 Dunlop Street West,
Barrie, Ontario

Figure Title:
Site Location Plan

Designed By:
MM

File No.:
3-21-0182-46

Drawn By:
SSK

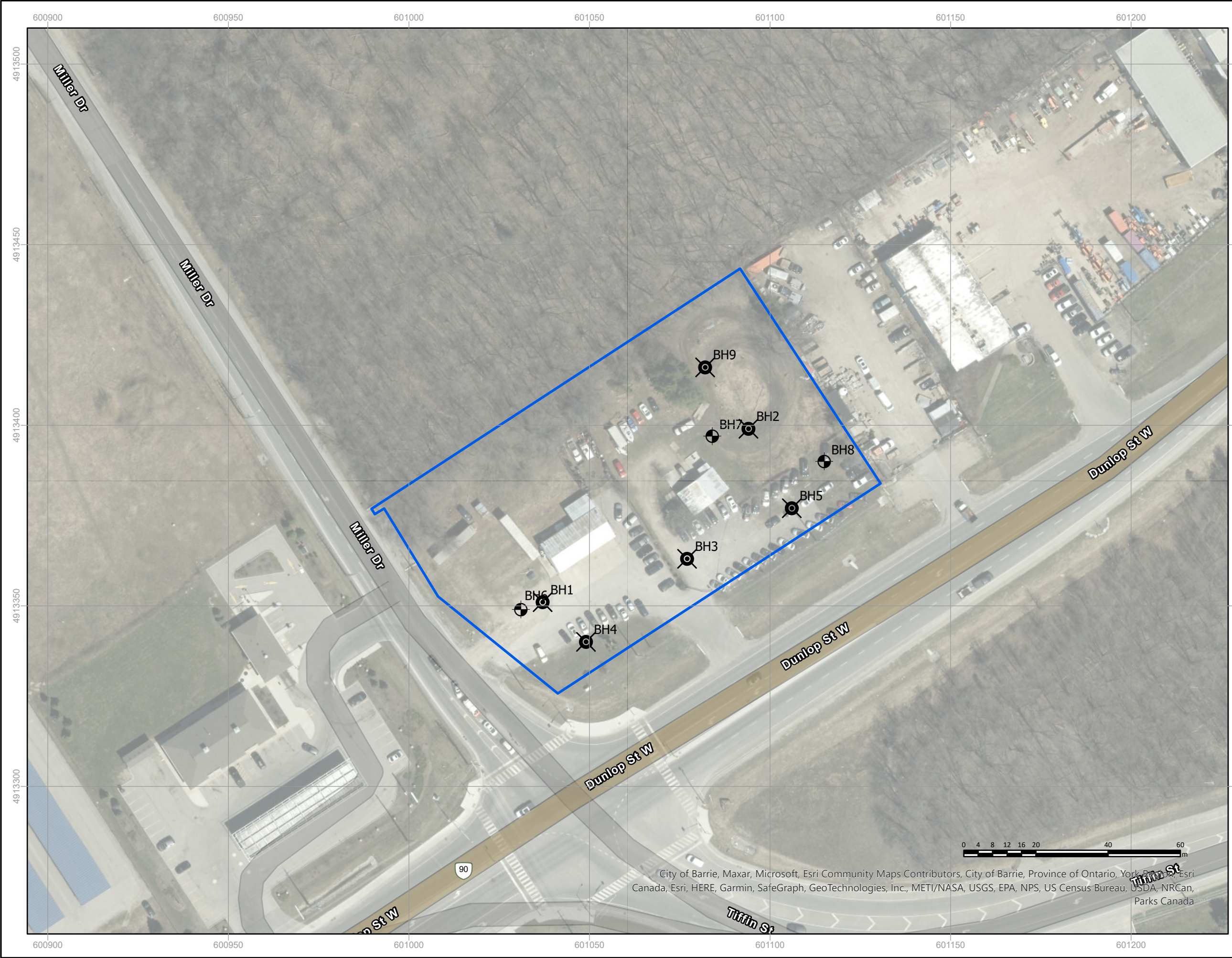
Scale:
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Reviewed By:
SO

Figure No.:

Date:
February 2022

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References:
ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus Ds, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Basemaps

Key Map

Esri Community Maps Contributors, City of Barrie, Province of Ontario, York Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCAN, Parks Canada

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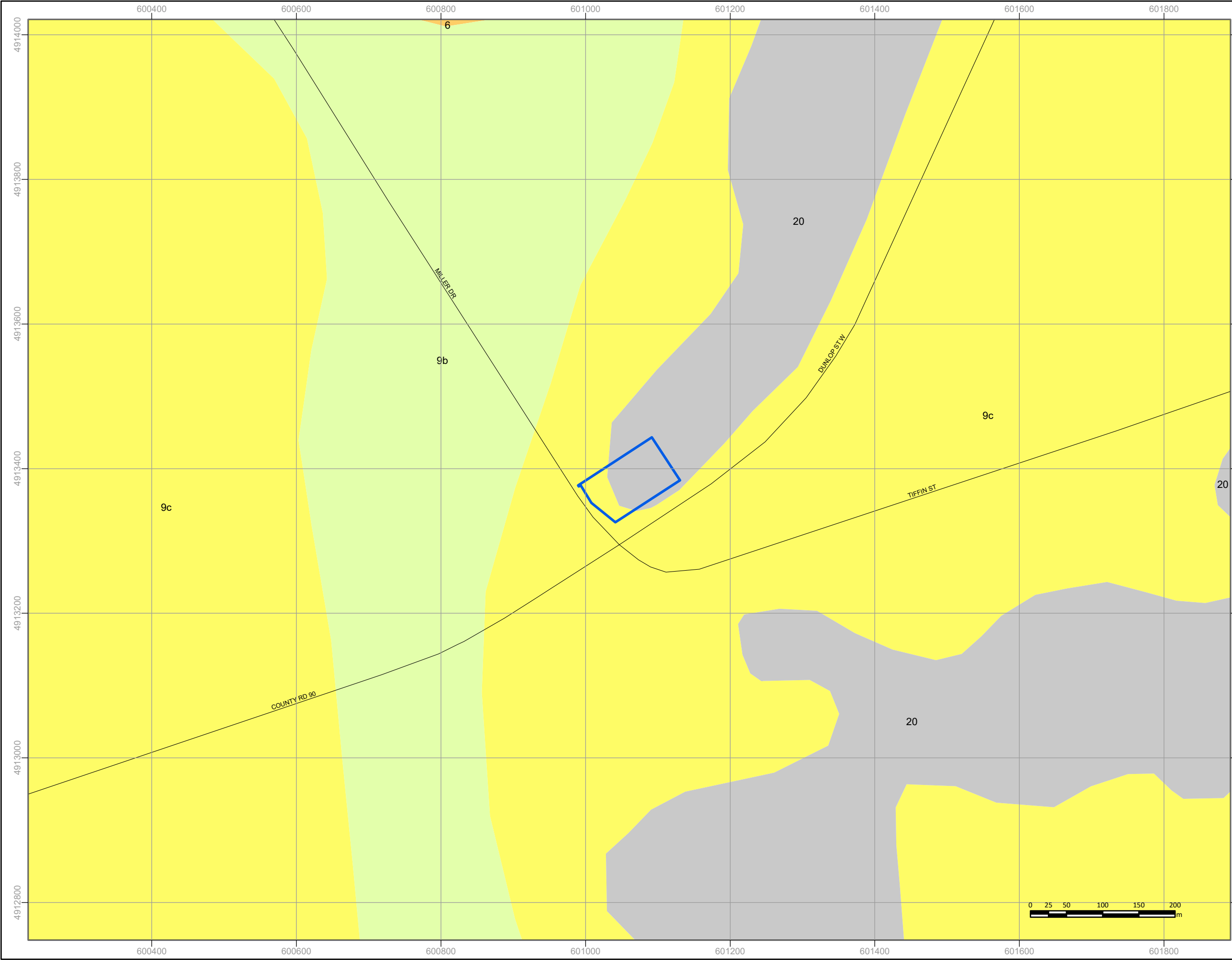
- Approximate Site Boundary
- Approximate Monitoring Well Location
- Approximate Borehole Location

Project Title:
Hydrogeological Assessment

Site Location:
642 Dunlop Street West,
Barrie, Ontario

Figure Title:
Borehole and Monitoring Well Plan

Designed By: MM	File No.: 3-21-0182-46
Drawn By: SSK	Scale: As Shown
Reviewed By: SO	Figure No.: 2
Date: February 2022	



References:

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Key Map

Esri Community Maps, Contributors, City of Barrie, Province of Ontario, York Region, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc., METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada

Notes:

Legend:

- Approximate Site Boundary
- 6: Ice-contact stratified deposits
- 9b: Littoral-foreshore deposits
- 9c: Foreshore-basinal deposits
- 20: Organic deposits
- Collector

Project Title:

Hydrogeological Assessment

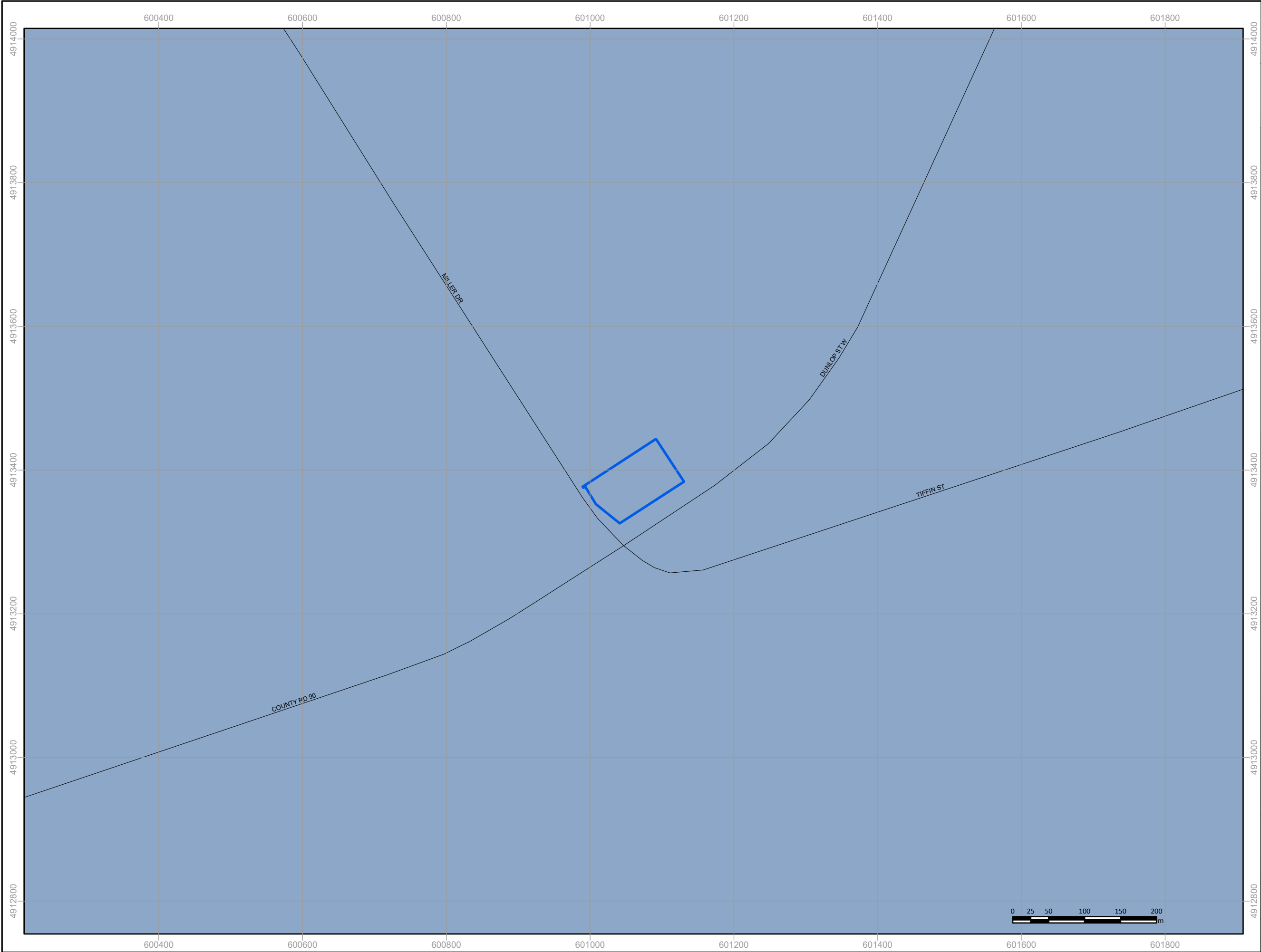
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642 Dunlop Street West,
Barrie, Ontario

Figure Title:

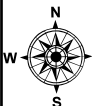
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Drawn By: SSK	Scale: As Shown
Reviewed By: SO	Figure No.: 3
Date: February 2022	





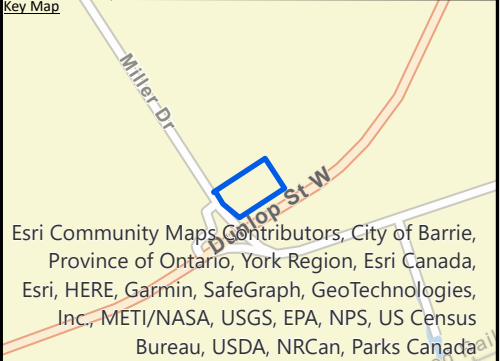
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing



References:

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Key Map



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Notes:

Legend:

-  Approximate Site Boundary
-  Collector
-  35, Simcoe Lowlands

Project Title:

Hydrogeological Assessment

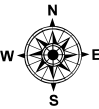
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Barrie, Ontario

Figure Title:

Physiography Map

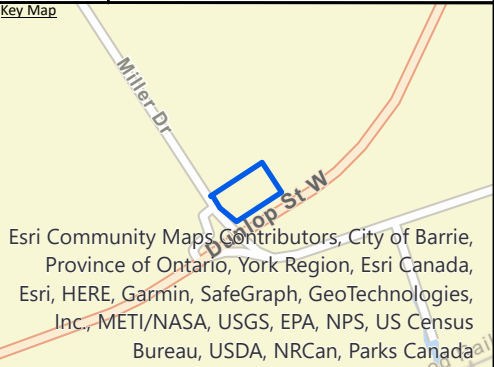
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Drawn By: SSK	Scale: As Shown
Reviewed By: SO	Figure No.: 4
Date: February 2022	



References:

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Key Map



Notes:

Legend:

- Approximate Site Boundary
- Collector
- Water Course
- Wetland Features-Evaluated-Provincial
- Wetland Features-Not evaluated
- Wooded Area

Project Title:

Hydrogeological Assessment

Site Location:

642 Dunlop Street West,
Barrie, Ontario

Figure Title:

Natural Heritage Feature Map

Designed By:

MM

File No.:

3-21-0182-46

Drawn By:

SSK

Scale:

As Shown

Reviewed By:

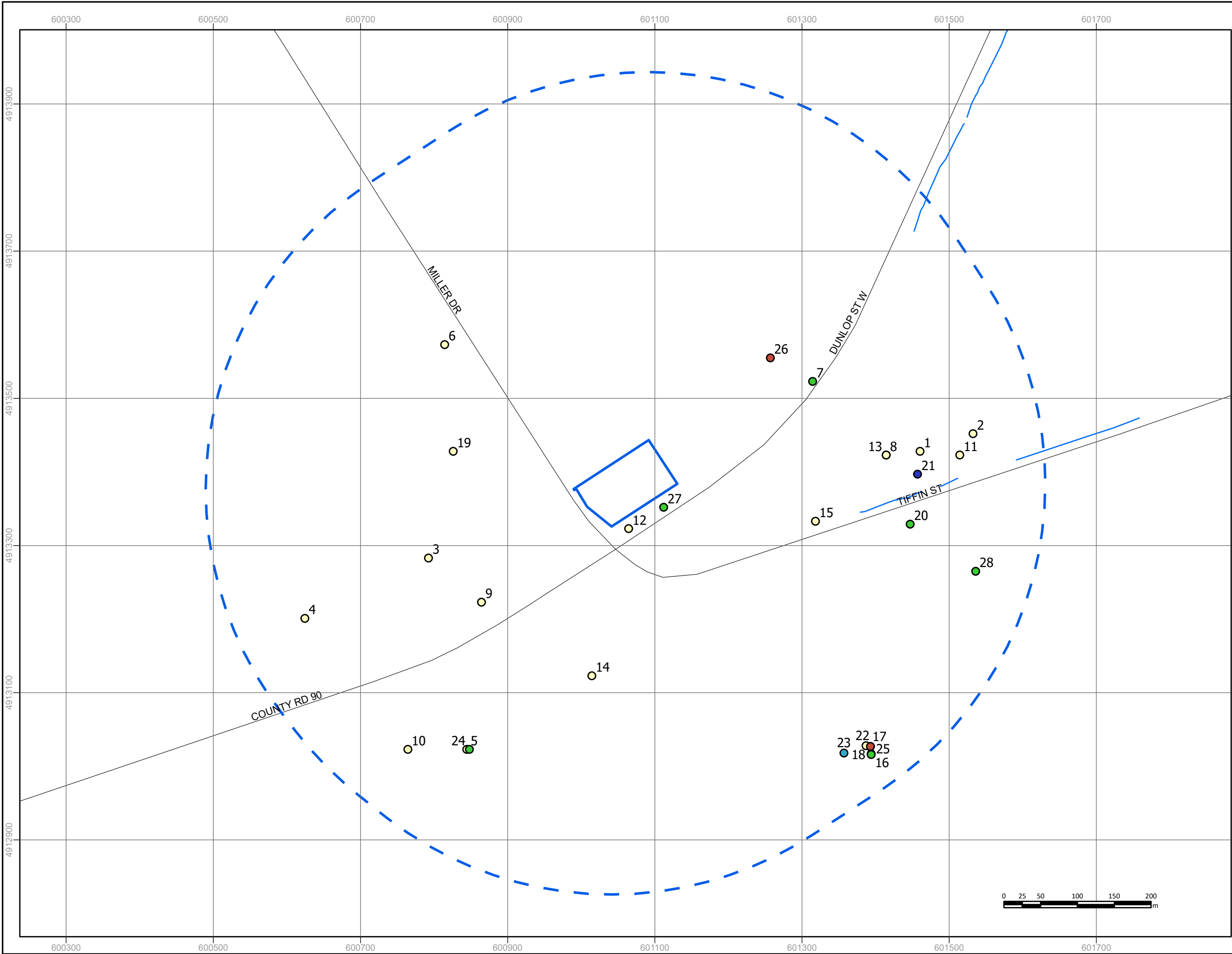
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Figure No.:

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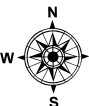
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February 2022



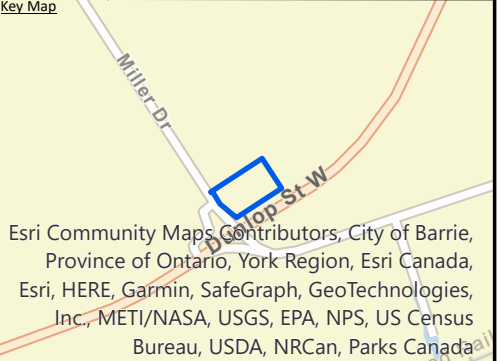


Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing



References:
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Key Map



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Notes:

Legend:

- Approximate Site Boundary
- Approximate Study Area; 500m
- Water Course
- Collector
- Unknown
- Abandoned-Other
- Observation Wells
- Test Hole
- Water Supply

Project Title:

Hydrogeological Assessment

Site Location:

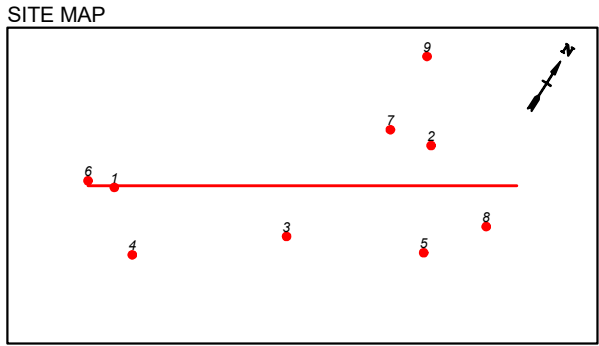
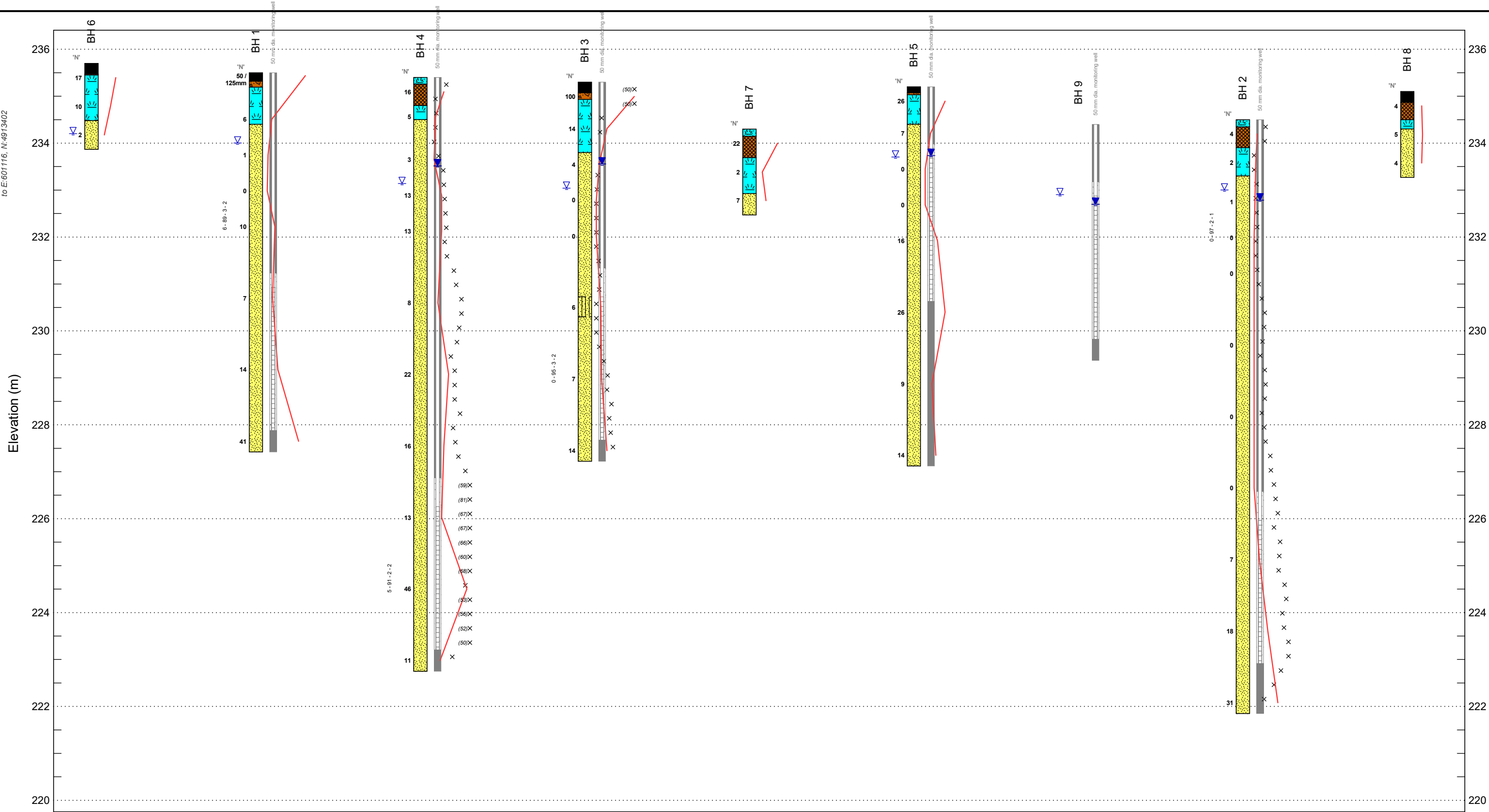
642 Dunlop Street West,
Barrie, Ontario

Figure Title:

MECP Well Records Map

Designed By: MM	File No.: 3-21-0182-46
Drawn By: SSK	Scale: As Shown
Reviewed By: SO	Figure No.: 7
Date: February 2022	

Alignment From E:601032, N:4913348,
to E:601116, N:4913402



LITHOLOGY GRAPHIC LEGEND

- | | |
|-----------|------------|
| Asphalt | Topsoil |
| Aggregate | Fill |
| Peat | Sandy Silt |
| Sand | |

INTERPRETIVE LEGEND

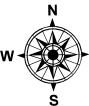
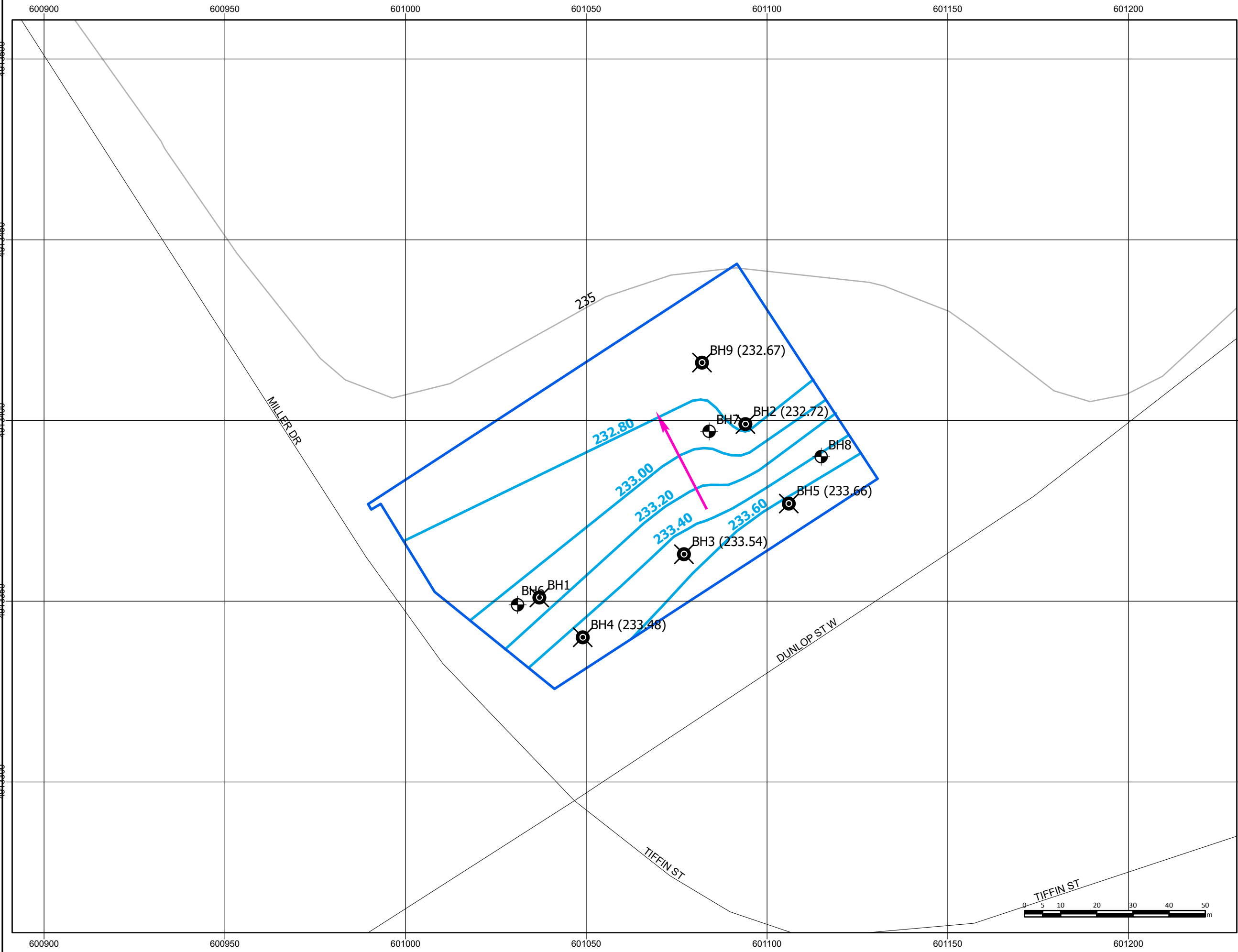
- WL on completion of drilling
 Stabilized WL, most recent

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

Title:	SUBSURFACE PROFILE	
File No.:	3-21-0182-01	

FIGURE:

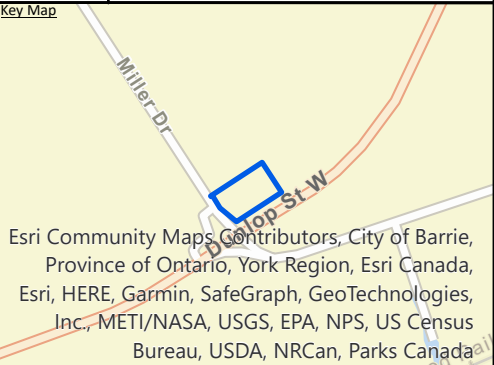
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References:

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Key Map



Notes:

Legend:

- Approximate Site Boundary
- Approximate Monitoring Well Location
- Approximate Borehole Location
- Collector
- Interpreted Groundwater Contours
- Interpreted Groundwater Flow Direction
- City of Barrie; Topographic Contours

Project Title:

Hydrogeological Assessment

Site Location:

642 Dunlop Street West,
Barrie, Ontario

Figure Title:

Groundwater Flow Direction

Designed By:

MM

File No.:

3-21-0182-46

Drawn By:

SSK

Scale:

As Shown

Reviewed By:

SO

Date:

February 2022

Figure No.:

8

APPENDIX A

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

Figure 2-4

Legend

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



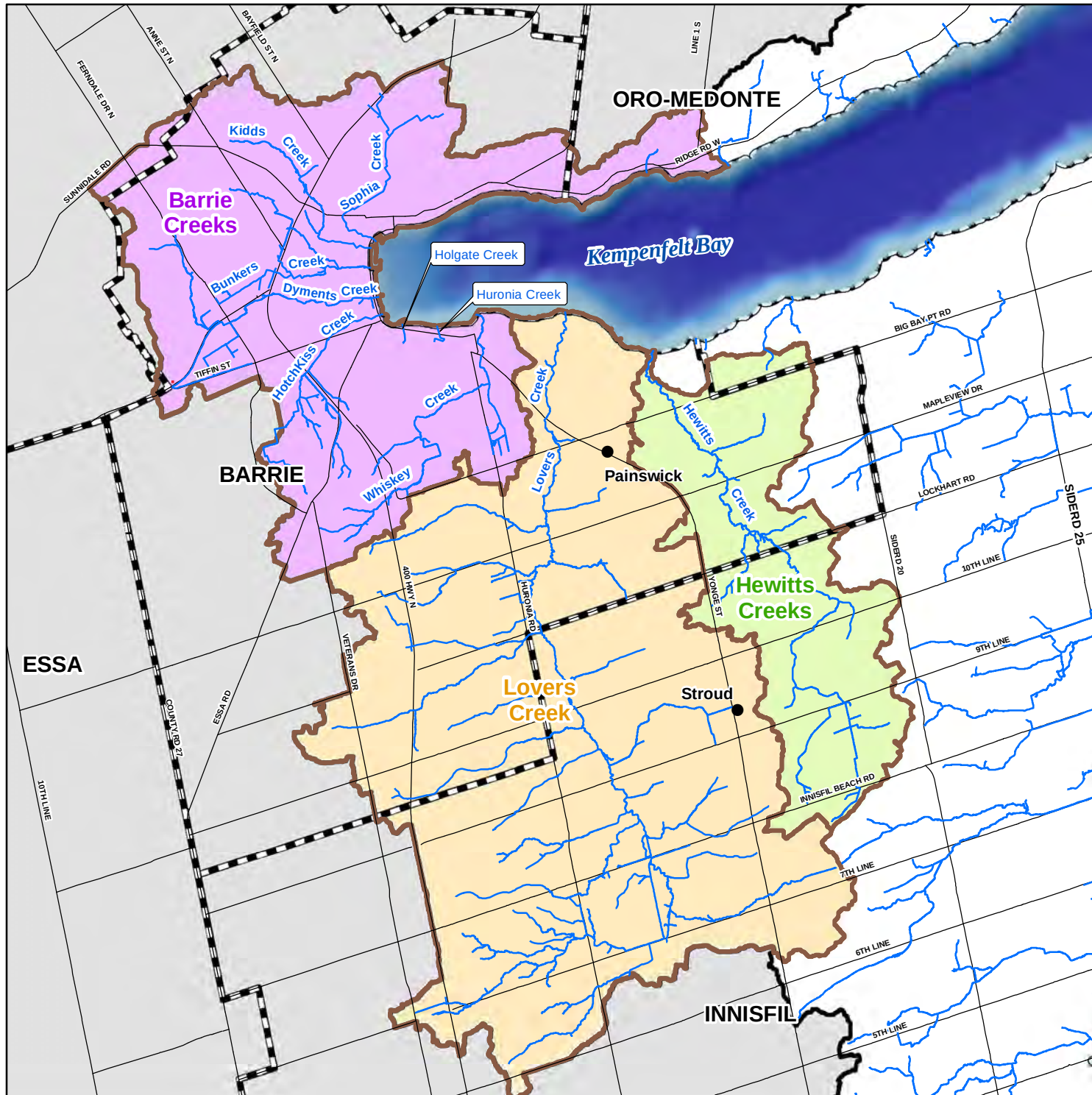
Lake Simcoe Region
conservation authority



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.

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The following datasets roads, municipal boundaries and Oak Ridges Moraine are
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Features

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

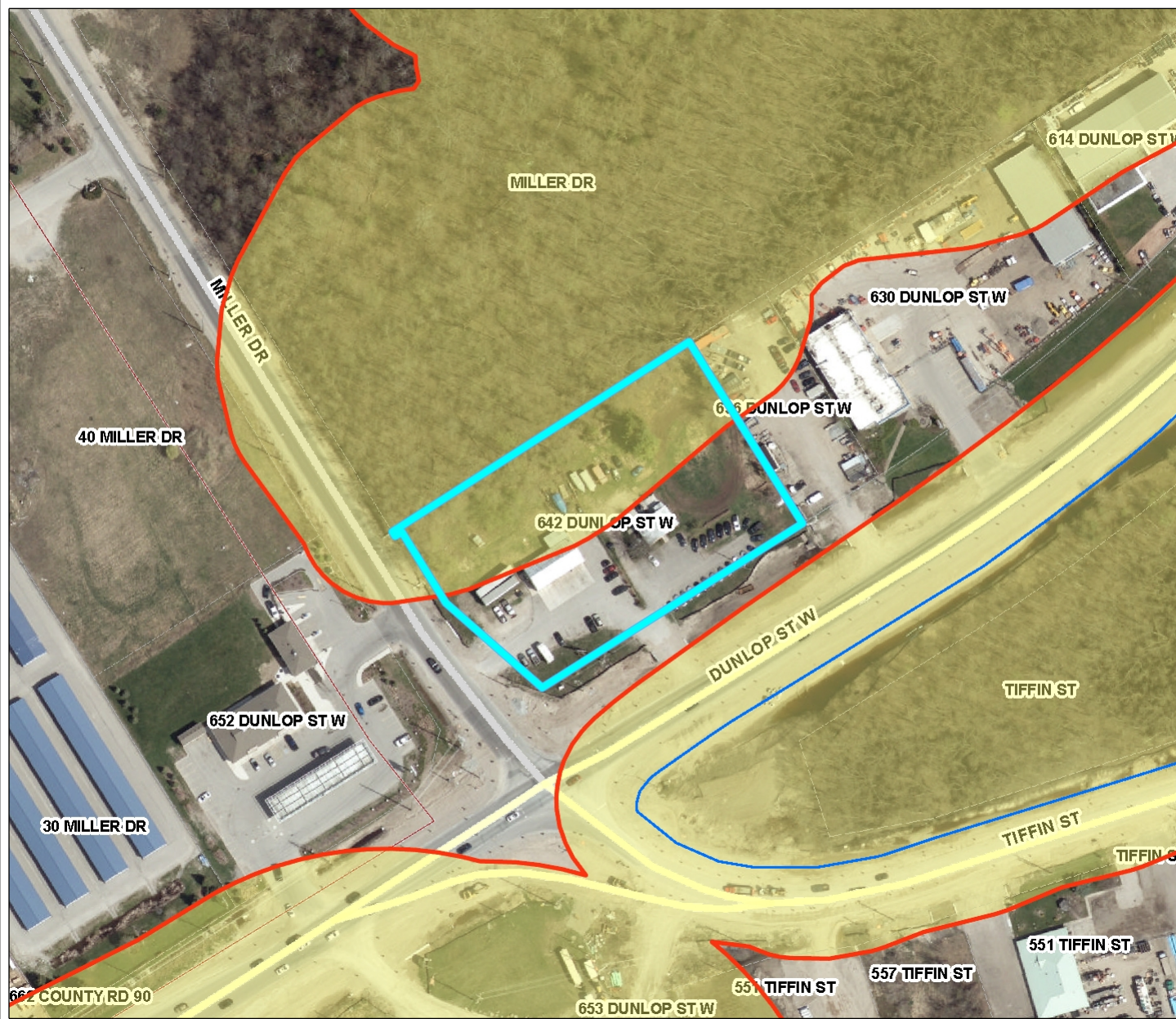
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3/2/2022



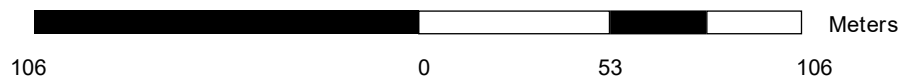
WGS_1984_Web_Mercator_
Auxiliary_Sphere

Mapped By:

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Scale 1: 2,096





Notes:

Natural Heritage Mapping

0.7 0 0.33 0.7 Kilometres

Absence of a feature in the map does not mean they do not exist in this area.

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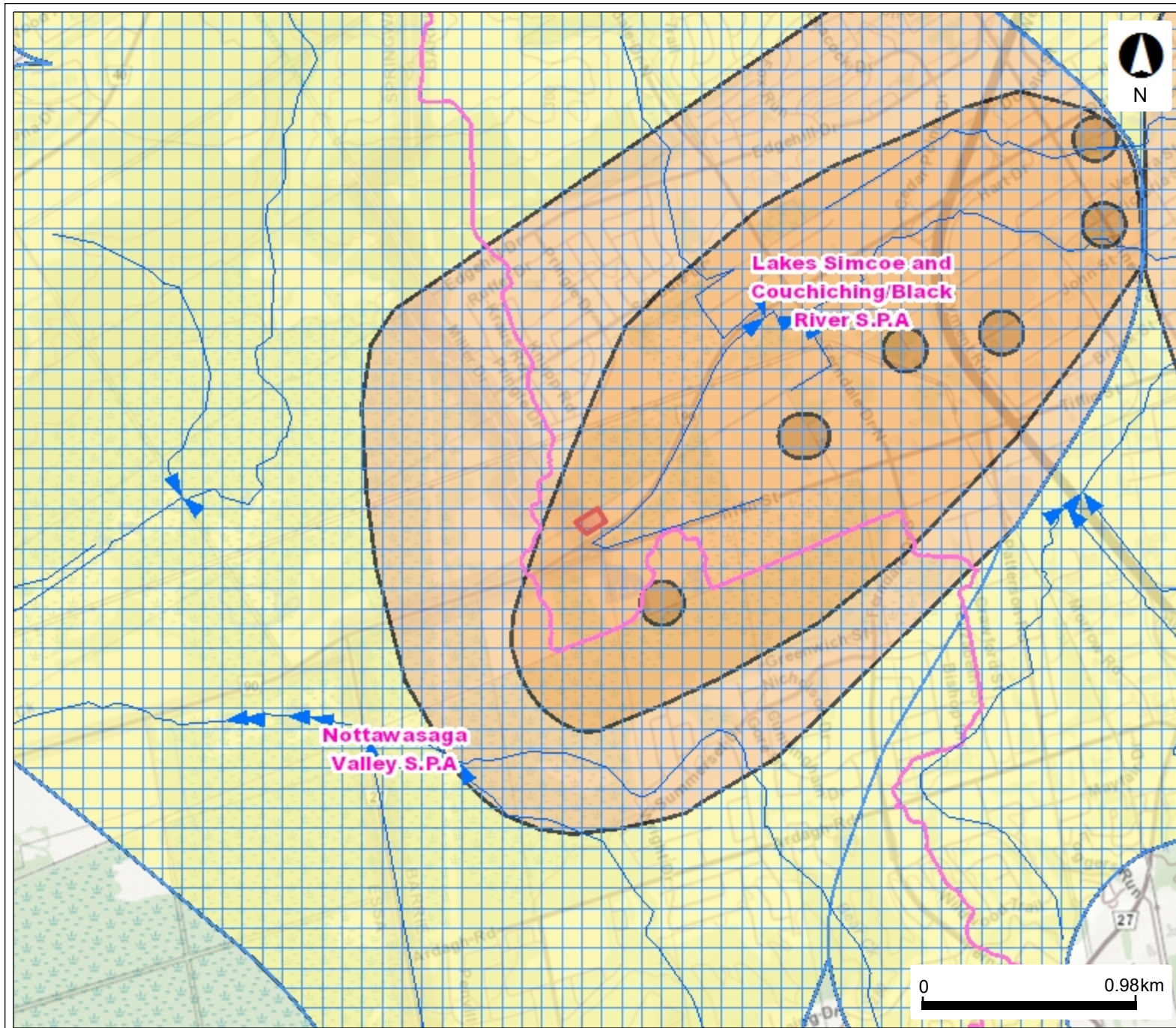
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Legend

- Assessment Parcel
- ANSI
- Earth Science Provincially Significant/sciences de la terre d'importance provinciale
- Earth Science Regionally Significant/sciences de la terre d'importance régionale
- Life Science Provincially Significant/sciences de la vie d'importance provinciale
- Life Science Regionally Significant/sciences de la vie d'importance régionale
- Evaluated Wetland
- Provincially Significant/considérée d'importance provinciale
- Non-Provincially Significant/non considérée d'importance provinciale
- Unevaluated Wetland
- Woodland
- Conservation Reserve
- Provincial Park
- Natural Heritage System



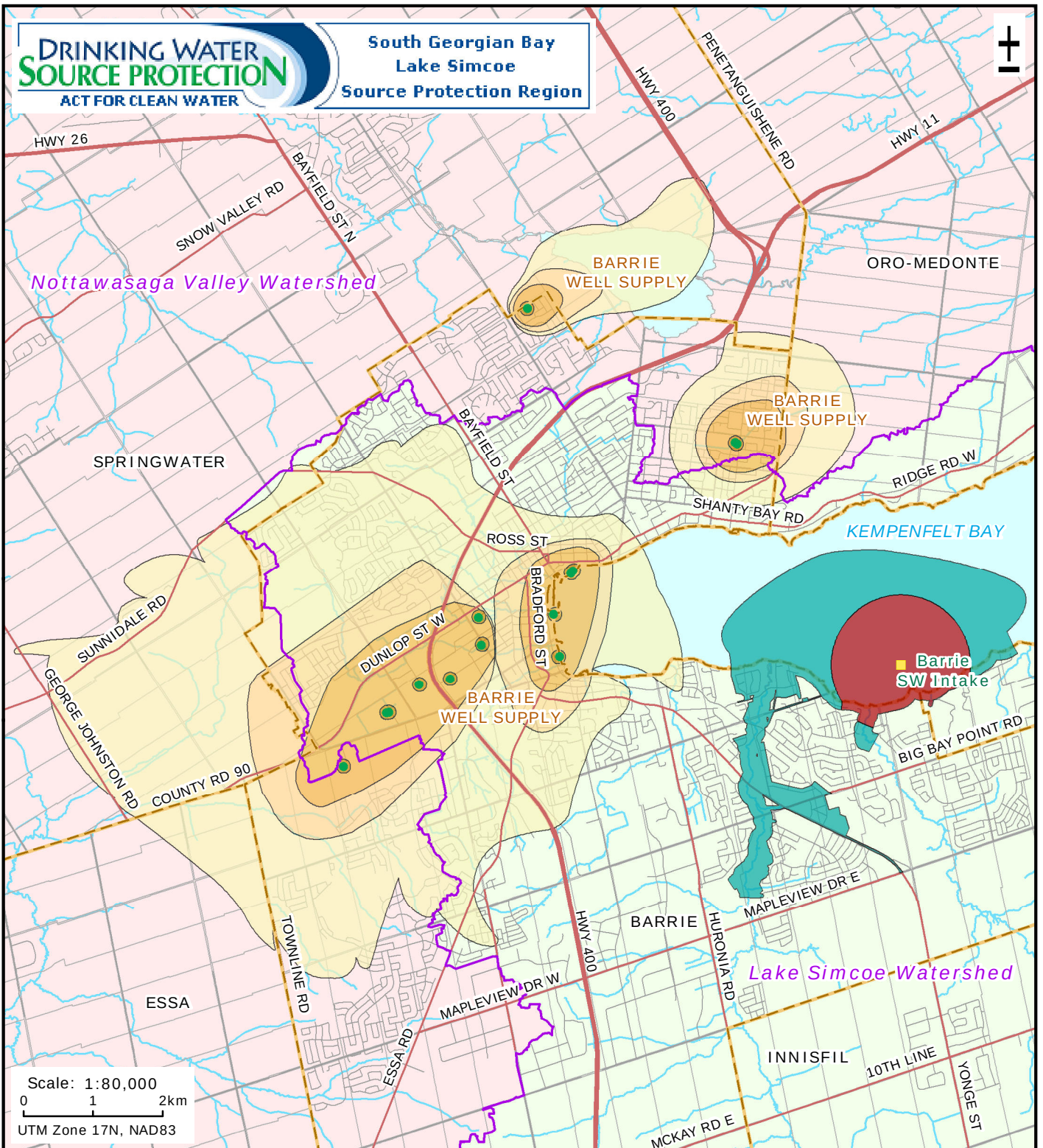
Source Water Protection Mapping



Legend

- Watercourse Direction
- Source Protection Areas
- Issue Contributing Areas
- Wellhead Protection Area**
 - A
 - B
 - C
 - C1
 - D
 - F
- Assessment Parcel with Address

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Scale: 1:80,000
0 1 2km
UTM Zone 17N, NAD83

- Municipal Surface Water Intakes
- IPZ-1 (1000m on water or 120m inland)
- IPZ-2 (2 hr time of travel)
- Municipal Supply Well in City of Barrie
- WHPA-A (100m)
- WHPA-B (2-years time of travel)
- WHPA-C (5-years time of travel)
- WHPA-D (25-years time of travel)

Drinking Water System Vulnerable Areas in City of Barrie



**Golder
Associates**

Barrie, Ontario

Created by: LSRCA
Date: 2014-04-10

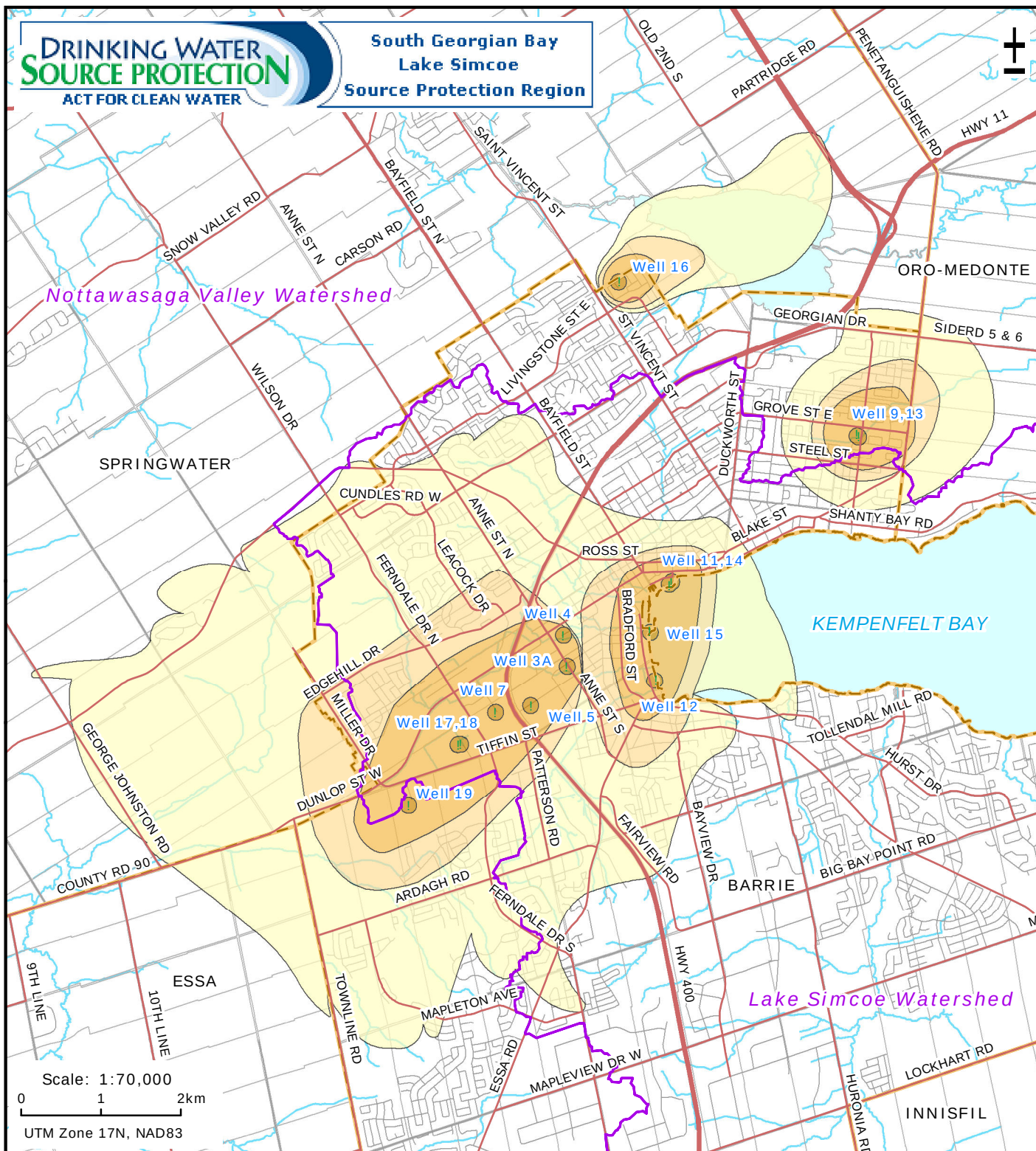


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Ontario

Figure 9-1



- Municipal Supply Well
- WHPA-A (100m)
- WHPA-B (2-years time of travel)
- WHPA-C (5-years time of travel)
- WHPA-D (25-years time of travel)
- SWP Watershed Area
- Municipality Boundary

City of Barrie
Wellhead Protection Areas

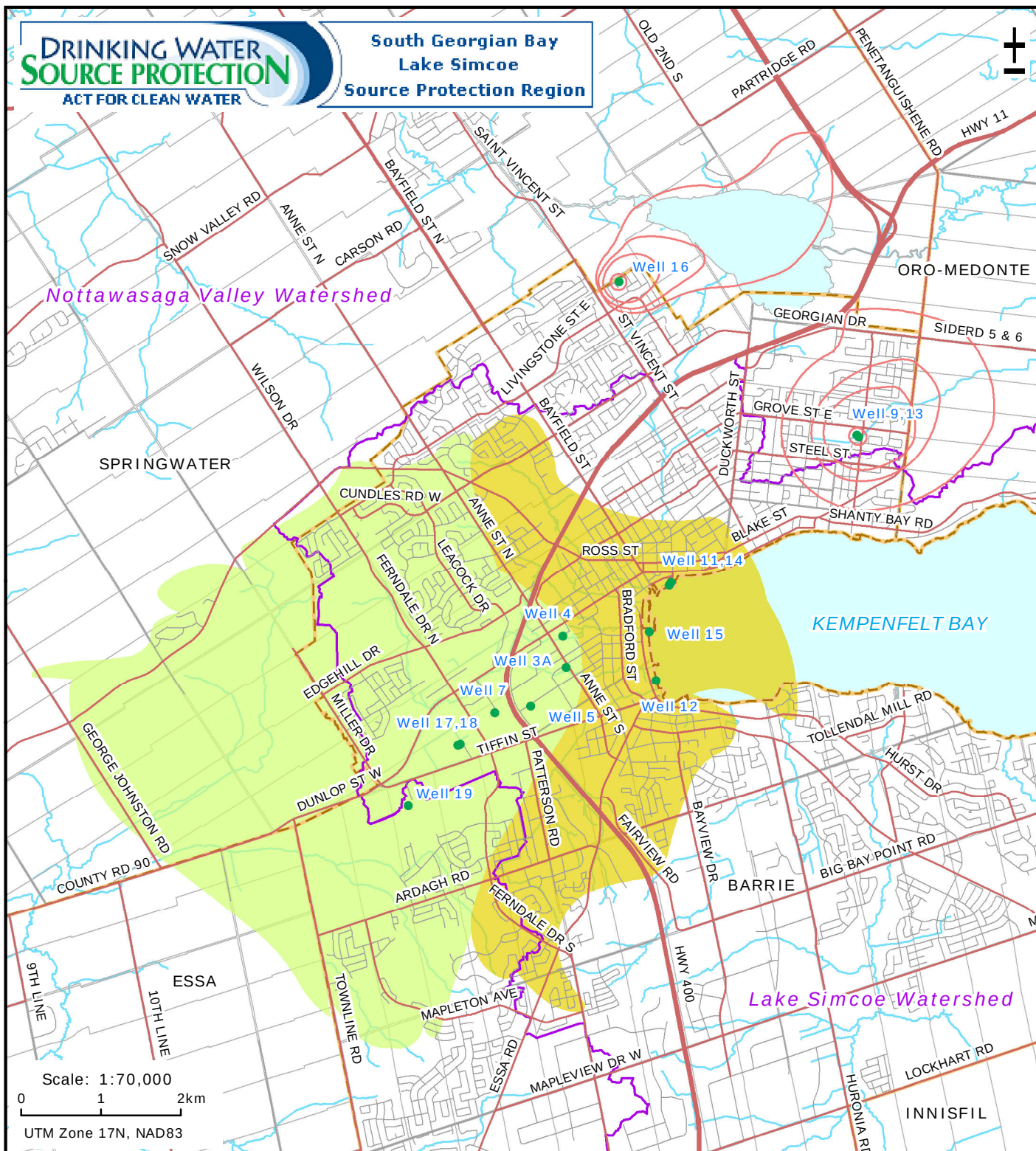
Created by: LSRCA
Date: 2014-04-10



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Figure 9a-1



- ! Municipal Supply Well
- Issue Contributing Area
 - Chloride and Sodium
 - Chloride
- SWP Watershed Area
- Municipality Boundary
- Adjacent Well Field WHPA

**City of Barrie
Drinking Water Issues
Contributing Areas**

Created by: LSRCA
Date: 2014-04-10



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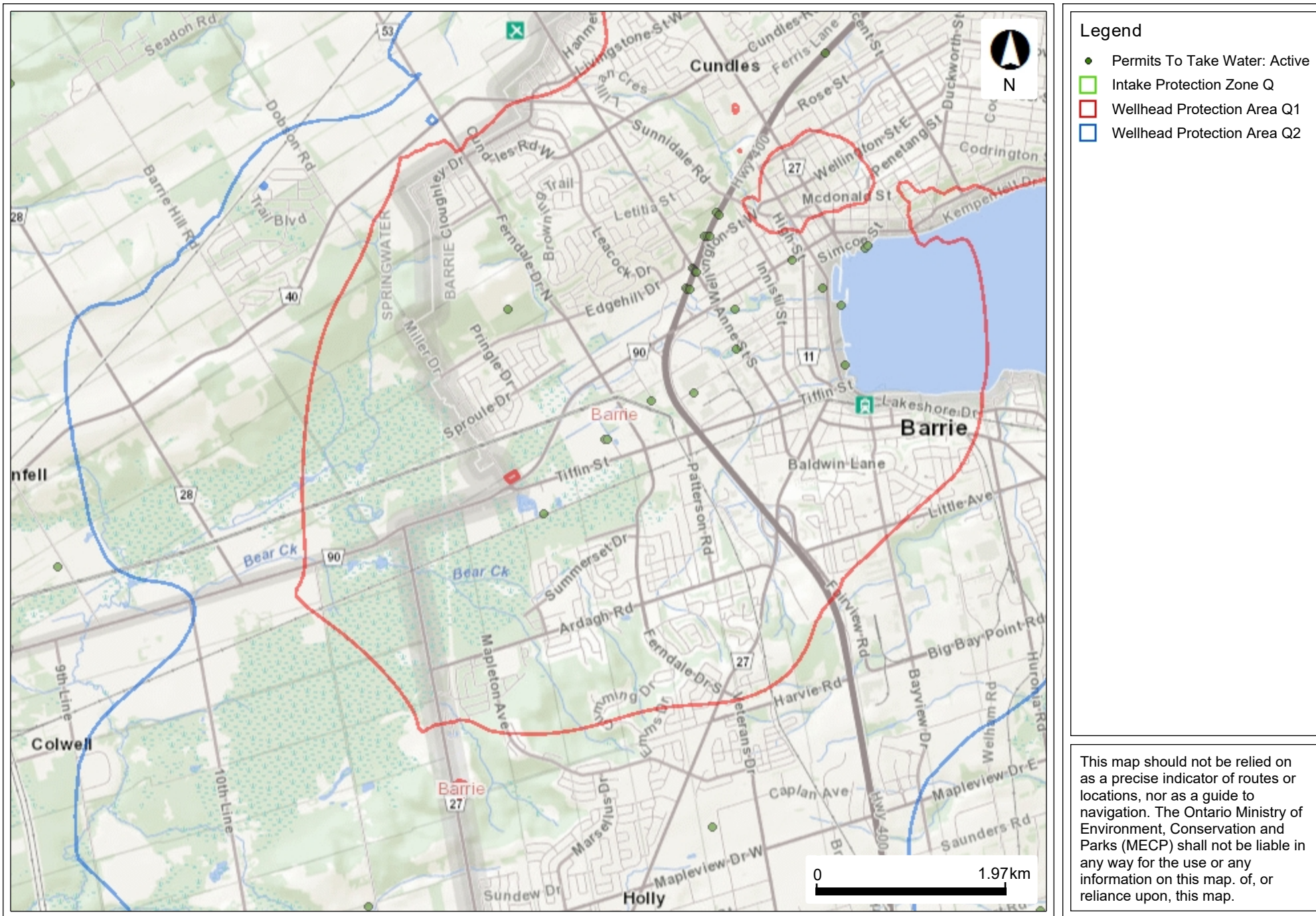


Figure 9a-4

 Source Protection Areas
 Highly Vulnerable Aquifers
 Significant Groundwater Recharge Area
 0
 2
 4
 6
 Intake Protection Zone 1
 Intake Protection Zone 2
 Intake Protection Zone 3
 Assessment Parcel with Address

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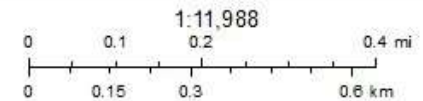
Source Area Protection Mapping



Toporama



March 3, 2022



Natural Resources
Canada

Ressources naturelles
Canada

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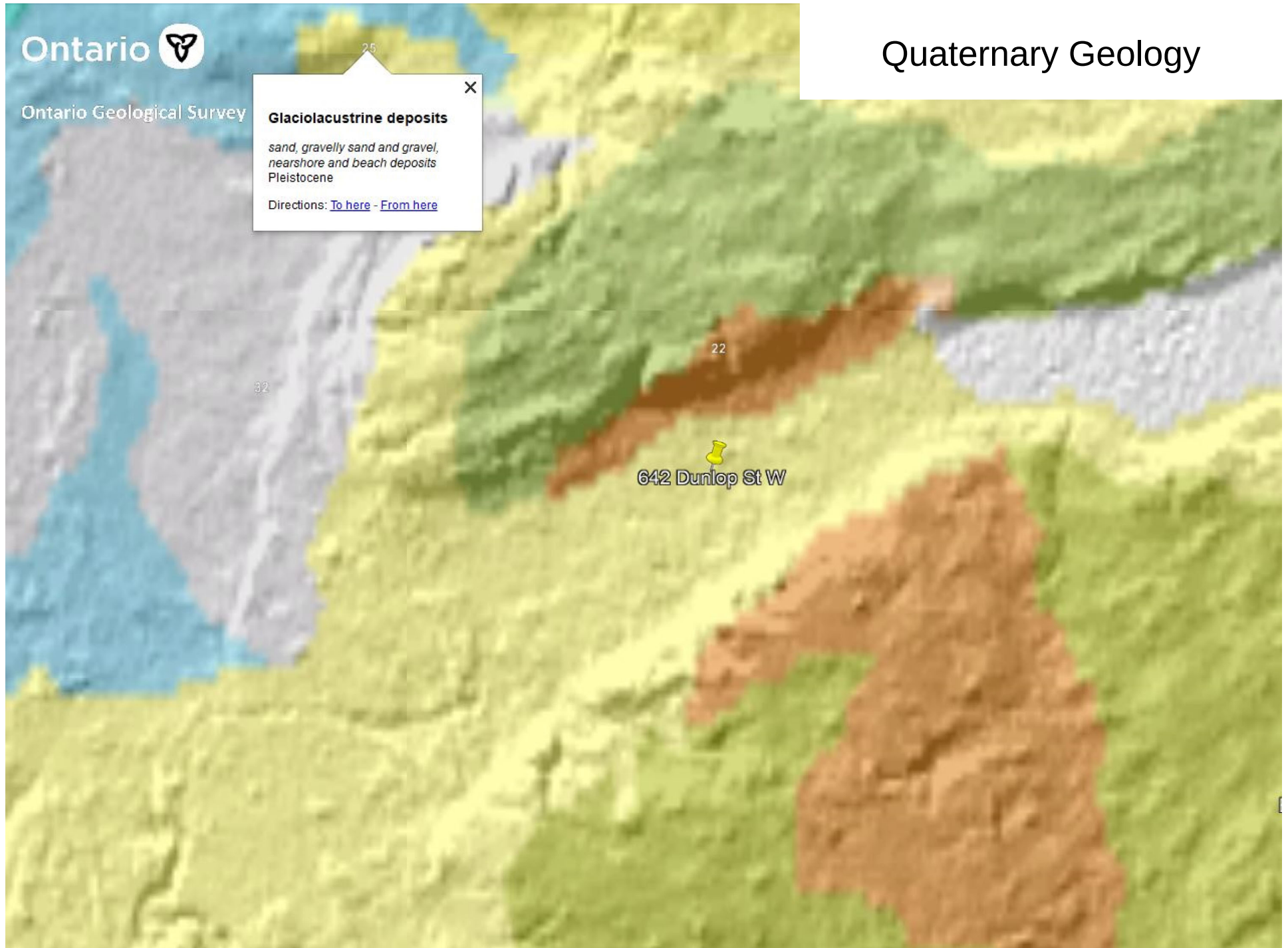
Canada

Glaciolacustrine deposits

*sand, gravelly sand and gravel,
nearshore and beach deposits
Pleistocene*

Directions: [To here](#) - [From here](#)

Quaternary Geology

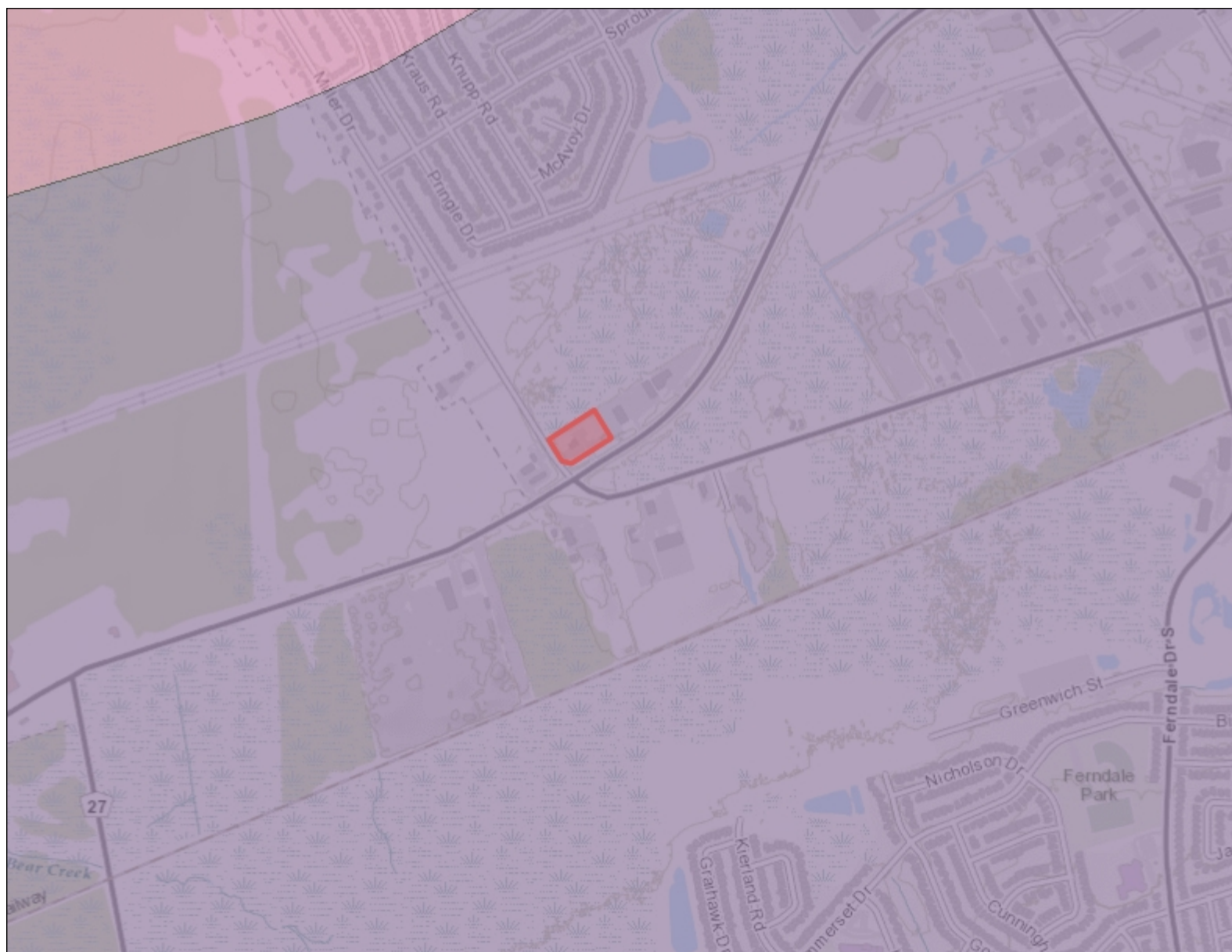


Physiographic Landforms

Legend

Physiographic Regions (OGS)

- Algonquin Highlands
- Beaver Valley
- Carden Plain
- Dummer Moraines
- Dundalk Till Plain
- Flamborough Plain
- Georgian Bay Fringe
- Guelph Drumlin Field
- Hillsburgh Sandhills
- Horseshoe Moraines
- Iroquois Plain
- Napanee Plain
- Niagara Escarpment
- Number 11 Strip
- Oak Ridges Moraine
- Peel Plain
- Peterborough Drumlin Field
- Prince Edward Peninsula
- Schomberg Clay Plains
- Simcoe Lowlands
- Simcoe Uplands
- South Slope
- Haldimand Clay Plain
- Norfolk Sand Plain



0.9 0 0.46 0.9 Km

1: 18,056



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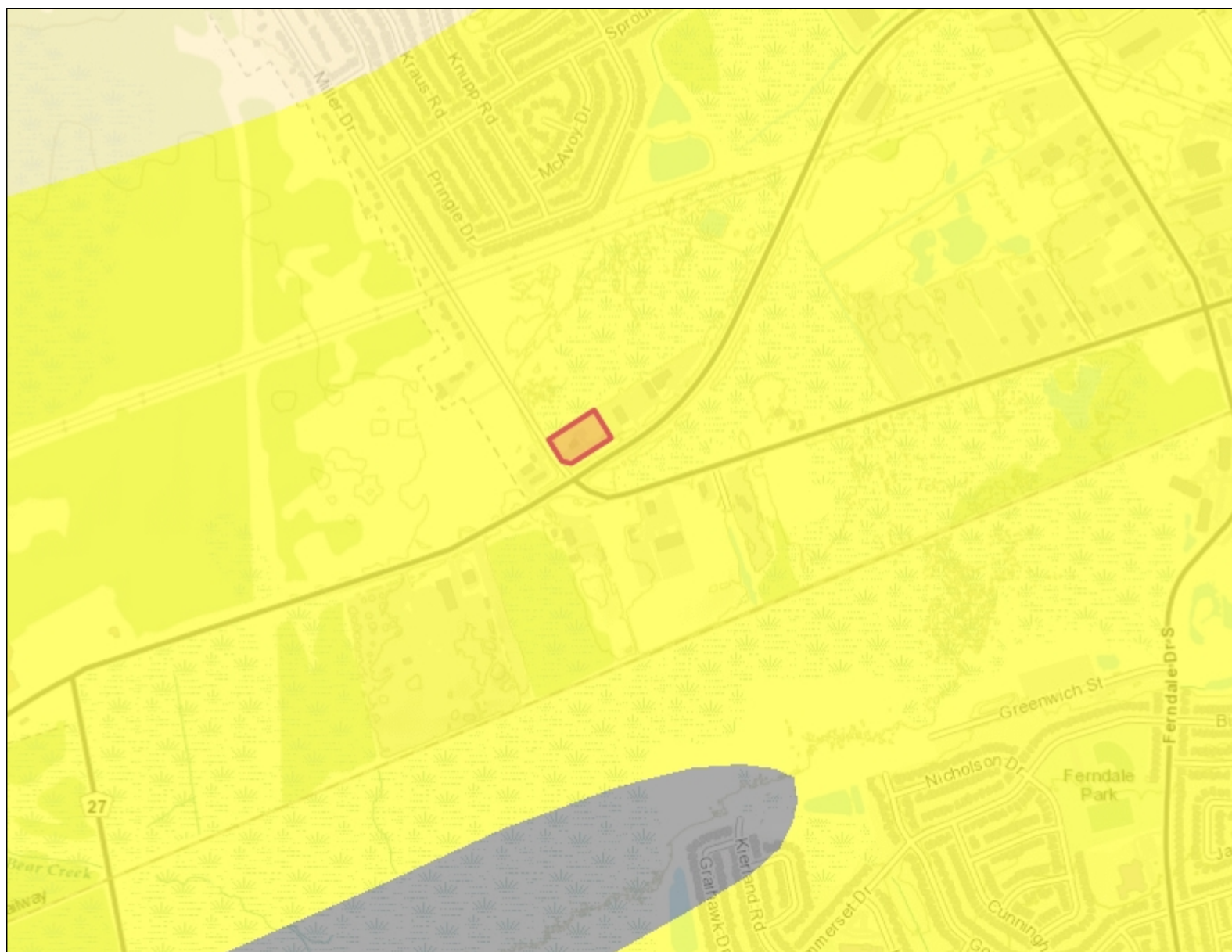
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PROJECTION: WGS_1984_Web_Mercator_Auxiliary_Sphere

DATE PRINTED: March 9, 2022

Physiographic Regions



Legend

Physiography (OGS)

- Bare Rock Ridges And Shallow Till
- Beaches
- Bevelled Till Plains
- Clay Plains
- Drumlins
- Escarpments
- Eskers
- Kame Moraines
- Limestone Plains
- Peat And Muck
- Sand Plains
- Shale Plains
- Shallow Till And Rock Ridges
- Spillways
- Till Moraines
- Till Plains (Drumlinized)
- Till Plains (Undrumlinized)



0.9 0 0.46 0.9 Km

1: 18,056

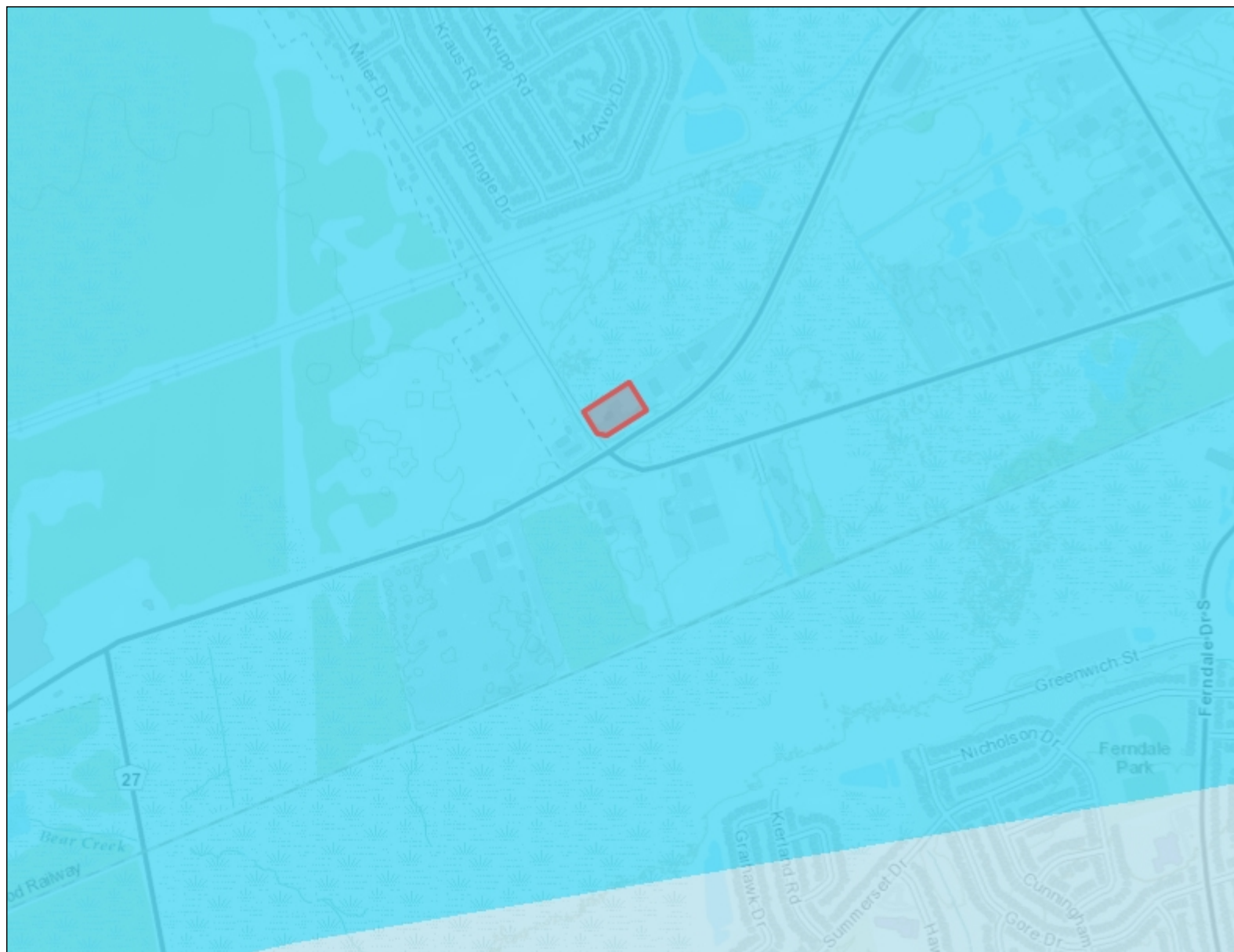


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uxiliary_Sphere
DATE PRINTED: March 9, 2022

Bedrock Geology



Legend

- ORMGP Boundary
- ORM Plan Boundary
- Niagara Escarpment Plan Boundary
- Bedrock Geology (OGS)**
- 1: Precambrian
- 7: Shadow Lake
- 8: Gull River
- 9: Bobcaygeon
- 10: Verulam
- 11: Lindsay
- 12: Blue Mountain
- 14: Georgian Bay
- 16: Queenston
- 17: Clinton-Cataract Group
- 18: Lockport
- 19: Amabel
- 20: Guelph



0.9 0 0.46 0.9 Km

1: 18,056



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PROJECTION: WGS_1984_Web_Mercator_Auxiliary_Sphere

DATE PRINTED: March 3, 2022

APPENDIX B

MECP Well Records Summary										
WELL ID	MECP* WWR ID	Construction Method	Well Depth (m)**	Well Usage		Water Found (mbgs)**	Static Water Level (mbgs)**	Top of Screen Depth (mbgs)**	Bottom of Screen Depth (mbgs)**	Date Completed
				Final Status	First Use					
1	5704843	Cable Tool	20.4	Water Supply	Domestic	18.3	1.8	18.9	20.4	May 6, 1959
2	5704844	Cable Tool	75.3	Water Supply	Domestic	67.7	6.1			October 21, 1964
3	5704866	Cable Tool	29.0	Water Supply	Domestic	29.0	2.7	27.5	29.0	September 18, 1958
4	5704867	Boring	4.3	Water Supply	Domestic	1.8	1.8			June 2, 1967
5	5709133	Cable Tool	34.1	Water Supply	Commercial		2.1	24.7	27.1	April 21, 1972
6	5711998	Boring	7.0	Water Supply	Domestic	4.0	4.0			July 5, 1974
7	5714854	Rotary (Convent.)	110.0	Observation Wells	Not Used		10.1	100.7	103.7	November 4, 1977
8	5714855	Rotary (Convent.)	108.8	Observation Wells	Not Used			95.8	102.5	November 11, 1977
9	5716164	Cable Tool	22.6	Water Supply	Commercial	20.4	3.1	21.7	22.6	July 12, 1979
10	5716689	Rotary (Convent.)	79.9	Water Supply	Industrial	75.6	9.8			June 8, 1979
11	5718060	Cable Tool	25.3	Water Supply	Domestic	22.3	22.3	25.3	26.2	April 23, 1982
12	5718624	Cable Tool	15.2	Water Supply	Commercial	5.8	2.4	12.5	13.4	August 3, 1983
13	5718988	Cable Tool	19.8	Water Supply	Domestic	16.5	4.0	18.3	19.8	January 26, 1984
14	5719487	Cable Tool	12.2	Water Supply	Domestic	12.2	1.8	10.4	11.3	November 7, 1984
15	5728600	Rotary (Convent.)	73.2	Water Supply	Domestic	72.3	10.7	72.3	73.2	October 18, 1991
16	5734829	Rotary (Convent.)	96.3	Water Supply	Test Hole		12.2	83.0	92.1	August 5, 1999
17	5734833	Rotary (Convent.)	99.1	Observation Wells	Municipal		13.7	71.4	77.5	May 11, 1999
18	5734835	Rotary (Convent.)	14.9	Observation Wells	Public		2.4	12.8	14.3	August 16, 1999
19	5739405	Cable Tool	5.5	Water Supply	Domestic	27.8	5.6	29.3	30.5	November 12, 2004
20	5740528	Rotary (Convent.)	91.1	Observation Wells	Not Used		11.7	76.2	85.3	February 10, 2006
21	5741280		26.5	Abandoned-Other	Domestic					September 5, 2006
22	7114203	Rotary (Reverse)	94.4	Water Supply	Municipal	12.0	13.7			December 7, 2007
23	7114205	Rotary (Convent.)	100.9	Test Hole	Test Hole		11.2			February 8, 2008
24	7124628		4.5	Observation Wells	Monitoring			1.5	4.5	April 24, 2009
25	7154757									October 14, 2010
26	7225837	Boring	4.6		Monitoring and Test Hole			2.7	4.3	August 1, 2014
27	7260721	Boring	4.6	Observation Wells	Test Hole	2.1		1.5	4.6	June 25, 2015
28	7286079	Rotary (Convent.)	4.6	Observation Wells	Monitoring	3.7	3.7	3.1	4.6	March 14, 2017

MECP*: Ministry of the Environment, Conservation and Parks

mbgs**: meters below ground surface

APPENDIX C

LOG OF BOREHOLE 1

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : SO
 Date started : January 19, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 1 of 1 Location : Barrie, Ontario Checked by : OB

Position : E: 601037, N: 4913351 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		X Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	235.5	GROUND SURFACE													
	235.3	180mm ASPHALT		1	SS	50 / 125mm									
	235.2	130mm GRANULAR FILL													
	235.2	PEAT, loose, black, moist													
1	234.4			2	SS	6									
	1.1	SAND, trace silt, trace clay, trace gravel, very loose to loose, brown, moist to wet													
		...at 1.5 m, wet below													
2				3	SS	1									
				4	SS	0									
3				5	SS	10									
		...at 3.4 m, compact													
4				6	SS	7									
5		...at 5.0 m, loose													
6				7	SS	14									
		...at 6.5 m, compact													
7															
		...at 7.5 m, dense, trace gravel													
8	227.4			8	SS	41									
	8.1														

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS
 Date Feb 1, 2022 Water Depth (m) Elevation (m)
 n/a

LOG OF BOREHOLE 2

Originated by : CB

Compiled by : GO

Checked by : OB

Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Description	Graphic Log	Number	Type	SPT 'N' Value	Dynamic Cone		Natural Water Content							
						10		20	30	40	PL	MC			
	Elev Depth (m)														
0	234.5	GROUND SURFACE													
	234.3	150mm TOPSOIL													
	0.2	FILL, sand/peat mix, some gravel, loose, black, moist		1	SS	4									
	233.9														
	0.6	PEAT, sand seam, very loose, black, moist		2	SS	2							59		
1	233.3														
	1.2	SAND, trace silt, trace clay, trace gravel, very loose, brown, moist to wet ...at 1.5 m, wet below													
</															

(continued next page)

LOG OF BOREHOLE 2

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : CB
 Date started : January 20, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 2 of 2 Location : Barrie, Ontario Checked by : OB

Position : E: 601094, N: 4913399 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value			Plastic Limit	Natural Water Content	Liquid Limit			
		(continued)						X Dynamic Cone 10 20 30 40 Undrained Shear Strength (kPa) O Unconfined + Field Vane ● Pocket Penetrometer ■ Lab Vane 40 80 120 160	PL MC LL 10 20 30					
	221.9	SAND, trace silt, trace clay, trace gravel, very loose, brown, moist to wet (continued)					224							
11		...at 11.0 m, compact		10	SS	18								
12							223							
	221.9			11	SS	31	222							
	12.6													

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS
 Date Feb 1, 2022 Water Depth (m) 1.7 Elevation (m) 232.8

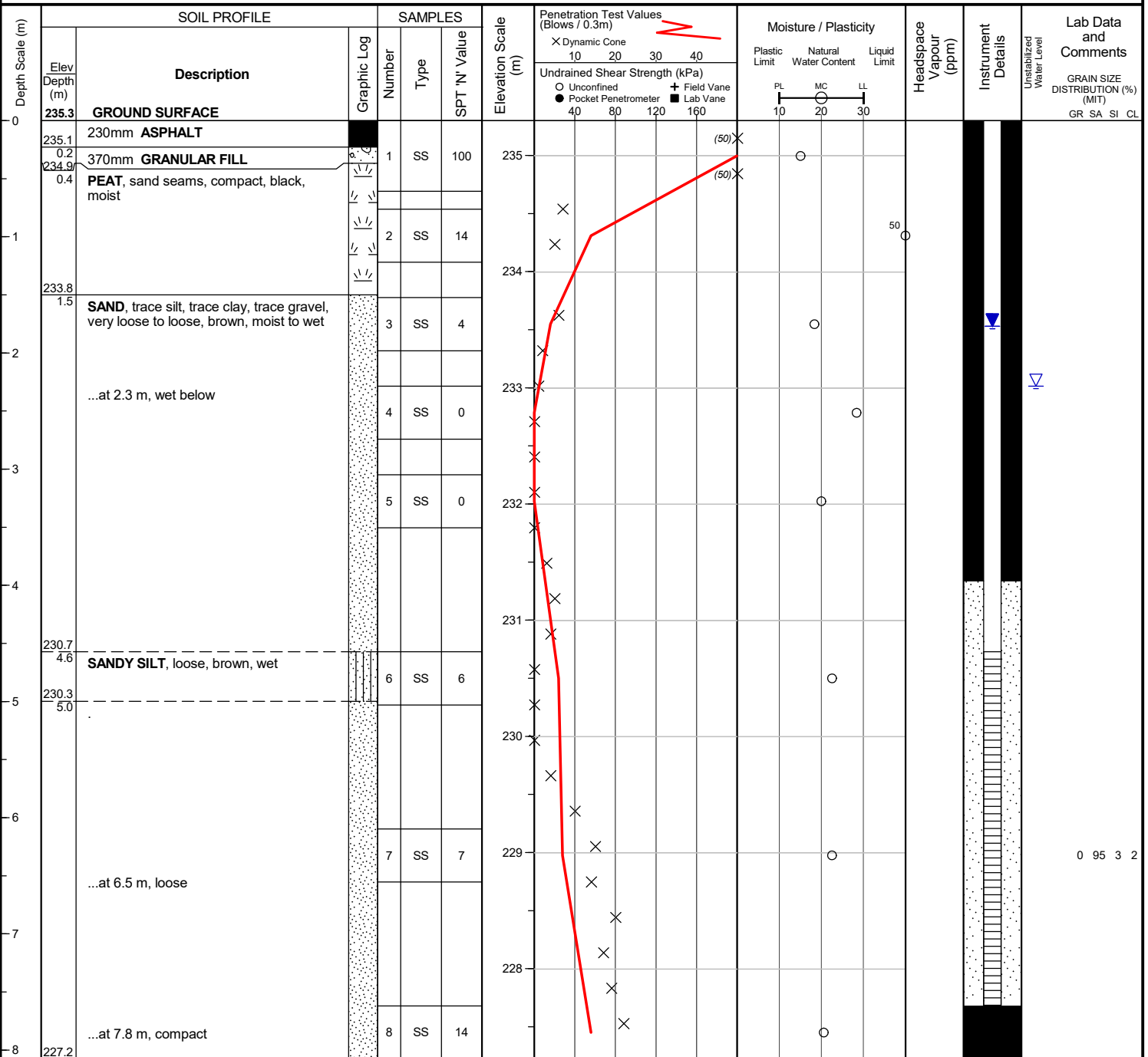
LOG OF BOREHOLE 3

Originated by : CB

Compiled by : GO

Checked by : OB

Drilling Method : Hollow stem augers



WATER LEVEL READINGS		
<u>Date</u>	<u>Water Depth (m)</u>	<u>Elevation (m)</u>
Feb 1, 2022	1.8	233.5

LOG OF BOREHOLE 4

Project No. : 3-21-0182-01

Client : 25707517 Ontario Inc.

Originated by : SO

Date started : January 19, 2022

Project : 642 Dunlop Street West

Compiled by : GO

Sheet No. : 1 of 2

Location : Barrie, Ontario

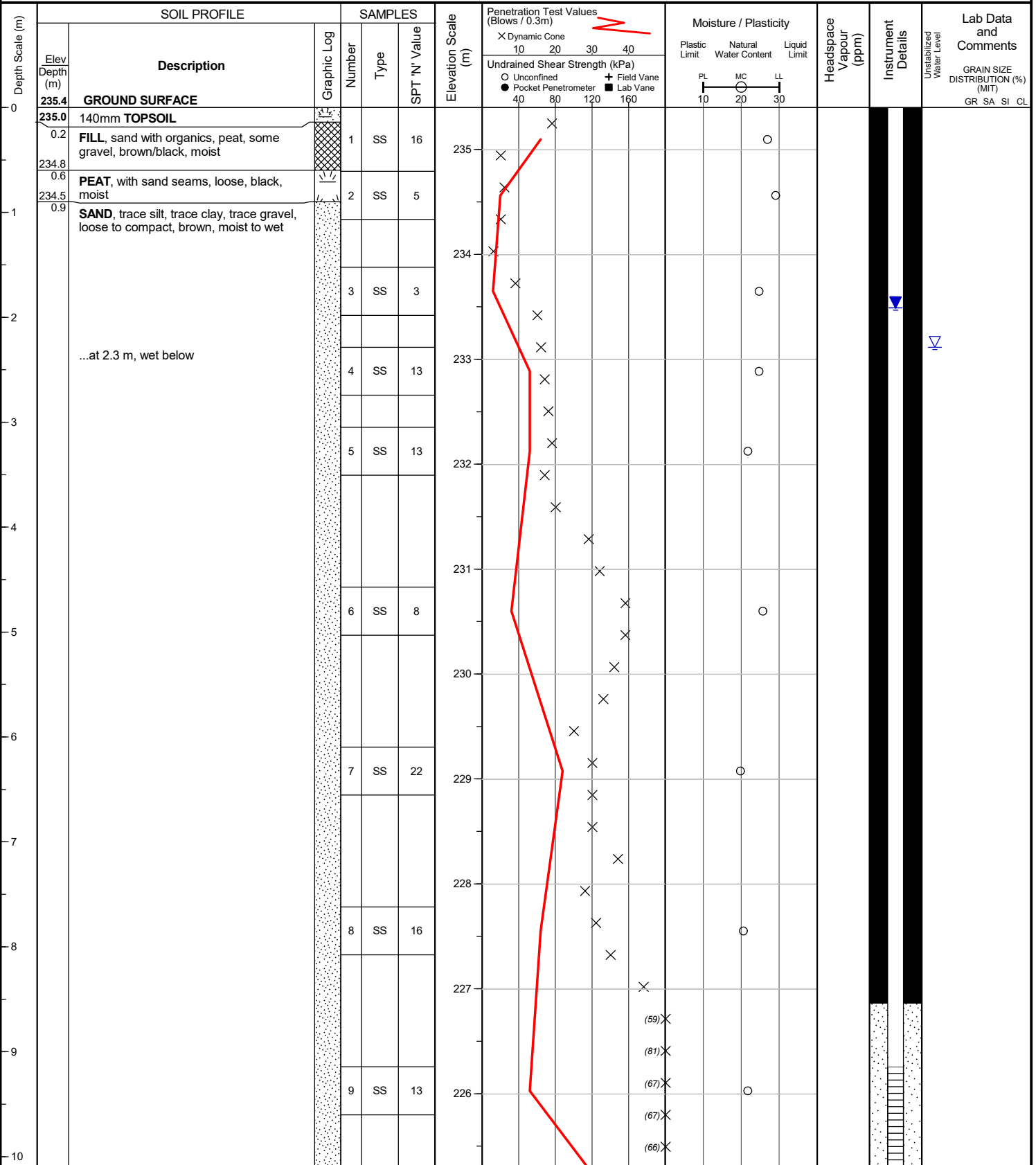
Checked by : OB

Position : E: 601049, N: 4913340 (UTM 17T)

Elevation Datum : Geodetic

Rig type : Track-mounted

Drilling Method : Hollow stem augers



(continued next page)

LOG OF BOREHOLE 4

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : SO
 Date started : January 19, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 2 of 2 Location : Barrie, Ontario Checked by : OB

Position : E: 601049, N: 4913340 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
		(continued)						10 20 30 40	40 80 120 160	PL MC LL	10 20 30				
		SAND, trace silt, trace clay, trace gravel, loose to compact, brown, moist to wet (continued)													
11		...at 10.8 m, dense		10	SS	46	225		(60)X						
									(68)X						
							224		(53)X						
									(56)X						
12									(52)X						
									(50)X						
	222.8 12.6			11	SS	11	223		X						disturbed sample

END OF BOREHOLE

Unstabilized water level measured at 2.3 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS
 Date Feb 1, 2022 Water Depth (m) 1.9 Elevation (m) 233.5

LOG OF BOREHOLE 5

Project No. : 3-21-0182-01

Client : 25707517 Ontario Inc.

Originated by : CB

Date started : January 19, 2022

Project : 642 Dunlop Street West

Compiled by : GO

Sheet No. : 1 of 1

Location : Barrie, Ontario

Checked by : OB

Position : E: 601106, N: 4913377 (UTM 17T)

Elevation Datum : Geodetic

Rig type : Track-mounted

Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone 10 20 30 40	Undrained Shear Strength (kPa) 40 80 120 160	Plastic Limit 10 20 30	Natural Water Content MC	Liquid Limit LL			
0	235.2	GROUND SURFACE													
0.2	235.0	130mm ASPHALT		1	SS	26	235						85		
		170mm GRANULAR FILL													
		PEAT, with silt, sand seams, loose, black, moist													
0.8	234.4	SAND, trace silt, trace clay, trace gravel, very loose to compact, brown, moist to wet		2	SS	7	234								
		...at 1.5 m, wet below													
				3	SS	0									
				4	SS	0									
				5	SS	16									
				6	SS	26									
				7	SS	9									
				8	SS	14									
8.1	227.1	END OF BOREHOLE													

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS
Date Feb 1, 2022 Water Depth (m) 1.5 Elevation (m) 233.7

LOG OF BOREHOLE 6

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : CB
 Date started : January 18, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 1 of 1 Location : Barrie, Ontario Checked by : OB

Position : E: 601031, N: 4913349 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		X Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	235.7	GROUND SURFACE													
	235.5	230mm ASPHALT		1	SS	17							86		
	235.5	250mm GRANULAR FILL													
	235.5	PEAT, compact, black, moist		2	SS	10							132		
	234.5														
	234.5	SAND, trace silt, trace clay, trace gravel, trace organics, very loose, brown, moist to wet		3	SS	2									
	233.9														
	1.8														

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface; borehole was open upon completion of drilling.

LOG OF BOREHOLE 7

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : CB
 Date started : January 18, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 1 of 1 Location : Barrie, Ontario Checked by : OB

Position : E: 601084, N: 4913397 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	234.3	GROUND SURFACE													
	234.1	150mm TOPSOIL													
	0.2	FILL, peat/ sandy silt, some gravel, compact, black, moist		1	SS	22	234								
	233.7	PEAT, sand seams,, very loose, black, wet		2	SS	2									
	0.6														
	232.9	SAND, trace silt, trace clay, trace gravel, trace organics, loose, brown, moist		3	SS	7	233								
	1.4														
	232.5														
	1.8														

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 8

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : CB
 Date started : January 18, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 1 of 1 Location : Barrie, Ontario Checked by : OB

Position : E: 601115, N: 4913390 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value			Plastic Limit	Natural Water Content	Liquid Limit			
0	235.1	GROUND SURFACE					235	10 20 30 40						
	234.9	230mm ASPHALT		1	SS	4								
	0.2	FILL, organics/peat, some gravel, sand, loose, black/brown, moist												
	234.5	PEAT, sand seams, loose, black, moist												
	0.6													
	234.3	SAND, trace silt, trace clay, trace gravel, some organics, loose, brown, moist		2	SS	5								
	0.8													
1				3	SS	4								
	233.3													
	1.8													

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 9

Project No. : 3-21-0182-01 Client : 25707517 Ontario Inc. Originated by : CB
 Date started : January 18, 2022 Project : 642 Dunlop Street West Compiled by : GO
 Sheet No. : 1 of 1 Location : Barrie, Ontario Checked by : OB

Position : E: 601082, N: 4913416 (UTM 17T) Elevation Datum : Geodetic
 Rig type : Track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)				Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Undrained Shear Strength (kPa)				Plastic Limit	Natural Water Content	Liquid Limit			
0	234.4	GROUND SURFACE						10	20	30	40						
1																	
2																	
3																	
4																	
5	229.4																

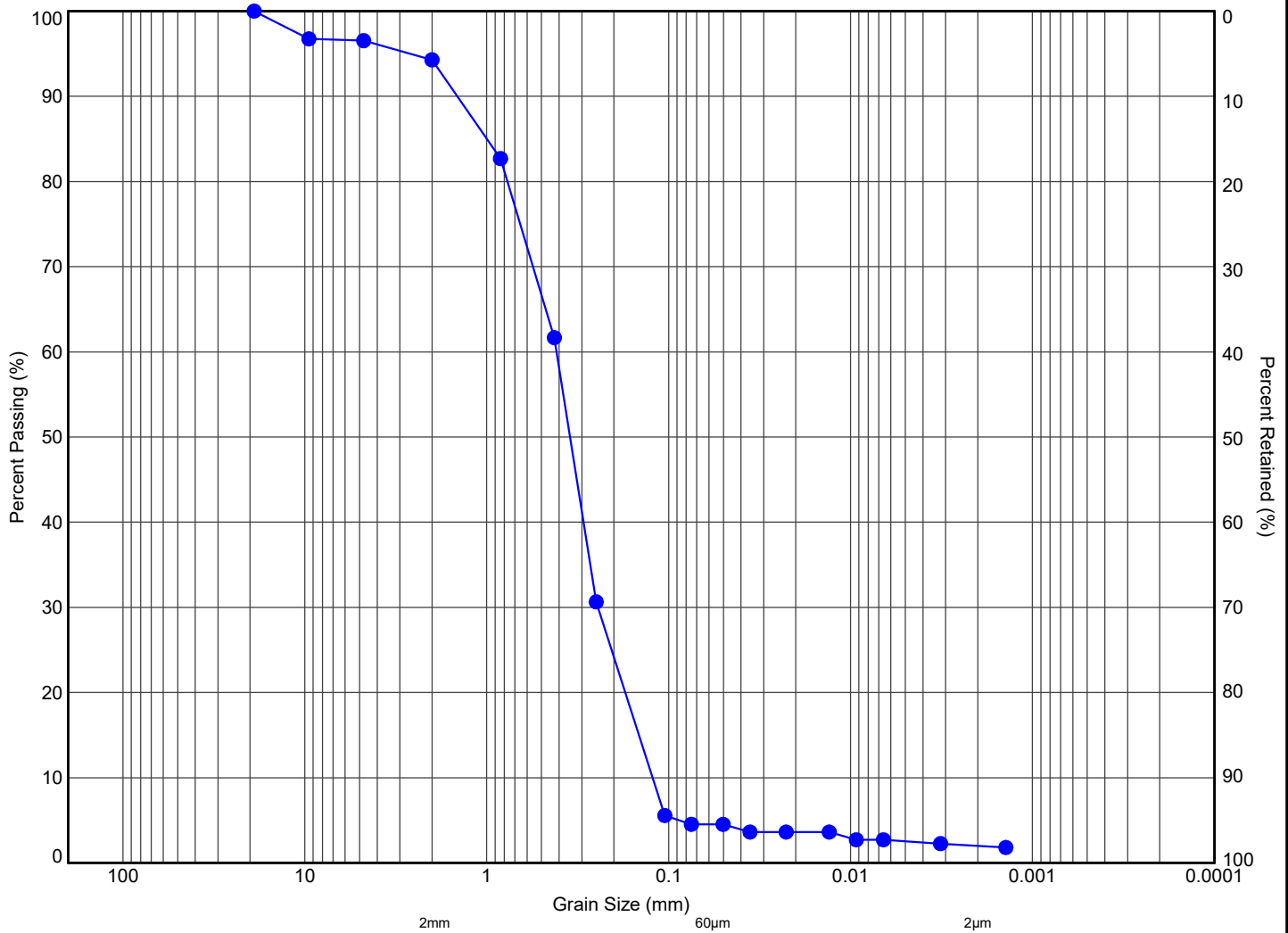
END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS
 Date Feb 1, 2022 Water Depth (m) 1.7 Elevation (m) 232.7

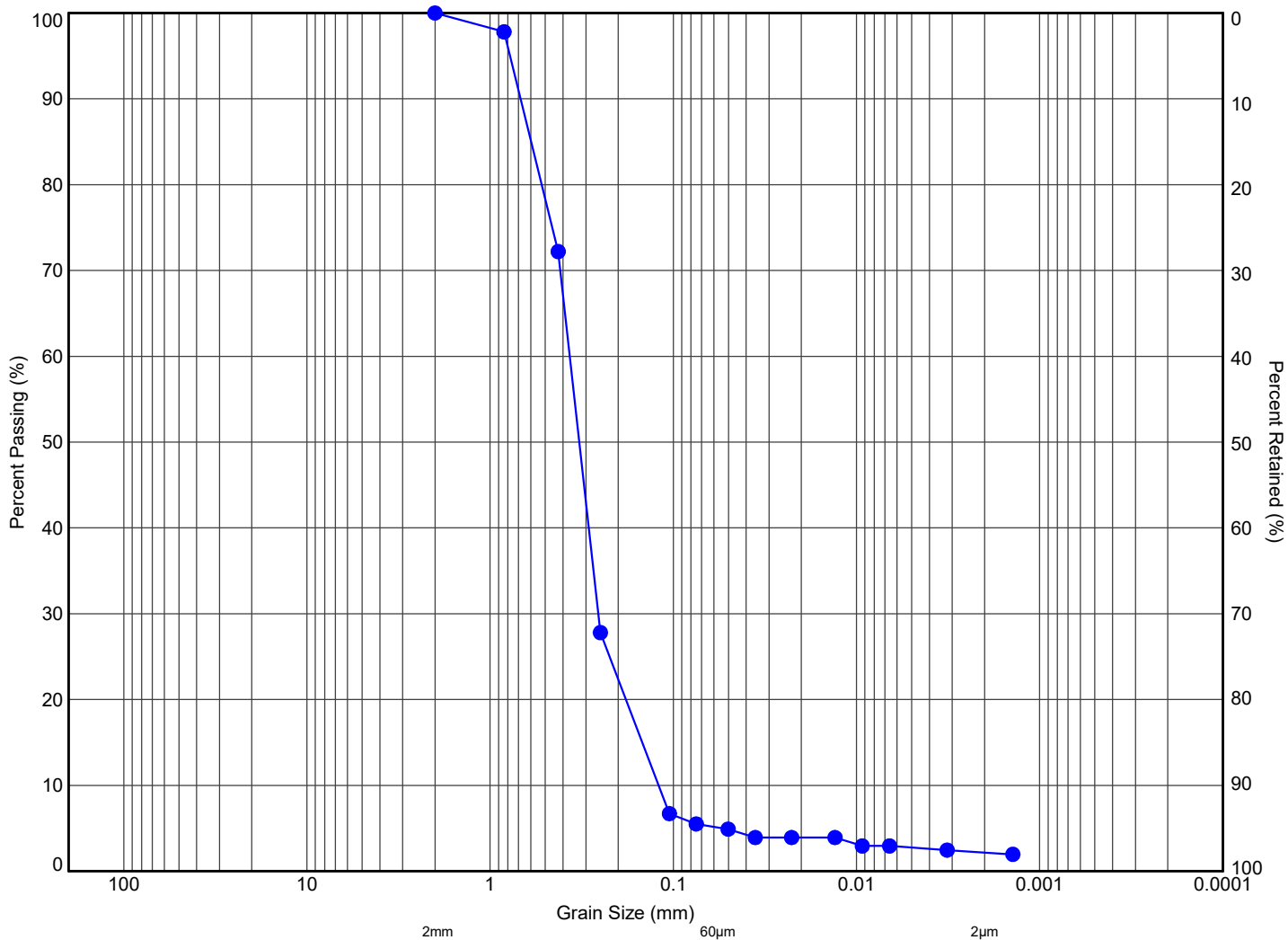
APPENDIX D



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

MIT SYSTEM									
Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	(Fines, %)	
● 1	SS5	3.3	232.2	6	89	3	2		

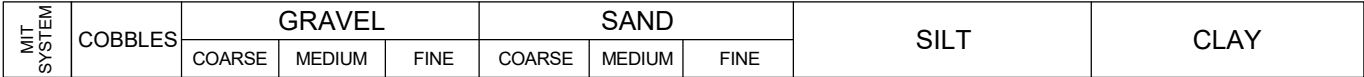
Title:	GRAIN SIZE DISTRIBUTION	
	SAND, TRACE GRAVEL, TRACE SILT, TRACE CLAY	
File No.:	3-21-0182-01	



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

MIT SYSTEM									
Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	(Fines, %)	
● 3	SS7	6.3	229.0	0	95	3	2		

Title:	GRAIN SIZE DISTRIBUTION	
	SAND, TRACE SILT, TRACE CLAY	
File No.:	3-21-0182-01	

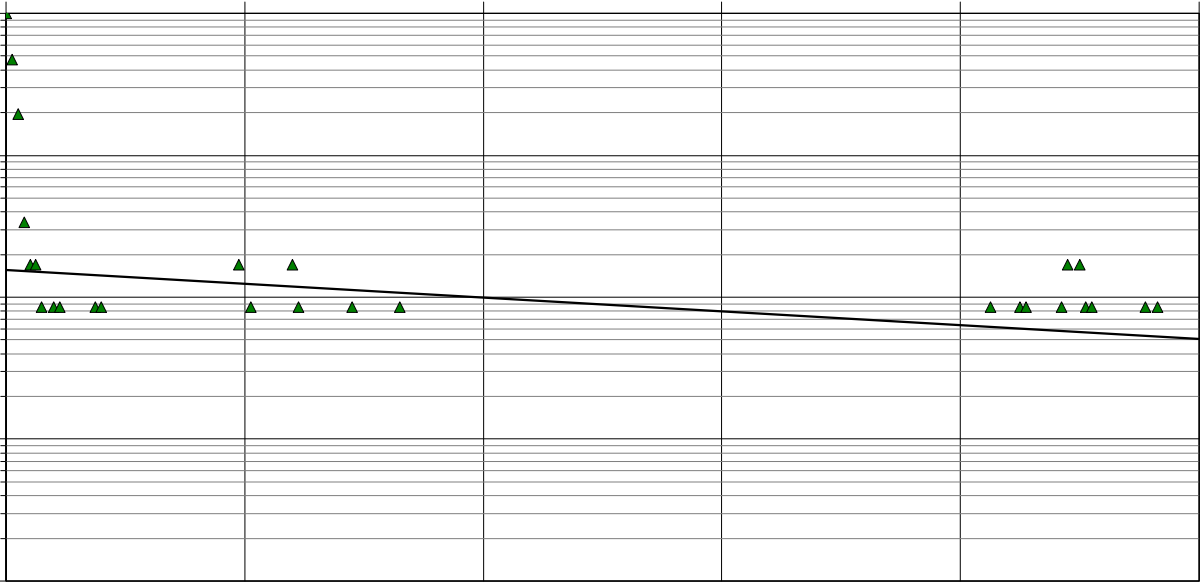


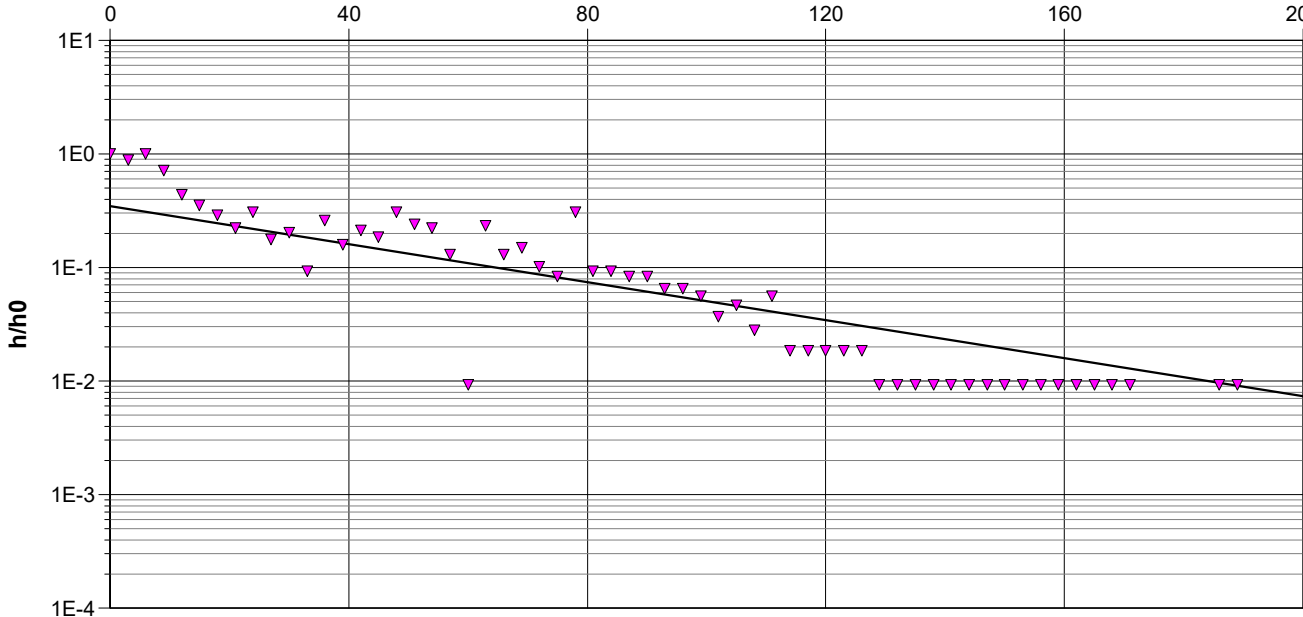
	Title: GRAIN SIZE DISTRIBUTION SAND, TRACE GRAVEL, TRACE SILT, TRACE CLAY
	File No.: 3-21-0182-01

APPENDIX E

			Slug Test Analysis Report																																														
			Project: 642 Dunlop Street West																																														
			Number: 3-21-0182-46																																														
			Client: 25707517 Ontario Inc.																																														
Location: Barrie, ON		Slug Test: BH 2		Test Well: BH 2																																													
Test Conducted by: CB				Test Date: 2022-02-01																																													
Analysis Performed by: UA		BH 2		Analysis Date: 2022-03-21																																													
Aquifer Thickness: 12.00 m																																																	
Time [s] <table border="1"><caption>Approximate data points from the h/h0 vs Time plot</caption><thead><tr><th>Time [s]</th><th>h/h0</th></tr></thead><tbody><tr><td>0</td><td>1.0</td></tr><tr><td>10</td><td>0.7</td></tr><tr><td>20</td><td>0.3</td></tr><tr><td>30</td><td>0.7</td></tr><tr><td>40</td><td>0.5</td></tr><tr><td>50</td><td>0.5</td></tr><tr><td>60</td><td>0.15</td></tr><tr><td>70</td><td>0.15</td></tr><tr><td>80</td><td>0.1</td></tr><tr><td>90</td><td>0.025</td></tr><tr><td>100</td><td>0.007</td></tr><tr><td>110</td><td>0.001</td></tr><tr><td>120</td><td>0.001</td></tr><tr><td>130</td><td>0.0005</td></tr><tr><td>140</td><td>0.0012</td></tr><tr><td>150</td><td>0.0015</td></tr><tr><td>160</td><td>0.0025</td></tr><tr><td>170</td><td>0.002</td></tr><tr><td>180</td><td>0.003</td></tr><tr><td>190</td><td>0.0025</td></tr><tr><td>200</td><td>0.002</td></tr></tbody></table>						Time [s]	h/h0	0	1.0	10	0.7	20	0.3	30	0.7	40	0.5	50	0.5	60	0.15	70	0.15	80	0.1	90	0.025	100	0.007	110	0.001	120	0.001	130	0.0005	140	0.0012	150	0.0015	160	0.0025	170	0.002	180	0.003	190	0.0025	200	0.002
Time [s]	h/h0																																																
0	1.0																																																
10	0.7																																																
20	0.3																																																
30	0.7																																																
40	0.5																																																
50	0.5																																																
60	0.15																																																
70	0.15																																																
80	0.1																																																
90	0.025																																																
100	0.007																																																
110	0.001																																																
120	0.001																																																
130	0.0005																																																
140	0.0012																																																
150	0.0015																																																
160	0.0025																																																
170	0.002																																																
180	0.003																																																
190	0.0025																																																
200	0.002																																																
Calculation using Bouwer & Rice																																																	
Observation Well		Hydraulic Conductivity [m/s]																																															
BH 2		4.08×10^{-6}																																															

			Slug Test Analysis Report		
			Project: 642 Dunlop Street West		
			Number: 3-21-0182-46		
			Client: 25707517 Ontario Inc.		
Location: Barrie, ON		Slug Test: BH 3		Test Well: BH 3	
Test Conducted by: CB				Test Date: 2022-02-01	
Analysis Performed by: UA		BH 3		Analysis Date: 2022-03-21	
Aquifer Thickness: 12.00 m					
Time [s] h/h0					
Calculation using Bouwer & Rice					
Observation Well		Hydraulic Conductivity [m/s]			
BH 3		5.75 × 10 ⁻⁶			

		Slug Test Analysis Report			
		Project: 642 Dunlop Street West			
		Number: 3-21-0182-46			
		Client: 25707517 Ontario Inc.			
Location: Barrie, ON		Slug Test: BH 4		Test Well: BH 4	
Test Conducted by: CB				Test Date: 2022-01-01	
Analysis Performed by: UA			BH 4		Analysis Date: 2022-03-21
Aquifer Thickness: 12.00 m					
Time [s] h/h₀ 0 40 80 120 160 200 1E0 1E-1 1E-2 1E-3 1E-4 					
Calculation using Bouwer & Rice					
Observation Well		Hydraulic Conductivity [m/s]			
BH 4		2.19 × 10 ⁻⁶			

			Slug Test Analysis Report		
			Project: 642 Dunlop Street West		
			Number: 3-21-0182-46		
			Client: 25707517 Ontario Inc.		
Location: Barrie, ON		Slug Test: BH 5		Test Well: BH 5	
Test Conducted by:				Test Date: 2022-03-21	
Analysis Performed by: UA		BH 5		Analysis Date: 2022-03-21	
Aquifer Thickness: 12.00 m					
Time [s] 					
Calculation using Bouwer & Rice					
Observation Well		Hydraulic Conductivity [m/s]			
BH 5		6.05 × 10 ⁻⁶			

APPENDIX F

CLIENT NAME: TERRAPROBE INC.
220 BAYVIEW DRIVE, UNIT 25
BARRIE, ON L4N4Y8
(705) 739-8355

ATTENTION TO: Justin Rumneey

PROJECT: 3-21-0182-46

AGAT WORK ORDER: 22T859620

WATER ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

DATE REPORTED: Feb 08, 2022

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 22T859620

PROJECT: 3-21-0182-46

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: TERRAPROBE INC.

SAMPLING SITE:Barrie

ATTENTION TO: Justin Rumneey

SAMPLED BY:Justin Rumney

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2022-02-02

DATE REPORTED: 2022-02-08

		SAMPLE DESCRIPTION:		BH2
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2022-01-02 12:40
Parameter	Unit	G / S	RDL	3474015
Electrical Conductivity	µS/cm		2	979
pH	pH Units	6.5-8.5	NA	7.87
Saturation pH (Calculated)				6.86
Langelier Index (Calculated)				1.01
Hardness (as CaCO3) (Calculated)	mg/L		0.5	349
Total Dissolved Solids	mg/L		10	564
Alkalinity (as CaCO3)	mg/L		5	307
Bicarbonate (as CaCO3)	mg/L		5	307
Carbonate (as CaCO3)	mg/L		5	<5
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L		0.12	108
Nitrate as N	mg/L		0.05	0.80
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L		0.10	51.0
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	<0.02
Ammonia-Un-ionized (Calculated)	mg/L	0.02	0.000002	<0.000002
Total Phosphorus	mg/L	*	0.02	0.08
Total Organic Carbon	mg/L		0.5	15.9
True Colour	TCU		5	24
Turbidity	NTU		0.5	13.2
Total Calcium	mg/L		0.32	120
Total Magnesium	mg/L		0.34	12.0
Total Potassium	mg/L		1.15	2.15
Total Sodium	mg/L		0.45	59.1
Aluminum-dissolved	mg/L	*	0.004	0.010
Total Antimony	mg/L	0.020	0.001	<0.001

Certified By:

José Verástegui



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 22T859620

PROJECT: 3-21-0182-46

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CLIENT NAME: TERRAPROBE INC.

SAMPLING SITE:Barrie

ATTENTION TO: Justin Rumneey

SAMPLED BY:Justin Rumney

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2022-02-02

DATE REPORTED: 2022-02-08

		SAMPLE DESCRIPTION:		BH2
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2022-01-02 12:40
Parameter	Unit	G / S	RDL	3474015
Total Arsenic	mg/L	0.1	0.003	<0.003
Total Barium	mg/L		0.002	0.083
Total Beryllium	mg/L	*	0.001	<0.001
Total Boron	mg/L	0.2	0.010	0.031
Total Cadmium	mg/L	0.0002	0.0001	<0.0001
Total Chromium	mg/L		0.003	<0.003
Total Cobalt	mg/L	0.0009	0.0005	0.0006
Total Copper	mg/L	0.005	0.001	0.005
Total Iron	mg/L	0.3	0.010	1.48
Total Lead	mg/L	*	0.001	0.001
Total Manganese	mg/L		0.002	0.145
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001
Total Molybdenum	mg/L	0.040	0.002	0.008
Total Nickel	mg/L	0.025	0.003	<0.003
Total Selenium	mg/L	0.1	0.002	<0.002
Total Silver	mg/L	0.0001	0.0001	<0.0001
Total Strontium	mg/L		0.005	0.257
Total Thallium	mg/L	0.0003	0.0003	<0.0003
Total Tin	mg/L		0.002	0.005
Total Titanium	mg/L		0.010	0.036
Total Tungsten	mg/L	0.030	0.010	<0.010
Total Uranium	mg/L	0.005	0.002	<0.002
Total Vanadium	mg/L	0.006	0.002	0.003
Total Zinc	mg/L	0.030	0.020	<0.020
Total Zirconium	mg/L	0.004	0.004	<0.004
Lab Filtration Aluminum Dissolved				2022/2/4
Lab Filtration mercury				2022/2/4

Certified By:

José Verástegui



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 22T859620

PROJECT: 3-21-0182-46

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CLIENT NAME: TERRAPROBE INC.

SAMPLING SITE: Barrie

ATTENTION TO: Justin Rumney

SAMPLED BY: Justin Rumney

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2022-02-02

DATE REPORTED: 2022-02-08

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
3474015 Dilution required, RDL has been increased accordingly.
Un-ionized Ammonia detection limit is a calculated RDL. The calculation of Un-ionized Ammonia is based on lab measured parameters (ammonia as N, pH and temperature). Values are reported as calculated.
Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Iris Veraistegui



AGAT Laboratories

Exceedance Summary

AGAT WORK ORDER: 22T859620

PROJECT: 3-21-0182-46

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Justin Rumneey

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3474015	BH2	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Iron	mg/L	0.3	1.48

Quality Assurance

CLIENT NAME: TERRAPROBE INC.

PROJECT: 3-21-0182-46

SAMPLING SITE:Barrie

AGAT WORK ORDER: 22T859620

ATTENTION TO: Justin Rumney

SAMPLED BY:Justin Rumney

Water Analysis															
RPT Date: Feb 08, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Water Quality Assessment - PWQO (mg/L)

Electrical Conductivity	3474986		30700	30900	0.6%	< 2	93%	90%	110%						
pH	3474986		7.63	7.67	0.5%	NA	101%	90%	110%						
Total Dissolved Solids	3474015	3474015	564	588	4.2%	< 10	102%	80%	120%						
Alkalinity (as CaCO ₃)	3474986		143	146	2.1%	< 5	99%	80%	120%						
Bicarbonate (as CaCO ₃)	3474986		143	146	2.1%	< 5	NA								
Carbonate (as CaCO ₃)	3474986		<5	<5	NA	< 5	NA								
Hydroxide (as CaCO ₃)	3474986		<5	<5	NA	< 5	NA								
Fluoride	3474015	3474015	<0.05	<0.05	NA	< 0.05	109%	70%	130%	106%	80%	120%	99%	70%	130%
Chloride	3474015	3474015	108	100	7.7%	< 0.10	91%	70%	130%	108%	80%	120%	103%	70%	130%
Nitrate as N	3474015	3474015	0.80	0.77	3.8%	< 0.05	96%	70%	130%	106%	80%	120%	104%	70%	130%
Nitrite as N	3474015	3474015	<0.05	<0.05	NA	< 0.05	93%	70%	130%	92%	80%	120%	98%	70%	130%
Bromide	3474015	3474015	<0.05	<0.05	NA	< 0.05	101%	70%	130%	109%	80%	120%	106%	70%	130%
Sulphate	3474015	3474015	51.0	48.0	6.1%	< 0.10	98%	70%	130%	106%	80%	120%	104%	70%	130%
Ortho Phosphate as P	3474015	3474015	<0.10	<0.10	NA	< 0.10	92%	70%	130%	99%	80%	120%	98%	70%	130%
Ammonia as N	3473280		0.03	0.03	NA	< 0.02	105%	70%	130%	103%	80%	120%	92%	70%	130%
Total Phosphorus	3474015	3474015	0.08	0.08	NA	< 0.02	101%	70%	130%	102%	80%	120%	103%	70%	130%
Total Organic Carbon	3474015	3474015	15.9	16.3	2.5%	< 0.5	97%	90%	110%	101%	90%	110%	NA	80%	120%
True Colour	3470143		<5	<5	NA	< 5	102%	90%	110%						
Turbidity	3474015	3474015	13.2	13.3	0.8%	< 0.5	101%	80%	120%						
Total Calcium	3473485		15.8	15.7	0.6%	< 0.10	93%	70%	130%	96%	80%	120%	100%	70%	130%
Total Magnesium	3473485		1.85	1.84	0.5%	< 0.10	96%	70%	130%	98%	80%	120%	103%	70%	130%
Total Potassium	3473485		<0.50	<0.50	NA	< 0.50	94%	70%	130%	97%	80%	120%	103%	70%	130%
Total Sodium	3473485		1.69	1.70	0.6%	< 0.10	95%	70%	130%	98%	80%	120%	104%	70%	130%
Aluminum-dissolved	3474015	3474015	0.010	0.008	NA	< 0.004	100%	70%	130%	103%	80%	120%	104%	70%	130%
Total Antimony	3478434		0.009	0.009	0.0%	< 0.001	99%	70%	130%	101%	80%	120%	104%	70%	130%
Total Arsenic	3478434		<0.003	<0.003	NA	< 0.003	97%	70%	130%	103%	80%	120%	108%	70%	130%
Total Barium	3478434		0.128	0.129	0.8%	< 0.002	99%	70%	130%	100%	80%	120%	104%	70%	130%
Total Beryllium	3478434		<0.001	<0.001	NA	< 0.001	101%	70%	130%	99%	80%	120%	112%	70%	130%
Total Boron	3478434		0.121	0.129	6.4%	< 0.010	99%	70%	130%	94%	80%	120%	108%	70%	130%
Total Cadmium	3478434		0.0002	0.0002	NA	< 0.0001	101%	70%	130%	101%	80%	120%	103%	70%	130%
Total Chromium	3478434		0.051	0.051	0.0%	< 0.003	101%	70%	130%	102%	80%	120%	100%	70%	130%
Total Cobalt	3478434		0.0018	0.0017	NA	< 0.0005	101%	70%	130%	105%	80%	120%	104%	70%	130%
Total Copper	3478434		0.009	0.010	10.5%	< 0.001	100%	70%	130%	104%	80%	120%	100%	70%	130%
Total Iron	3478434		1.31	1.32	0.8%	< 0.010	95%	70%	130%	101%	80%	120%	93%	70%	130%
Total Lead	3478434		<0.001	<0.001	NA	< 0.001	97%	70%	130%	98%	80%	120%	93%	70%	130%
Total Manganese	3478434		0.037	0.036	2.7%	< 0.002	99%	70%	130%	102%	80%	120%	102%	70%	130%
Dissolved Mercury	3474015	3474015	<0.0001	<0.0001	NA	< 0.0001	102%	70%	130%	97%	80%	120%	94%	70%	130%
Total Molybdenum	3478434		0.036	0.037	2.7%	< 0.002	102%	70%	130%	104%	80%	120%	109%	70%	130%
Total Nickel	3478434		0.045	0.045	0.0%	< 0.003	102%	70%	130%	107%	80%	120%	102%	70%	130%



Quality Assurance

CLIENT NAME: TERRAPROBE INC.

PROJECT: 3-21-0182-46

SAMPLING SITE: Barrie

AGAT WORK ORDER: 22T859620

ATTENTION TO: Justin Rumney

SAMPLED BY: Justin Rumney

Water Analysis (Continued)

RPT Date: Feb 08, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Selenium	3478434		0.005	0.003	NA	<0.002	106%	70%	130%	113%	80%	120%	110%	70%	130%
Total Silver	3478434		<0.0001	<0.0001	NA	< 0.0001	100%	70%	130%	103%	80%	120%	99%	70%	130%
Total Strontium	3478434		1.89	1.90	0.5%	< 0.005	98%	70%	130%	102%	80%	120%	105%	70%	130%
Total Thallium	3478434		<0.0003	<0.0003	NA	< 0.0003	95%	70%	130%	103%	80%	120%	99%	70%	130%
Total Tin	3478434		0.006	0.006	NA	< 0.002	110%	70%	130%	102%	80%	120%	113%	70%	130%
Total Titanium	3478434		<0.010	<0.010	NA	< 0.010	97%	70%	130%	104%	80%	120%	103%	70%	130%
Total Tungsten	3478434		<0.010	<0.010	NA	< 0.010	88%	70%	130%	85%	80%	120%	95%	70%	130%
Total Uranium	3478434		<0.002	<0.002	NA	< 0.002	97%	70%	130%	102%	80%	120%	101%	70%	130%
Total Vanadium	3478434		0.008	0.008	NA	< 0.002	100%	70%	130%	101%	80%	120%	105%	70%	130%
Total Zinc	3478434		0.039	0.048	NA	< 0.020	99%	70%	130%	105%	80%	120%	100%	70%	130%
Total Zirconium	3478434		<0.004	<0.004	NA	< 0.004	102%	70%	130%	103%	80%	120%	110%	70%	130%

Comments: NA signifies Not Applicable.

If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By:

Yris Veraestegui

Method Summary

CLIENT NAME: TERRAPROBE INC.

PROJECT: 3-21-0182-46

SAMPLING SITE:Barrie

AGAT WORK ORDER: 22T859620

ATTENTION TO: Justin Rumney

SAMPLED BY:Justin Rumney

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO ₃) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO ₃)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Bicarbonate (as CaCO ₃)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Carbonate (as CaCO ₃)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO ₃)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH ₃ H	LACHAT FIA
Ammonia-Un-ionized (Calculated)		MOE REFERENCE, PWQOs Tab 2	CALCULATION
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6044	modified from SM 2130 B	NEPHELOMETER
Total Calcium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Magnesium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Potassium	MET-93-6105	modified from EPA 6010D	ICP/OES
Total Sodium	MET-93-6105	modified from EPA 6010D	ICP/OES
Aluminum-dissolved	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Beryllium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS



Method Summary

CLIENT NAME: TERRAPROBE INC.

PROJECT: 3-21-0182-46

SAMPLING SITE: Barrie

AGAT WORK ORDER: 22T859620

ATTENTION TO: Justin Rumney

SAMPLED BY: Justin Rumney

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Strontium	INOR-93-6003	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Lab Filtration Aluminum Dissolved	SR-78-9001		FILTRATION
Lab Filtration mercury	SR-78-9001		FILTRATION



Laboratories

* Faircliff

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
web@earth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Terraprobe
Contact: Justin Rummey
Address: 220 Bayview Dr., Barrie
Phone: _____ Fax: _____
Reports to be sent to:
1. Email: jrummy@terraprobe.ca
2. Email: _____

Project Information:

Project: 3-21-0152-46
Site Location: Barrie
Sampled By: Justin Rummey
AGAT Quote #: _____ PO: _____
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Company: _____
Contact: Lorina Rossi
Address: _____
Email: Lrossi@terraprobe.ca
Bill To Same: Yes ☐ No ☐

Regulatory Requirements:

(Please check all applicable boxes)

- ☐ Regulation 153/04 ☐ Excess Soils R406 ☐ Sewer Use
☐ Sanitary ☐ Storm
Table Indicate One Table Indicate One Region _____
☐ Ind/Com ☐ Res/Park ☒ Prov. Water Quality
☐ Agriculture Objectives (PWQO)
Soil Texture (Check One) ☐ CCME ☐ Other
☐ Coarse ☐ Fine Indicate One

Is this submission for a Record of Site Condition?

☐ Yes ☐ No

Report Guideline on Certificate of Analysis

☒ Yes ☐ No

Sample Matrix Legend

B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Field Filtered - Metals, Hg, CrVI, DOC

O. Reg 153

Metals & Inorganics
Metals - ☐ CrVI, ☐ Hg, ☐ HWSB
BTEX, F1-F4 PHCs
Analyze F4G if required ☐ Yes ☐ No

PAHs

PCBs

VOC

O. Reg 558

Landfill Disposal Characterization TCLP:
TCLP: ☐ M&I, ☐ VOCs, ☐ ABNs, ☐ Bep, ☐ PCBs

Excess Soils SPLP Rainwater Leach

SPLP: ☐ Metals, ☐ VOCs, ☐ SVOCs

Excess Soils Characterization Package

pH, ICPMs Metals, BTEX, F1-F4

Salt - EC/SAR

PWQO

X

Potentially Hazardous or High Concentration (Y/N)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Metals & Inorganics	Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs	Analyze F4G if required ☐ Yes ☐ No	PAHs	PCBs	VOC	Landfill Disposal Characterization TCLP: TCLP: ☐ M&I, ☐ VOCs, ☐ ABNs, ☐ Bep, ☐ PCBs	Excess Soils SPLP Rainwater Leach	SPLP: ☐ Metals, ☐ VOCs, ☐ SVOCs	Excess Soils Characterization Package	pH, ICPMs Metals, BTEX, F1-F4	Salt - EC/SAR	PWQO	Potentially Hazardous or High Concentration (Y/N)
BH2	11/21/22	12:40 AM	7	GW																	
		AM																			
		PM																			
		AM																			
		PM																			
		AM																			
		PM																			
		AM																			
		PM																			
		AM																			
		PM																			
		AM																			
		PM																			

Samples Relinquished By (Print Name and Sign): <u>Justin Rummey</u>	Date: <u>11/21/22</u>	Time: _____	Samples Received By (Print Name and Sign): <u>Anthony Basile</u>	Date: <u>11/21/22</u>	Time: _____
Samples Relinquished By (Print Name and Sign): _____	Date: _____	Time: _____	Samples Received By (Print Name and Sign): _____	Date: _____	Time: _____
Samples Relinquished By (Print Name and Sign): _____	Date: _____	Time: _____	Samples Received By (Print Name and Sign): _____	Date: _____	Time: _____

Page _____ of _____
N: T **130347**

Laboratory Use Only

Work Order #: 22T859620
Cooler Quantity: 1 small
Arrival Temperatures: 2.5 | 6.2 | 5.6
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: Ice Pack

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): _____

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

APPENDIX G

APPENDIX G - Feature Based Water Balance (West draining to North wetland) - 642 Dunlop File No. 3-21-0182-46

1. Climate Information

Precipitation ¹	952 mm/a	0.95 m/a
Actual Evapotranspiration ¹	420 mm/a	0.42 m/a
Precipitation Surplus	532 mm/a	0.53 m/a

2. Infiltration Rates

Table 3 Approach - Infiltration Factors² (Pre and Post Development)

Soil: Peat		
Infiltration	399 mm/a	0.399 m/a
Run-off	133 mm/a	0.133 m/a

3. Property Statistics

Pre- Development Site Coverage			Percentage
Building Area/Coverage	200 m ²	0.02 ha	3 %
Hardscape/Impervious	1,200 m ²	0.12 ha	20 %
Softscape/Landscape (Undeveloped area)	4,600 m ²	0.46 ha	77 %
TOTAL	6,000.00 m²	0.60 ha	100 %
Post-Development Coverage			
Building Area/Coverage - B1, B2a, B2b & B2c (Roof Runoff)	2,400 m ²	0.24 ha	40 %
Hardscape/Impervious-B1 (Paved area- Run-off discharge to Wetland)	300 m ²	0.03 ha	5 %
Softscape/Landscape (B1 (Pervious Area)	2,200 m ²	0.22 ha	37 %
Hardscape/Impervious-A1 (Paved area- Run off Discharge to Dunlop St.)	1,100 m ²	0.11 ha	18 %
TOTAL:	6,000.00 m²	0.60 ha	100 %

Notes/References:

Water Balance Analysis Method: Thornthwaite and Matther approach

1 Lake Simcoe Climate Data Reference Document (April 2017)

2 MOEE Technical Information Requirements for Land Development Applications (1995)

APPENDIX G - Feature Based Water Balance (West Draining to the North Wetland- 642 Dunlop Street West, Barrie-21-0182-46)

4. Annual Water Balance (Pre Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	200	190	nil	19	nil	171
Hardscape/Impervious	1,200	1,142	nil	114	nil	1,028
Softscape/Landscape	4,600	4,379	1,932	nil	1,835	612
TOTAL	6,000	5,712	1,932	133	1,835	1,811

6. Annual Water Balance (Post Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	2,400	2,285	nil	228	nil	2,056
Hardscape/Impervious from B area	300	286	nil	29	nil	257
Hardscape/Impervious from A Area	1,100	462	nil	46	nil	416
Softscape/Landscape	2,200	2,094	924	nil	878	293
TOTAL	6,000	5,127	924	303	878	3,022

7. Comparison of Pre-Development (before building 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	5,712	1,932	133	1,835	1,811
Post-Development	5,127	924	303	878	3,022
Difference	585	-1,008	170	-958	1,210

8. Requirement for Infiltration Maintenance from roof run-off

Volume of roof run-off captured (90%) (roof run-off available in post development)	1,851 m ³
Volume of roof run-off required to match pre-development infiltration rates (Infiltration deficit in post development)	958 m ³
Percentage of roof run-off required to match pre-development infiltration	52%
Volume of Run-Off remaining after post development infiltration deficit compensation	893 m ³
Volume of Run-Off proposed from paved area to be directed to Wetland north of the site Based on Storm Water Management Report.	257 m ³
Volume of Run-Off proposed pervous area to be directed to Wetland north of the site Based on Storm Water Management Report.	293 m ³
Total Volume of Run-Off proposed to be directed to Wetland north of the site Based on Storm Water Management Report.	1,443 m ³
Volume of Pre-Post Developemnt RunOff deficit Based on Storm Water Management Report.	369 m ³

APPENDIX G - Feature Based Water Balance (East draining to Dunlop Street) - 642

File No. 3-21-0182-46

1. Climate Information

Precipitation ¹	952 mm/a	0.95 m/a
Actual Evapotranspiration ¹	420 mm/a	0.42 m/a
Precipitation Surplus	532 mm/a	0.53 m/a

2. Infiltration Rates**Table 3 Approach - Infiltration Factors²****(Pre and Post Development)**

Soil: Peat

Infiltration	399 mm/a	0.399 m/a
Run-off	133 mm/a	0.133 m/a

3. Property Statistics**Pre- Development Site Coverage****Percentage**

Building Area/Coverage	0 m ²	0.00 ha	0 %
Hardscape/Impervious	1,600 m ²	0.16 ha	76 %
Softscape/Landscape (Undeveloped area)	500 m ²	0.05 ha	24 %
TOTAL	2,100.00 m²	0.21 ha	100 %

Post-Development Coverage

Building Area/Coverage, A2, B2a, Part of B2b, (Roof Runoff)	1,600 m ²	0.16 ha	76 %
Hardscape/Impervious-A2, B2a, & Part B2b, (Paved area)	150 m ²	0.02 ha	7 %
Softscape/Landscape -A2, B2a, & Part of B2b (Pervious)	350 m ²	0.04 ha	17 %
TOTAL:	2,100.00 m²	0.21 ha	100 %

Notes/References:

Water Balance Analysis Method: Thornthwaite and Matther approach

1 Lake Simcoe Climate Data Reference Document (April 2017)

2 MOEE Technical Information Requirements for Land Development Applications (1995)

APPENDIX G - Feature Based Water Balance (East Draining to the Dunlop Street- 642 Dunlop Street West, Barrie)

4. Annual Water Balance (Pre Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	0	0	nil	0	nil	0
Hardscape/Impervious	1,600	1,523	nil	152	nil	1,371
Softscape/Landscape	500	476	210	nil	200	67
TOTAL	2,100	1,999	210	152	200	1,437

6. Annual Water Balance (Post Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	1,600	1,523	nil	152	nil	1,371
Hardscape/Impervious	150	143	nil	14	nil	129
Softscape/Landscape	350	333	147	nil	140	47
TOTAL	2,100	1,999	147	167	140	1,546

7. Comparison of Pre-Development (before building 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	1,999	210	152	200	1,437
Post-Development	1,999	147	167	140	1,546
Difference	0	-63	14	-60	109

8. Requirement for Infiltration Maintenance from roof run-off

Volume of roof run-off captured (90%) (roof run-off available in post development)	1,234 m ³
Volume of roof run-off required to match pre-development infiltration rates (Infiltration deficit in post development)	60 m ³
Volume of Available post development roof runoff surplus after application marching infiltration deficit	-1,174 m ³
Percentage of roof run-off required to match pre-development infiltration	5%

APPENDIX G - Based Water Balance (Entire Site) - 642 Dunlop Street West, Barrie			File No. 3-21-0182-46
1. Climate Information			
Precipitation ¹	952 mm/a	0.95 m/a	
Actual Evapotranspiration ¹	420 mm/a	0.42 m/a	
Precipitation Surplus	532 mm/a	0.53 m/a	
2. Infiltration Rates			
Table 3 Approach - Infiltration Factors²		(Pre and Post Development)	
Soil: Peat			
Infiltration	399 mm/a	0.399 m/a	
Run-off	133 mm/a	0.133 m/a	
3. Drainage A (Catchment Area) - Property Statistics			
Pre- Development Site Coverage		Percentage	
Building Area/Coverage	200 m ²	0.02 ha	3 %
Hardscape/Impervious	1,200 m ²	0.12 ha	20 %
Softscape/Landscape (Undeveloped area)	4,600 m ²	0.46 ha	77 %
TOTAL	6,000.00 m²	0.60 ha	100 %
4. Entire Site Property Statistics			
Pre- Development Site Coverage		Percentage	
Building Area/Coverage	200 m ²	0.02 ha	2 %
Hardscape/Impervious	2,800 m ²	0.28 ha	35 %
Softscape/Landscape (Undeveloped area)	5,100 m ²	0.51 ha	63 %
TOTAL	8,100.00 m²	0.81 ha	100 %
Post-Development Coverage			
Building Area (Roof Runoff)	2,400 m ²	0.24 ha	30 %
Hardscape/Impervious (Paved area- Run-off Discharge to Municipal Strom	3,000 m ²	0.30 ha	37 %
Softscape/Landscape (B1 (Pervious Area)	2,700 m ²	0.27 ha	33 %
TOTAL:	8,100.00 m²	0.81 ha	100 %
Notes/References:			
Water Balance Analysis Method: Thornthwaite and Matther approach			
1 Lake Simcoe Climate Data Reference Document (April 2017)			
2 MOEE Technical Information Requirements for Land Development Applications (1995)			

APPENDIX G - Water Balance (Entire Site)- 642 Dunlop Street West, Barrie

File No. File No. 3-21-0182-46

5. Drainage A- Catchment Area)Annual Water Balance (Pre Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	200	190	nil	19	nil	171
Hardscape/Impervious	1,200	1,142	nil	114	nil	1,028
Softscape/Landscape	4,600	4,379	1,932	nil	1,835	612
TOTAL	6,000	5,712	1,932	133	1,835	1,811

4. Annual Water Balance (Pre Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	200	190	nil	19	nil	171
Hardscape/Impervious	2,800	2,666	nil	267	nil	2,399
Softscape/Landscape	5,100	4,855	2,142	nil	2,035	678
TOTAL	8,100	7,711	2,142	286	2,035	3,249

6. Annual Water Balance (Post Development)

Land Use	Area (m ²)	Precipitation (m ³)	Evapotranspiration (m ³)	Evaporation (m ³)	Infiltration (m ³)	Run-Off (m ³)
Building Area/Coverage	2,400	2,285	nil	228	nil	2,056
Hardscape/Impervious areas	3,000	2,856	nil	286	nil	2,570
Softscape/Landscape	2,700	2,570	1,134	nil	1,077	359
TOTAL	8,100	7,711	1,134	514	1,077	4,986

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	7,711	2,142	286	2,035	3,249
Post-Development	7,711	1,134	514	1,077	4,986
Difference	0	-1,008	228	-958	1,737

8. Requirement for Infiltration Maintaenance from roof run-off

Volume of roof run-off captured (90%) (roof run-off available in post development)	1,851 m ³
Volume of roof run-off required to match pre-development Run-off to Adjacent North Wetland (Runoff deficit in post development)	1,811 m ³
Percentage of roof run-off required to match pre-development infiltration	98%
Volume of roof run-off required to match pre-development Infiltration rates (site infiltration deficit in post development)	958 m ³
Volume of Run-Off remaining after post development run-off available for wetland adjacent north of the Site	39.4
Final-Volume of Site Infiltration deficit in post development condition	918 m ³

Appendix A: Climate Data Tables

Barrie Creeks Subwatershed

Hydrologic Soil Group		Subwatershed Area (km ²)	Mean Annual Precipitation (mm/yr.)	Actual Evapotranspiration (mm/yr.)	Precipitation Surplus (mm/yr.)
Urban Lawns/Golf Courses					
Fine Sand	A	1.74	952	525	427
Fine Sandy Loam	B		952	539	413
Silt Loam	C		952	573	380
Clay	D		952	643	310
Forest					
Fine Sand	A	4.12	952	521	431
Fine Sandy Loam	B		952	540	412
Silt Loam	C		952	434	518
Clay	D		952	598	354
Pasture & Shrubs					
Fine Sand	A	0.40	952	565	387
Fine Sandy Loam	B		952	546	406
Silt Loam	C		952	558	394
Clay	D		-	-	-
Non-Intensive Agriculture (e.g. Hay)					
Fine Sand	A	0.92	952	528	424
Fine Sandy Loam	B		952	636	316
Silt Loam	C		-	-	-
Clay	D		-	-	-
Intensive Agriculture (e.g. Row crop)					
Fine Sand	A	0.43	952	556	396
Fine Sandy Loam	B		952	532	420
Silt Loam	C		-	-	-
Clay	D		-	-	-
Open Alvar					
Fine Sand	A	-	-	-	-
Fine Sandy Loam	B		-	-	-
Silt Loam	C		-	-	-
Clay	D		-	-	-
Aggregates					
Fine Sand	A	0.62	952	471	481
Fine Sandy Loam	B		952	456	496
Silt Loam	C		-	-	-
Clay	D		-	-	-
Mean Annual			952	446	506
Notes: Precipitation and Actual Evapotranspiration values are the AVERAGE ANNUAL estimates obtained from the Lake Simcoe PRMS model (Earthfx, 2010).					

APPENDIX H

File No. 3-21-0182-46.1

642 Dunlop St. W., Barrie, ON

Monitoring Well I.D.	MW1		MW 2		MW 3		MW 4		MW 5		MW 9	
Stick Up (magl)	0.0		0.9		0.0		0.0		0.0		0.9	
Depth (mbgl)	-		11.7		7.2		11.8		4.4		4.4	
Geodetic Elevation (masl)	235.5		234.5		235.3		235.4		235.2		234.4	
Drilling Date	19-Jan-22		20-Jan-22		18-Jan-22		19-Jan-22		19-Jan-22		18-Jan-22	
Data Logger Installation Date	-		-		-		-		-		-	
Date	Water Level (mbgl)	Water Elevation (masl)	Water Level (mbgl)	Water Elevation (masl)	Water Level (mbgl)	Water Elevation (masl)	Water Level (mbgl)	Water Elevation (masl)	Water Level (mbgl)	Water Elevation (masl)	Water Level (mbgl)	Water Elevation (masl)
1-Feb-22	#	Not Measured	1.74	232.76	1.77	233.53	1.91	233.49	1.49	233.71	1.73	232.67
31-Mar-22	#	Not Measured	1.10	233.40	1.77	233.53	1.24	234.16	0.78	234.42	1.06	233.34
14-Apr-22	#	Not Measured	1.02	233.48	1.09	234.21	1.24	234.16	0.78	234.42	1.07	233.33
2-May-22	#	Not Measured	1.11	233.39	1.22	234.08	1.37	234.03	0.91	234.29	1.17	233.23
22-Jun-22	#	Not Measured	1.46	233.04	1.57	233.73	1.57	233.83	1.23	233.97	1.54	232.86
4-Jul-22	#	Not Measured	0.66	233.84	1.78	233.52	1.91	233.49	1.43	233.77	1.74	232.66
2-Aug-22	#	Not Measured	1.96	232.54	2.10	233.20	2.25	233.15	2.89	232.31	2.04	232.36
14-Sep-22	#	Not Measured	2.03	232.47	2.12	233.18	2.27	233.13	1.82	233.38	1.65	232.75
3-Oct-22	#	Not Measured	1.93	232.57	2.07	233.23	1.73	233.67	1.76	233.44	1.65	232.75
1-Nov-22	#	Not Measured	1.98	232.52	2.14	233.16	1.81	233.59	1.83	233.37	2.14	232.26
1-Dec-22	#	Not Measured	2.06	232.44	2.22	233.08	1.90	233.50	1.92	233.28	2.23	232.17

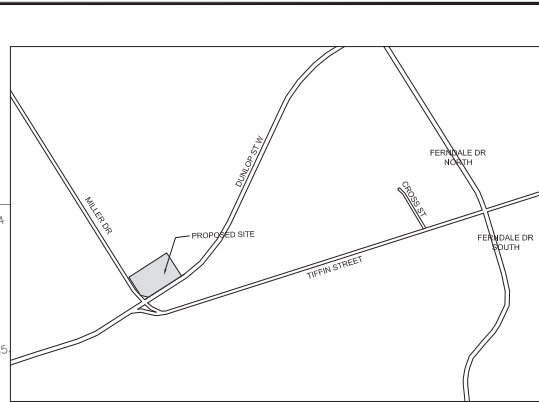
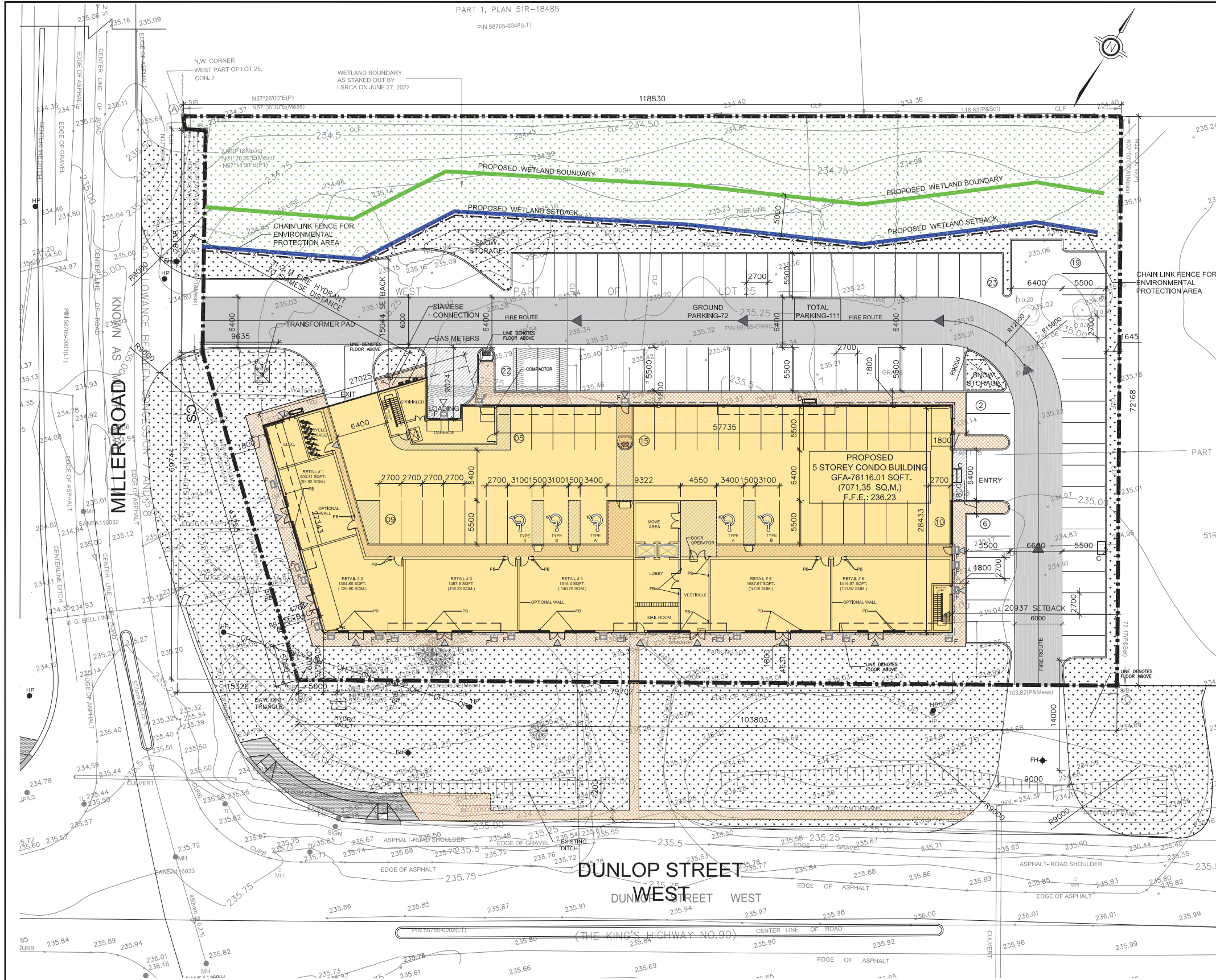
Note:

mbgl - Metres Below Ground Level

masl - Metres Above Sea Level

MW1 was not found, first covered in snow, later in water flooded area.

APPENDIX I



KEY PLAN

PROJECT STATISTICS		
ADDRESS 642 DUNLOP STREET WEST, BARRIE, ON.		
ZONING	GENERAL COMMERCIAL (C4)	
	REQUIRED	PROPOSED
LOT(SITE) AREA (m²)	450 SQ.M.	8084.59 SQ.M.
RETAIL		778.89 SQ.M.
RESIDENTIAL UNITS		6233.07 SQ.M.
AMENITY AREA		341.95 SQ.M.
TOTAL G.F.A.		7071.35 SQ.M.
COVERAGE	50% MAX	2420.23 SQ.M. (29.93%)
LANDSCAPE AREA		2811.57 SQ.M. (34.77%)
PAVED AREA		522.91 SQ.M. (6.47%)
BUILDING HEIGHT (MAX.)	14.0 M.	13.95 M.
TOTAL PARKING (MIN.)	128 CARS	111 CARS
BARRIER FREE PARKING (MIN.)	5 CARS	5 CARS
BICYCLE PARKING (MIN.)	4	7
LOADING SPACE (MIN.)	1	1
LOT FRONTAGE (MIN.)	15 M.	69.7 M.
DUNLOP STREET WEST		

BUILDING SETBACKS	REQUIRED	PROPOSED
FRONT YARD (WEST)	6.0M	4.76 M.
EXTERIOR SIDE YARD (SOUTH)	5.0M	6.0 M.
INTERIOR SIDE YARD (NORTH)	3.0M	15.04 M.
REAR YARD (EAST)	7.0M	20.93 M.

PARKING CALCULATIONS				
ITEM	AREA(SQM.)	RATE	REQUIRED	PROVIDED
RETAIL	769.15	1 PER 24 SQ.M.	32	16
RESIDENTIAL UNITS (72)	6233.07	1.25 PER DWELLING	90	90
H.C. PARKING (OVER 100 - 1+3% OF REQ. PARKING)			5	5
TOTAL			127	111
CAR SPACE SIZE			2.7X5.5M	2.7X5.5M
H/C CAR SPACE SIZE (TYPE-A)			3.4X5.5M	3.4X5.5M
(TYPE-B)			3.1X5.5M	3.1X5.5M

LEGEND	
[Yellow Box]	NEW BUILDING
[White Box]	ASPHALT
[Dotted Box]	LANDSCAPE
[Brown Box]	CONC. PAVEMENT, 150MM RAISED
[Blue Box]	HANDICAP PARKING
[Triangle]	MAIN ENTRANCE
[Diamond]	OVERHEAD DOOR
[Circle]	TREE
[Line]	BARRIER CURB
[Line]	BARRIER FREE CURB
[Line]	PB BARRIER FREE PUSH BUTTON

MUNICIPAL ADDRESS & LEGAL DESCRIPTION:
PART 3 OF LOT 25 REGISTERED PLAN F45 CITY OF BARRIE COUNTY OF SIMCOE

APPLICANT:
n Architecture Inc., 9120 Leslie St., Suite 208, Richmond Hill, Ontario L4B 3J9
T: 905.597.5937 F: 1.866.340.5265
E: info@narchitecture.com
WEB: www.narchitecture.com

SURVEY INFORMATION TAKEN FROM:
OMARI MWINYI SURVEYING LTD.
1905 PINE GROVE AVENUE PICKERING
ONTARIO, L1V 6T1
Ph: (905) 728-8863
Fax: (905) 492-5485

TOTAL UNITS:	
TWO BED ROOM UNITS	33
ONE BED ROOM UNITS	27
ACCESSIBLE ONE BED ROOM UNITS	06
ACCESSIBLE TWO BED ROOM UNITS	06
TOTAL	72



n Architecture Inc
PRINCIPAL: NITIN MALHOTRA, ARCHITECT.
9120 Leslie Street, Suite-208
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T : 4 1 6 . 2 5 6 . 9 7 4 1
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www.narchitecture.com



13th MARCH 2023
NOT FOR CONSTRUCTION

No.	Date	Version	Dwn.
3.		ISSUED FOR SPA	SB
2.	13-JUN-2018	ISSUED FOR PRE-CONSULTATION	SB
1.	04-APR-2016	ISSUED FOR PRE-CONSULTATION	FK

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PROJECT:

**PROPOSED 5-STOREY CONDO BUILDING
642 DUNLOP STREET W
BARRIE, ON.**

DRAWING TITLE:

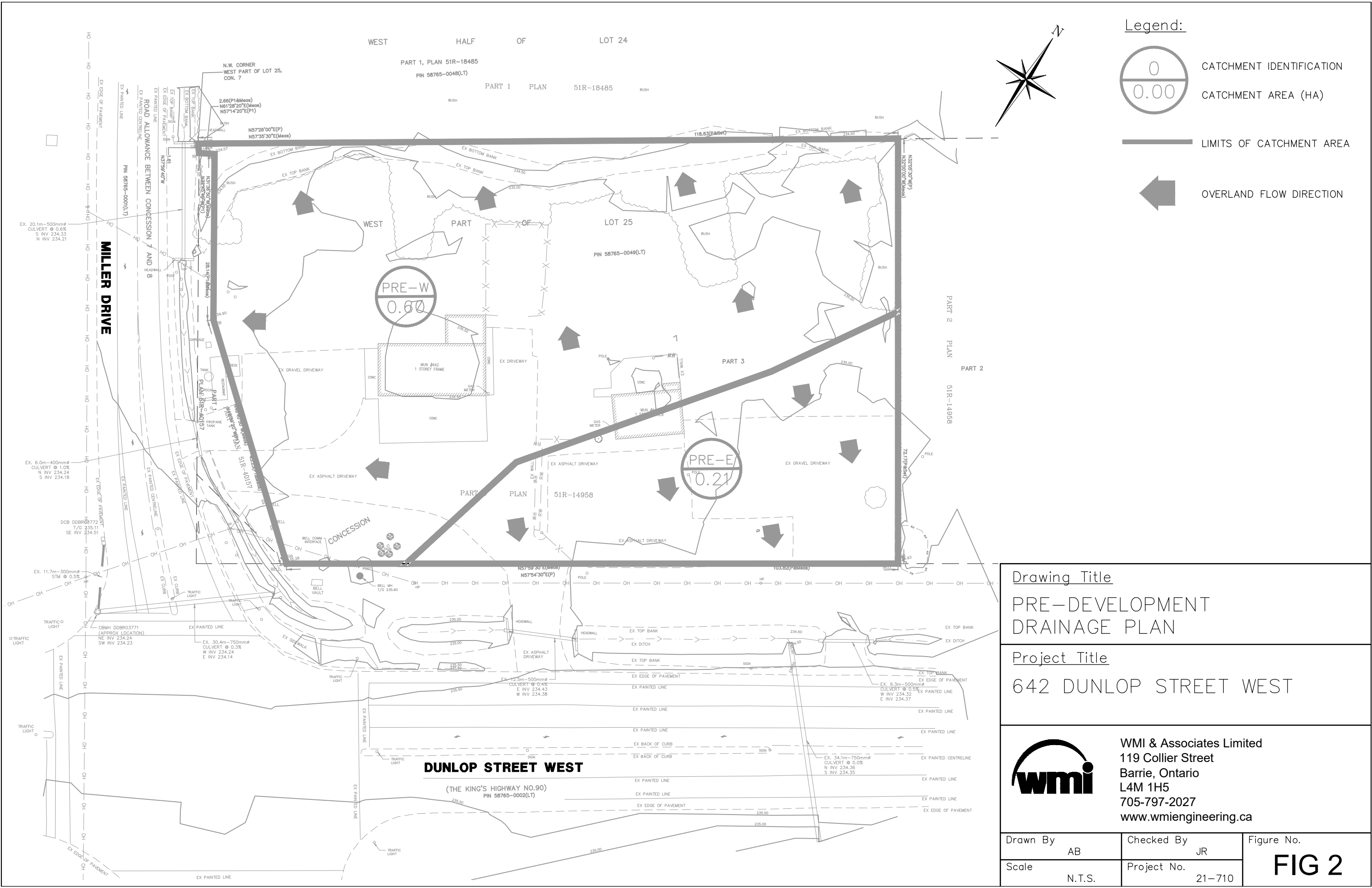
SITE PLAN

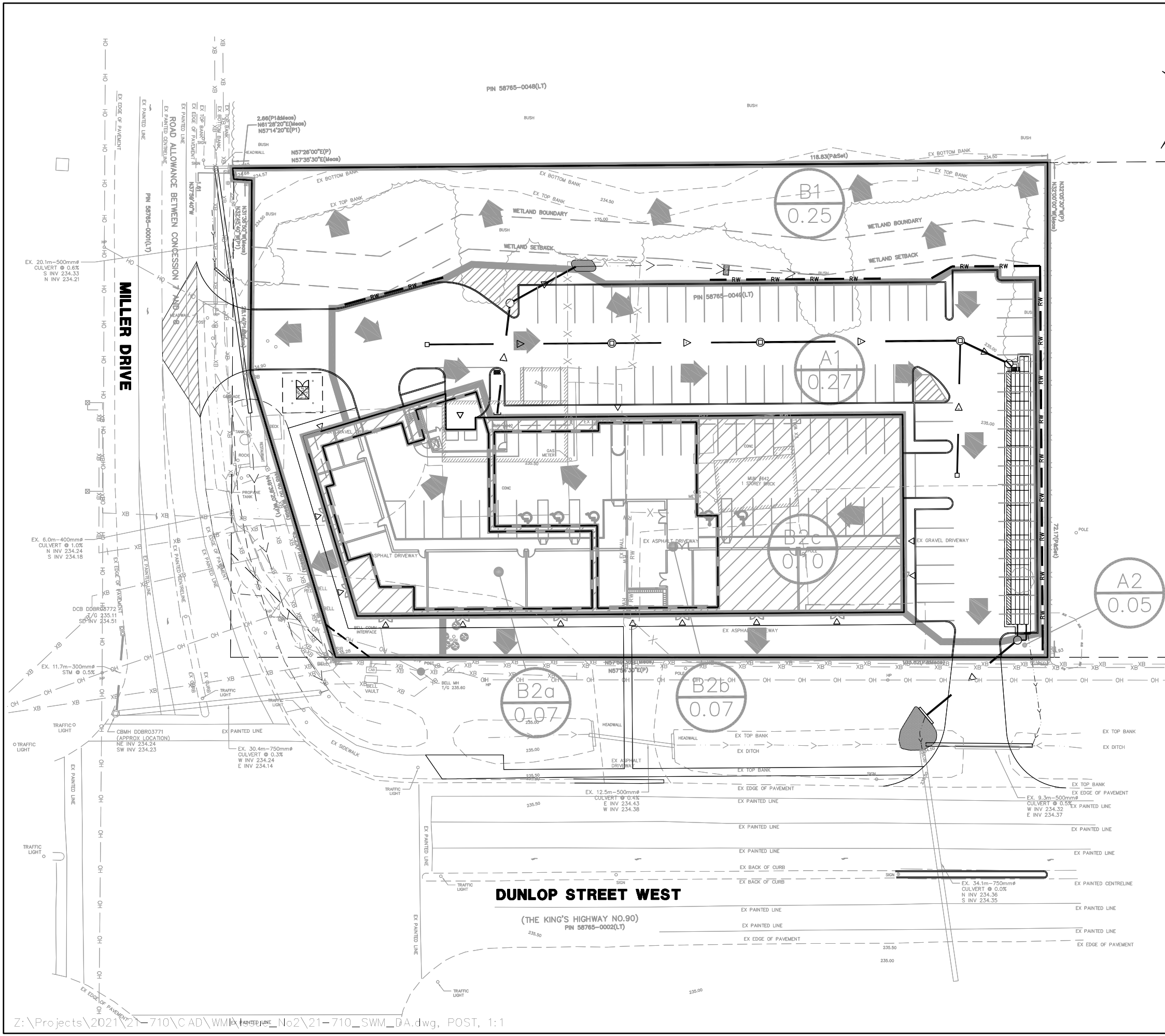
DRAWN BY: FK	DATE: DEC 02 2015
CHECKED BY: NM	SCALE: AS NOTED
PROJECT NO.:	DRAWING NO.:

15-48

A-1.0

1 SITE PLAN
A-1.0 SCALE: 1:250





Legend:

0
0.00

CATCHMENT IDENTIFICATION

CATCHMENT AREA (HA)

LIMITS OF CATCHMENT AREA

OVERLAND FLOW DIRECTION

Drawing Title

POST-DEVELOPMENT DRAINAGE PLAN

Project Title

642 DUNLOP STREET WEST



WMI & Associates Limited
119 Collier Street
Barrie, Ontario
L4M 1H5
705-797-2027
www.wmiengineering.ca

Drawn By	AB	Checked By	JR	Figure No.
Scale	N.T.S.	Project No.	21-710	

FIG 3