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A REPORT TO
MOSAIK (UXBRIDGE) INC.

HYDROGEOLOGICAL ASSESSMENT FOR PROPOSED RESIDENTIAL DEVELOPMENT

62 MILL STREET
TOWNSHIP OF UXBRIDGE

REFERENCE NO. 2104-W092

JUNE 2021

DISTRIBUTION

3 Copies –Mosaik (Uxbridge) Inc.

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1.0 EXECUTIVE SUMMARY

Soil Engineers Ltd. has conducted a hydrogeological assessment for proposed development site, located 62 Mill Street, in the Town of Uxbridge at the location shown on Drawing 1. At the time of investigation, the subject site was occupied as a single dwelling with a shed structure located at the property. The surrounding land uses include; an existing residential development and a park. The proposed development will involve the construction of detached residential development which will be provided with full municipal services and access roadways meeting urban standards.

The subject site lies within the Physiographic Region of Southern Ontario known as the Peterborough Drumlin Field, and is located on the mapped clay plains shallow surficial physiographic feature. Based on review of the surface geological map of Ontario, the subject site is situated on glaciofluvial ice-contact deposits, consisting predominantly gravel and sand with minor till, includes eskers, kames, end moraines, ice-margin delta, and subaqueous fan deposits.

The subject site is located within the Lake Simcoe Watershed and within the Uxbridge Brook Sub-watershed.

A review of the topography for the subject site and the surrounding area shows that it exhibits an undulating terrain, exhibiting a decline in elevation relief towards the north part of the site.

This study has disclosed that beneath a layer topsoil and earth fill, the native subsoils underlying the subject site consists of sand, sandy silt, silt and silt till deposits, extending to the maximum termination depth of the investigation.

The findings of this study confirm that the measured groundwater level elevations range from El. 269.67 to 272.23 masl.

The single well response test yielded a hydraulic conductivity (K) estimates that range from 1.0 1.1 x10^{-5} to 1.3 x10^{-5} m/sec for the sand till, sandy silt and silt units encountered at the monitoring well screened depths. The K test results suggests that low groundwater seepage rates can be anticipated into open excavations below the groundwater table.

The dewatering flow estimates for the installation of the underground services suggests that the construction dewatering flow could reach a daily rate of 104,967.9 L/day; by considering a 3x safety factor, it could reach an approximate daily maximum of 314,903.8 L/day. The

estimated dewatering flow rate for housing basement structure construction could reach a daily rate of 128,805.1 /day; by considering a 3x safety factor, it could reach an approximate daily maximum of 386,415.3 L/day. Since the estimated dewatering flow rate exceeds 50,000 L/day, but is below the 400,000 L/day threshold limit for requiring a PTTW, the approval for any proposed temporary groundwater-taking for construction is by means of applying for an EASR approval which is recommended to be applied for to facilitate a temporary construction dewatering program.

The estimated zone of influence associated with construction dewatering could reach a maximum of 30.3 m away from the limits of the conceptual dewatering alignment around the excavation areas

2.0 INTRODUCTION

2.1 Project Description

In accordance with a purchase order authorization, dated April 16, 2021, from Mr. Paul Bailey of Mosiak (Uxbridge) Inc., Soil Engineers Ltd. (SEL) has completed a hydrogeological assessment for the proposed residential development site, located on the south side of Mill Street, between Water Street and Joseph Street, at 62 Mill Street in the Township of Uxbridge. The location of the subject site is shown on Drawing No. 1.

At the time of investigation, the subject site was occupied as a single dwelling with a shed structure located at the property. The subject site was also covered by grass and trees. Surrounding land uses include; an existing residential development to the north, to the east and west. and park to the south. The subject site comprises an area of about ±2.9 acres. A proposed development will involve a construction of residential housing subdivision, along with associated municipal services, meeting urban standards.

The purpose of this hydrogeological assessment is to summarizes the findings of the field study and the associated groundwater monitoring and testing, to provide a description and characterization of the interpreted hydrogeostratigraphy setting for the subject site and the local surrounding area. In addition, this study provides recommendations for any construction- related dewatering needs and estimated dewatering flows to facilitate earthworks, and underground servicing that may be needed prior to detailed design. Furthermore, the report provides recommendations for any need to acquire an Environmental Activity and Sector Registry (EASR), or a Permit-To-Take Water (PTTW) as approvals for proposed groundwater talking for facilitate a temporary construction dewatering program.

2.2 **Project Objectives**

The major objectives of this Hydrogeological Study Report are as follows:

1. Establish the local hydrogeological setting for the subject site and the local surrounding area;
2. Interpretation of the shallow groundwater flow and runoff patterns;
3. Characterize the hydraulic conductivity (K) for the groundwater-bearing subsoil strata;
4. Estimate the anticipated, temporary construction dewatering flows that may be required to lower the groundwater table to facilitate earth works for construction of the underground services and housing basements, and for any long-term foundation drainage needs following the site development;
5. Identify zones of higher groundwater yield as potential sources for any ongoing shallow groundwater seepage;
6. Prepare an interpreted hydrogeostratigraphic cross-section across the subject site;
7. Evaluate potential impacts to nearby groundwater receptors within the anticipated zone of influence for construction dewatering;
8. Determine the groundwater function of the subject site, and assess potential impacts to nearby groundwater receptors from the proposed development;
9. Provide comments regarding any need to file for an Environmental Activity and Sector Registry (EASR) or to acquire a Permit-To-Take Water (PTTW) as approvals to facilitate a construction dewatering program for proposed earthworks.

2.3 **Scope of Work**

The scope of work for the Hydrogeological Study is summarized below:

1. Installation of three (3) monitoring wells within the site's development footprint;
2. Monitoring well development and groundwater level measurements at the three (3) installed monitoring wells;
3. Performance of Single Well Response Tests (SWRTs) at the monitoring wells to estimate the hydraulic conductivity (K) for the groundwater-bearing subsoil strata at the depths of the monitoring well screens;
4. Describing the geological and hydrogeological setting for the subject site and the nearby surrounding area;
5. Review of the MECP water well records for the area to complete a review of nearby groundwater receptors around the subject site.
6. Estimating the hydraulic conductivity (K) for the groundwater bearing subsoil strata, based on the SWRT results, and from review of soil sample grain size, texture analyses.
7. Review of available engineering development plans and profiles for any proposed underground services and housing basement structures, and assessing preliminary dewatering needs and estimation of any anticipated dewatering flows necessary to lower the groundwater levels to facilitate earthworks and construction;
8. Providing comments regarding any need to register any proposed groundwater-taking through an Environmental Activity and Sector Registry (EASR), or to apply for a Permit-To-Take Water (PTTW) as groundwater taking approvals to facilitate a construction dewatering program;

3.0 METHODOLOGY

3.1 Borehole Advancement and Monitoring Well Installation

The fieldwork for the borehole drilling and monitoring well construction was performed, on May 10, 2021. The program consisted of the drilling of three (3) boreholes (BH) and the installation of three (3) monitoring wells, one within each of the three (3) boreholes at the time of the field investigation. The boreholes and monitoring well locations are shown on Drawing No. 2.

The borehole drilling and monitoring well construction were completed by licensed water well contractor, ACE Environmental Drilling Ltd, under the full-time supervision of a hydrogeological technician from SEL, who also logged the subsoil strata encountered during borehole advancement, and collected representative soil samples for textural classification and supervised the monitoring well installations. The boreholes were drilled using continuous-flight, augers on a drill rig machine, equipped with solid-stem augers. Selected subsoil samples retrieved from the drilling program underwent laboratory grain size analysis to confirm the subsoil textures. Detailed descriptions of the encountered subsurface soil and groundwater conditions are presented on the borehole and monitoring well logs, Figures 1 to 3, inclusive.

The monitoring wells were constructed, using 50 mm diameter PVC riser pipes and screen sections, which were installed in the boreholes in accordance with Ontario Regulation (O. Reg.) 903. All of the monitoring wells were provided with monument-type, steel protective casings at the ground surface. The details for monitoring well construction are provided on the enclosed Borehole Logs (Figures 1 to 3).

The ground surface elevations and horizontal coordinates at the monitoring well locations were determined at the time of the investigation, using a handheld Global Navigation Satellite System survey equipment (Trimble Geoexplorer unit TSC3) which has an accuracy of ±0.05 m. The UTM coordinates and ground surface elevations at the borehole/monitoring well locations, together with the summary of the monitoring well installation details, are provided in Table 3-1.

Table 3-1 - Monitoring Well Installation Details

Well ID	Installation Date	UTM Coordinates		Ground Elevation (masl)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Casing Dia. (mm)
		East (m)	North (m)				
BH/MW 201	May 10, 2021	650385.4	4885173.4	273.92	6.0	3.0-6.0	50
BH/MW 202	May 10, 2021	650367.1	4885086.9	277.46	6.0	3.0-6.0	50
BH/MW 203	May 10, 2021	650425.5	4885036.9	275.43	6.0	3.0-6.0	50

Notes: mbgs - metres below ground surface masl -- metres above sea level

3.2 Groundwater Monitoring

The groundwater levels in the monitoring wells were measured, manually on May 18, and June 7, 2021 to record the fluctuation of the shallow groundwater table beneath the site, with the details discussed in the section 6.3 of this report.

3.3 Mapping of Ontario Water Well Records

SEL reviewed the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWRs) for the registered wells located on the subject site and within 500 m of the site boundaries (study area). The water well records indicate that thirty-nine (39) wells are located within the 500 m zone of influence study area relative to the subject site. The well record locations are marked and presented in Drawing No. 3, and related WWRs review information is discussed in Section 6.2 with details for the water well records being provided in Appendix 'A'.

3.4 Monitoring Well Development and Single Well Response Tests

The monitoring wells underwent development in preparation for single well response tests (SWRT) to estimate the hydraulic conductivity (K) for saturated subsoil strata at the depths of the monitoring well screens. Well development involved the purging and removal of several casing volumes of groundwater from each monitoring well to remove remnants of clay, silt and other debris introduced into the monitoring wells 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 monitoring well screen depths.

The test results from SWRT's are used to estimate the hydraulic conductivity (K) for groundwater-bearing soil strata at the depths of the monitoring well screens. The K values estimated from the SWRTs provide an indication of the yield capacity for the groundwater-

bearing subsoil strata, and can be used to estimate the flow of groundwater through the groundwater-bearing subsoil strata.

The SWRT involves the placement of a slug of known volume into the monitoring well, below the water table, to displace the groundwater level upward. The rate at which the groundwater level recovers to static conditions (falling head) is tracked using a data logger/ pressure transducer, and/or manually, using a water level tape.

The rate at which the groundwater table recovers to static conditions is used to estimate the K value for the groundwater-bearing subsoil formation at the monitoring well screen depth interval. Due to insufficient groundwater volume within BH/MW 202 at the time of the field study, only two monitoring wells, identified as BH/MW 201, and 203 underwent a SWRT on June 7, 2021. The SWRT test results are provided in Appendix 'B', with a summary of the findings being provided in Table 6-4.

3.5 **Review Summary of Previous Report**

The following, previous geotechnical soil investigation report was reviewed for the preparation of this hydrogeological study:

A Report submitted to Bazil Development Inc., A Geotechnical Investigation for Proposed Residential Development, 62 Mill Street, Town of Uxbridge, (SEL Reference No. 2011-S193, dated January 2021).

4.0 REGIONAL AND LOCAL SETTING

4.1 Regional Geology

The subject site is partially located within the regional kame moraine physiographic feature, known as the Oak Ridges Moraine (Chapman and Putnam, 2007). The subject site lies within the mapped Physiographic Region of Southern Ontario known as the Peterborough Drumlin Field which is located on the clay plains shallow, surficial physiographic feature. The Peterborough Drumlin Field is a rolling till plain which is noted for its eskers and drumlins. The drumlins are composed, usually of highly calcareous till but there are local differences. While the eskers are perhaps the most striking feature for the clay plain, apart from the drumlins themselves, they are not as prominent as the rest to soils as the deposits of clay which lie between the drumlins.

Based on review of the surface geological map of Ontario, the subject site is located within the mapped glaciofluvial ice contact deposits, consisting predominantly gravel and sand, minor till, includes eskers, kames, end moraine, ice-margin delta and subaqueous fan deposits. Drawing No. 4, as reproduced from Ontario Geological Survey (OGS) mapping, illustrates the Quaternary surface soil geology for the subject site and the surrounding area.

The bedrock underling the site is comprised mainly of Upper Ordovician aged shale limestone, dolostone and siltstone of the Georgian Bay Formation, the Blue Mountain Formation, the Billings Formation, the Collingwood Member and the Eastview Member (Ontario Ministry of Northern Department and Mines, 1991). Bedrock was not contacted at the bottom of the boreholes advanced beneath the site. The approximate elevation for the top of bedrock beneath the site is at about 184 masl (Bedrock Topography of the Newmarket Area, 1993) which is about 90 m below the existing site grades

4.2 Physical Topography

A review of the topography for the subject site and the surrounding area shows a decline in elevation relief towards the northern site limits, towards the Mill Street. Runoff from the site is expected to mimic the local topography, and drain in a northern direction. Based on the review of the topographic map for the area, and from the review of the ground surface elevations at the borehole and monitoring well locations, the total elevation relief across the subject site is about 3.5 m. Drawing No. 5 shows the mapped topography contours for the subject site and the surrounding area.

4.3 Watershed Setting

The subject site is located within the Lake Simcoe Watershed and the Uxbridge Brook Sub-Watershed, which are mapped, as shown on Drawing No. 6. The Lake Simcoe watershed includes 3,400 m² of land and water surfaces, of which the lake occupies about 20 percent of the area, and provides a source of safe drinking water to seven municipalities. There are 20 municipal borders from the Oaks Ridge Moraine in the north, through York and Durham regions, Simcoe Conty and the cities of Kawartha Lakes, Barrie and Orilla. The Lake Simcoe watershed has been divided into 18 sub-watersheds (Lake Simcoe Region Conservation Authority). Drawing No. 6 shows the location of the subject site within the Lake Simcoe Watershed and the Uxbridge Brook Sub-Watershed.

4.4 Local Surface Water and Natural Features

The subject site and the adjacent lands to the east are wooded, with a small portion of the southwest area of the subject site being within the Oak Ridges Moraine (Settlement Area). The closest wetland feature (Not evaluated per OWES as being provincially significant) is situated about 112 m north of the subject site, and a wetland feature (classified as Provincially significant) is found, approximately 350 m southeast of the site. Furthermore, bodies of water are also mapped, both east and west of the site, with the closest water body being located, about 100 m east of the site.

A tributary for the Uxbridge Brook which flows northwards is mapped, both to the east and west of the subject site where they merge together about 325 m north of the property and flows towards Lake Simcoe. The locations of the subject site and the noted natural features are shown on Drawing No. 7.

5.0 SOIL LITHOLOGY

This study has disclosed that beneath a layer of topsoil and earth fill in places, the native subsoils underlying the subject site consists of sand, sandy silt, silt, and silt till deposits, extending to the maximum depths of the investigation. A Key Plan and the interpreted hydro-geo-stratigraphic cross-section, along two transects. one being northwest to southeast, and the other running northeast to southwest are presented on Drawing No's. 8-1 and 8-2.

5.1 **Topsoil** (All BH/MW)

A layer of topsoil, ranging in thickness from 20-30 cm was observed at the ground surface at the all BH/MW locations.

5.2 **Earth Fill** (BH/MW 202)

Earth fill, 0.6 m thick was observed at the BH/MW 202 location, below the prevailing ground surface. It consists of silty clay with a trace of sand and occasional topsoil and rootlet inclusions. The moisture content for the retrieved subsoil samples ranges from 21.7% to 25.2% indicating saturated conditions.

5.3 **Sand** (All BH/MW's)

The sand deposit, was encountered at all of the BH/MW locations, beneath the topsoil or earth fill layers. Sand was encountered at the depths of 0.2 to 0.9 m. It is brown in colour and the thickness of the layer ranges from 0.6 to 5.8 m. The moisture contents for the retrieved subsoil samples ranges from 9 to 16%, indicating moist to saturated conditions. The estimated permeability for this layer at a depth of 4.5 mbgs is about 10^{-3} cm/sec. A grain size analysis was performed on one (1) sample, and the gradation is plotted on Figure 4.

5.4 **Sand Till** (BH/MW 201 and 203)

The sand till deposit, was encountered at a depth of 6.1 mbgs at BH/MW 201, and at 0.8 mbgs at the BH/MW 203 location. It is brown in colour, having trace of clay and occasional sand seams and layers. The moisture contents for the retrieved subsoil samples ranges from 13% to 21%, indication that it is damp to saturated conditions. The estimated permeability for this layer at depth of 6 mbgs is about 10^{-5} cm/sec. A grain size analysis was performed on one (1) sample, and the soil gradation is plotted on Figure 5.

5.5 **Sandy Silt** (BH/MW 202)

The sandy silt deposit, approximately 5.1 m thick was encountered at a depth of 1.5 mbgs at the BH/MW 202 location. It is brown in colour, having trace of clay and occasional sand seams and layers. The moisture contents for the retrieved subsoil samples ranges from 8% to 19%, indication that it is moist to saturated conditions. The estimated permeability for this layer at a depth of 3.1 mbgs is about 10^{-4} cm/sec. A grain size analysis was performed on one (1) sample, and the soil gradation is plotted on Figure 6.

6.0 GROUNDWATER STUDY

6.1 Review of Previous Reports

A review of the findings of the previous geotechnical soil investigation (SEL Reference No. 2011-S19, dated January 2021) indicates that six (6) BH's were drilled during the subsurface investigation at time of the drilling program. The investigation has disclosed that beneath the topsoil layer, and earth fill soil horizons, the subject site is underlain by sand and silt, at variable locations and depths.

Groundwater was encountered in the open boreholes, at depths of 3.1 to 4.8 m (E. 269.2 to 272.8 masl). The groundwater appears to be draining in an east direction and the groundwater levels are subject to seasonal fluctuation.

6.2 Review of Ontario Water Well Records

The Ministry of the Environment, Conservation and Parks (MECP) water well records (WWRs) for the subject site, and for the properties within a 500 m radius of the site boundaries (study area) were reviewed.

The records indicate that thirty-nine (39) well records are located within the study area relative to the subject site boundaries. The locations of these water wells, based on the UTM coordinates provided by the well records, are shown on Drawing No. 3. A detailed summary of the MECP WWRs that were reviewed for this assessment is provided in Appendix 'A'.

A review of the final status of the well records within the study area reveals that eight (8) are listed as water supply wells, two (2) are listed as test hole wells, five (5) are listed as observation wells, four (4) are listed as abandoned-other wells, one (1) is listed as abandoned-supply well, two (2) are listed as dewatering wells, ten (10) are listed as monitoring and test hole wells, and seven (7) wells are listed having an unknown status.

A review of the first status of the well records shows that eight (8) are domestic wells, eleven (11) are monitoring and test hole wells, five (5) are monitoring wells, two (2) are dewatering wells, one (1) is listed as commercial well, four (4) wells are not being used, and eight (8) wells are unknown.

6.3 Groundwater Monitoring

The groundwaters levels in the monitoring wells were measured, manually on two occasions, during the study period, extending from May 18 to June 7, 2021, to record the fluctuation of the shallow groundwater table beneath the subject site. A third set of groundwater levels will be recorded in July 2021. The recorded groundwater levels and their corresponding elevations are provided in Table 6-1.

Table 6-1 – Ground Water Level Measurements

Well ID		May 18, 2021	June 7, 2021	Average	Fluctuation
BH/MW 201	mbgs	4.05	4.25	4.15	0.15
	masl	269.87	269.67	269.77	
BH/MW 202	mbgs	Dry	Dry	Dry	-
	masl	<271.29	<271.29	<271.29	
BH/MW 203	mbgs	3.20	3.61	3.4	0.41
	masl	272.23	271.82	272.03	

Notes: mbgs -- metres below ground surface masl -- metres above sea level

As shown above, the groundwater levels at the BH/MW 201 and 203 locations exhibited a declining trend throughout the monitoring period. The groundwater levels at BH/MW 202, were below the monitoring well screen and the well was recorded as being dry throughout the monitoring period. The greatest fluctuation was recorded at BH/MW 203, where the groundwater levels exhibited a 0.41 m difference in their elevations during the monitoring period.

6.4 Single Well Response Test Analysis

Out of three (3) monitoring wells, only two (2) wells BH/MW 201, and 203 underwent a single well response test (SWRTs) to assess the hydraulic conductivity (K) for saturated shallow aquifer subsoils at the depths of the monitoring well screen. BH/MW 102 contained insufficient groundwater volume within the monitoring well throughout the monitoring period to successfully complete the SWRT.

The results of the SWRT analysis are presented in Appendix ‘B’, with a summary of the findings provided in Table 6-2.

Table 6-2 - Summary of SWRT Results

Well ID	Ground El. (masl)	Monitoring Well Depth (mbgs)	Borehole Depth (mbgs)	Screen Interval (mbgs)	Screened Soil Strata	Hydraulic Conductivity (K) (m/sec)
BH/MW 201	273.92	6.1	6.5	3.1-6.1	Sand Till	1.1×10^{-5}
BH/MW 203	275.43	6.1	6.5	3.1-6.1	Silt	1.3×10^{-5}

As shown above, the estimated K values range from 1.1×10^{-5} to 1.3×10^{-5} m/sec. The results for the SWRTs suggest that the hydraulic conductivity(K) estimate for the groundwater-bearing subsoils at the depth of the monitoring well screen ranges is moderate to high, with corresponding moderate to high anticipated groundwater seepage rates being anticipated into open excavations below the groundwater table.

6.5 Shallow Groundwater Flow Pattern

The shallow groundwater flow pattern for the subject site will be interpreted after the 3rd set of groundwater level readings, which will take place in July. The report will be updated once the 3rd set of levels are recorded from the average of all the groundwater level measurements.

7.0 GROUNDWATER CONTROL DURING CONSTRUCTION

The hydraulic conductivity (K) estimates suggest that groundwater seepage rates into open excavations below the groundwater table will be moderate to high. To provide safe, dry and stable conditions for earthworks excavations for construction of the proposed underground housing basement structures and for installation of the associated underground services, it is recommended that the groundwater table should be lowered in advance of, or during construction. The preliminary estimates for the temporary construction dewatering flows required to locally lower the groundwater table, based on the K test results, are discussed in the following section.

7.1 Groundwater Construction Dewatering Rates

The grading and development plans, showing the proposed finished grade elevations and the proposed invert elevations for underground services were not available for review at the time of the preparation for the current hydrogeological assessment report. However, it is understood that the proposed development will comprise construction of detached residential housing dwellings, having basement structures along with the associated underground services.

Based on the measured shallow groundwater level elevations, construction dewatering is anticipated to complete the underground housing basement structures and for the installation of the associated underground services. The construction dewatering flow rate estimates are discussed below:

Dewatering Flow Rate Estimates each with a basement structure

The proposed finished floor elevations were not available for review at the time of the current report. The bases for the proposed underground housing structures have been considered at depth of 3.0± m beneath the existing grade surface elevations, ranging from 273.92 to 277.46 masl. By considering the above, the measured shallow groundwater levels, and the hydraulic conductivity (K) estimates for the shallow subsoil profile, the construction dewatering needs assessment was completed for the proposed development. To facilitate excavation and construction in dry and stable subsoil conditions, it is proposed that the groundwater table be lowered to elevations, ranging from 269.92 to 273.43 masl which is about 1 m below the lowest considered excavation depthd. The subsoil profile consists of silty clay till and sand till, extending to the maximum anticipated excavated depths for housing basement foundations.

The construction dewatering needs assessment was completed, assuming an approximate, rectangular excavations for the housing structures, where the estimated temporary construction dewatering flow is anticipated to reach an estimated, daily rate of 128,805.1 L/day; by considering a 3x safety factor, it could reach an approximate daily maximum of 386,415.3 L/day. It should be noted that a rectangular construction footprint shape, having a length of 30 m, and a width of 12 m, having a perimeter of 84 m was considered for this dewatering need assessment, for the proposed housing basement structure construction.

Construction Dewatering Flow Rates for underground Infrastructure Servicing Construction

The proposed invert elevations for installation of underground services were not available for review at the time of the current report preparation. As such, the underground services invert depth elevations, ranging from 273.92 to 275.43 masl were estimated by considering a depth of 5.0± m beneath the existing grading surface elevations, with the invert depths ranging from 268.9 to 270.4 masl at the BH/MWs locations for the current dewatering needs assessment for underground servicing. To facilitate excavation and construction in dry and stable subsoil conditions, it is proposed that the groundwater table be lowered to an elevation, ranging from 267.9 to 269.4 masl which is about 1 m below the lowest considered excavation depth. The highest shallow groundwater level was measured at El. 272.23 masl, at the BH/MW 203 location. The subsoil profile consists of sand till and silt extending to the maximum anticipated excavated depth. As such, the estimated dewatering flow is anticipated to reach a daily rate of 104,967.9 L/day; by considering a 3x safety factor, it could reach an approximate daily maximum of 314,903.8 L/day. It should be noted that an active dewatering array for an underground servicing trench length of 100 m was considered for the current dewatering needs assessment.

In accordance with the current policy of the Ministry of the Environment, Conservation and Parks (MECP), where the construction dewatering flow rate is between 50,000 L/day and 400,000 L/day, the approval for proposed groundwater taking for construction is by means of the registering for proposed groundwater-taking for construction by means of the filing an Environmental Activity and Sector Registry (EASR) with the MECP. Since the estimated dewatering flow rate exceeds 50,000 l/day, and is below the 400.000 L/day PTTW threshold limit, the registering for any proposed groundwater-taking for construction would be through an EASR, and its filing through the MECP. It is recommended that the EASR be filed for the maximum allowable construction dewatering flow rate of 400,000 L/day to also account for the management and removal of any accumulated runoff within the construction excavations following high rainfall events.

It is recommended that the construction dewatering needs estimation be revised and updated, once finalized development plans, showing the proposed housing finished floor elevations, and the associated underground servicing invert elevations become available for review, and/or if there are any significant differences between the above considerations and the finalized finished floor elevations, and underground servicing invert elevations.

7.2 Groundwater Control Methodology

Moderate to high groundwater seepage rates are being anticipated into open excavations below the groundwater table. Any construction dewatering can likely be controlled by occasional pumping from sump pits when and where required during construction. Well points can be employed to lower the shallow groundwater table if wet sand, or unstable subsoils are encountered and seepage cannot be controlled via sump pumping. The final design for any temporary construction dewatering system will be the responsibility of the construction contractors.

7.3 Mitigation of Potential Impacts Associated with Dewatering

The zone of influence for any conceptual dewatering wells or dewatering array used during construction could reach a maximum of 30.3 m away from the dewatering array or sump pit wells around the underground servicing trench excavations and housing footprint excavations. It is recommended that these wells be decommissioned in advance of earthworks if they are no longer needed. There are adjacent buildings that could potentially be affected by potential groundwater settlement associated with the zone of influence for temporary construction dewatering. The subject site is scattered with wooded area. There are no records for, bodies of water, or wetlands being present within the conceptual zone of influence for any construction dewatering. It is recommended that a geotechnical engineer should be consulted to review potential ground settlement concerns to nearby structures prior to construction.

7.4 Groundwater Function for the Subject Site

The proposed development will consist of residential housing subdivision, having associated underground services and utilities. The study shows that the shallow groundwater table should be temporarily lowered in advance of, and during construction. At the time of investigation, the subject site was occupied as a single dwelling along with a shed structure located at the property. The subject site is also currently covered by grass and trees where the site is located within an existing, developed residential neighbourhood.

As such, the local shallow groundwater flow pattern for the local area may be temporarily impacted from the proposed development, where the construction activities will be below the shallow groundwater level.

7.5 Ground Settlement

It is recommended that the potential ground settlement concerns associated with any temporary construction dewatering should be assessed by a geotechnical engineer prior to earthworks and construction.

7.6 Low Impact Development Infrastructure

The surficial soil at the subject site consists, predominantly of sand till and silt. The groundwater level lies at depths, ranging between 3.20 to 4.25 m below the existing ground surface (EL. 269.67 to 272.23 masl). The existing shallow sand till and silt layer could facilitate the infiltration of precipitation received at the developed site to the subsurface to recharge the shallow groundwater table. If the shallow soils remain unsaturated, proposed Low Impact Development (LID) infrastructure should be considered for implementation in areas where the shallow groundwater is deeper than 1.0 m below the ground surface, and where it is possible to maintain a minimum 1.0 m separation between the bases for any proposed LID stormwater management infiltration infrastructure and the high groundwater table to address future stormwater management planning for the proposed development. Any proposed LID infrastructure should be designed by the stormwater engineer for the project.

8.0 CONCLUSIONS AND RECOMMENDATIONS

1. The subject site is located within the Physiographic Region of Southern Ontario known as the Peterborough Drumlin Field of the Oak Ridges Moraine.
2. Based on review of the surface geological map of Ontario, the subject site is located on glaciofluvial ice-contact deposits, consisting predominantly gravel and sand minor till, including eskers, kames, end moraines, along with ice-margin delta and subaqueous fan deposits.
3. Based on the review of the topography map for the area and from the review of the ground surface elevation at the borehole and monitoring well locations, the total elevation relief across the site is about 3.5 m.
4. The subject site is located within the Lake Simcoe Watershed, and the Uxbridge Brook Sub-Watershed.
5. This study has disclosed that beneath the layers of topsoil and earth fill in places, the underlying native subsoils consists of sand, sandy silt, silt, and silt till deposits, extending to the maximum depths of the subsurface investigation.
6. The study indicates that the measured groundwater level elevations ranged from 269.67 to 272.23 masl. Shallow groundwater is interpreted to flow in a northerly direction. The highest shallow groundwater level was measured at BH/MW 203.
7. The single well response testing yielded a hydraulic conductivity (K) estimates that range from to $1.1x10^{-5}$ to $1.3\ x10^{-5}$ m/s for the sand till, sandy silt and silt deposits encountered at the monitoring wells screen depth intervals. The test results suggest that moderate groundwater seepage rates can be anticipated into open excavations below the groundwater table.
8. The estimated temporary dewatering flow for installation of the underground services could reach a maximum daily rate of 104,967.9 L/day; by considering a 3x safety factor, it could reach an approximate daily maximum of 314,903.8 L/day and the estimated temporary dewatering flow for housing basement structure construction could reach daily rate of 128,805.1 L/day; by considering a 3x safety factor, it could reach an approximate daily maximum of 386,415.3 L/day. Since the estimated dewatering flow rate exceeds 50,000 L/day but is below the 400,000 L/day PTTW threshold limit, the approval for any proposed groundwater-taking for construction is by means of applying for an EASR approval with the MECP.
9. The zone of influence for any conceptual dewatering wells or dewatering array around excavation footprints could reach maximums of 30.3 m away from the conceptual dewatering arrays. There are adjacent buildings that could potentially be affected by potential groundwater settlement associated with the zone of influence for temporary construction dewatering. It is recommended that potential groundwater settlement

concerns relative to the proposed development be assessed by geotechnical engineer in advance of construction.

10. Based on review of the native subsoil beneath the subject site, consisting of sand till, sandy silt and silt layer, opportunities may exist to facilitate the infiltration of precipitation received at the developed site to the subsurface to recharge the shallow aquifer at depth to address future stormwater management planning for the proposed development. Passive LID measures such as implementation of bioswales, rain gardens, thickening topsoil and use of permeable fill material at the site grading stages are recommended to facilitate shallow soil conditions that will enhance and promote infiltration and evapotranspiration to maintain the water balance for the subject site after development.

Yours truly,
SOIL ENGINEERS LTD.

Bhawandeep S. Brar, B.Sc.

Gavin O'Brien, M.Sc., P.Geo
BB/GO

9.0 REFERENCES

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2. Bedrock Geology of Ontario, 1991, Data set 6, Ministry of Northern Development

3. Bedrock Topography of the Newmarket Area, 1993

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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

FIGURES 1 to 6

BOREHOLE LOGS AND GRAIN SIZE DISTRIBUTION GRAPHS

REFERENCE NO. 2104-W092

JOB NO.: 2104-W092 # LOG OF BOREHOLE NO.: BH/MW 201 **FIGURE NO.:** 1

PROJECT DESCRIPTION: Proposed Residential Development **METHOD OF BORING:** Flight-Auger

PROJECT LOCATION: 62, Mill Street
Township of Uxbridge **DRILLING DATE:** May 10, 2021

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
273.9	Ground Surface							
0.0	30 cm TOPSOIL				0			
273.6 / 0.3		1	DO	6			5.5	
		2	DO	14	1		10.4	
		3	DO	16			14.1	
		4	DO	18	2		11.1	
	Brown **SAND** Fine to Medium some silt trace of clay, course sand and gravel occ. silt seams and layers	5	DO	16	3		9.8	
		6	DO	31	4		13.9	
267.8 / 6.1	Grey **SILT** a trace of clay occ. sand seams and layers	7	DO	18	5		19.6	
267.3 / 6.6	**END OF BOREHOLE**				6			
	Installed 50mm Ø monitoring well to 6.0 m 3.05 m screen from 3.05 to 6.1 m Sand backfill from 2.44 to 6.1 m Bentonite seal from 0.0 to 2.44 m Provided with Monument Casing				7			W.L. @ El. 269.87 m on May 18, 2021 W.L. @ El. 269.67 m on June 07, 2021
					8			
					9			

JOB NO.: 2104-W092 # LOG OF BOREHOLE NO.: BH/MW 202 **FIGURE NO.:** 2

PROJECT DESCRIPTION: Proposed Residential Development **METHOD OF BORING:** Flight-Auger

PROJECT LOCATION: 62, Mill Street
Township of Uxbridge **DRILLING DATE:** May 10, 2021

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
277.5	Ground Surface				
0.0	25 cm TOPSOIL				0
277.2 / 0.3	Dark Brown **EARTH FILL** Silty Clay trace fo sand occ top soil and rootlet inclusions	1	DO	6	
		2A			
276.6 / 0.9	Brown **SAND** fine grained occ. silt seams and layers	2B	DO	7	1
		3	DO	10	2
276.0 / 1.5		4	DO	31	
					3
		5	DO	39	
	Brown **SANDY SILT** trace of clay occ. sand seams and layers				4
		6	DO	32	5
					6
270.9		7	DO	24	
6.6	**END OF BOREHOLE**				7
	Installed 50 mm Ø monitoring well to 6.1 m 3 m slotted screen from 3.1 to 6.1 m Sand backfill from 2.4 to 6.1 m Bentonite backfill from 0 and 2.4 m Provided with a monument protective casing				8
					9

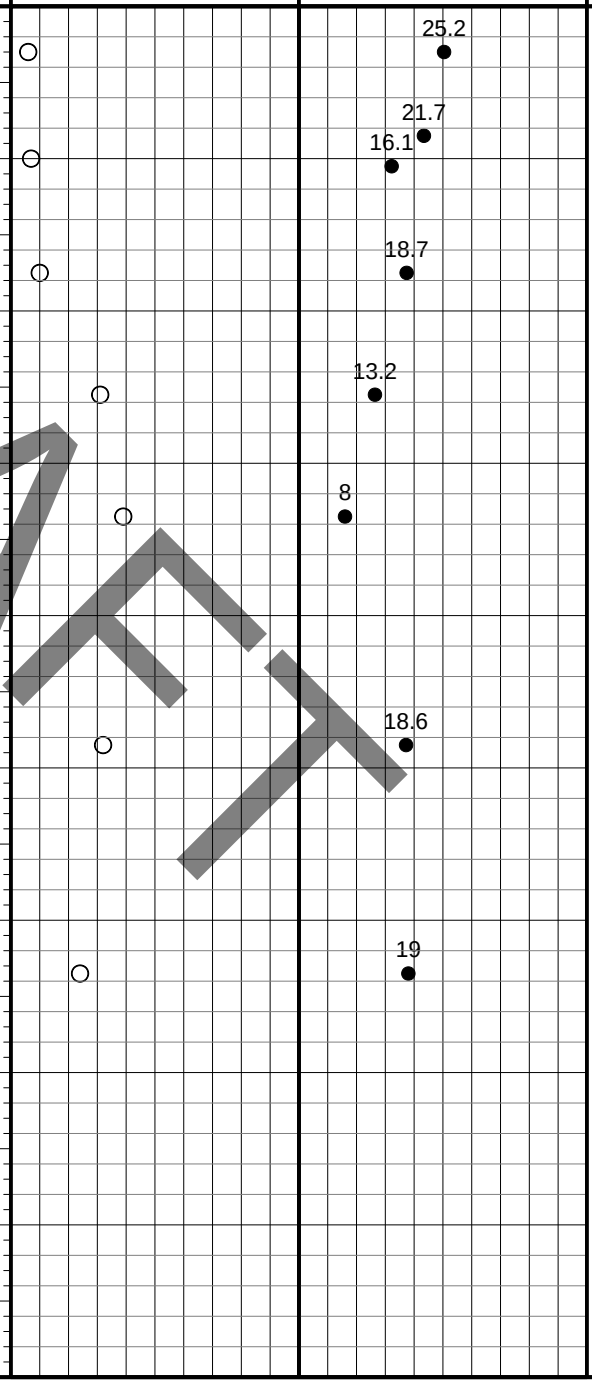
Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40



WATER LEVEL

Dry on May 18, 2021
Dry on June 07, 2021

JOB NO.: 2104-W092 # LOG OF BOREHOLE NO.: BH/MW 203 **FIGURE NO.:** 3

PROJECT DESCRIPTION: Proposed Residential Development **METHOD OF BORING:** Flight-Auger

PROJECT LOCATION: 62, Mill Street
Township of Uxbridge **DRILLING DATE:** May 10, 2021

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
275.4	Ground Surface							
0.0	20 cm TOPSOIL				0			
0.2 / 274.6	Brown **SAND** fine grained	1	DO	2			10.7	
0.8		2	DO	11	1		14.8	
		3	DO	13			13	
		4	DO	15	2		19.7	
	Brown **SILT** trace of clay occ sand seams and layers	5	DO	18	3		19.6	
		6	AS	15	4		20.1	
269.3					5			
6.1 / 268.8	grey **SILT TILL** some sand trace of clay and gravel	7	DO	13	6		15.3	
6.6	**END OF BOREHOLE**				7			
	Installed 50 mm Ø monitoring well to 6.1 m 3 m slotted screen from 3.1 to 6.1 m Sand backfill from 2.4 to 6.1 m Bentonite backfill from 0 and 2.4 m Provided with a monument protective casing				8			
					9			

W.L. @ El. 272.23 m on May 18, 2021
W.L. @ El. 271.82 m on June 07, 2021

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

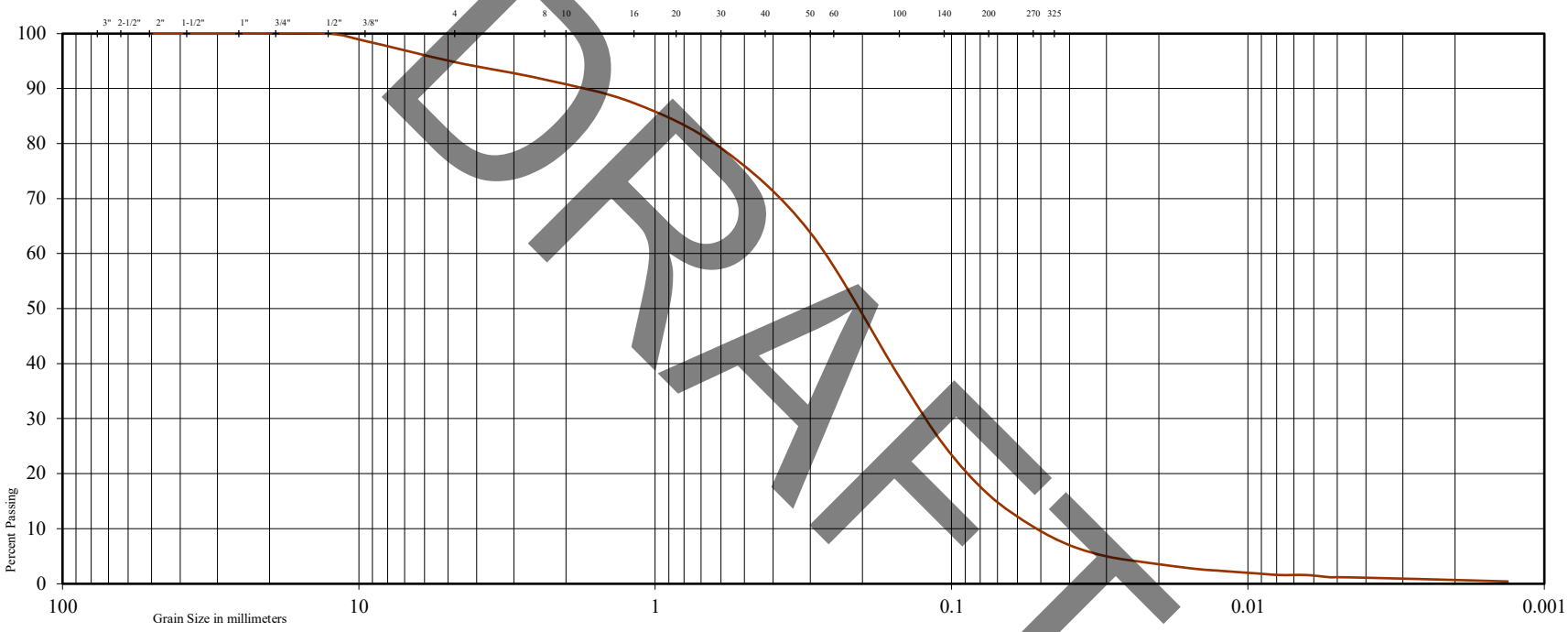
Reference No: 2104-W092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No: 201

Sample No: 6

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-3}

Classification of Sample [& Group Symbol]: FINE TO MEDIUM SAND

some silt, traces of clay, coarse sand and gravel

Figure: 4

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

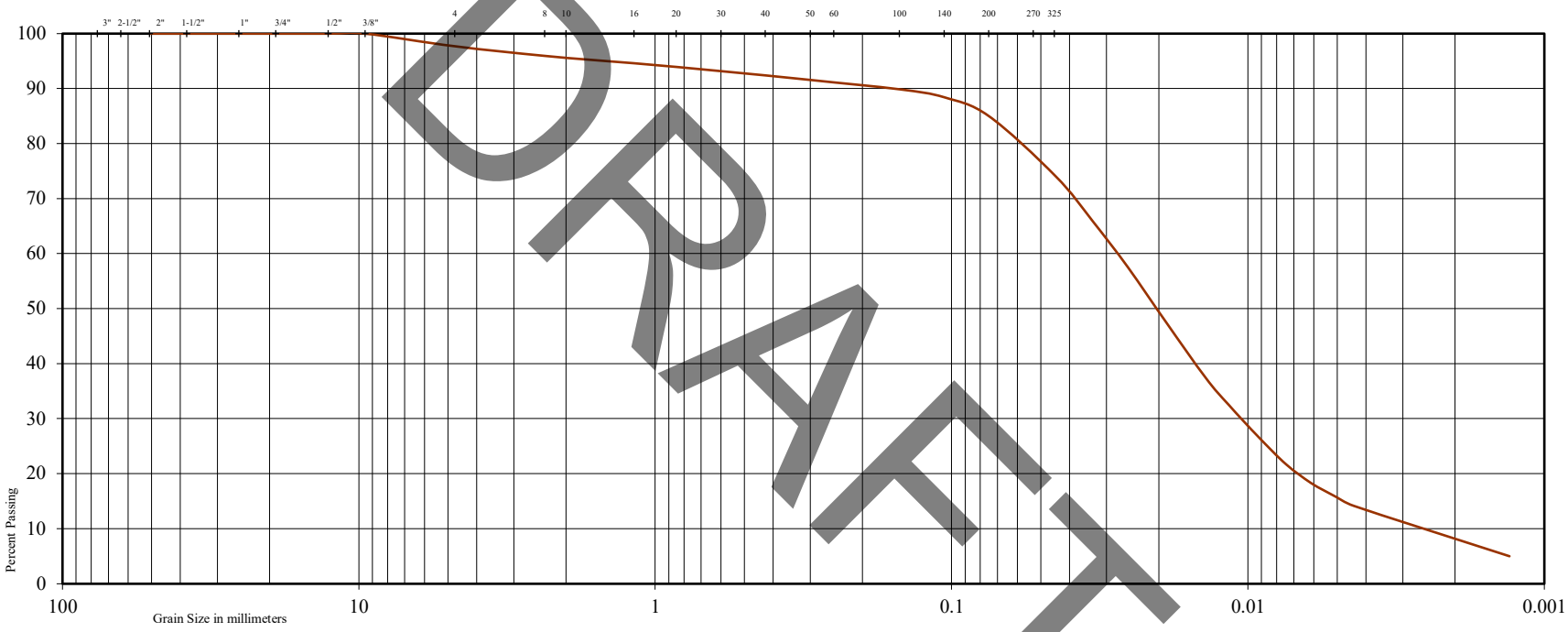
Reference No: 2104-W092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No: 203

Sample No: 7

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-5}

Classification of Sample [& Group Symbol]: SILT, TILL

some sand, traces of clay and gravel

Figure: 5

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

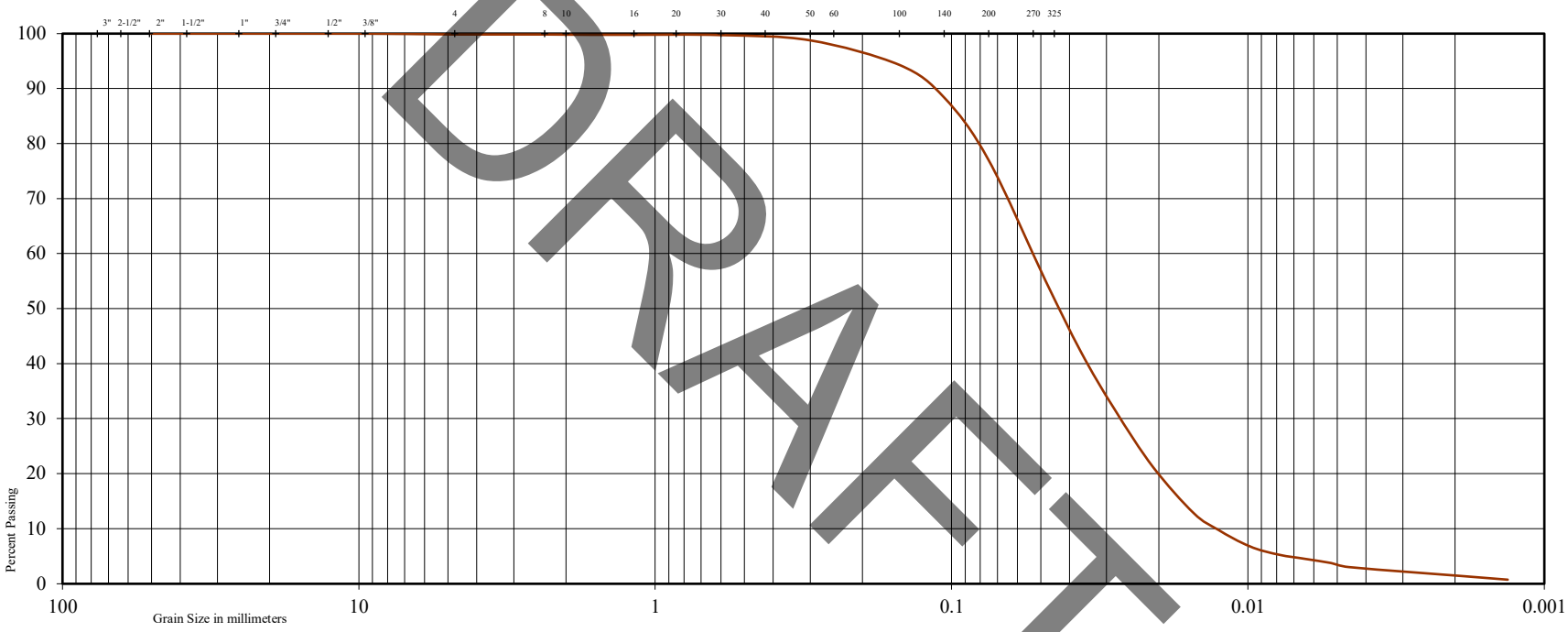
Reference No: 2104-W092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No: 202

Sample No: 5

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-4}

Classification of Sample [& Group Symbol]: SANDY SILT
a trace of clay

Figure: 6

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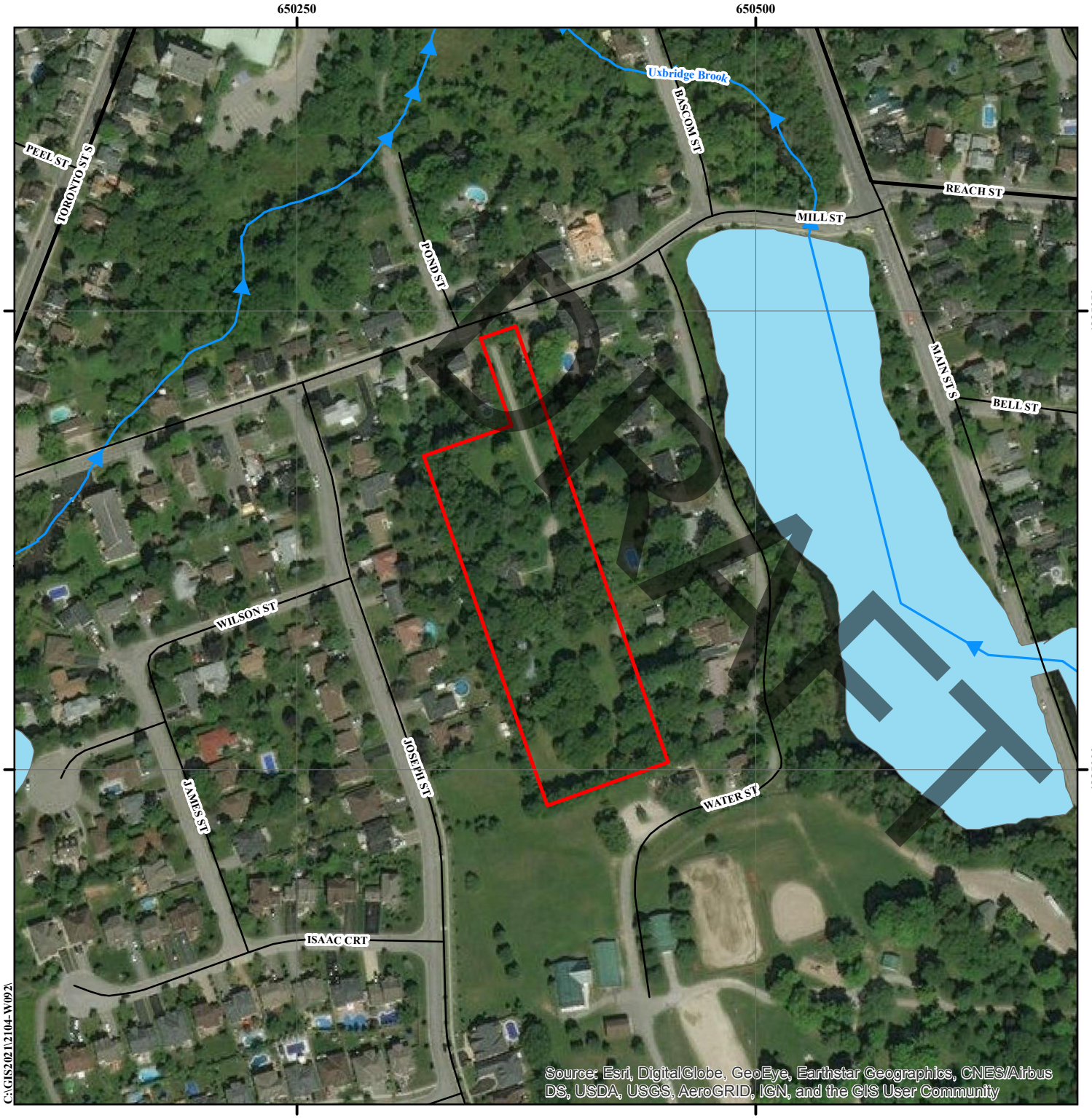
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

DRAWINGS 1 to 9

REFERENCE NO. 2104-W092



N

Approximate Boundary of Subject Site

Waterbody

Watercourse

Major Road

Local Road

Soil Engineers Ltd.

Title: Site Location Plan

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: April 16, 2021

Scale:
0 10 20 40 60 80 100
Metres

Drawing No. 1

N

Approximate Boundary of Subject Site

Borehole with Monitoring Well

Waterbody

Local Road

Soil Engineers Ltd.

Title: Borehole and Monitoring Well Location Plan

Project:

Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: April 16, 2021

Scale:

0 5 10 20 30 40 50

Metres

Drawing No. 2

N

Approximate Boundary of Subject Site

500 metres from Subject Site Boundary

Well Location from MECP Well Records (see Appendix 'A')

Waterbody

Watercourse

Major Road

Local Road

Railway

Soil Engineers Ltd.

Title: MECP Well Location Plan

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

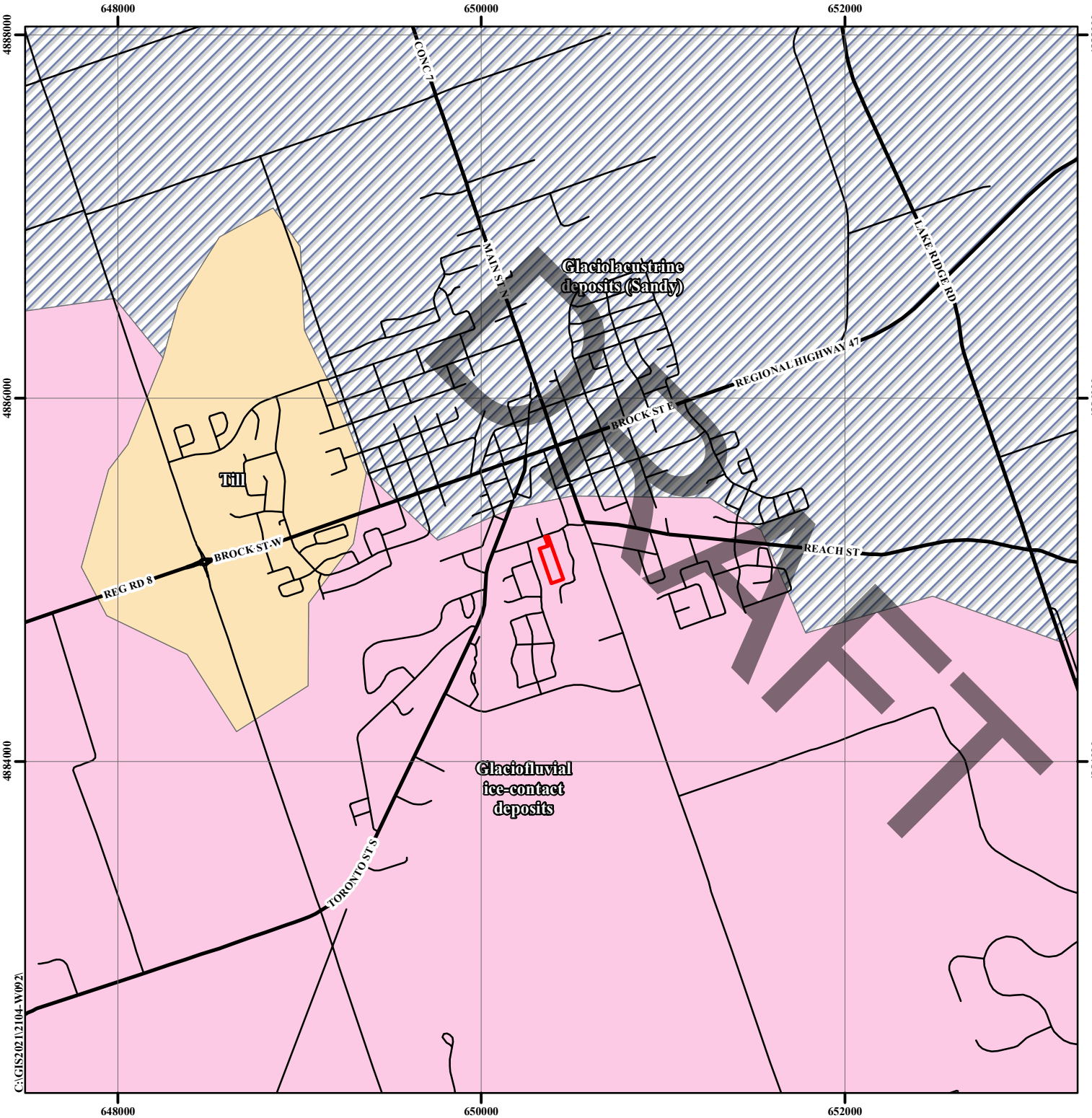
Reference No. 2104-W092

Date: April 16, 2021

Scale:
0 50 100 200 300 400
Metres

Drawing No. 3

Source: Ontario Ministry of Natural Resources and Forestry



N

Approximate Boundary of Subject Site

Glaciofluvial ice-contact deposits
Material: gravel and sand, minor till, includes esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits

Glaciolacustrine deposits (Sandy)
Material: sand, gravelly sand and gravel, nearshore and beach deposits

Till
Material: undifferentiated, predominantly sandy silt to silt matrix, commonly rich in clasts, often high in total matrix carbonate content

Major Road

Local Road

Soil Engineers Ltd.

Title: Quarternary and Surface Geology Map

Project:

Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

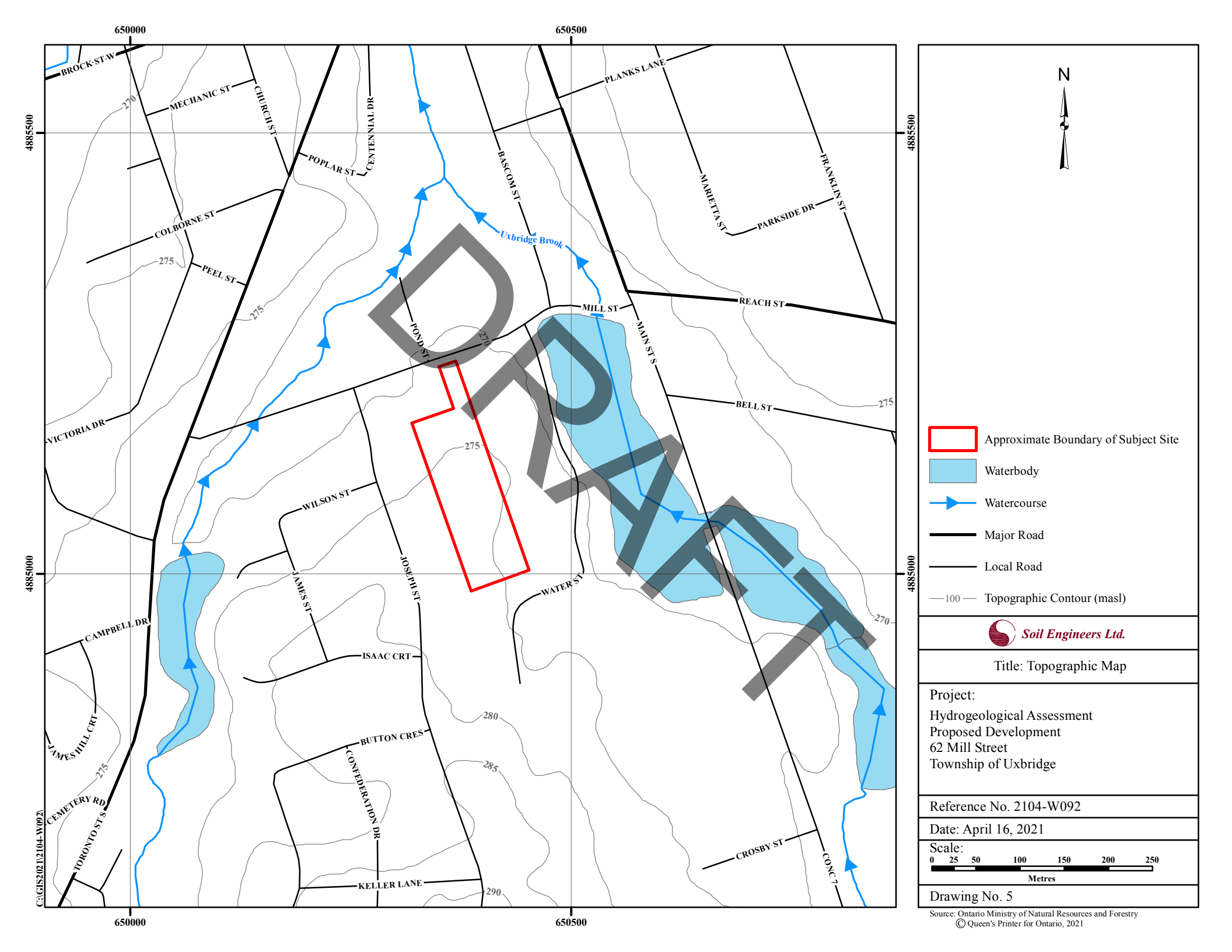
Date: April 16, 2021

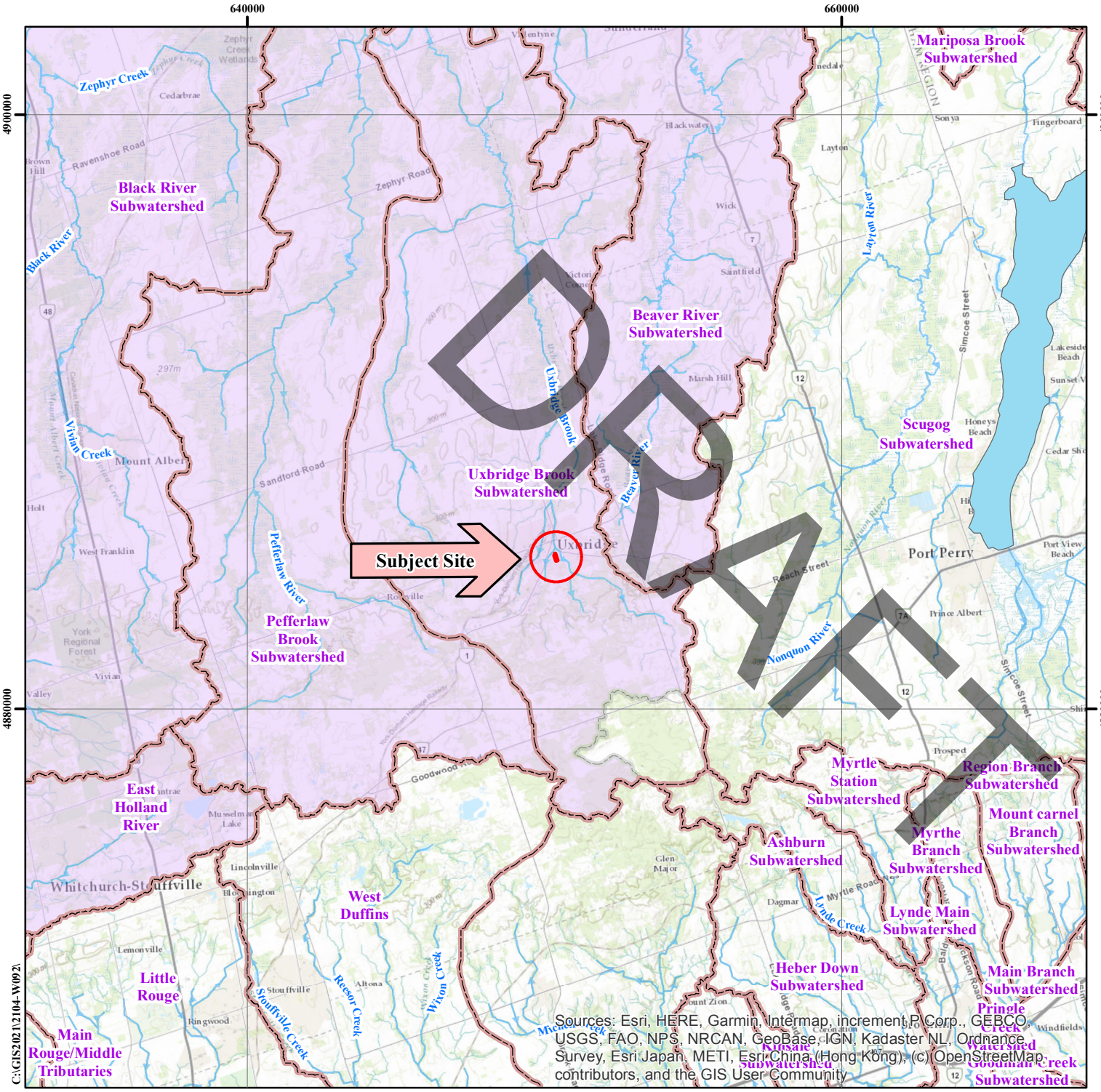
Scale:

0 100 200 400 600 800 1,000
Metres

Drawing No. 4

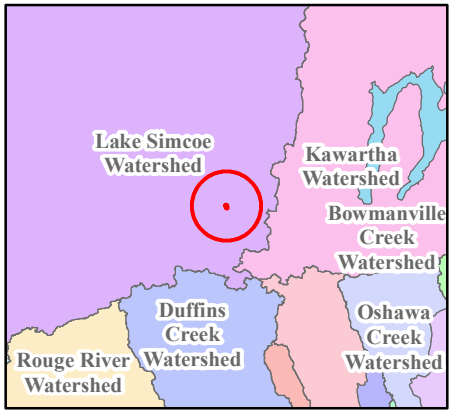
Source: Ontario Geological Survey, 1997, Surface Geology of Ontario; Ontario Geological Survey, Miscellaneous Released-Data 0014


650000
650500
4885500
4885000
BROCK ST W
MECHANIC ST
CHURCH ST
POPLAR ST
CENTENNIAL DR
BASCOM ST
PLANKS LANE
MARIETTA ST
PARKSIDE DR
FRANKLIN ST
COLBORNE ST
PEEL ST
Uxbridge Brook
MILL ST
REACH ST
POND ST
MAIN ST S
BELL ST
VICTORIA DR
WILSON ST
JAMES ST
JOSEPH ST
WATER ST
CAMPBELL DR
ISAAC CRT
JAMES HILL CRT
CEMETERY RD
BUTTON CRES
CONFEDERATION DR
TORONTO ST S
KELLER LANE
CROSBY ST
CONC 7
270
275
280
285
290
DRAFT
N
Approximate Boundary of Subject Site
Waterbody
Watercourse
Major Road
Local Road
100 Topographic Contour (masl)
Soil Engineers Ltd.
Title: Topographic Map
Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge
Reference No. 2104-W092
Date: April 16, 2021
Scale:
0 25 50 100 150 200 250
Metres
Drawing No. 5
C:\GIS\2021\2104-W092\
Source: Ontario Ministry of Natural Resources and Forestry
© Queen's Printer for Ontario, 2021



N

Watershed:



- Approximate Boundary of the Subject Site
- Watershed Boundaries
- Waterbody
- Watercourse
- Expressway/Major Road

Soil Engineers Ltd.

Title: Watershed and Subwatershed Map

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

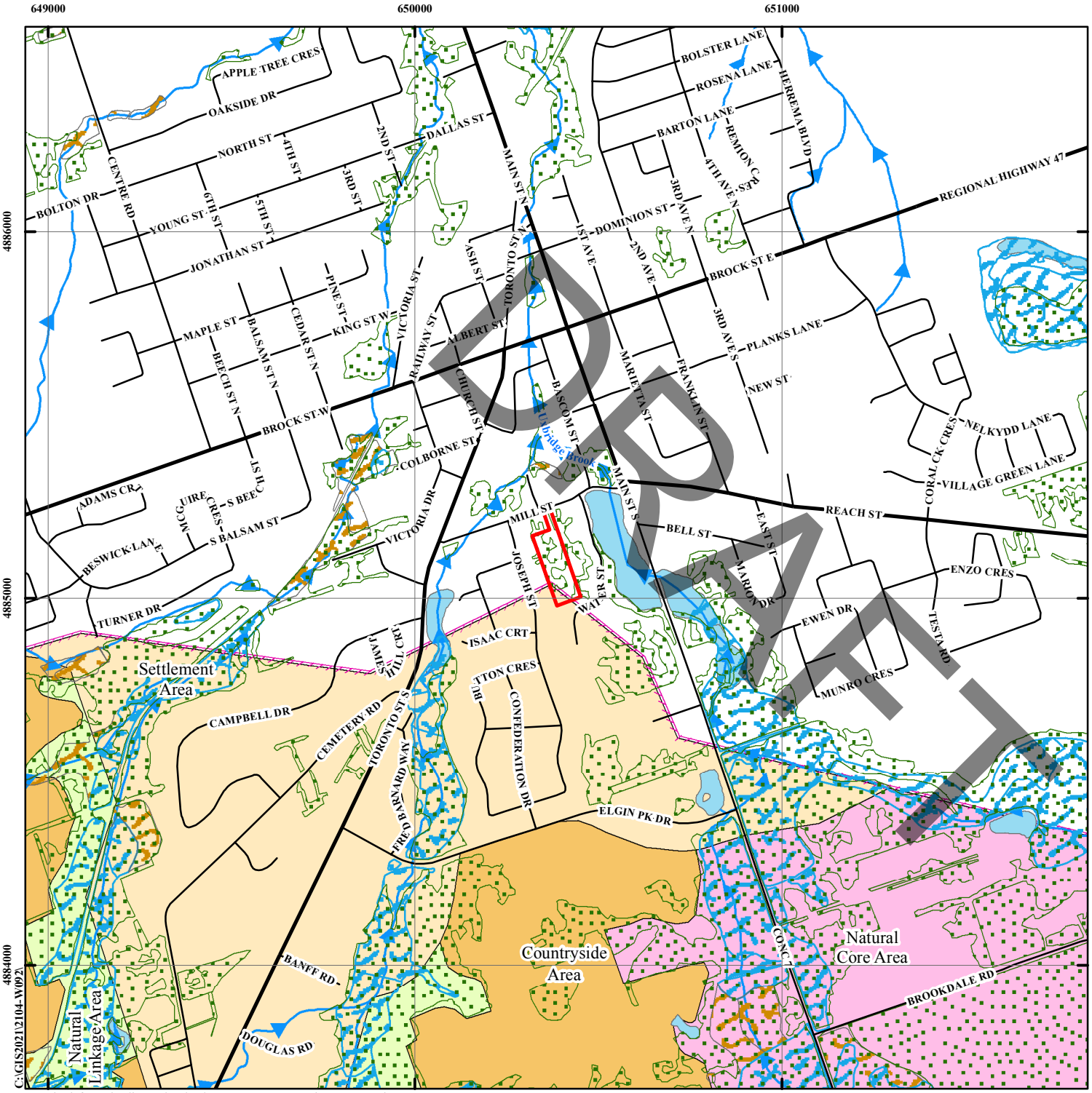
Date: April 16, 2021

Scale:
0 1,000 2,000 4,000 6,000 8,000 10,000
Metres

Drawing No. 6

C:\GIS2021\2104-W092\

This mapping was produced by SEL and should be used for information purposes only.
Data sources used in its production are of varying quality and accuracy and all boundaries should be considered approximate.



Approximate Boundary of Subject Site
Wetland (classified as Provincial)
Wetland (Not evaluated per OWES)
Oak Ridges Moraine Boundary
Oak Ridges Moraine (Countryside Area)
Oak Ridges Moraine (Natural Core Area)
Oak Ridges Moraine (Natural Linkage Area)
Oak Ridges Moraine (Settlement Area)
Wooded Area
Waterbody
Watercourse
Major Road
Local Road

Soil Engineers Ltd.

Title: Natural Features and Protection Area Plan

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: April 16, 2021

Scale:
0 50 100 200 300 400 500
Metres

Drawing No. 7

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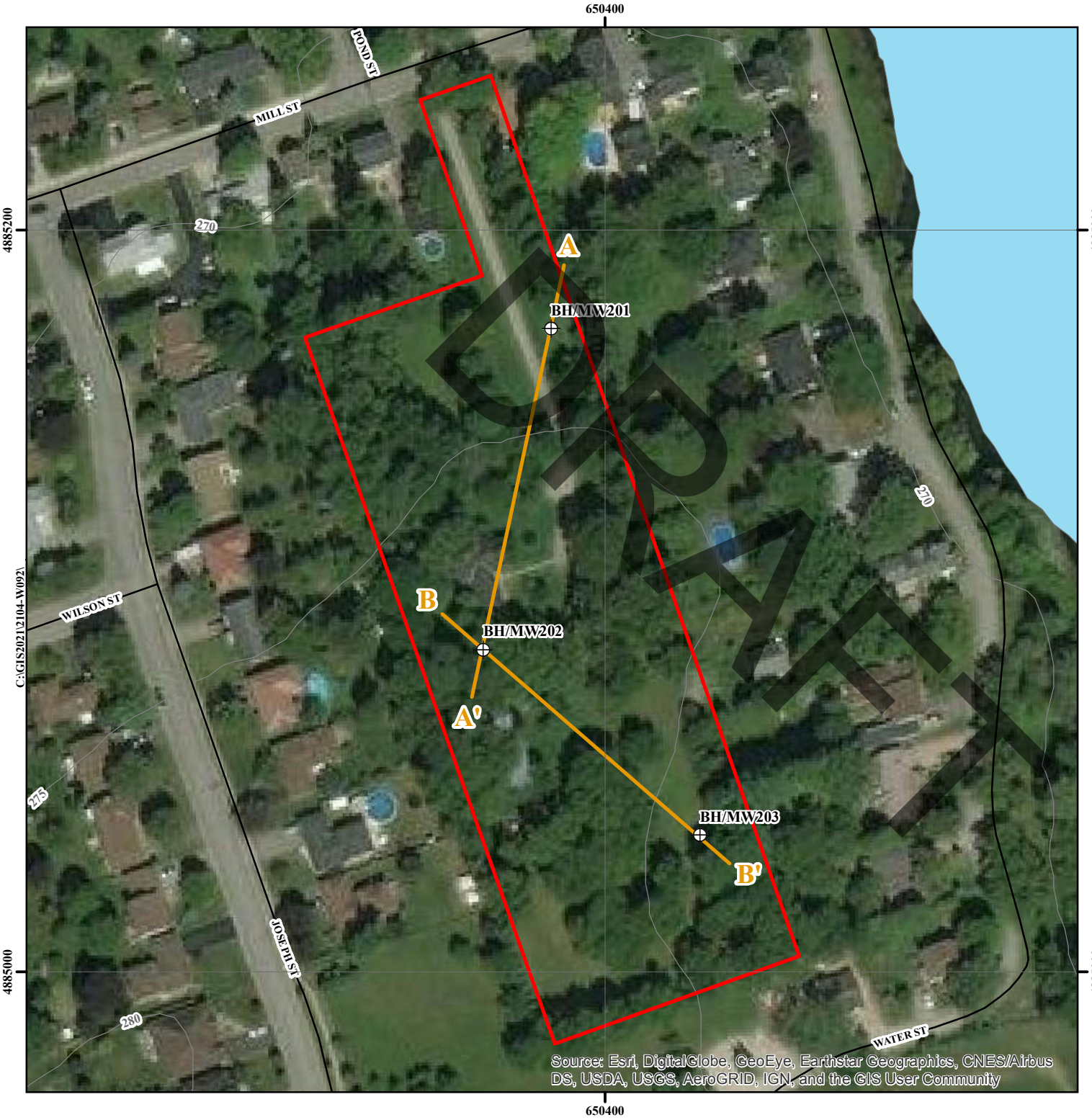
Source: Ontario Ministry of Natural Resources and Forestry

OWES: Ontario Wetland Evaluation System



N

Approximate Boundary of Subject Site

Borehole with Monitoring Well

Waterbody

Local Road

A A' Cross-Section Direction Topographic

100 Contour (masl)

Soil Engineers Ltd.

Title: Cross-Section Key Plan

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: June 10, 2021

Scale:
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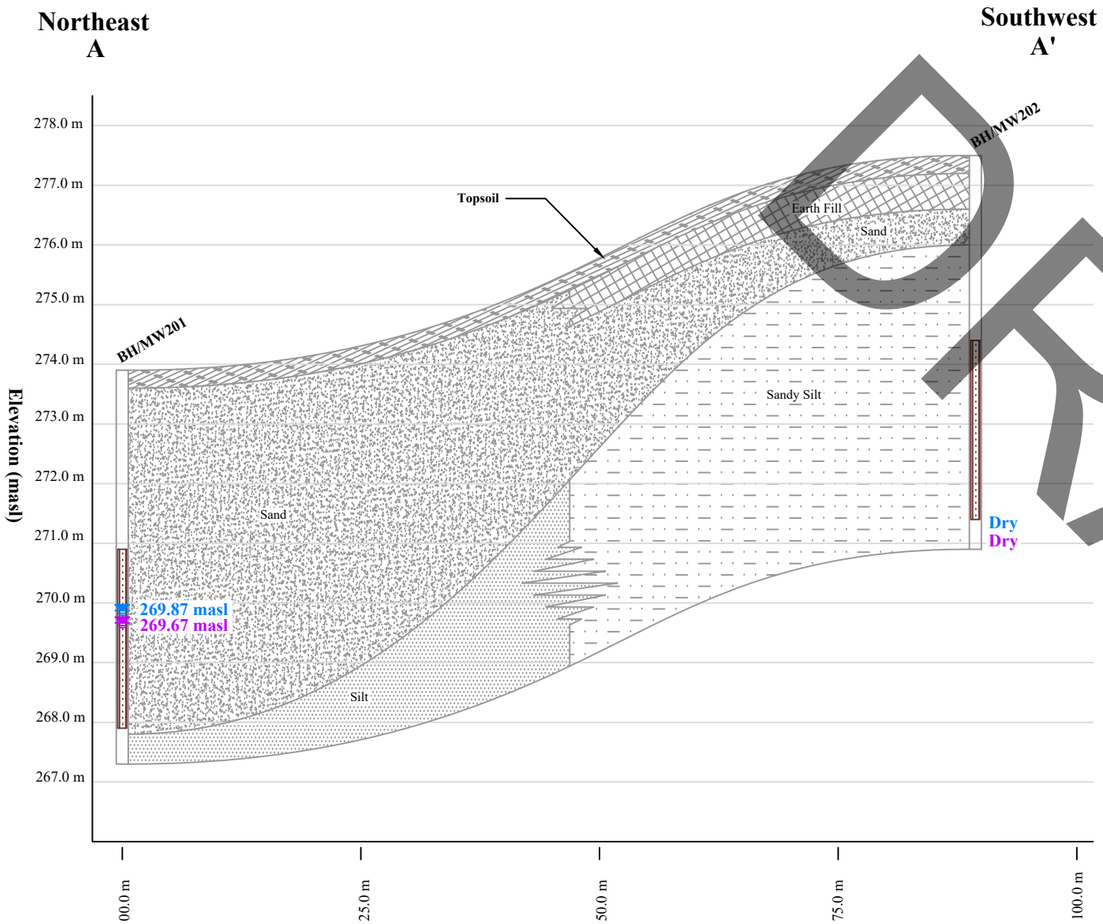
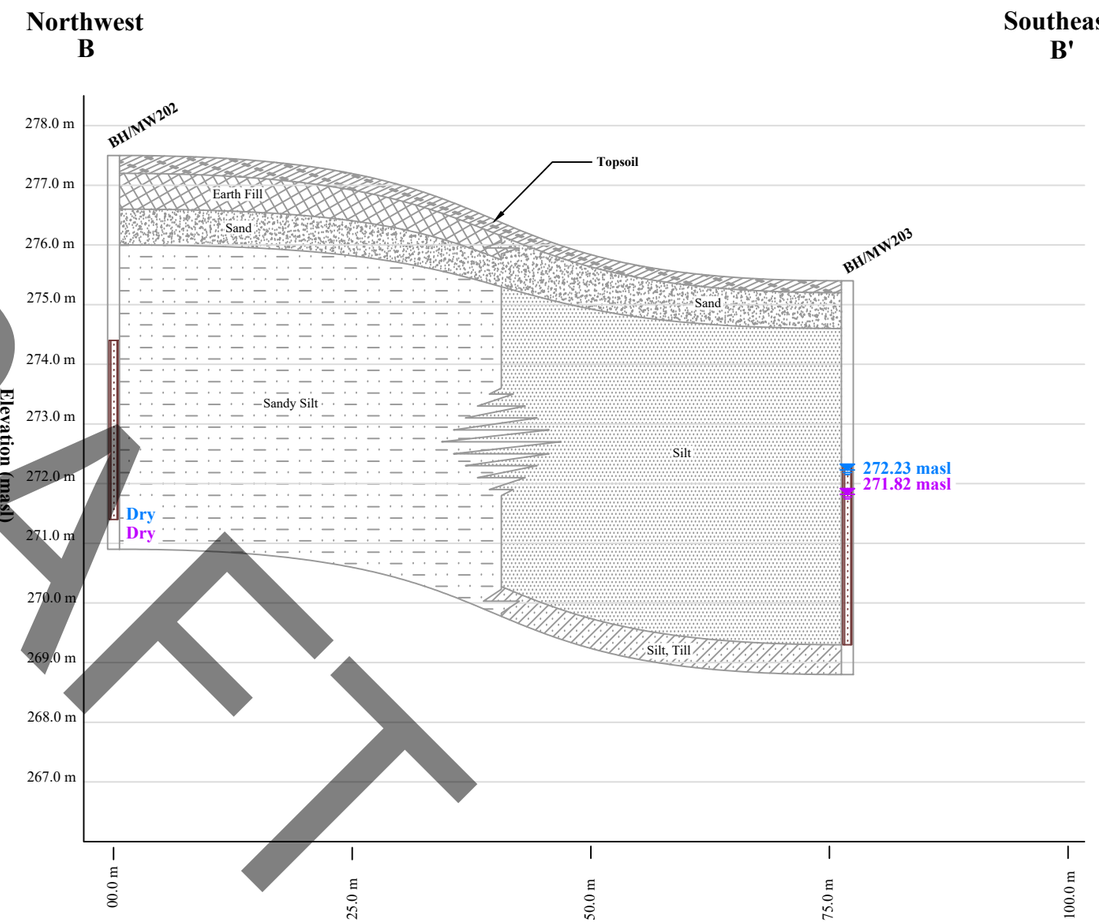
Metres

Drawing No. 8-1



Section A-A'



Section B-B'

Topsoil
Earth Fill
Silt
Silt, Till
Sandy Silt
Sand

3.0 m Screen

Water Table on May 18, 2021
Water Table on June 7, 2021

C:Projects/2019 Jobs/1903-W079

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CONSULTING SOIL, FOUNDATION & ENVIRONMENTAL ENGINEERS

Title: Geological Cross-Section (A-A' and B-B')

Project: Hydrogeological Assessment
Proposed Development
62 Mill Street, Township of Uxbridge

Reference No:	Date:	Scale: V	Scale: H	Drawing No.
2104-W092	June, 2021	1:100	1:2500	8-2

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APPENDIX 'A'

MECP WATER WELL RECORDS SUMMARY

REFERENCE NO. 2104-W092

Ontario Water Well Records									
WELL ID	MECP WWR ID	Construction Method	Well Depth (m)	Well Usage		Water Found (m)	Static Water Level (m)	Top of Screen Depth (m)	Bottom of Screen Depth (m)
				Final Status	First Use				
1	7273366	Direct Push	5.49	Monitoring and Test Hole	Monitoring and Test Hole	-	-	2.44	5.49
2	1904902	Rotary (Convent.)	-	Test Hole	Not Use	-	-	-	-
3	1904904	Rotary (Convent.)	-	Observation Wells	Not Use	-	-3.00	-	-
4	7195685	Rotary (Convent.)	-	Dewatering	Dewatering	-	-	-	-
5	7197204	Direct Push	7.32	Monitoring and Test Hole	Monitoring and Test Hole	-	-	4.27	7.32
6	4606577	Cable Tool	-	Water Supply	Domestic	10.67	1.20	17.37	18.29
7	7269312	Direct Push	6.10	Monitoring and Test Hole	Monitoring and Test Hole	-	-	3.05	6.10
8	7198295	-	-	Abandoned-Supply	-	-	-	-	-
9	1904901	Rotary (Convent.)	-	Observation Wells	Not Use	-	3.00	53.34	56.39
10	7195615	Rotary (Air)	8.08	Observation Wells	Commercial	-	1.90	5.03	8.08
11	7195684	Rotary (Air)	-	Dewatering	Dewatering	-	-	-	-
12	7273367	Direct Push	5.49	Monitoring and Test Hole	Monitoring and Test Hole	-	-	2.44	5.49
13	7315088	Auger	4.57	-	Monitoring	-	-	1.52	4.57
14	7315086	Auger	4.57	-	Monitoring	-	-	1.52	4.57
15	7121344	Other Method	4.57	Monitoring and Test Hole	Monitoring and Test Hole	-	-	1.50	4.57
16	1904903	Rotary (Convent.)	-	Test Hole	Not Use	-	-	-	-
17	7195619	Rotary (Air)	8.08	Observation Wells	Monitoring	-	1.10	5.03	8.08
18	7195620	-	-	Abandoned-Other	-	-	-	-	-
19	1906125	Rotary (Convent.)	-	Water Supply	Domestic	13.72	1.50	12.50	13.72
20	1912974	Cable Tool	-	Water Supply	Domestic	26.52	3.00	25.60	26.52
21	7197180	Direct Push	7.32	Monitoring and Test Hole	Monitoring and Test Hole	-	-	4.27	7.32
22	1911942	Cable Tool	-	Water Supply	Domestic	21.95	5.80	22.56	24.38
23	4605928	Cable Tool	-	Water Supply	Domestic	-	3.70	22.56	24.99
24	7226552	-	-	Abandoned-Other	-	-	-	-	-
25	4602993	Cable Tool	-	Water Supply	Domestic	25.91	-	27.43	28.65
26	7273365	Direct Push	20.00	Monitoring and Test Hole	Monitoring and Test Hole	-	-	10.00	20.00

Notes:

*MECP WWID: Ministry of the Environment, Conservation and Parks Water Well Records Identification

**metres below ground surface

Ontario Water Well Records									
WELL ID	MECP WWR ID	Construction Method	Well Depth (m)	Well Usage		Water Found (m)	Static Water Level (m)	Top of Screen Depth (m)	Bottom of Screen Depth (m)
				Final Status	First Use				
27	4605916	Rotary (Convent.)	-	Water Supply	Domestic	19.81	1.50	18.59	19.81
28	7321324	-	-	-	-	-	-	-	-
29	7269311	Direct Push	6.10	Monitoring and Test Hole	Monitoring and Test Hole	-	-	3.05	6.10
30	7260106	-	-	-	-	-	-	-	-
31	7043927	Cable Tool	22.76	Water Supply	Domestic	21.00	4.00	21.53	22.74
32	7195616	-	-	Abandoned-Other	-	-	-	-	-
33	7195621	Cable Tool	7.62	Observation Wells	Monitoring	-	-	2.44	7.62
34	7195594	-	0.00	Abandoned-Other	-	-	-	-	-
35	7121343	Other Method	4.57	Monitoring and Test Hole	Monitoring and Test Hole	-	-	1.50	4.57
36	7043937	-	-	-	-	-	-	-	-
37	7315087	Auger	4.57	-	Monitoring	-	-	1.52	4.57
38	7197205	Direct Push	7.32	-	Monitoring and Test Hole	-	-	4.27	7.32
39	7257934	Auger	4.57	Monitoring and Test Hole	Monitoring and Test Hole	-	-	1.52	4.57

Notes:

*MECP WWID: Ministry of the Environment, Conservation and Parks Water Well Records Identification

**metres below ground surface

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APPENDIX 'B'

SINGLE WELL RESPONSE TEST RESULTS

REFERENCE NO. 2104-W092

Falling Head Test (Slug Test)

Test Date:		07-Jun-21	
Piezometer/Well No.:		BH/MW 201	
Ground level:		273.92	m
Screen top level:		270.82	m
Screen bottom level:		267.82	m
Test El. (at midpoint of screen):		269.32	m
Test depth (at midpoint of screen):		4.6	m
Screen length	L=	3.0	m
Diameter of undisturbed portion o	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.3485	m
Initial water depth		4.25	m
Aquifer material:		**SAND, SILT**	

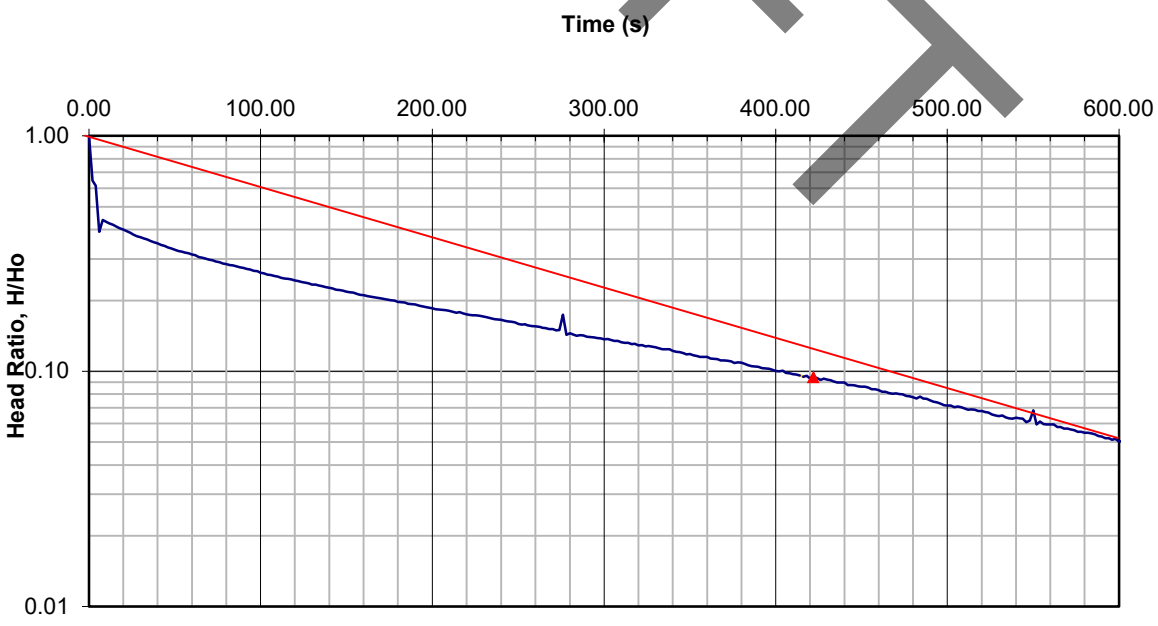
Shape factor $F = \frac{2 \times 3.14 \times L}{\ln(L/R)} = 5.701815$ m

Permeability $K = \frac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$\frac{\ln(H1/H2)}{(t2 - t1)} = 0.03139806$

K= **1.1E-03** cm/s

1.1E-05 m/s



Falling Head Test (Slug Test)

Test Date:		07-Jun-21	
Piezometer/Well No.:		BH/MW 203	
Ground level:		275.43	m
Screen top level:		272.33	m
Screen bottom level:		269.33	m
Test El. (at midpoint of screen):		270.83	m
Test depth (at midpoint of screen):		4.6	m
Screen length	L=	3.0	m
Diameter of undisturbed portion c	2R=	0.22	m
Standpipe diameter	2r=	0.05	m
Initial unbalanced head	Ho=	-0.3846	m
Initial water depth		3.61	m
Aquifer material:		**SILT**	

Shape factor $F = \frac{2 \times 3.14 \times L}{\ln(L/R)} = 5.701815$ m

Permeability $K = \frac{3.14 \times r2}{F \times (t2 - t1)} \times \ln(H1/H2)$ (Bouwer and Rice Method)

$\frac{\ln(H1/H2)}{(t2 - t1)} = 0.03764727$

K= **1.3E-03** cm/s

1.3E-05 m/s