Hydrogeological Investigation

17-27 Jacob's Terrace
Barrie, Ontario
L4N 2N7

Prepared For:

Tonlu Holdings Ltd.

Project No: 21-018-100
Date: August 10, 2021

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August 10, 2021

Tonlu Holdings Ltd.
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Attention: Mr. Richard Faccio

RE: Hydrogeological Investigation
17-27 Jacob's Terrace, Barrie, Ontario

DS Consultants Limited (DS) was retained by Tonlu Holdings Limited to undertake a hydrogeological investigation in support of the future residential development, which is located at 17-27 Jacob's Terrace Barrie, Ontario. The investigation was completed to provide an overview of the existing geological and hydrogeological conditions at the Site and to provide an assessment of the hydrogeological constraints to development including an estimation of construction dewatering requirements and potential impacts to local groundwater resources. Based on the results of our investigation, the following summary of conclusions and recommendations are presented:

1. A review of the water well records indicated that there are seventy-five (75) registered water wells within 500 m. Of the seventy-five records, six (6) are records of well abandonments/dewatering wells, one (1) is listed as public supply well and two (2) as a municipal observation well, three (3) are listed as domestic supply wells, fifty-six (56) as test holes/observation wells and seven (7) that did not specify. The depths of the water supply wells range from 4.6 to 110.3 mbgs.
2. There were four (4) boreholes drilled at the Site in February 2021. The depths of these boreholes ranged from 31.1 to 45.9 m below the existing ground surface. All boreholes were used to interpret the subsurface soils on-site.
3. Groundwater conditions in the upper groundwater zone were assessed using three (3) monitoring wells MW21-1, MW21-3 and MW21-4. The installed monitoring wells are screened in sandy silt to fine silty sand to sand ranging in depth between 12 and 15.2 m below the existing ground surface.
4. Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the Site is covered by a coarse-textured glaciolacustrine deposit including sand, gravel, minor silt and clay littoral deposits. Locally, the glaciolacustrine deposit forms a thin veneer overlying the regionally extensive Glacial till. The glaciolacustrine deposits are generally discontinuous, deposited in valley systems and low-lying areas.
5. Groundwater levels were measured on February 26th and May 25th, 2021. The water levels ranged from 3.65 - 4.32 mbgs, corresponding to elevations ranging from 225.70 - 226.14 masl. Based on measured water levels, the localized groundwater flow in the vicinity of the Site is interpreted to be in a north-easterly direction with an approximated horizontal gradient of about 0.003 m/m across the Site.

6. Single Well Response Tests (SWRTs) to assess in-situ hydraulic conductivity (K) were completed by DS on February 26, 2021, at each of the three (3) monitoring wells. The K values ranged from 7.35 x 10^{-6} m/sec in the fine silty sand unit to as high as 1.11 x 10-4 m/sec in the sand unit with a geometric mean of 3.60 x 10-5 m/sec.
7. A pre-development and post-development water balance was completed to understand existing hydrologic conditions. Based on results, the proposed development will produce a reduction in annual AET (56 m^3/yr), a slight increase in annual ET (3 m^3/yr), a reduction in annual infiltration (20 m^3/yr) and an increase in annual runoff (73 m^3/yr). The effects are mainly the result of reduced soil moisture, and infiltration as a result of compaction during construction since there is no increased impervious area replacing pervious areas of the site.
8. To address the small loss of infiltration pre to post-development (20 m^3/yr), Low Impact Development (LID) measures which promote onsite infiltration can be incorporated into development plan. The permeability and storage of proposed pervious areas could be enhanced to provide more topsoil thickness. Additional LIDs suitable for the site includes the collection, storage and infiltration of runoff from the roof area via buried infiltration facilities or infiltration of runoff from other impervious surfaces following pre-treatment.
9. Based on conceptual plans, it is understood that the proposed development will not include underground parking or a basement. The design grades are not known at this stage however, based on well data, the building foundation requiring excavation will be founded above the seasonally high water table. Dewatering is not anticipated with exception to the potential need to remove storm water. Based on the anticipated size of the excavation, a large storm event (40mm) could result in approximately 240 m^3 which could be pumped out of the excavation in a single day. The dewatering would require registration on the Environmental Activity Sector Registration (EASR) as required by the Ministry of the Environment, Conservation and Parks (MECP) for takings between 50,000 L/day and 400,000 L/ day.
10. In conformance with Regulation 903 of the Ontario Water Resources Act, the decommissioning of any dewatering system and monitoring wells should be carried out by a licensed contractor under the supervision of a licensed water well technician.

Should you have any questions regarding these findings, please contact the undersigned.

DS Consultants Ltd

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1. INTRODUCTION

DS Consultants Limited (DS) was retained by Tonlu Holdings Limited to complete a hydrogeological investigation in support of the proposed residential development located at 17-27 Jacob's Terrace Barrie, Ontario (site). The site is bounded by Jacob's Terrace to the north, Commercial and industrial properties to the east and west, and residential properties to the south. The site consists of two low-rise industrial buildings and paved surfaces. The paved surfaces are partially granular and partially asphalt pavement. The total site area is about 0.9 ha in size. It is treed along the east, west, and south boundaries. The proposed development will consist of one condominium complex with a 27- and 31-storey tower at the east and west sides including a 4-storey podium and one level of underground parking.

The investigation was completed to characterize groundwater conditions and understand potential constraints to development.

1.1 Purpose

The purpose of this investigation is to document existing hydrogeological conditions of the site, identify potential impacts to local groundwater conditions from the proposed development, and recommend mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment.

1.2 Scope of Work

The scope of work for this investigation included:

(i) Background information review of relevant information to assess local conditions, available through past geotechnical, geological, and environmental studies along with the Ministry of the Environment and Climate Change Water Well Record database for the area

(ii) Drilling program to confirm soil and groundwater conditions at the site including four (4) boreholes with three (3) monitoring wells, as well as in-situ conductivity testing;

(iii) Collect one (1) groundwater sample for laboratory analysis to assess discharge options of dewatering water;

(iv) Complete a Thornthwaite site water balance assessment; and

(v) Data analyses and preparation of a hydrogeological report.

2. PHYSICAL SETTING

2.1 Regional Physiography and Drainage

The Site is situated within the Simcoe Lowlands Physiographic Region of Southern Ontario (Chapman and Putnam, 1984). The Simcoe Lowlands are generally characterized as flat-lying contiguous valleys, consisting

of sandy glacial till interpreted as the Newmarket Till. The site lies within a Sand Plain Physiographic Landform. Relief across the Site is low ranging from an elevation of about 230 masl on the west boundary sloping east toward lake Simcoe to an elevation of approximately 229 masl, in a distance of around 100m. The site drains toward Lake Simcoe. The site lies within the regulatory limits of the Lake Simcoe Region Conservation Authority (LSRCA) and is located within the Barrie Creeks Sub Watershed.

2.2 Geology

Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the site is covered by a coarse-textured glaciolacustrine deposit including sand, gravel, minor silt and clay littoral deposits. Locally, the glaciolacustrine deposit forms a thin veneer overlying the regionally extensive Glacial till. The glaciolacustrine deposits are generally discontinuous, deposited in valley systems and low-lying areas. An illustration of surficial geology for the site and surrounding area is provided in **Figure 2.**

Bedrock mapping suggests that the site is underlain by the bedrock of the Middle Ordovician sedimentary period. The bedrock surface surrounding the Site is generally flat, consisting of grey shale over Limestone each belonging to the Simcoe Group Formation. Based on local MECP water well records within 500m of the Site, bedrock was encountered at a test well (WWR ID 5700287) completed about 400m west of the site in 1966. The bedrock was found at a depth of 110m below ground. Overburden thickness in the area likely ranges from approximately 85 - 120 metres based on bedrock mapping.

As part of the geotechnical investigation completed concurrently, four (4) boreholes (BH21-1 to BH21-4) were completed by DS on February 3rd to February 10th, 2021. The depths of these boreholes ranged from 31.1 to 45.9 m below the existing ground surface (mbgs). All boreholes were used to interpret the subsurface soils on-site. The locations of the boreholes are shown in **Figure 3**, and detailed subsurface conditions are presented on the Borehole Logs in **Appendix A**. Subsurface conditions are summarized as follows:

Pavement: A layer of asphalt, varying in thickness from 75 to 150 mm, was present at the surface of all the boreholes except BH21-1. Granular base, consisting of sand and gravel and varying in thickness from 305 to 430 mm, underlies the asphalt in the boreholes. Granular fill, about 800 mm in thickness, was also observed at the surface at borehole BH21-1.

Fill Materials: Fill materials consisting of silty sand material was detected below the granular fill in all the boreholes and extended to depths ranging from about 2.3 to 2.6 m below the existing ground surface. The fill was brown in color and contained trace of rootlets.

SPT 'N' values measured in fill material ranged in general from 4 to 6 blows per 300mm penetration, indicating a loose state. The moisture content of this moist to wet moist fill layer varied from 8 to 31%.

The type/quantity and extent of the existing fill/granular fill layers must be explored by further test pit investigation prior to excavations.

Silty Sand/Sand to Sandy Silt: Brown to grey deposit consisting of silty sand to sand and sandy silt to silt extended below the fill materials to the maximum explored depth of all the boreholes except BH21-1 where it extended to the underlying sand and gravel, to an approximate depth of 41.3 m. This deposit included a layer of clayey silt to silt (in BH21-2 and BH21-4) between approximate depths of 18.3 to 24.3 m. This deposit also contained some to trace of clay, sand and gravel. SPT 'N' values measured within the sandy/silty layers varied from 5 to over 100 blows per 300mm of penetration, indicating loose to very dense relative density. SPT 'N' values measured in the clayey layers ranged from 8 to 20 blows per 300mm of penetration, indicating a stiff to very stiff consistency. The moisture content of the moist to wet cohesive clayey material varied from 17 to 22% and the cohesionless sandy/silty materials varied from 6 to 24%.

Sand and Gravel: Grey sand and gravel extended below the silty sand/sandy silt deposit (at an approximate depth of 41.3 m) to the maximum depth of BH21-1 (to a depth of 45.9 m). This deposit contained trace of silt. SPT 'N' values measured within the sand and gravel layer varied from 41 to over 100 blows per 300mm of penetration, indicating dense to very dense relative density. The moisture content of the moist to wet cohesionless sand and gravel materials varied from 11 to 13%.

2.3 Hydrogeology

The following sections provide an overview of the general hydrogeological characteristics of the study area. The hydrogeological conditions were evaluated using the data collected from the MECP water well records, on-site monitoring wells installed as part of this investigation, and other reports for the area.

2.3.1 Regional Hydrostratigraphy

Hydrostratigraphy of the Barrie Creeks subwatershed is largely the result of deposition and erosion events occurring during glacial and post-glacial periods. Initiatives to characterize the hydrostratigraphy of Barrie has been completed as part of the Tier 3 Water Budget and Risk Assessment. A stratigraphic model of quaternary sediments was completed by AquaResource et al. (2011). The conceptual model builds upon previous studies and includes four (4) regional aquifers defined throughout the City of Barrie. The aquifers are named A1 through A4, from top to bottom. The aquifers are separated by confining layers ranging from clay and silt to silty sand and sandy silt with varying thickness. A description of the aquifers is provided below.

- The A1 aquifer is located mainly in upland areas (not regionally extensive). The aquifer is described as being composed of fine to medium grained sand with occasional occurrences of gravel.

- The A2 aquifer is generally found within the elevation range of approximately 175 to 230 masl (LSRCA, 2012). The aquifer is generally described as ranging in thickness from approximately 10 to 30 m and is regionally extensive. The aquifer mainly consists of sand however is noted for its

complexity in the central core of Barrie, where stratigraphy is inter-layered with sand and silt/clay deposits. The aquifer is interpreted to extend under Kempenfelt Bay with potential connections to the deeper channelized aquifers in this area which were formed as in-filled former river channels.

- The A3 and A4 aquifers are connected within the Barrie area and are commonly referred to as the lower aquifer. This is the primary supply source for the City of Barrie's drinking water. A discussion of municipal groundwater supply wells is provided in Section 2.3.2 of this report. The A3 and A4 aquifer is generally found at an elevation ranging from 150 to 195 masl, and 115 to 160 masl, respectively (LSRCA, 2012). The A3/A4 aquifer is generally composed of coarse grained sand and gravel.

2.3.2 Groundwater Resources and Supply

As part of the hydrogeological study, DS completed a search of the Ministry of Environment, Climate and Parks (MECP) Water Well Record (WWR) and Permit to Take Water (PTTW) database. A summary of the search is presented in **Appendix E** and **Figure 1** shows the location of all MECP-registered water well and PTTW records within a 500-meter radius of the site.

A review of the water well records indicated that there are seventy-five (75) registered water wells within 500 m. Of the seventy-five records, six (6) are records of well abandonments/dewatering wells, one (1) is listed as public supply well and two (2) as a municipal observation well, three (3) are listed as domestic supply wells, fifty-six (56) as test holes/observation wells and seven (7) that did not specify. The depths of the water supply wells range from 4.6 to 110.3 mbgs.

Records for the three (3) domestic water wells (MECP WWR # 5701723, 5700243 and 5700270) indicate that the wells were drilled in 1953, 1958 and 1963, respectively. It is interpreted that the supply wells were completed in underlying Silty Sand/Sand to Sandy Silt deposit found onsite between 2.3 and 41.3mbg. The well records show fine to coarse sand deposits with intermittent (stratified) silt and clay deposits. The area is currently serviced by a municipal water supply and these wells have likely since been decommissioned or are no longer in use.

The city of Barrie began supplying water from surface water sources in 2011, however only for the south end of the city. The north end does still use ground water sources. The Site is located along the boundary of the groundwater and surface water sourced groundwater distribution systems. The public supply well found within 500m (MECP WWR # 5706146) was completed in January 1969 however is not currently in use. The closest municipal wells currently in use includes Production Well W5 (WWR #5700253) which is located approximately 1km northwest on John St., and Production Well W12 (WWR #5720696) located about 750m northeast in Centennial Park adjacent Kempenfelt Bay.

Based on a review of the water well record for Production Well W5, the well is screened at a depth of about 94 to 107 mbgs corresponding to an approximate elevation of about 126 to 139 masl. The well was completed in a gravel and sand deposit which is confined by a clay unit extending from about 42 to

50 mbgs (~ 191 to 183 masl). The bottom of the confining layer is interpreted to be the top of the A3 aquifer as described in Section 2.3.1.

Based on a review of the water well record for Production Well W12, the well is screened at a depth of about 66 to 90 mbgs corresponding to an approximate elevation of about 144 to 156 masl. The log provided in the record does not indicate stratigraphy encountered below 58 mbgs and so a description of screened overburden is not available however it is expected that there is a continuation of sand and gravel as last logged. The sand and gravel is confined by a clay unit extending from about 45 to 48 mbgs (~ 174 to 177 masl). The bottom of the confining layer is interpreted to be the top of the A3 aquifer as described in Section 2.3.1. The site is noted as being within the Well Head Protection Area (WHPA) "C" for W12. This area represents a 5 year time of travel for the W12 catchment area.

2.3.3 Groundwater Conditions

Groundwater conditions at the Site were assessed using three monitoring wells (BH21-1, BH21-3, and BH21-4) installed in the upper groundwater zone at depths between 9.0 and 15.2 m below ground surface. The monitoring wells are screened in sandy silt, fine silty sand, and sand for boreholes BH21-1, BH21-3, and BH21-4 respectively. The most recent groundwater level monitoring was conducted on May 25th, 2021, at all available monitoring wells. The location of the monitoring wells is presented in **Figure 3**. A summary of the measured groundwater level elevations is provided in **Table 1** below.

Table 1: Groundwater Levels in Monitoring Wells

Monitoring Well	Ground Elevation (masl)	Well Depth (mbgs)	Screened Interval (mbgs)	Ground Water Elevation (masl)	Ground Water Elevation (masl)
				February 26, 2021	May 25, 2021
MW21-1	229.45	11.83	9.0 – 12.0	225.8	225.7
MW21-3	230.36	14.65	12.2 – 15.2	226.14	226.0
MW21-4	229.87	12.20	9.2– 12.2	225.97	225.8

Notes: Water levels measured are representative of stabilized conditions.

Groundwater levels were measured on February 26th and May 25th, 2021. The water levels ranged from 3.65 - 4.32 mbgs, corresponding to elevations ranging from 225.70 - 226.14 masl. Based on measured water levels, the localized groundwater flow in the vicinity of the Site is interpreted to be in a north-easterly direction with an approximated horizontal gradient of about 0.003 m/m across the site. A groundwater flow direction map is provided in **Figure 4**.

2.3.4 Hydraulic Conductivity

Single Well Response Tests (SWRTs) to assess in-situ hydraulic conductivity (K) were completed by DS on February 26, 2021, at all three (3) monitoring wells. The testing was completed using data loggers placed at the bottom of the wells to accurately measure the change in the hydraulic head versus time. Manual water level measurements were also collected to confirm datalogger readings. K values were calculated using the Bouwer and Rice method. The K values ranged from 7.35 x 10^{-6} m/sec in the fine silty sand unit

to as high as 1.11 x 10^{-4} m/sec in the sand unit with a geometric mean of 3.60 x 10^{-5} m/sec. **Table 2** presents a summary of the Hydraulic Conductivity (K) results for the testing. Individual reports are provided in **Appendix B.**

Table 2: Summary of Hydraulic Conductivity Results

Monitoring Well	Depth (mbgs)	Sample Screened Interval (masl)	Screen Formation	In-situ Hydraulic Conductivity (K) (m/sec)	Geomean Hydraulic Conductivity * (m/sec)
MW21-1	11.83	217.45-220.45	Sand and silt	5.75 x 10^{-5}	3.60 x 10^{-5}
MW21-3	14.65	215.16-218.16	Fine silty sand	7.35 x 10^{-6}	
MW21-4	12.20	217.67-220.67	Sand	1.11 x 10^{-4}	

2.3.5 Water Quality

To assess groundwater quality and evaluate options for discharging water collected during construction, one unfiltered groundwater sample was collected on March 1, 2021. The groundwater sample was submitted under a chain of custody to SGS Environmental, a CALA certified laboratory, for chemical analysis of various parameters required for Barrie storm and sanitary discharge in the Provincial Water Quality Objective (PWQO). All samples were within guideline limits for Barrie sanitary sewer bylaw. All but Total Suspended Solids (TSS) was within guideline limits for Barrie storm sewer bylaw. **Table 3** presents a summary of exceeded parameters, and the certificate of analysis is provided in **Appendix C.**

Table 3: Parameters in Groundwater Exceeding the PWQO for Surface Water

Parameter Exceeded	Ontario Sewer Use	Unit	Guideline Limit	BH/MW19-1 Concentration
Total Suspended Solids	Barrie Storm Sewer	mg/L	15	**22**

Note: **Bold** – Exceeded the Sewer use bylaw for storm sewer

TSS is a treatable parameter which can be mitigated using sedimentation and filtration techniques. With treatment, it is expected that the quality would be within the limits for Barrie sanitary sewer bylaw.

3. SITE WATER BALANCE

To understand and compare existing hydrologic conditions, a Thornthwaite site water balance was completed. The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes

in ST. The annual water budget can be stated as **P = ET + R + I + ST** and the components are discussed below.

Precipitation (P)

Based on the 30-year average for the Shanty Bay Climate Station in Ontario, the average precipitation for the area is about 968 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table E1, Appendix E.**

Storage (St)

Groundwater storage (ST) of native soils for the existing Site was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site include urban lawn and a fine sand soil-graded with a water holding capacity of 75 mm applied to March for monthly calculations. Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (Et)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt

Where:
d = the number of days in the month
D = the mean monthly hours of daylight in units of 12 hours
Wt = a saturated water vapour density term = 4.95 * e0.627/100
T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (Δ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to approximately 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and cover as prescribed in

Table 3.1 of the SWM Planning & Design Manual give infiltration factors for existing conditions on the Site as shown below in **Table 4**. The runoff component calculated in the pre-development model is the remaining volume of precipitation surplus following AET, ET, and infiltration.

Table 4- Existing Conditions – Infiltration Factor

Land uses / soil types	Topography	Soil	Cover	Total infiltration factor
Urban Lawn /Fine Sand	0.30	0.20	0.10	0.60

3.1 Pre-development Water Balance

The subject Site has a total area of 9,152 m^2 with existing buildings and asphalt/gravel parking/storage areas consisting of about 7,629 m^2. Pervious areas of the site consist of a treed east, south and west perimeter (940 m^2) and a lawn area (583 m^2) at the front of the property. For the purpose of this assessment, the gravel area is assumed to be relatively impermeable as a result of compaction. **Figure 5** shows the pre-development conceptual model considered for establishing current hydrologic conditions. To predict outputs of the pre-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are summarised below. The detailed calculations are presented in **Table E-1, E-2 Appendix E**.

The average precipitation for the area is about 968 mm/yr. For the pervious area, the calculated PET is 574 mm/year or about 59% of the total precipitation. The monthly distribution of ST for landscaped area (urban lawns) with sandy soils produced a unit area annual AET of 506 mm/yr. For the treed borders AET is 554 mm/yr. Given existing conditions, the pre-development site water balance includes 1,108 m^3/yr evaporation, 816 m^3/year of evapotranspiration, a total of 395 m^3/year infiltration and 6,541 m^3/year runoff.

3.2 Post-development Water Balance

The proposed development has the same total area of 9,152 m^2 with approximately 608 m^2 being within the road allowance. The proposed building has an area of 5,561 m^2. Additional impervious areas include the paved drive (629 m^2) and hardscaped surfaces (853 m^2). The pervious area of the proposed development includes 1,501 m^2 of lawn. **Figure 6** shows the pre-development conceptual model considered for establishing proposed hydrologic conditions. To predict outputs of the post-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are summarised below. The detailed calculations are presented in **Table E-1, E-3 Appendix E**.

PRECIPITATION (P)

Precipitation remains the same (ie. The 30-year climate normals (1981-2010) for the Shanty Bay Climate Station).

STORAGE (ST)

Groundwater storage (ST) of native soils for the post-development site changes to reflect the increased landscaped areas. These areas are given a soil moisture holding capacity of 50 mm for sandy soils. Similar to the pre-development conditions, using the procedures outlined in the SWM Planning & Design Manual for each land use, the annual change in storage is 0. The monthly distribution of ST for each of the land use/soil types is presented in Table E-3 Appendix E.

EVAPORATION / EVAPOTRANSPIRATION (ET)

In the post construction scenario, changes in land use do not result in a significant change in pervious/impervious areas. This is due to the site currently being primarily impervious to begin with. Considering a total annual precipitation of 968 mm, evaporation is estimated at 145 mm. As a result, a total annual volume of evaporation is estimated at 1,111 m^3/yr. The detailed calculations for evaporation are included in Table E-3 Appendix E.

For post-development pervious areas, monthly PET is estimated using the same inputs and calculations described in the pre-development model respective of land use and soil moisture holding capacity. In the post-development scenario, annual AET is 760 m^3/yr. The monthly distribution of Post-development AET and detailed calculations are presented in Table E-3, Appendix E.

PRECIPITATION SURPLUS (S)

For post-development pervious surfaces at the site, precipitation surplus is calculated as P –AET which includes about 462 mm/yr. For Impervious surfaces at the site, surplus is P-ET where ET is estimated at 15% of P. The resulting precipitation surplus is about 823 mm/yr. The more detailed calculations are included in Table E-3, Appendix E.

INFILTRATION (I)

The same accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual were used give infiltration factors for post-development conditions.

A 10% decrease in the infiltration factor was applied to account for soil compaction activities which may occur during construction practices. It is expected that fill materials brought in to reclaim the areas of these structures will be of a similar quality or better with regards to permeability.

Considering the infiltration factors used, the total volume of Infiltration (I) estimated for post-development conditions is about 374 m^3/yr. The more detailed calculations are presented in Table E-3, Appendix E.

RUNOFF (R)

The runoff component calculated in the post-development model is a combination of the remaining volume of precipitation surplus for both pervious and impervious areas. The total volume of runoff (R)

estimated for post-development conditions is 6,614 m^3/yr. The more detailed calculations are presented in Table E-3, Appendix E.

3.3 POST-DEVELOPMENT WATER BALANCE (WITH MITIGATION)

Based on results of the pre-development and post-development water balance completed, the proposed development will produce a reduction in annual AET (56 m^3/yr), a slight increase in annual ET (3 m^3/yr), a reduction in annual infiltration (20 m^3/yr) and an increase in annual runoff (73 m^3/yr), as shown in Table E-4, Appendix E. The effects are mainly the result of reduced infiltration and soil moisture storage since there isn't a net increase in impervious area.

Based on the results of the pre and post-development site water balance, the hydrology of the site pre to post development is relatively unchanged. The small infiltration deficit of 20m^3/yr could be mitigated with enhanced topsoil to improve soil moisture storage and permeability. For additional benefits, the permeability of the native soils and groundwater conditions are favorable for infiltration facilities. Buried facilities should maintain 1m between the seasonally high water table and the bottom of the facility to ensure an effective design. In-situ testing in the area of any proposed infiltration facility is recommended.

4. CONSTRUCTION DEWATERING

4.1 Estimation of Flow Rates- Proposed Building and Site Servicing

Building concept plans were provided for review however detailed designs were not available at the time of writing the report. It is understood that the proposed development will not include underground parking or a basement. The design grades are not known at this stage. Based on well data, most of the building foundation requiring excavation will be founded above the groundwater elevation during high water table. Dewatering will not be required during the construction of the proposed building unless it is to remove stormwater from precipitation events.

4.2 Total Estimation of Flow Rate (Short-Term/ Temporary Discharge)

Temporary dewatering to remove groundwater seepage for an unsealed excavation is not anticipated to be a requirement considering excavation work is not expected to intersect the water table. To estimate dewatering to remove storm water from the excavation, a rainfall of 40mm is considered for the approximated 6,000 m^2 excavation. The resulting volume of water would be 240 m^3 which could be pumped out of the excavation in a single day without going over the 400 m^3/day bottom limit requiring a PTTW.

4.3 Permanent Drainage (Long-term Discharge)

The proposed construction of the building is expected to remain above the water table at the site and as such, permanent dewatering is not anticipated.

4.4 Environmental Activity and Sector Registry (EASR) /Permit to Take Water (PTTW) Application

An Environmental Activity Sector Registration (EASR) is required to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the taking of groundwater and stormwater for a temporary construction project is between 50,000 L/day and 400,000 L/ day. The EASR application is an online registry and should be submitted to the MECP before any construction dewatering. A PTTW is required to be submitted to the MECP if the taking of groundwater and stormwater for a temporary construction project is more than 400,000 L/ day.

Since the temporary dewatering rate could be greater than 50,000 L/day with a large precipitation event, an EASR is required from the MECP for short-term dewatering, however a PTTW is not.

5. POTENTIAL IMPACTS

The following are the predicted potential impacts as a result of the proposed development and associated construction dewatering:

5.1 Local Groundwater Use

Based on the MECP WWRs, there are no wells expected in the predicted radius of Influence (40m). Water supply wells are noted to be installed at deeper depths within lower aquifers. Since the proposed construction is anticipated to be above the water table, there will be no short-term or long-term predicted impacts on private and public water wells occurring from dewatering.

No adverse impact on any source water is anticipated since the proposed construction will not have permanent under-slab drainage and short-term construction dewatering is expected to remove stormwater only.

5.2 Point of Discharge and Groundwater Quality

Since the proposed construction is anticipated to be above the water table, there will be no short-term or long-term dewatering to control groundwater. Any discharged water from the excavation would be from stormwater events during construction. The water could be high in suspended solids as a result of encountering loose soils from the excavation. As a result any pumped water should first be treated with a settling tank and possibly a filtration system to remove solids prior to discharge. Should dewatering be required in this regard, testing of the water against the Barrie Sewer use By law should be completed to confirm acceptable quality.

5.3 Groundwater Recharge

Potential impacts to aquifer recharge are anticipated since there is not a reduction in pervious area where infiltration can occur. A small infiltration deficit of $20m^3/yr$ was estimated as a result of decreased infiltration from compaction activities over the pervious area. Decreasing the effects of soil compaction

can be achieved by increasing topsoil depth over the pervious areas. Other Low Impact Development (LID) measures to improve infiltration are not considered necessary unless to provide a post-development phosphorus load reduction.

6.4 Well Decommissioning

Following the completion of construction activities, all dewatering wells, well points, eductors and monitoring wells installed at various stages of this project must be decommissioned. The installation and eventual decommissioning of the wells and the dewatering system must be carried out by a licenced water well contractor in accordance with Regulation 903 of the Ontario Water Resources Act.

6. LIMITATIONS

This report was prepared for the sole use of the addressee to provide an assessment of the hydrogeological conditions on the property. The information presented in this report is based on information collected during the completion of the hydrogeological investigation. DS Consultants Ltd. was required to use and rely upon various information sources produced by other parties. The information provides in this report reflects DS's judgment in light of the information available at the time of report preparation. This report may not be relied upon by any other person or entity without the written authorization of DS Consultants Ltd. The scope of services performed in the execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or reuse of these documents or findings, conclusions, and recommendations represented herein, is at the sole risk of said users. The conclusions drawn from the Hydrogeological report were based on information at selected observation and sampling locations. Different conditions between and beyond these locations may become apparent during future investigations or on-site work, which could not be detected or anticipated at the time of this investigation. DS Consultants Ltd. cannot be held responsible for hydrogeological conditions at the Site that was not apparent from the available information.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

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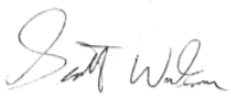
Prepared By:



Scott Watson, B.A.T.
Project Manager

Reviewed By:

Martin Gedeon, M.Sc. P.Geo.,
Senior Hydrogeologist

7. REFERENCES

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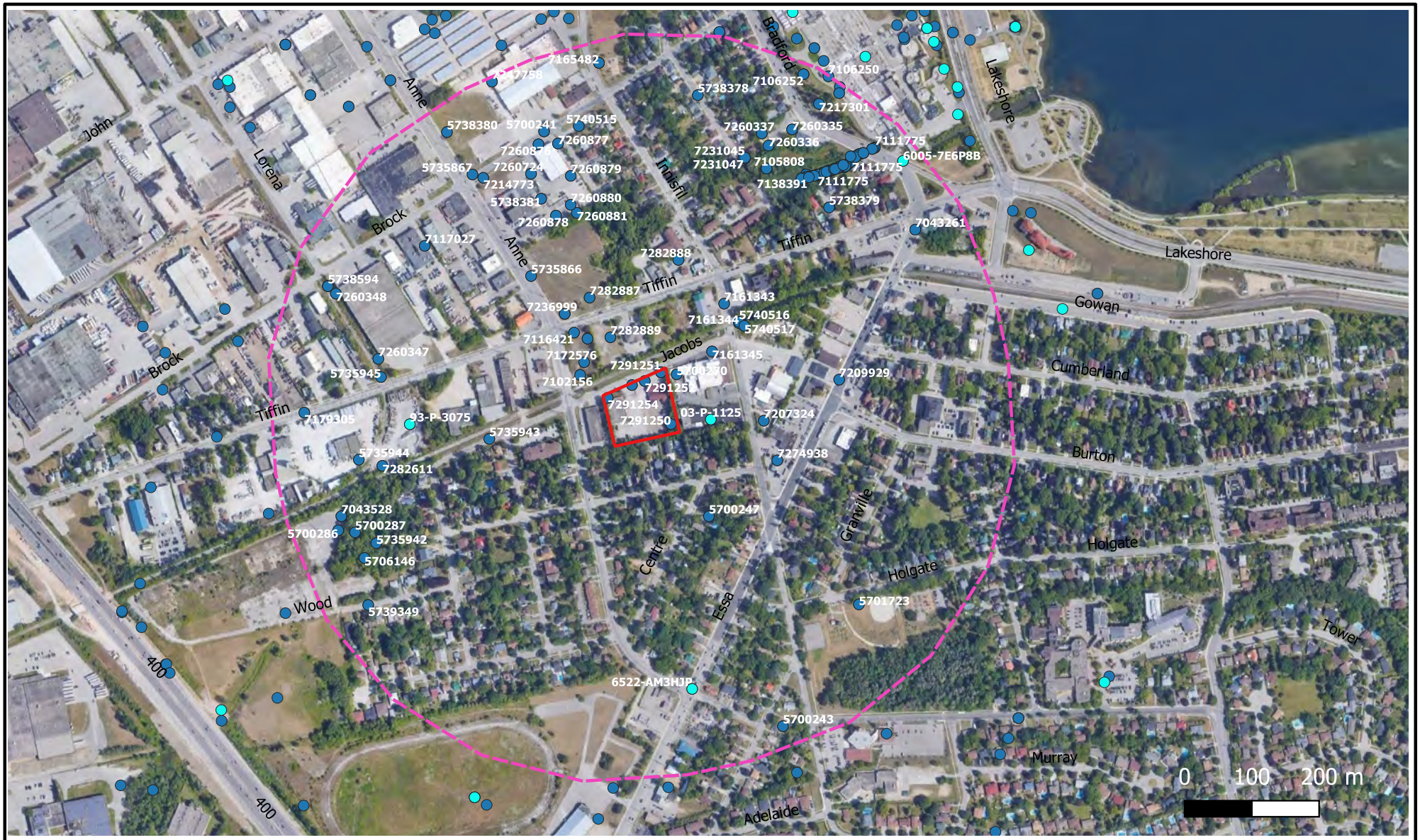
Drawings

J:\-GIS\00-2021 Projects\21-018-100 Tonlu Holdings\1-QGIS\Figure 1 - MECP water well location map.qgz Jul-26 13:41



Legend

- Approx Site Boundary
- 500m Buffer
- MOECP Water Well Records
- Permits to Take Water

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Telephone: (905) 264-9393
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Project: HYDROGEOLOGICAL INVESTIGATION - 17-27 Jacob's Terrace, Barrie

Title: **MECP WWR and PTTW MAP**

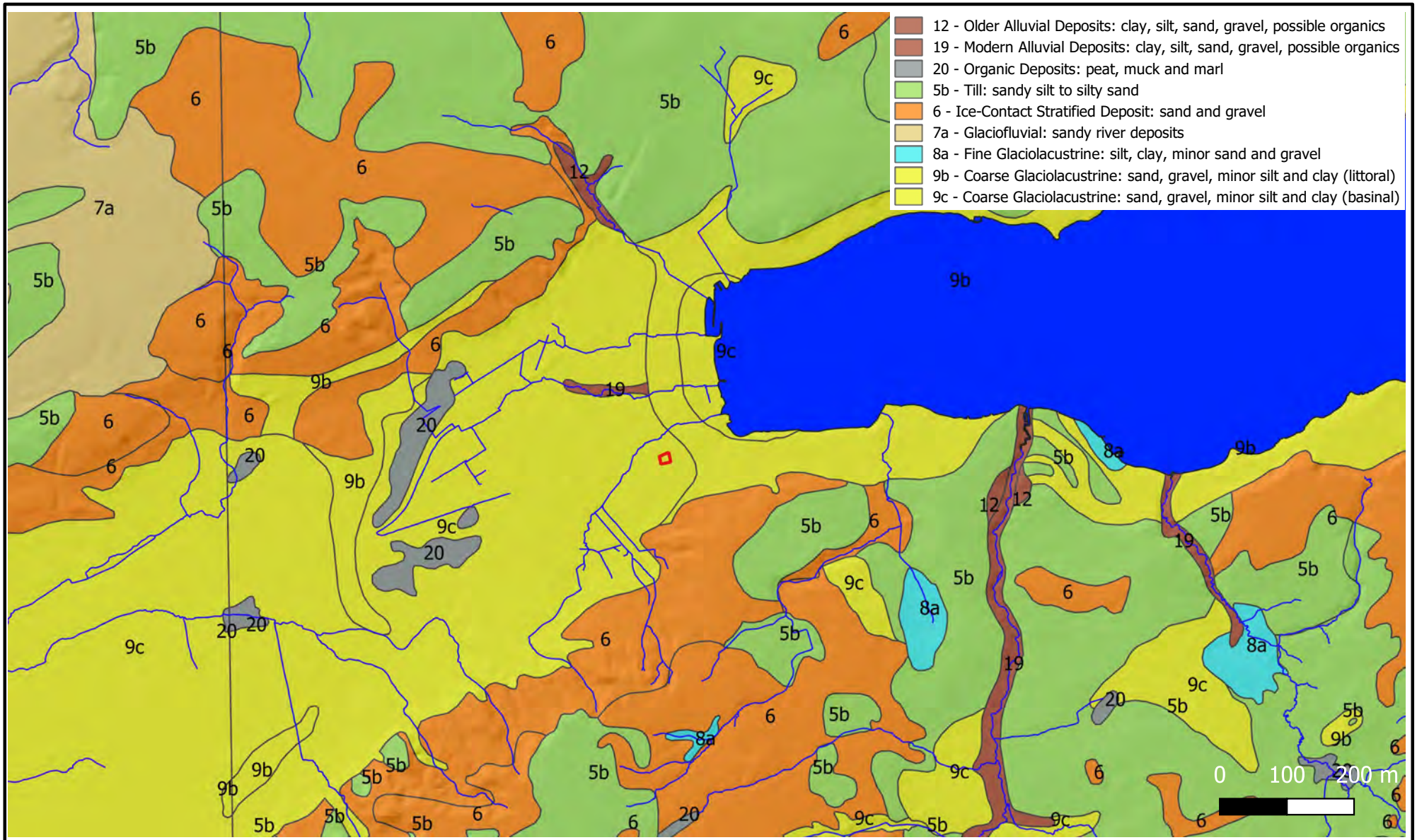
N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W.	M.Z.	July 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: 1

Image/Map Source: *Google Satellite Image*

J:\-GIS\00-2021 Projects\21-018-100 Tonlu Holdings\1-QGIS\Figure 2 - Surficial Geology Map.qgz Jul-29 16:16



Site Boundary
Lake
Watercourse
0 1 2 km

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Project: HYDROGEOLOGICAL INVESTIGATION - 17-27 Jacob's Terrace, Barrie

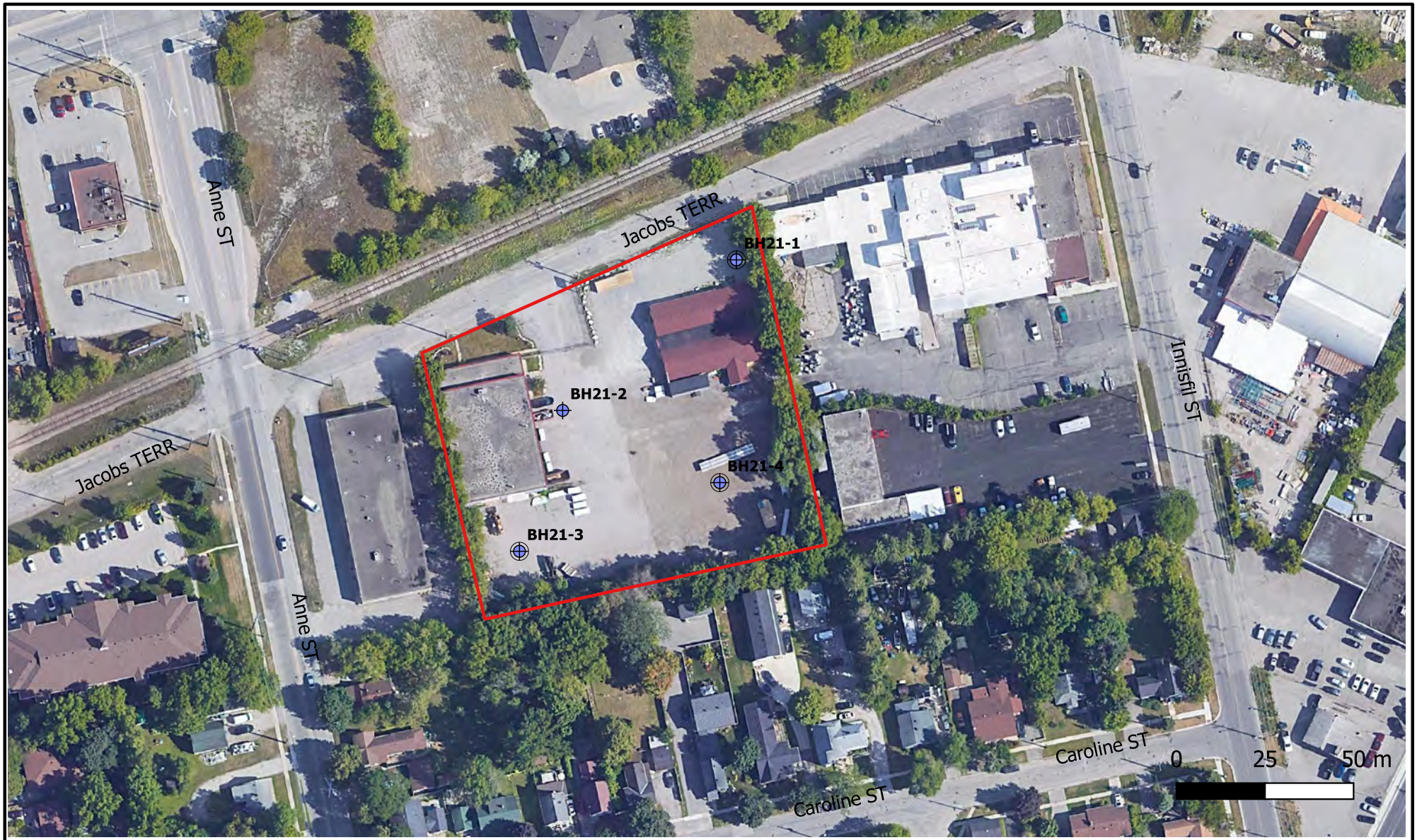
Title: **SURFICIAL GEOLOGY MAP**

N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W.	M.Z.	July 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: **2**
	Image/Map Source: *Google Satellite Image*		

J:\-GIS\00-2021 Projects\21-018-100 Tonlu Holdings\1-QGIS\Figure 3 - Borehole Location Map.qgz Aug-06 12:26



Legend

- Approx Site Boundary
- Borehole Location
- Monitoring Well Location

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Project: HYDROGEOLOGICAL INVESTIGATION - 17-27 Jacob's Terrace, Barrie

Title: **BOREHOLE AND MONITORING WELL LOCATION MAP**

N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W.	M.Z.	July 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: 3

Image/Map Source: *Google Satellite Image*

J:\-GIS\00-2021 Projects\21-018-100 Tonlu Holdings\1-QGIS\Figure 4 - Groundwater Flow Map.qgz Jul-29 16:14

Legend

- Approx Site Boundary
- Groundwater Flow Direction
- Groundwater Contour
- Borehole Location
- Monitoring Well Location

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Project: HYDROGEOLOGICAL INVESTIGATION - 17-27 Jacob's Terrace, Barrie

Title: **GROUNDWATER FLOW MAP**

N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W.	M.Z.	July 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: 4

Image/Map Source: *Google Satellite Image*

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Legend

- Site Boundary
- Impervious Area
- Pervious Area - Urban Lawn
- Pervious Area - Wooded

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Project: Hydrogeological Investigation
17-27 Jacob's Terrace Barrie, Ontario

Title: **Pre-Development Conceptual Site Model**

N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	L.M	S.W	August 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: **5**

Image/Map Source: *Google Satellite Image*

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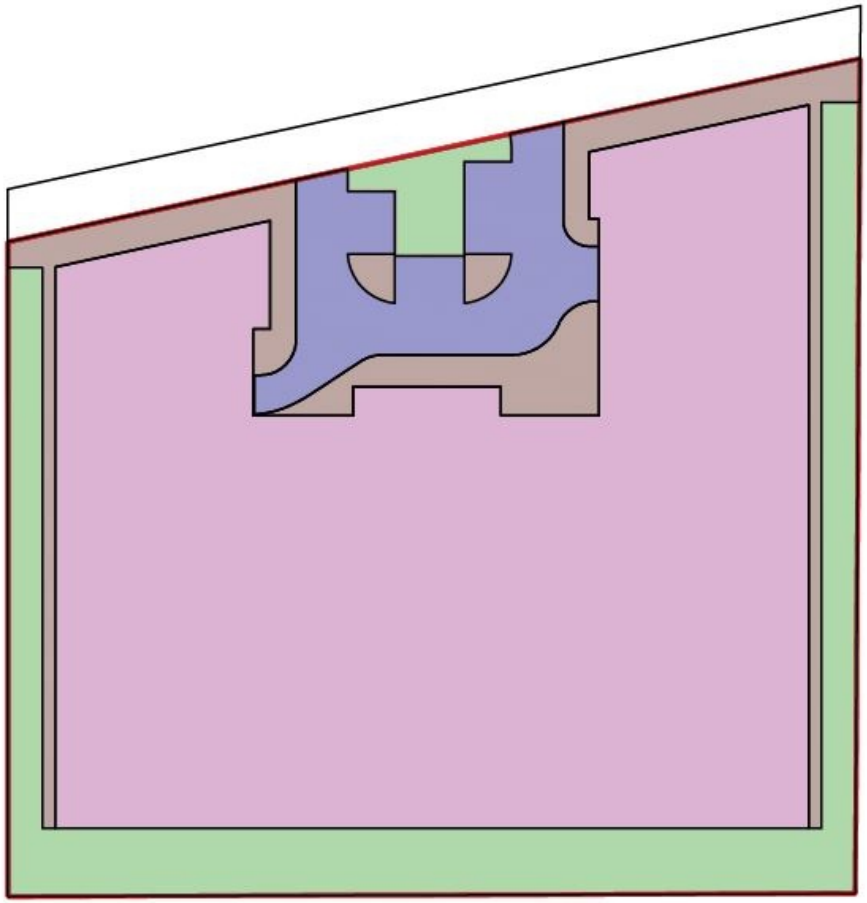

AREAS

- BUILDING AREA 5,560.90 SM (59,857.03 SF)
- HARDSCAPE AREA 853.15 SM (9,183.23 SF)
- ROADS AREA 628.56 SM (6,765.76 SF)
- SOFTSCAPE AREA 1,500.95 SM (16,156.09 SF)

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Project: Hydrogeological Investigation
17-27 Jacob's Terrace Barrie, Ontario

Title: **Post-Development Conceptual Site Model**

N

Client: Tonlu Holdings Ltd.

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	L.M	S.W	August 2021
Rev: 0	Scale: As Shown	Project No.: 21-018-100	Figure No.: 6

Image/Map Source: *Google Satellite Image*

Appendix A

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-1

PROJECT: Geotechnical Investigation - Proposed Residential Development
CLIENT: Tonlu Holdings Limited
PROJECT LOCATION: 17-27 Jacobs Terrace, Barrie, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4914070.44 E 603957.52

DRILLING DATA
Method: Hollow Stem Auger/ Mud Rotary
Diameter: 200mm
Date: Feb/08/2020

REF. NO.: 21-018-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
229.5 / 0.0	**FILL:** sand and gravel, brown, moist, compact	1	SS	21	
228.7 / 0.8	**FILL:** silty sand, brown, moist, loose	2	SS	5	
		3	SS	4	
227.2 / 2.3	**SILTY SAND TO SANDY SILT:** trace clay, brown, wet, loose to dense	4	SS	5	
		5	SS	15	226
		6	SS	21	224
	grey below 6m	7	SS	45	
	sandy silt, wet below 7.5m	8	SS	47	222
		9	SS	22	220
		10	SS	29	218
217.3 / 12.2	**MEDIUM SAND:** trace silt, grey, wet, very dense	11	SS	31	
216.0 / 13.5	**FINE SILTY SAND TO SANDY SILT:** trace clay, grey, wet, dense to very dense	12	SS	51	216
		13	SS	33	214
		14	SS	34	212
		15	SS	38	
209.7 / 19.8	**SILT:** trace to some clay, trace sand, grey, wet, compact to dense	16	SS	19	210
		17	SS	12	208
	some sand below 22.9m	18	SS	33	206
		19	SS	11	
202.5 / 27.0	**FINE SAND:** some silt, trace clay, grey, wet, compact to very dense	20	SS	42	204
		21	SS	69	202
		22	SS	56	200
198.0 / 31.5	**SILTY TO SANDY SILT:** trace clay, grey, wet, compact	23	SS	16	
		24	SS	20	198
196.0 / 33.5	**MEDIUM TO COARSE SAND:** some silt, grey, wet, compact to very dense	25	SS	26	196
		26	SS	57	194
192.9 / 36.6	**SILTY SAND:** trace clay, grey, wet, compact	27	SS	23	
191.4 / 38.1		28	SS	36	192

GROUND WATER CONDITIONS: W. L. 225.8 m Feb 26, 2021; Filter Pack; Slotted Pipe; Bentonite: Bottom of hole; Grout

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
	0	86	13	1
	0	47	51	2
	0	9	81	10
	1	17	75	7
	0	93		(7)

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 21-018-100 PROPOSED RESIDENTIAL DEVELOPMENT_TONLU HOLDINGS LIMITED.GPJ DS.GDT 3/5/21

LOG OF BOREHOLE BH21-1

PROJECT: Geotechnical Investigation - Proposed Residential Development
CLIENT: Tonlu Holdings Limited
PROJECT LOCATION: 17-27 Jacobs Terrace, Barrie, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4914070.44 E 603957.52

DRILLING DATA
Method: Hollow Stem Auger/ Mud Rotary
Diameter: 200mm
Date: Feb/08/2020

REF. NO.: 21-018-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
40	**MEDIUM TO COARSE SAND:** some silt, grey, wet, dense to very dense(Continued)		29	SS	76		190					
188.2												
41.3	interbed of silt at 41.1m		30	SS	41		188					0 7 82 11
42	**SAND AND GRAVEL:** trace silt, grey, wet, dense to very dense		31	SS	50/ 100mm							
44							186					
			32	SS	50/ 125mm							57 31 (12)
183.6							184					
45.9	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water level Reading: Date: Feb 26, 2021 Water Level (mbgl): 3.7		33	SS	60/ 150mm							

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 21-018-100 PROPOSED RESIDENTIAL DEVELOPMENT_TONLU HOLDINGS LIMITED.GPJ DS.GDT 3/5/21

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH21-2

PROJECT: Geotechnical Investigation - Proposed Residential Development
CLIENT: Tonlu Holdings Limited
PROJECT LOCATION: 17-27 Jacobs Terrace, Barrie, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4914027.94 E 603908.51

DRILLING DATA
Method: Hollow Stem Auger/ Mud Rotary
Diameter: 200mm
Date: Feb/04/2020

REF. NO.: 21-018-100
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
229.6												
229.6 / 0.0	**ASPHALT:** 150mm		1	SS	50/ 100mm							
229.5 / 0.1	**GRANULAR BASE:** sand and gravel, 430mm		2	SS	5							
227.3 / 2.3	**FILL:** silty sand, brown, moist, loose		3	SS	6		228					
			4	SS	5							
	SAND: some silt, brown, moist to very moist, loose to compact		5	SS	16		226					0 86 13 1
225.1 / 4.5	**SILTY SAND TO SANDY SILT:** trace clay, brown, wet, compact to dense		6	SS	18							
	grey below 6m		7	SS	43		224					
222.1 / 7.5	**FINE SAND:** some silt, trace clay, grey, wet, compact to dense		8	SS	28		222					
			9	SS	30		220					
			10	SS	28							0 80 19 1
			11	SS	35		218					
			12	SS	19		216					
214.4 / 15.2	**SANDY SILT TO FINE SILTY SAND:** trace clay, grey, wet, compact		13	SS	27		214					0 42 56 2
			14	SS	24		212					
211.3 / 18.3	**CLAYEY SILT AND SILT:** interbeded, trace to some sand, occasional gravel, grey, wet, stiff to very stiff		15	SS	18							0 1 88 11
			16	SS	18		210					
			17	SS	10		208					
			18	SS	8							2 12 74 12
205.2 / 24.4	**SILTY SAND TO SANDY SILT:** trace clay, grey, wet, compact to very dense		19	SS	67		206					
			20	SS	58		204					
			21	SS	14		202					
200.6 / 29.0	**FINE TO MEDIUM SAND:** trace silt, occasional gravel, grey, wet, dense		22	SS	47		200					
			23	SS	37							1 90 (9)
			24	SS	48		198					
195.5 / 34.1	**END OF BOREHOLE:** Notes: 1)		25	SS	47		196					

DS SOIL LOG 21-018-100 PROPOSED RESIDENTIAL DEVELOPMENT_TONLU HOLDINGS LIMITED.GPJ DS.GDT 3/5/21

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-3

PROJECT: Geotechnical Investigation - Proposed Residential Development
CLIENT: Tonlu Holdings Limited
PROJECT LOCATION: 17-27 Jacobs Terrace, Barrie, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4913988.19 E 603896.32

DRILLING DATA
Method: Hollow Stem Auger/ Mud Rotary
Diameter: 200mm
Date: Feb/03/2020

REF. NO.: 21-018-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
230.4				
230.0 0.0	**ASPHALT:** 75mm	1	SS	21
230.0 0.4	**GRANULAR BASE:** sand and gravel, 305mm	2	SS	4
		3	SS	4
228.1	**FILL:** silty sand, trace rootlets,			
2.3	brown, moist, loose	4	SS	8
	SAND: trace to some silt, trace clay, brown, very moist, loose to dense	5	SS	16
	wet below 4.5m	6	SS	15
		7	SS	30
		8	SS	15
		9	SS	37
	grey below 10.5m	10	SS	40
218.2				
12.2	**FINE SILTY SAND:** trace clay, grey, wet, dense	11	SS	33
		12	SS	31
		13	SS	32
		14	SS	39
212.1				
18.3	**SILT:** trace sand, trace clay, grey, wet, compact	15	SS	14
		16	SS	13
208.8				
21.6	**SANDY SILT:** trace clay, trace gravel, grey, wet, compact	17	SS	25
		18	SS	96/ 280mm
206.4				
24.0	**SILTY SAND:** trace clay, grey, wet, very dense	19	SS	50/ 125mm
204.5				
25.9	**SANDY SILT:** trace clay, grey, wet, very dense	20	SS	68
		21	SS	79
201.4				
29.0	**SILTY SAND TO SANDY SILT:** trace clay, grey, wet, very dense	22	SS	53
		23	SS	57
		24	SS	65
196.3		25	SS	76
34.1	**END OF BOREHOLE:**			

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
Feb 26, 2021	4.2

W. L. 226.1 m Feb 26, 2021
Bentonite
Filter Pack
Slotted Pipe
Bentonite: Bottom of hole
Grout

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
(20 40 60 80 100)

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)				
GR	SA	SI	CL	
0	85	14	1	
0	92		(8)	
0	63	36	1	
0	1	93	6	
2	22	69	7	
0	15	81	4	
0	45	53	2	

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 21-018-100 PROPOSED RESIDENTIAL DEVELOPMENT_TONLU HOLDINGS LIMITED.GPJ DS.GDT 3/5/21

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH21-4

PROJECT: Geotechnical Investigation - Proposed Residential Development
CLIENT: Tonlu Holdings Limited
PROJECT LOCATION: 17-27 Jacobs Terrace, Barrie, ON
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4914007.57 E 603952.83

DRILLING DATA
Method: Hollow Stem Auger/ Mud Rotary
Diameter: 200mm
Date: Feb/09/2020

REF. NO.: 21-018-100
ENCL NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
229.9									
229.8 0.0	**ASPHALT:** 75mm	1	SS	50/125mm					
229.5 0.4	**GRANULAR BASE:** sand and gravel, 330mm	2	SS	4					
227.3 2.6	**FILL:** silty sand, trace rootlets, brown, moist, loose	3	SS	4		228			
	SAND: some silt, trace clay, brown, wet, loose to dense	4	SS	6					
		5	SS	11	▽	226			
						W. L. 226.0 m Feb 26, 2021			
		6	SS	26					0 88 (12)
		7	SS	24		224			
		8	SS	26		222			
	grey below 9m	9	SS	42		220			
		10	SS	28		Filter Pack Slotted Pipe			
217.7 12.2	**FINE SILTY SAND:** trace clay, brown, wet, compact to dense	11	SS	20		218			0 53 46 1
		12	SS	25		Bentonite: Bottom of hole			
		13	SS	25		214			0 58 41 1
		14	SS	36					
211.6 18.3	**CLAYEY SILT TO SILT:** trace sand, grey, wet, stiff to very stiff	15	SS	10		212			0 2 83 15
		16	SS	20		210			
208.6 21.3	**SILTY SAND TO SANDY SILT:** trace clay, grey, wet, dense	17	SS	40		208			
207.0 22.9	**SILT:** trace sand, trace to some clay, grey, wet, very dense	18	SS	52		Grout			0 4 86 10
	sandy below 24.4m	19	SS	57		206			0 20 74 6
204.0 25.9	**SILTY SAND TO SANDY SILT:** trace clay, grey, wet, dense to very dense	20	SS	50		204			
		21	SS	46		202			
		22	SS	43					0 42 56 2
198.8 31.1	**END OF BOREHOLE:**	23	SS	48		200			

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
Feb 26, 2021	3.9

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

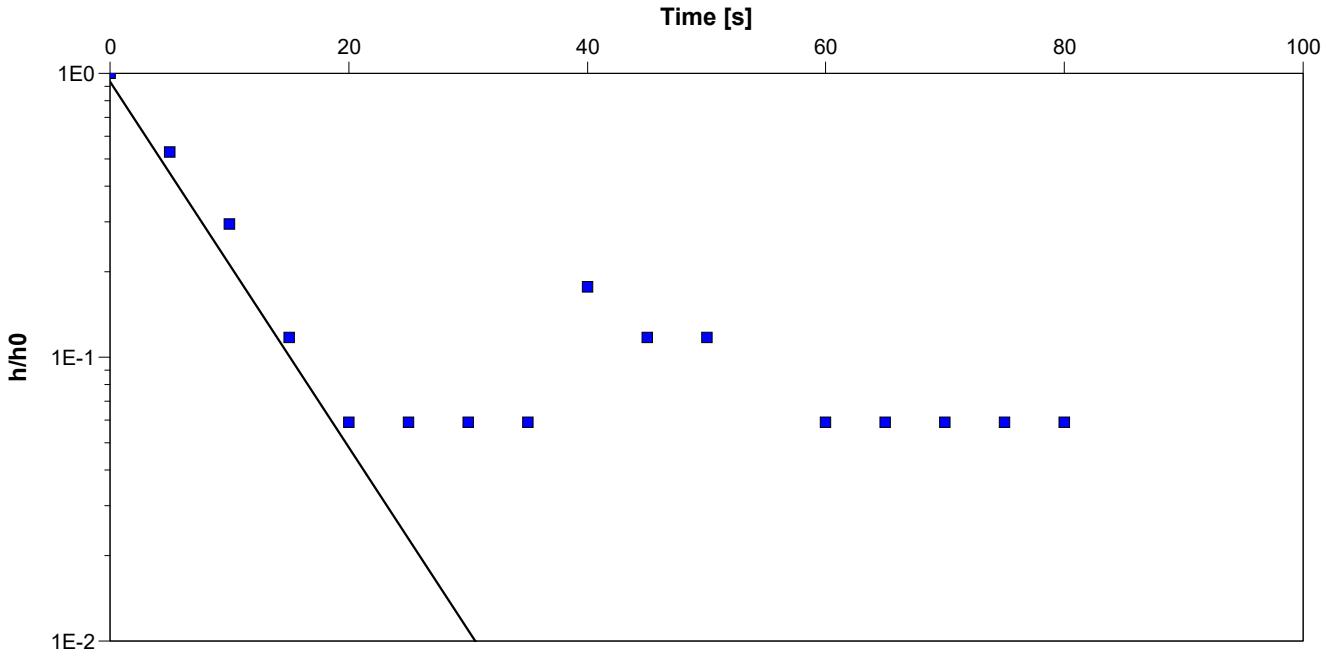
GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 21-018-100 PROPOSED RESIDENTIAL DEVELOPMENT_TONLU HOLDINGS LIMITED.GPJ DS.GDT 3/5/21

Appendix B

	Slug Test Analysis Report
	Project: 17 Jacobs Terrace
	Number: 21-018-100
	Client: Tonlu Holdings

Location: 17 Jacob's Terrace	Slug Test: BH21-1	Test Well: BH21-1
Test Conducted by: MZ		Test Date: 02/26/2021
Analysis Performed by: MZ	Bouwer & Rice 1	Analysis Date: 7/29/2021
Aquifer Thickness: 20.00 m		

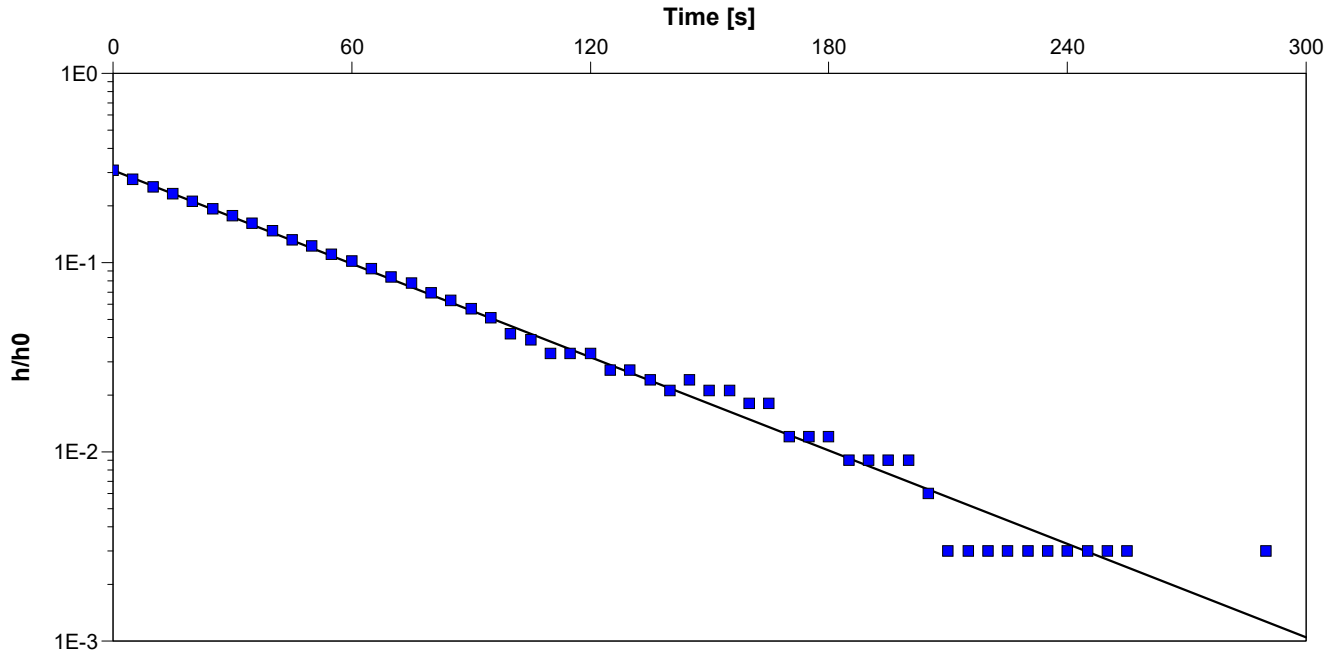


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH21-1	5.75×10^{-5}	

	Slug Test Analysis Report
	Project: 17 Jacobs Terrace
	Number: 21-018-100
	Client: Tonlu Holdings

Location: 17 Jacob's Terrace	Slug Test: BH21-3	Test Well: BH21-3
Test Conducted by: MZ		Test Date: 2/26/2021
Analysis Performed by: MZ	Bouwer & Rice	Analysis Date: 7/29/2021
Aquifer Thickness: 18.00 m		

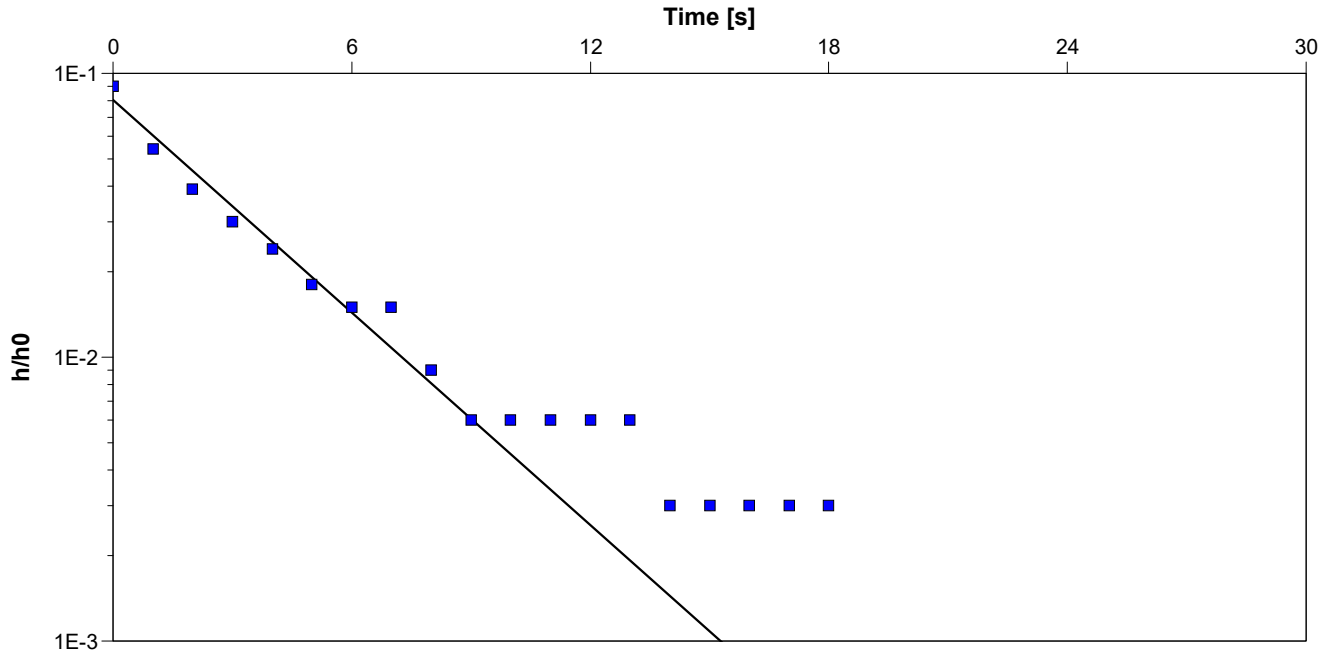


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH21-3	7.35×10^{-6}	

	Slug Test Analysis Report
	Project: 17 Jacobs Terrace
	Number: 21-018-100
	Client: Tonlu Holdings

Location: 17 Jacob's Terrace	Slug Test: BH21-4	Test Well: BH21-4
Test Conducted by: MZ		Test Date: 2/26/2021
Analysis Performed by: MZ	Bouwer & Rice	Analysis Date: 7/29/2021
Aquifer Thickness: 18.30 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH21-4	1.11×10^{-4}	

Appendix C

FINAL REPORT

CA14013-MAR21 R1

21-018-100, Barrie, ON

Prepared for

DS Consultants

FINAL REPORT

First Page

CLIENT DETAILS

Client	DS Consultants
Address	6221 Highway 7 Vaughan, Ontario L4H 0K8. Canada
Contact	Scott Watson
Telephone	905-264-9393
Facsimile	905-264-2685
Email	scott.Watson@dsconsultants.ca;kirstin.olsen@dsconsultants.ca
Project	21-018-100, Barrie, ON
Order Number	
Samples	Ground Water (1)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2165
Facsimile	705-652-6365
Email	jill.campbell@sgs.com
SGS Reference	CA14013-MAR21
Received	03/01/2021
Approved	03/08/2021
Report Number	CA14013-MAR21 R1
Date Reported	07/30/2021

COMMENTS

RL - SGS Reporting Limit

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:019107

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - General Chemistry**
(WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

General Chemistry

Parameter	Units	RL	L1	L2	Result
Biochemical Oxygen Demand (BOD5)	mg/L	2	300	15	< 4 ↑
Total Suspended Solids	mg/L	2	350	15	22
Total Kjeldahl Nitrogen	as N mg/L	0.5	100		< 0.5
Chemical Oxygen Demand	mg/L	8	600		< 8

PACKAGE: **SANSEW - Metals and Inorganics**
(WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Metals and Inorganics

Parameter	Units	RL	L1	L2	Result
Sulphide	mg/L	0.02	1		< 0.02
Cyanide (total)	mg/L	0.01	1.2		< 0.01
Fluoride	mg/L	0.06	10		0.14
Sulphate	mg/L	2	1500		79
Aluminum (total)	mg/L	0.001	50		0.444
Antimony (total)	mg/L	0.0009	5		< 0.0009
Arsenic (total)	mg/L	0.0002	1		0.0015
Barium (total)	mg/L	0.00002	5		0.164
Bismuth (total)	mg/L	0.000007	5		0.000031

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - Metals and Inorganics**
(WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Metals and Inorganics (continued)

Parameter	Units	RL	L1	L2	Result
Cadmium (total)	mg/L	0.000003	0.7	0.001	0.000004
Chromium (total)	mg/L	0.00008	2	0.08	0.00092
Cobalt (total)	mg/L	0.000004	5		0.00036
Copper (total)	mg/L	0.0002	2	0.01	0.0010
Iron (total)	mg/L	0.007	50		0.319
Lead (total)	mg/L	0.00001	0.7	0.05	0.00051
Manganese (total)	mg/L	0.00001	5		0.0468
Molybdenum (total)	mg/L	0.00004	5		0.0051
Nickel (total)	mg/L	0.0001	2	0.05	0.0014
Phosphorus (total)	mg/L	0.003	10		0.018
Selenium (total)	mg/L	0.00004	1		< 0.00004
Silver (total)	mg/L	0.00005	0.4		< 0.00005
Tin (total)	mg/L	0.00006	5		0.0017
Vanadium (total)	mg/L	0.00001	5		0.0011
Zinc (total)	mg/L	0.002	2	0.04	0.004
Gold (total)	mg/L	0.00001	5		< 0.00001
Platinum (total)	mg/L	0.0001	5		< 0.0001
Rhodium (total)	mg/L	0.00001	5		< 0.00001

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - Oil and Grease** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
Oil and Grease					
Oil & Grease (total)	mg/L	2			< 2
Oil & Grease (animal/vegetable)	mg/L	4	150		< 4
Oil & Grease (mineral/synthetic)	mg/L	4	15		< 4

PACKAGE: **SANSEW - Other (ORP)** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
Other (ORP)					
pH	No unit	0.05	9.5	9.5	7.68
Chloride	mg/L	1	1500		140
Mercury (total)	mg/L	0.00001	0.01		< 0.00001

PACKAGE: **SANSEW - PAHs** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
PAHs					
Benzo(b+j)fluoranthene	mg/L	0.0001			< 0.0001

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - Phenols** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
Phenols					
4AAP-Phenolics	mg/L	0.002	0.1		< 0.002

PACKAGE: **SANSEW - SVOCs** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
SVOCs					
PAHs (Total)	mg/L	-	0.005		< 0.001
Perylene	mg/L	0.0005			< 0.0005
Hexachlorobenzene	mg/L	0.0001	0.001		< 0.0001

PACKAGE: **SANSEW - SVOCs - PAHs** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002
L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
SVOCs - PAHs					
7Hdibenzo(c,g)carbazole	mg/L	0.0001			< 0.0001
Anthracene	mg/L	0.0001			< 0.0001
Benzo(a)anthracene	mg/L	0.0001			< 0.0001
Benzo(a)pyrene	mg/L	0.0001			< 0.0001
Benzo[e]pyrene	mg/L	0.0001			< 0.0001
Benzo(ghi)perylene	mg/L	0.0002			< 0.0002

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - SVOCs - PAHs** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002

L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
SVOCs - PAHs (continued)					
Benzo(k)fluoranthene	mg/L	0.0001			< 0.0001
Chrysene	mg/L	0.0001			< 0.0001
Dibenzo(a,h)anthracene	mg/L	0.0001			< 0.0001
Dibenzo(a,i)pyrene	mg/L	0.0001			< 0.0001
Dibenzo(a,j)acridine	mg/L	0.0001			< 0.0001
Fluoranthene	mg/L	0.0001			< 0.0001
Indeno(1,2,3-cd)pyrene	mg/L	0.0002			< 0.0002
Phenanthrene	mg/L	0.0001			< 0.0001
Pyrene	mg/L	0.0001			< 0.0001

Client: DS Consultants
Project: 21-018-100, Barrie, ON
Project Manager: Scott Watson
Samplers: Matt Zammit

PACKAGE: **SANSEW - VOCs** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002

L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
VOCs					
1,2-Dichlorobenzene	mg/L	0.0005	0.05		< 0.0005
1,4-Dichlorobenzene	mg/L	0.0005	0.08		< 0.0005
Methylene Chloride	mg/L	0.0005	0.09		< 0.0005
1,1,2,2-Tetrachloroethane	mg/L	0.0005	0.06		< 0.0005
Tetrachloroethylene (perchloroethylene)	mg/L	0.0005	0.06		< 0.0005
Trichloroethylene	mg/L	0.0005	0.05		< 0.0005

PACKAGE: **SANSEW - VOCs - BTEX** (WATER)

L1 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002

L2 = SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002

Sample Number	8
Sample Name	21-3
Sample Matrix	Ground Water
Sample Date	01/03/2021

Parameter	Units	RL	L1	L2	Result
VOCs - BTEX					
Benzene	mg/L	0.0005	0.01		< 0.0005
Ethylbenzene	mg/L	0.0005	0.06		< 0.0005
Toluene	mg/L	0.0005	0.02		< 0.0005
Xylene (total)	mg/L	0.0005	0.3		< 0.0005
m-p-xylene	mg/L	0.0005			< 0.0005
o-xylene	mg/L	0.0005			< 0.0005

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	SANSEW / WATER / - - Barrie Sewer Use - Sanitary Sewers & Combined - BL_2021_002 L1	SANSEW / WATER / - - Barrie Sewer Use - Sanitary Storm - BL_2021_002 L2
21-3					
Total Suspended Solids	SM 2540D	mg/L	22		15

QC SUMMARY

Anions by discrete analyzer

Method: US EPA 325.2 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-026

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO5008-MAR21	mg/L	1	<1	1	20	104	80	120	98	75	125
Sulphate	DIO5008-MAR21	mg/L	2	<2	ND	20	100	80	120	109	75	125

Biochemical Oxygen Demand

Method: SM 5210 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Biochemical Oxygen Demand (BOD5)	BOD0004-MAR21	mg/L	2	< 2	0	30	102	70	130	NV	70	130

Chemical Oxygen Demand

Method: HACH 8000 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chemical Oxygen Demand	EWL0046-MAR21	mg/L	8	<8	4	20	88	80	120	96	75	125

QC SUMMARY

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0021-MAR21	mg/L	0.01	<0.01	ND	10	94	90	110	90	75	125

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0064-MAR21	mg/L	0.06	<0.06	ND	10	101	90	110	104	75	125

Mercury by CVAAS

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0005-MAR21	mg/L	0.00001	< 0.00001	ND	20	116	80	120	107	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0015-MAR21	mg/L	0.00005	<0.00005	ND	20	103	90	110	98	70	130
Aluminum (total)	EMS0015-MAR21	mg/L	0.001	<0.001	6	20	103	90	110	125	70	130
Arsenic (total)	EMS0015-MAR21	mg/L	0.0002	<0.0002	1	20	107	90	110	107	70	130
Barium (total)	EMS0015-MAR21	mg/L	0.00002	<0.00002	1	20	106	90	110	111	70	130
Bismuth (total)	EMS0015-MAR21	mg/L	0.000007	<0.000007	ND	20	99	90	110	90	70	130
Cadmium (total)	EMS0015-MAR21	mg/L	0.000003	<0.000003	2	20	103	90	110	109	70	130
Cobalt (total)	EMS0015-MAR21	mg/L	0.000004	<0.000004	0	20	104	90	110	116	70	130
Chromium (total)	EMS0015-MAR21	mg/L	0.00008	<0.00008	4	20	103	90	110	112	70	130
Copper (total)	EMS0015-MAR21	mg/L	0.0002	<0.0002	1	20	106	90	110	107	70	130
Iron (total)	EMS0015-MAR21	mg/L	0.007	<0.007	ND	20	96	90	110	NV	70	130
Manganese (total)	EMS0015-MAR21	mg/L	0.00001	<0.00001	2	20	105	90	110	102	70	130
Molybdenum (total)	EMS0015-MAR21	mg/L	0.00004	<0.00004	12	20	102	90	110	104	70	130
Nickel (total)	EMS0015-MAR21	mg/L	0.0001	<0.0001	1	20	100	90	110	92	70	130
Lead (total)	EMS0015-MAR21	mg/L	0.00001	<0.00001	14	20	101	90	110	106	70	130
Phosphorus (total)	EMS0015-MAR21	mg/L	0.003	<0.003	ND	20	100	90	110	NV	70	130
Antimony (total)	EMS0015-MAR21	mg/L	0.0009	<0.0009	3	20	100	90	110	105	70	130
Selenium (total)	EMS0015-MAR21	mg/L	0.00004	<0.00004	ND	20	107	90	110	110	70	130
Tin (total)	EMS0015-MAR21	mg/L	0.00006	<0.00006	18	20	101	90	110	NV	70	130
Vanadium (total)	EMS0015-MAR21	mg/L	0.00001	<0.00001	3	20	104	90	110	105	70	130
Zinc (total)	EMS0015-MAR21	mg/L	0.002	<0.002	0	20	104	90	110	107	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Gold (total)	EMS0031-MAR21	mg/L	0.00001	<0.00001	ND	20	100	90	110	NV	70	130
Platinum (total)	EMS0031-MAR21	mg/L	0.0001	<0.0001	ND	20	99	90	110	NV	70	130
Rhodium (total)	EMS0031-MAR21	mg/L	0.00001	<0.0001	ND	20	95	90	110	NV	70	130

Oil & Grease

Method: MOE E3401 | Internal ref.: ME-CA-IENVIGC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (total)	GCM0064-MAR21	mg/L	2	<2	NSS	20	112	75	125			

QC SUMMARY

Oil & Grease-AV/MS

Method: MOE E3401/SM 5520F | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (animal/vegetable)	GCM0064-MAR21	mg/L	4	< 4	NSS	20	NA	70	130			
Oil & Grease (mineral/synthetic)	GCM0064-MAR21	mg/L	4	< 4	NSS	20	NA	70	130			

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0025-MAR21	No unit	0.05	NA	0		100			NA		

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0022-MAR21	mg/L	0.002	<0.002	ND	10	104	80	120	114	75	125

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
7Hdibenzo(c,g)carbazole	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	110	50	140	NSS	50	140
Anthracene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	97	50	140	NSS	50	140
Benzo(a)anthracene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	101	50	140	NSS	50	140
Benzo(a)pyrene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	91	50	140	NSS	50	140
Benzo(b+j)fluoranthene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	107	50	140	NSS	50	140
Benzo[e]pyrene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	92	50	140	NSS	50	140
Benzo(ghi)perylene	GCM0026-MAR21	mg/L	0.0002	< 0.0002	NSS	30	103	50	140	NSS	50	140
Benzo(k)fluoranthene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	104	50	140	NSS	50	140
Chrysene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	104	50	140	NSS	50	140
Dibenzo(a,h)anthracene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	101	50	140	NSS	50	140
Dibenzo(a,i)pyrene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	96	50	140	NSS	50	140
Dibenzo(a,j)acridine	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	106	50	140	NSS	50	140
Fluoranthene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	105	50	140	NSS	50	140
Hexachlorobenzene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	93	50	140	NSS	50	140
Indeno(1,2,3-cd)pyrene	GCM0026-MAR21	mg/L	0.0002	< 0.0002	NSS	30	103	50	140	NSS	50	140
Perylene	GCM0026-MAR21	mg/L	0.0005	< 0.0005	NSS	30	106	50	140	NSS	50	140
Phenanthrene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	100	50	140	NSS	50	140
Pyrene	GCM0026-MAR21	mg/L	0.0001	< 0.0001	NSS	30	101	50	140	NSS	50	140

QC SUMMARY

Sulphide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENVISFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0026-MAR21	mg/L	0.02	<0.02	ND	20	81	80	120	NA	75	125

Suspended Solids

Method: SM 2540D I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0044-MAR21	mg/L	2	< 2	1	10	96	90	110	NA		

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F I Internal ref.: ME-CA-[ENVISFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0037-MAR21	as N mg/L	0.5	<0.5	ND	10	97	90	110	93	75	125

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,2,2-Tetrachloroethane	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	108	60	130	104	50	140
1,2-Dichlorobenzene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	108	60	130	105	50	140
1,4-Dichlorobenzene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	107	60	130	105	50	140
Benzene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	109	60	130	105	50	140
Ethylbenzene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	109	60	130	105	50	140
m-p-xylene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	108	60	130	104	50	140
Methylene Chloride	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	109	60	130	104	50	140
o-xylene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	109	60	130	104	50	140
Tetrachloroethylene (perchloroethylene)	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	105	60	130	105	50	140
Toluene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	109	60	130	106	50	140
Trichloroethylene	GCM0094-MAR21	mg/L	0.0005	<0.0005	ND	30	107	60	130	103	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 019107

Page 1 of

Laboratory Information Section - Lab use only

Received By: Scott Re
Received Date: 03 / 01 / 2021 (mm/dd/yy)
Received Time: 12 15 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☐ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: Ice
Temperature Upon Receipt (°C) 4° 4° 4°
CA 14013-MAR1
LAB LIMS #:

REPORT INFORMATION	INVOICE INFORMATION
Company: DS Consultants	☐ (same as Report Information)
Contact: Scott Watson	Company:
Address: 6221 Hwy 7 unit 16 Vaughan, ON L4H 0K8	Contact: Patricia Dermi
Phone:	Address:
Fax:	Phone:
Email: Scott.Watson@DSconsultants.ca	Email: Patricia.dermi@dsconsultants.ca

Quotation #: Standard
Project #: 21-018-100
P.O. #:
Site Location/ID: Barrie, ON

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days)
TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days
PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M & I: Metals & Inorganics incl CrVI, CN, Hg pH (B(HWS) EC,SAR-soil) (Cl, Na-water)	M & I: Full Metals Suite ICP metals plus B(HWS-soil only) Hg, CrVI	M & I: ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs ☐ Total ☐ Aroclor	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other (please specify): Barrie Storm / Sani	Other: Appendix 2: 406/19 Leachate Screening Levels Table : ____	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg General ☐ Extended ☐	TCLP: Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
1	21-3	Mar 1st/21	8am	18	GW													✓					
2																							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Observations/Comments/Special Instructions

Sampled By (NAME): Matt Zammit
Signature: Matt Zammit
Date: 03 / 01 / 21 (mm/dd/yy)

Relinquished by (NAME):
Signature:
Date: / / (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision # 1.4
Date of Issue: 22 May. 2020

Appendix D

Table: MECP Water Wells Records (500 m Radius)

Project: 21-18-100

Location: 17-27 Jacob's Terrace, Barrie, ON

MOECC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
7223750	603846	4914129	-	-	-	-	-	-	-	-	-	-	-	-	-	16/Jun/14	Abandoned	-
5739349	603520	4913733	5	1.5	5	1.5	Black	Loam	-	-	-	-	-	-	-	4/Nov/04	Test hole	-
			20	6.1	15	4.6	Brown	Sand	-	-								
			42	12.8	22	6.7	Grey	Sand	silty	-								
			46	14.0	4	1.2	Grey	Clay	-	-								
5740517	604079	4914148	31	9.4	31	9.4	Brown	MSND	MSND	-	-	-	23.5	7.2	-	1/Dec/05	Observation Wells	Monitoring
			39	11.9	8	2.4	Brown	Sand	Clay	LYRD								
			102	31.1	63	19.2	Brown	MGVL	MGVL	Loose								
			111	33.8	9	2.7	Grey	Clay	HARD	-								
			163	49.7	52	15.8	Brown	FSND	-	-								
			271	82.6	108	32.9	Brown	CGVL	CGVL	-								
7111775	604241	4914398	4.92	1.5	4.92	1.5	Brown	Fill	-	-	-	-	-	-	-	8/Dec/08	Dewatering	Monitoring
			13.77	4.2	8.85	2.7	Brown	Sand	WBRG	-								
			29.85	9.1	16.08	4.9	Brown	Sand	-	DNSE								
7214773	603691	4914368	25	7.6	25	7.6	Brown	Sand	Gravel	FSND	7	2.1	-	-	Untested	13/Dec/12	Observ.	Monitoring
7165482	603863	4914539	10	3.0	10	3.0	Brown	-	-	-	-	-	-	-	-	4/Nov/10	Observ.	-
			30	9.1	20	6.1	Grey	Sand	-	-								
7138391	604241	4914398	4.92	1.5	4.92	1.5	Brown	Fill	-	-	-	-	-	-	-	6/Sep/08	Abandoned	Dewatering
			13.78	4.2	8.8595	2.7	Brown	Sand	WBRG	FSND								
			29.856	9.1	16.076	4.9	Brown	Sand		DNSE								
5738380	603637	4914436	2	0.6	2	0.6	Brown	Loam	Silt	-	4	1.2192	-	-	Fresh	3/Oct/03	Observ.	-
			7	2.1	5	1.5	Brown	Sand	Silt	-								
			14	4.3	7	2.1	Grey	Clay	Silt	-								
			17	5.2	3	0.9	Brown	Sand	-	-								
			21	6.4	4	1.2	Grey	Sand	-	-								
5738378	604010	4914491	5	1.5	5	1.5	-	Fill	-	-	4	1.2192	-	-	Fresh	23/Sep/03	Observ.	-
			10	3.0	5	1.5	Brown	Sand	-	-								
			13	4.0	3	0.9	Grey	Silt	sndy	-								
			14	4.3	1	0.3	Grey	Sand	-	-								
			15	4.6	1	0.3	Grey	Silt	Clay	-								
5700241	603781.4	4914437	6	1.8	6	1.8	-	Loam		-	-	-	-	-	-	12/Aug/55	Test Hole	-
			42	12.8	36	11.0	-	Fsnd		-								
			91	27.7	49	14.9	-	Fsnd	Silt	-								
			104	31.7	13	4.0	-	Fsnd	Clay	-								
			170	51.8	66	20.1	-	Clay	Msnd	-								
			192	58.5	22	6.7	-	Fsnd	-	-								
			205	62.5	13	4.0	-	Clay	Msnd	-								
			215	65.5	10	3.0	-	Msnd	Silt	-								
			224	68.3	9	2.7	-	Fsnd	-	-								
5735867	603675	4914373	5	1.5	5	1.5	-	Sand	-	-	-	-	10	3.048	-	2/Jan/01	Observ.	-
			8	2.4	3	0.9	Black	Peat	-	-								
			10	3.0	2	0.6	Grey	Fsnd	-	-								
			14	4.3	4	1.2	Brown	Fsnd	-	-								
			23	7.0	9	2.7	Grey	Fsnd	-	-								
			26	7.9	3	0.9	Grey	Fsnd	Silt	Clay								
			40	12.2	14	4.3	Grey	Silt	Fsnd	-								
			42	12.8	2	0.6	Grey	Fsnd	Silt	-								
			62	18.9	20	6.1	Grey	Fsnd	-	-								
			4	1.2	4	1.2		Fill	Sand									
			10	3.0	6	1.8	Black	Fsnd										
			14	4.3	4	1.2		Fsnd	Silt									
			18	5.5	4	1.2		Fsnd	Silt	Clay								
			27	8.2	9	2.7	Brown	Fsnd	Msnd									

5735945	603539	4914072	29	8.8	2	0.6	Brown	Fsnd			-	-	12	3.6576	-	26/Jul/00	Observ.	-
			31	9.4	2	0.6		Fsnd	Silt	Clay								
			45	13.7	14	4.3	Grey	Fsnd	Silt									
			50	15.2	5	1.5	Grey	Sand	Silt									
			51	15.5	1	0.3	Grey	Silt	Clay									
			60	18.3	9	2.7	Grey	Clay	Silt									
7231046	604080	4914397	28	8.5	28	8.5	Brown	Sand	Silt	Loose	-	-	-	-	-	30/Sep/14	Observ.	Monitoring
7260724	603762	4914374	-	-	-	-	-	-	-	-	10	3.0	-	-	-	7/Jul/15	Test Hole	Test Hole
7260877	603802	4914419	-	-	-	-	-	-	-	-	10	3.0	-	-	-	8/Jul/15	Test Hole	Test Hole
7102156	603835	4914075	19.685	6.0	19.685	6.0	Brown	Sand	-	-	-	-	-	-	-	6/Feb/08	Observ.	-
			24.934	7.6	17.3	5.3	Grey	Sand	-	-								
7260880	603821	4914328	-	-	-	-	-	-	-	-	10	3.0	-	-	-	7/Jul/15	Test Hole	Test Hole
7231047	604078	4914398	40	12.2	40	12.2	Brown	Sand	Silt	Loose	-	-	-	-	-	30/Sep/14	Observ.	Monitoring
			45	13.7	5.0	1.5	Grey	Silt	Clay	Loose								
			73	22.3	28.0	8.5	Grey	Sand	Silt	Loose								
			75	22.9	2.0	0.6	Grey	Silt	Clay	Loose								
5735943	603700	4913980	14	4.3	14	4.3	Brown	Fsnd		-	-	-	18	5.48	-	26/Jul/00	Observ.	-
			18	5.5	4.0	1.2	Brown	Fsnd	Msnd	-								
			24	7.3	6.0	1.8	Brown	Fsnd	Silt	-								
			36	11.0	12.0	3.7	Brown	Fsnd		-								
			42	12.8	6.0	1.8	Brown	Fsnd	Silt	-								
			69	21.0	27.0	8.2	Brown	Fsnd		-								
			70	21.3	1.0	0.3	Grey	Fsnd	Silt	-								
7209929	604220	4914068	-	-	-	-	-	-	-	-	-	-	-	-	-	13/Mar/13	-	-
7260878	603799	4914312	-	-	-	-	-	-	-	-	10	3.0	-	-	-	7/Jul/15	Test hole	Test Hole
7161344	604071	4914152	0.5	0.2	0.5	0.2	Black	-	-		-	-	-	-	-	24/Mar/11	Test Hole	Monitoring
			1	0.3	0.5	0.2	Brown	Sand	Gravel	-								
			22	6.7	21.0	6.4	Brown	Sand	Silt	-								
5735944	603506	4913949	6	1.8	6.0	1.8	Red	Fsnd	Msnd	-	-	-	15	4.57	-	26/Jul/00	Observ.	-
			14	4.3	8.0	2.4	Brown	Fsnd	Msnd	-								
			16	4.9	2.0	0.6	Brown	Fsnd	-	-								
			18	5.5	2.0	0.6	-	Fsnd	Silt	-								
			20	6.1	2.0	0.6	-	Fsnd	Silt	-								
			22	6.7	2.0	0.6	-	Fsnd	Msnd	-								
			30	9.1	8.0	2.4	-	Fsnd	Silt	-								
			36	11.0	6.0	1.8	Grey	Fsnd	Silt	-								
			52	15.8	16.0	4.9	-	Fsnd	Silt	-								
			60	18.3	8.0	2.4	-	Fsnd	Clay	-								
5738595	603460	4914207	59	18.0	59.0	18.0	Brown	Fsnd		-	-	-	23.95	7.3	-	22/Oct/03	Observ.	-
			79	24.1	20.0	6.1	Grey	Silt	Clay	Sand								
			109.9	33.5	30.9	9.4	Grey	Sand	Silt	-								
			112.53	34.3	2.6	0.8	Grey	Silt	Sand	Clay								
			170.6	52.0	58.1	17.7	Grey	Fsnd	Msnd	Silt								
			231.95	70.7	61.4	18.7	Grey	Msnd	Mgvl	Csnd								
			233.92	71.3	2.0	0.6	Grey	SIlt	Sand	-								
			278.8	85.0	44.9	13.7	-	Gravl	-	-								
			282.15	86.0	3.3	1.0	-	Gravl	Sand	-								
			288	87.8	5.9	1.8	-	Fsnd	Fgvl	-								
			293.96	89.6	6.0	1.8	-	Silt	CLay	Till								
			299.86	91.4	5.9	1.8	-	Fgvl	Fsnd	Mgvl								
			319.88	97.5	20.0	6.1	-	Sand	Grvl	-								
			332	101.2	12.1	3.7	-	Gravl	Stns	-								
7291254	603876	4914041	20	6.1	20.0	6.1	Brown	Sand	Silt	Loose	-	-	-	-	-	9/Jun/17	Test Hole	Monitoring
			23.5	7.2	3.5	1.1	Grey	Silt	Sand	Soft								
7291253	603912	4914060	2	0.6	2.0	0.6	Brown	Fill		Dnse	-	-	-	-	-	9/Jun/17	Test Hole	Monitoring
			18	5.5	16.0	4.9	Brown	Sand	Silt	Loose								
			23	7.0	5.0	1.5	Grey	Silt	Sand	Soft								
7291252	603931	4914066	2	0.6	2.0	0.6	Brown	Fill	-	Dnse	-	-	-	-	-	9/Jun/17	Test Hole	Monitoring
			20	6.1	18.0	5.5	Brown	Sand	Silt	Loose								
			24.5	7.5	4.5	1.4	Brown	Silt	Sand	Soft								
7291251	603955	4914079	9	2.7	9.0	2.7	Brown	Sand	-	-						14/Jun/17	Test Hole	Monitoring

7291251	603955	4914079	25	7.6	16.0	4.9	Brown	Sand	Wbrg	-	-	-	-	-	-	14/Jun/17	Test Hole	Monitoring
7291250	603970	4914002	2	0.6	2.0	0.6	Brown	Fill	-	Dnse	-	-	-	-	-	9/Jun/17	Test Hole	Monitoring
			20	6.1	18.0	5.5	Brown	Sand	Silt	Loose								
			25	7.6	5.0	1.5	Grey	Silt	Sand	Soft								
7282889	603880	4914131	8	2.4	8.0	2.4	Brown	Sand	Grvl	-	-	-	-	-	-	5/Feb/17	Test Hole	Monitoring
			17	5.2	9.0	2.7	Brown	Sand	Cgrd	Wbrg								
7282888	603981	4914246	10	3.0	10.0	3.0	Brown	Sand	Grvl	-	-	-	-	-	-	5/Feb/17	Test Hole	Monitoring
			18	5.5	8.0	2.4	Brown	Sand										
7282887	603849	4914190	15	4.6	15.0	4.6	Brown	Sand	Grvl	-	-	-	-	-	-	5/Feb/17	Test Hole	Monitoring
			21	6.4	6.0	1.8	Brown	Sand										
7282611	603541	4913940	10	3.0	10.0	3.0	Brown	Sand	Grvl	-	-	-	-	-	-	5/Feb/17	Test Hole	Monitoring
			20	6.1	10.0	3.0	Brown	Sand										
7274938	604128	4913948	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7260881	603830	4914316	-	-	-	-	-	-	-	-	10	32.8	-	-	-	7/Jul/17	Test Hole	Test Hole
7260879	603821	4914371	-	-	-	-	-	-	-	-	10	32.8	-	-	-	7/Jul/17	Test Hole	Test Hole
7260876	603773	4914418	-	-	-	-	-	-	-	-	10	32.8	-	-	-	8/Jul/17	Test Hole	Test Hole
7260348	603472	4914196	9	2.7	9.0	2.7	Brown	Fsnd	-	-	-	-	-	-	-	17/Dec/15	Test Hole	Monitoring
			20	6.1	11.0	3.4	Brown	Fsnd	-	Wbrg								
7260347	603535	4914099	9	2.7	9.0	2.7	Brown	Fsnd		-	-	-	-	-	-	17/Dec/15	Test Hole	Monitoring
			20	6.1	11.0	3.4	Brown	Fsnd		Wbrg								
7260337	604105	4914434	20	6.1	20.0	6.1	Brown	Sand	Silt	Soft			-	-	-	23/Feb/16	Test Hole	Monitoring
7260336	604115	4914416	20	6.1	20.0	6.1	Brown	Sand	Silt	Soft			-	-	-	23/Feb/16	Test Hole	Monitoring
7260335	604150	4914440	20	6.1	20.0	6.1	Brown	Sand	Silt	-			-	-	-	23/Feb/16	Test Hole	Monitoring
7247758	603704	4914511	-	-	-	-	-	-	-	-			-	-	-	16/Jun/14	-	-
7237000	603812	4914166	35	10.7	35.0	10.7	Brown	Sand	Silt	Loose	-	-	-	-	-	4/Sep/14	Observ.	Monitoring
			45	13.7	10.0	3.0	Grey	Silt	Clay	Loose								
			56	17.1	11.0	3.4	Grey	Sand	Silt	Loose								
7236999	603812	4914166	28	8.5	28.0	8.5	Brown	Sand	Silt	Loose	-	-	-	-	-	5/Sep/14	Observ.	Monitoring
7231045	604080	4914398	20	6.1	20.0	6.1	Brown	Sand	Silt	Loose	-	-	-	-	-	30/Sep/14	Observ.	Monitoring
7217301	604190	4914478	-	-	-	-	-	-	-	-	-	-	-	-	-	9/Jul/13	-	-
7207324	604108	4914007	-	-	-	-	-	-	-	-	-	-	-	-	-	1/May/12	-	-
7179305	603425	4914019	-	-	-	-	-	-	-	-	-	-	-	-	-	10/Nov/12	-	-
7172576	603841	4914094	14	4.3	14.0	4.3	Brown	Sand	Silt	Soft	-	-	-	-	-	17/Dec/15	Observ.	Monitoring
			22	6.7	8.0	2.4	Brown	Sand	Dnse	Wbrg								
7165481	603863	4914539	10	3.0	10.0	3.0	Brown	Sand		Dry	-	-	-	-	-	24/Nov/10	Obersv.	Monitoring
			45	13.7	35.0	10.7	Grey	Sand		Wbrg								
			47.5	14.5	2.5	0.8	Grey			Silt								
7161345	604031	4914110	0.5	0.2	0.5	0.2	Brown	Sand	Grvl	Loose	-	-	-	-	-	24/Mar/11	-	Monitoring
			22	6.7	21.5	6.6	Brown	Sand	Silt	Loose								
7161343	604049	4914181	0.5	0.2	0.5	0.2	Brown	Sand	Grvl	Loose	-	-	-	-	-	24/Mar/11	Test Hole	Monitoring
			20	6.1	19.5	5.9	Brown	Sand	Silt	Loose								
7117039	604237	4914400	-	-	-	-	-	-	-	-			-	-	-	18/Sep/08	Abandoned	Dewatering
7117027	603604	4914267	10	3.0	10.0	3.0	Brown	Sand	Dry	Loose	-	-	-	-	-	17/Sep/08	Obersv.	-
			18	5.5	8.0	2.4	Brown	Sand	Wbrg	Loose								
7116421	603826	4914138	18	5.5	18.0	5.5	Brown	Sand			-	-	-	-	-	6/Oct/08	Obersv.	Monitoring
			24.93	7.6	6.9	2.1	Grey	Sand										
7106252	604167	4914522	13.12	4.0	13.1	4.0	Brown	Fill	-		-	-	12.13	3.70	-	7/Mar/08	Obersv.	Monitoring
			29.52	9.0	16.4	5.0	Brown	Sand										
			36.08	11.0	6.6	2.0	Grey	Clay	Till									
7106250	604183	4914561	9.84	3.0	9.8	3.0	Brown	Fill	-		8.20	2.50	8.20	2.50	-	6/Mar/08	Dewatering	Dewatering
			26.9	8.2	17.1	5.2	Brown	Sand	Silt									
			27.231	8.3	0.3	0.1	Grey	Clay	Till	Silty								
7105808	604112	4914382	25	7.6	25.0	7.6	Brown	Peat	Soft	Wbrg			-	-	-	22/Apr/08	Observ.	Monitoring
7043528	603480	4913865											-	-	-	21/Mar/07	Observ.	-
7043261	604333	4914291	1.96	0.6	2.0	0.6	Brown	Sand	Gravel	Fill	-	-	-	-	-	13/Feb/07	Abandoned	-
			10.17	3.1	8.2	2.5	Brown	Sand	Sand									
			14	4.3	3.8	1.2	Brown	Sand	Sand									
5740516	604071	4914154	31	9.4	31	9.4	Brown	Fsnd	MSND	-	-	-	23.5	7.2	-	3/Dec/05	Observation	Municipal
			39	11.9	8	2.4	Brown	Sand	Clay	LYRD								
			102	31.1	63	19.2	Brown	Msnd	MGVL	Loose								

5740516	604071	4914134	111	33.8	9	2.7	Grey	Clay	HARD	-		-	23.5	7.2	-	3/Dec/05	Wells	Municipal
			163	49.7	52	15.8	Brown	FSND	-	-								
			210	64.0	47	14.3	Brown	CGVL	CGVL	-								
5740515	603833	4914445	1	0.3	1	0.3	-	Loam	-	-	-	-	25.5	7.77	-	1/Dec/05	Observ.	Municipal
			38	11.6	37	11.3	Black	Sand	Loose	-								
			69	21.0	31	9.4	Grey	Ckay	Soft	-								
			96	29.3	27	8.2	Brown	Fsnd	Msnd	-								
			121	36.9	25	7.6	Grey	Clay	SOft	-								
			149	45.4	28	8.5	Brown	Msnd	-	-								
			154	46.9	5	1.5	Grey	Clay	Silt	Hard								
			164	50.0	10	3.0	Brown	Msnd	Loose	-								
			237	72.2	73	22.3	Brown	Sand	Clay	Lyrd								
5738594	603460	4914207	59	18.0	59	18.0	Brown	Fsnd	-	-	27.88	8.5	-	-	-	3/Oct/03	Observ.	-
			79	24.1	20	6.1	Grey	Silt	Clay	Sand								
			109.9	33.5	30.9	9.4	Grey	Sand	Silt	-								
			112.53	34.3	2.63	0.8	Grey	Silt	Sand	Clay								
			170.6	52.0	58.07	17.7	Grey	Msnd	Fsnd	Silt								
			231.95	70.7	61.35	18.7	Grey	Msnd	Mgvl	Csnd								
			233.92	71.3	1.97	0.6	Grey	Silt	SAnd	-								
			278.87	85.0	44.95	13.7	Grey	Gravl	-	-								
5738381	603777	4914337	2	0.6	2	0.6	Brown	Sand	-	-	3	0.9144	-	-	Fresh	4/Oct/03	Observ.	not used
			9	2.7	7	2.1	Grey	Sand	Silty	-								
			11	3.4	2	0.6	Grey	Clay	Silty	-								
			12	3.7	1	0.3	Grey	Silt	Sandy	-								
			20	6.1	8	2.4	Grey	Sand	-	-								
5738379	604205	4914324	1	0.3	1	0.3	-	Fill	-	-	5	1.524	-	-	Fresh	22/Sep/03	Observ.	not used
			7	2.1	6.0	1.8	Brown	Silt	Sandy	-								
			12	3.7	5.0	1.5	Grey	Silt	-	-								
			16	4.9	4.0	1.2	Grey	Silt	Sand	-								
5735942	603532	4913825	5	1.5	5	1.5	Brown	FSND	-	-	-	-	34	10.36	-	26/Jul/00	Observ.	Not Used
			6	1.8	1	0.3	Brown	FSND	MSND	Stones								
			11	3.4	5	1.5	Brown	FSND	-	-								
			12	3.7	1	0.3	Brown	FSND	MSND	-								
			15	4.6	3	0.9	Brown	FSND	STNS	-								
			22	6.7	7	2.1	Brown	FSND	Silt	-								
			27	8.2	5	1.5	Grey	Silt	Clay	-								
			37	11.3	10	3.0	Grey	FSND	Silty	-								
			42	12.8	5	1.5	Grey	Silt	Sand	Clay								
			47	14.3	5	1.5	Grey	Clay	Silt	Sand								
			61	18.6	14	4.3	Grey	FSND	Silt	-								
5735866	603762	4914222	8	2.4	8	2.4	-	Fill	-	-	-	-	13	3.9624	-	20/Jan/01	Observ.	Not Used
			10	3.0	2.0	0.6	-	Peat	-	-								
			20	6.1	10.0	3.0	Brown	FSND	-	-								
			22	6.7	2.0	0.6	Grey	FSND	-	-								
			27	8.2	5.0	1.5	-	Silt	Sandy	-								
			59	18.0	32.0	9.8	Grey	FSND	-	-								
			62	18.9	3.0	0.9	Grey	Clay	Silty	-								
5706146	603514	4913803	11	3.4	11.0	3.4	-	MSND	-	-	106	32.309	13	3.9624	Fresh	17/Jan/69	Water supply	Municipal
			15	4.6	4.0	1.2	-	MSND	Gravel	-								
			16	4.9	1.0	0.3	Brown	Clay	MSND	-								
			67	20.4	51.0	15.5	Grey	Clay	MSND	-								
			83	25.3	16.0	4.9	-	FSND	Clay	-								
			85	25.9	2.0	0.6	-	Clay	Gravel	MSND								
			104	31.7	19.0	5.8	-	MSND	Silt	Clay								
			106	32.3	2.0	0.6	-	Clay	Gravel	-								
			110	33.5	4.0	1.2	-	FSND	Gravel	Clay								
			117	35.7	7.0	2.1	-	MSND	Gravel	Clay								
			127	38.7	10.0	3.0	-	CSND	Gravel	-								
			187	57.0	60.0	18.3	-	Gravel	MSND	BLDR								
			189	57.6	2.0	0.6	-	FSND	Gravel	-								
			207	63.1	18.0	5.5	-	MSND	Gravel	BLDR								
			213	64.9	6.0	1.8	-	MSND	CSND	-								

			235	71.6	22.0	6.7	-	MSND	Gravel	BLDR							
			236	71.9	1.0	0.3	Grey	Clay	-	-							
5701723	604249	4913734	28	8.5	28	8.5	-	PRDG	-	-	72	21.946	24	7.3152	Fresh	9/Dec/53	Water Supply	Domestic
			72	21.9	44.0	13.4	-	Clay	MSND	-								
			78	23.8	6.0	1.8	-	FSND	-	-								
			82	25.0	4.0	1.2	-	CSND	-	-								
5700287	603500	4913841	14	4.3	14.0	4.3	-	MSND	Gravel	-	127	38.71	13	3.9624	Fresh	16/Jun/66	Test Hole	Not Used
			16	4.9	2.0	0.6	Brown	Clay	-	-								
			24	7.3	8.0	2.4	-	FSND	Silt	-								
			35	10.7	11.0	3.4	-	FSND	Silt	Clay								
			63	19.2	28.0	8.5	Grey	Clay	-	-								
			108	32.9	45.0	13.7	-	FSND	Silt	Clay								
			115	35.1	7.0	2.1	Grey	Clay	MSND	-								
			127	38.7	12.0	3.7	-	MSND	Silt	-								
			187	57.0	60.0	18.3	-	Gravel	MSND	BLDR								
			192	58.5	5.0	1.5	Grey	Clay	MSND	Gravel								
			208	63.4	16.0	4.9	-	Gravel	MSND	BLDR								
			223	68.0	15.0	4.6	Grey	Clay	MSND	Gravel								
			236	71.9	13.0	4.0	-	Gravel	MSND	Clay								
			247	75.3	11.0	3.4	Grey	Clay	-	-								
			301	91.7	54.0	16.5	Grey	Clay	MSND	-								
			321	97.8	20.0	6.1	-	MSND	Gravel	-								
			336	102.4	15.0	4.6	Grey	Clay	MSND	Gravel								
			339	103.3	3.0	0.9	-	Clay	MSND	Gravel								
			343	104.5	4.0	1.2	Grey	Clay	MSND	-								
			358	109.1	15.0	4.6	Grey	Clay	MSND	Gravel								
			362	110.3	4.0	1.2	-	LMSN	-	-								
5700286	603475	4913844	15	4.6	15	4.6	-	MSND	-	-	130	39.624	14	4.2672	Fresh	16/Jun/66	Test Hole	not used
			16	4.9	1	0.3	Brown	Clay	-	-								
			38	11.6	22	6.7	-	FSND	Clay	-								
			44	13.4	6	1.8	Grey	Clay	-	-								
			47	14.3	3	0.9	Grey	Clay	Silt	-								
			73	22.3	26	7.9	-	FSND	Clay	-								
			109	33.2	36	11.0	Grey	Clay	Silt	-								
			114	34.7	5	1.5	Grey	Clay	-	-								
			130	39.6	16	4.9	-	MSND	Clay	-								
			136	41.5	6	1.8	-	MSND	Gravel	BLDR								
			194	59.1	58	17.7	-	Gravel	BLDR	MSND								
			197	60.0	3	0.9	Grey	MSND	Clay	-								
			205	62.5	8	2.4	Grey	Clay	MSND	Gravel								
5700270	603978	4914076	1	0.3	1	0.3	-	Fill	-	-	272	82.9	11	3.4	Fresh	23/Nov/63	Water supply	Domestic
			60	18.3	59	18.0	-	MSND	-	-								
			70	21.3	10	3.0	Blue	Clay	-	-								
			160	48.8	90	27.4	-	FSND	-	-								
			265	80.8	105	32.0	-	CSND	Gravel	Silt								
			290	88.4	25	7.6	-	FSND	Gravel	-								
5700247	604129	4913595	13	4.0	13	4.0	-	MSND	Silt	-	-	-	-	-	-	15/May/59	Test Hole	-
			18	5.5	5	1.5	-	Gravel	-	-								
			218	66.4	200	61.0	-	Clay	Gravel	BLDR								
			278	84.7	60	18.3	-	Clay	MSND	Gravel								
			307	93.6	29	8.8	Blue	Clay	-	-								
			324	98.8	17	5.2	Blue	Clay	Gravel	BLDR								
5700243	604136	4913553	14	4.3	14.0	4.3	-	MSND	-	-	57	17	32.00	10	Fresh	4/Aug/58	Water supply	Domestic
			43	13.1	29.0	8.8	-	Clay	MSND	-								
			57	17.4	14.0	4.3	-	FSND	-	-								

Table: PTTW Summary

Permit Number	Active	Client Name	Source	Purpose	Max L / Day	Max Days / Year	Max Hrs / Day	L / Min	Expiry Date	Address
93-P-3075	No	City of Barrie	Ground Water	Municipal Water Supply	6,552,000	365	24	4550	2003, 03, 31	Wood Street, Well #6
6005-7E6P8B	No	City of Barrie	Groundwater	Construction Dewatering	450,000	245	24	312.5	2009, 07, 01	N/A
6522-AM3HJP	No	City of Barrie	Ground Water	Construction Dewatering	2,000,000	365	24	1389	2018, 06, 30	Essa Rd between Anne and Gowan
03-P-1125	No	City of Barrie	Groundwater	Construction Dewatering	1,094,400	80	24	760	2003, 10, 15	N/A

Appendix E

TABLE E-1

CLIMATE NORMALS 1981-2010 (SHANTY BAY CLIMATE STATION)

17-27 Jacob's Terrace , Barrie, ON.

	Thornthwaite (1948)					
Month	Mean Temperature (°C)	Heat Index	Unadjusted Potential Evapotranspiration (mm)	Daylight Correction Value	Adjusted Potential Evapotranspiration (mm)	Total Precipitation (mm)
January	-7.7	0.0	0.0	0.77	0.0	88.8
February	-6.5	0.0	0.0	0.87	0.0	69.8
March	-1.9	0.0	0.0	0.99	0.0	63.8
April	5.7	1.2	26.4	1.12	29.5	65.0
May	12.1	3.8	58.5	1.23	71.9	79.9
June	17.4	6.6	86.0	1.29	110.5	88.6
July	20.1	8.2	100.2	1.26	126.1	73.2
August	19.2	7.7	95.4	1.16	111.2	86.2
September	15.2	5.4	74.5	1.04	77.7	92.2
October	8.7	2.3	41.3	0.92	37.9	78.2
November	2.6	0.4	11.5	0.81	9.2	98.0
December	-3.6	0.0	0.0	0.75	0.0	84.3
TOTALS		**35.6**	**493.7**		**574.0**	**968.0**

Notes: Daylight Correction values obtained from Instruction and Tables For Computing Potential Evapotranspiration and The Water Balance (Thornthwaite & Mather, 1957)

TABLE E-2
PRE-DEVELOPMENT SITE WATER BALANCE
17-27 Jacob's Terrace , Barrie, ON.

Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.00	29.48	71.89	110.55	126.10	111.17	77.71	37.88	9.25	0.00	0.00	0.00	**574.04**
P - Total Precipitation (mm)			63.80	65.00	79.90	88.60	73.20	86.20	92.20	78.20	98.00	84.30	88.80	69.80	**968.00**
P-PET (mm)			63.80	35.52	8.01	-21.95	-52.90	-24.97	14.49	40.32	88.75	84.30	88.80	69.80	**393.96**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-21.95	-74.85	-99.82	-85.33	-45.02	0.00	0.00	0.00	0.00	-
Total Site	Pervious Area (Urban Lawns +)	Soil Moisture Storage (mm)	50.00	50.00	50.00	28.05	0.00	0.00	14.49	50.00	50.00	50.00	50.00	50.00	-
		Actual Evapotranspiration (mm)	0.00	29.48	71.89	105.73	88.04	86.20	77.71	37.88	9.25	0.00	0.00	0.00	**506.19**
		P-AET (mm)	63.80	35.52	8.01	-17.13	-14.84	0.00	14.49	40.32	88.75	84.30	88.80	69.80	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-17.13	-31.97	-31.97	-17.48	0.00	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	17.13	14.84	0.00	-14.49	-17.48	0.00	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	63.80	35.52	8.01	0.00	0.00	0.00	0.00	22.83	88.75	84.30	88.80	69.80	**461.81**
		MOECC Infiltration Factor	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Run-Off Coefficient	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Infiltration (mm)	38.28	21.31	4.80	0.00	0.00	0.00	0.00	13.70	53.25	50.58	53.28	41.88	**277.08**
		Run-Off (mm)	25.52	14.21	3.20	0.00	0.00	0.00	0.00	9.13	35.50	33.72	35.52	27.92	**184.72**
		Catchment Area (m^2) = 583	**Monthly Volumes (Pervious Area)**												
		Total AET (m^3)	0.00	17.18	41.89	61.61	51.30	50.23	45.28	22.07	5.39	0.00	0.00	0.00	**294.94**
		Total Evaporation (m^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Total Infiltration (m^3)	22.30	12.42	2.80	0.00	0.00	0.00	0.00	7.98	31.03	29.47	31.04	24.40	**161.45**
		Total Run-Off (m^3)	14.87	8.28	1.87	0.00	0.00	0.00	0.00	5.32	20.68	19.65	20.70	16.27	**107.63**
	Pervious Area (Treed)	Soil Moisture Storage (mm)	250.00	250.00	250.00	228.05	175.15	150.18	164.67	100.00	145.02	145.02	145.02	145.02	-
		Actual Evapotranspiration (mm)	0.00	29.48	71.89	109.58	115.86	102.45	77.71	37.88	9.25	0.00	0.00	0.00	**554.11**
		P-AET (mm)	63.80	35.52	8.01	-20.98	-42.66	-16.25	14.49	40.32	88.75	84.30	88.80	69.80	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-20.98	-63.65	-79.89	-65.41	-25.09	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	20.98	42.66	16.25	-14.49	-40.32	-25.09	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	63.80	35.52	8.01	0.00	0.00	0.00	0.00	0.00	63.66	84.30	88.80	69.80	**413.89**
		MOECC Infiltration Factor	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Run-Off Coefficient	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Infiltration (mm)	38.28	21.31	4.80	0.00	0.00	0.00	0.00	0.00	38.20	50.58	53.28	41.88	**248.33**
		Run-Off (mm)	25.52	14.21	3.20	0.00	0.00	0.00	0.00	0.00	25.46	33.72	35.52	27.92	**165.55**
		Catchment Area (m^2) = 940	**Monthly Volumes (Pervious Area)**												
		Total AET (m^3)	0.00	27.70	67.55	102.97	108.87	96.26	73.02	35.60	8.69	0.00	0.00	0.00	**520.66**
		Total Evaporation (m^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Total Infiltration (m^3)	35.97	20.02	4.51	0.00	0.00	0.00	0.00	0.00	35.89	47.53	50.06	39.35	**233.34**
		Total Run-Off (m^3)	23.98	13.35	3.01	0.00	0.00	0.00	0.00	0.00	23.93	31.68	33.38	26.23	**155.56**
	Impervious Area (Roof and Paved)	Catchment Area (m^2) = 7629	**Monthly Volumes (Impervious Area)**												
		Evaporation from Imperv. (m^3), 15% of P.	73.01	74.39	91.44	101.40	83.77	98.65	105.52	89.49	112.15	96.47	101.62	79.88	**1107.80**
		Run-Off from Imperv. (m^3), P - ET	413.75	421.53	518.15	574.57	474.70	559.01	597.92	507.13	635.53	546.69	575.87	452.66	**6277.51**
		Total Monthly Volumes (No Mitigation)													
		Total ET (m^3)	**73.01**	**74.39**	**91.44**	**101.40**	**83.77**	**98.65**	**105.52**	**89.49**	**112.15**	**96.47**	**101.62**	**79.88**	**1107.80**
		Total AET (m^3)	**0.00**	**44.88**	**109.44**	**164.57**	**160.17**	**146.49**	**118.30**	**57.67**	**14.08**	**0.00**	**0.00**	**0.00**	**815.61**
		Total Infiltration (m^3)	**58.27**	**32.44**	**7.31**	**0.00**	**0.00**	**0.00**	**0.00**	**7.98**	**66.92**	**77.00**	**81.11**	**63.75**	**394.79**
		Total Runoff (m^3)	**452.59**	**443.16**	**523.03**	**574.57**	**474.70**	**559.01**	**597.92**	**512.45**	**680.15**	**598.02**	**629.94**	**495.16**	**6540.70**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE E-3
POST-DEVELOPMENT SITE WATER BALANCE
17-27 Jacob's Terrace , Barrie, ON.

Hydrologic Components			Month											Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.00	29.48	71.89	110.55	126.10	111.17	77.71	37.88	9.25	0.00	0.00	0.00	**574.04**
P - Total Precipitation (mm)			63.80	65.00	79.90	88.60	73.20	86.20	92.20	78.20	98.00	84.30	88.80	69.80	**968.00**
P-PET (mm)			63.80	35.52	8.01	-21.95	-52.90	-24.97	14.49	40.32	88.75	84.30	88.80	69.80	**393.96**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-21.95	-74.85	-99.82	-85.33	-45.02	0.00	0.00	0.00	0.00	-
Total Site	Pervious Area (Urban Lawns)	Soil Moisture Storage (mm)	50.00	50.00	50.00	28.05	0.00	0.00	14.49	50.00	50.00	50.00	50.00	50.00	-
		Actual Evapotranspiration (mm)	0.00	29.48	71.89	105.73	88.04	86.20	77.71	37.88	9.25	0.00	0.00	0.00	**506.19**
		P-AET (mm)	63.80	35.52	8.01	-17.13	-14.84	0.00	14.49	40.32	88.75	84.30	88.80	69.80	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-17.13	-31.97	-31.97	-17.48	0.00	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	17.13	14.84	0.00	-14.49	-17.48	0.00	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	63.80	35.52	8.01	0.00	0.00	0.00	0.00	22.83	88.75	84.30	88.80	69.80	**461.81**
		MOECC Infiltration Factor	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	-
		Run-Off Coefficient	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	-
		Infiltration (mm)	34.45	19.18	4.32	0.00	0.00	0.00	0.00	12.33	47.93	45.52	47.95	37.69	**249.38**
		Run-Off (mm)	29.35	16.34	3.68	0.00	0.00	0.00	0.00	10.50	40.83	38.78	40.85	32.11	**212.43**
		Catchment Area (m^2) = 1501	**Monthly Volumes (Pervious Area)**												
		Total AET (m^3)	0.00	44.25	107.91	158.70	132.15	129.38	116.64	56.86	13.88	0.00	0.00	0.00	**759.77**
		Total Evaporation (m^3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Total Infiltration (m^3)	51.71	28.79	6.49	0.00	0.00	0.00	0.00	18.50	71.93	68.33	71.97	56.57	**374.30**
		Total Run-Off (m^3)	44.05	24.52	5.53	0.00	0.00	0.00	0.00	15.76	61.28	58.20	61.31	48.19	**318.85**
	Impervious Area (Roof and Paved)	Catchment Area (m^2) = 7651	**Monthly Volumes (Impervious Area)**												
		Evaporation from Imperv. (m^3), 15% of P.	73.22	74.60	91.70	101.68	84.01	98.93	105.81	89.75	112.47	96.75	101.91	80.11	**1110.93**
		Run-Off from Imperv. (m^3), P - ET	414.92	422.72	519.62	576.20	476.05	560.59	599.61	508.57	637.33	548.24	577.50	453.94	**6295.28**
	Total Monthly Volumes (No Mitigation)														
	Total ET (m^3)		**73.22**	**74.60**	**91.70**	**101.68**	**84.01**	**98.93**	**105.81**	**89.75**	**112.47**	**96.75**	**101.91**	**80.11**	**1110.93**
	Total AET (m^3)		**0.00**	**44.25**	**107.91**	**158.70**	**132.15**	**129.38**	**116.64**	**56.86**	**13.88**	**0.00**	**0.00**	**0.00**	**759.77**
	Total Infiltration (m^3)		**51.71**	**28.79**	**6.49**	**0.00**	**0.00**	**0.00**	**0.00**	**18.50**	**71.93**	**68.33**	**71.97**	**56.57**	**374.30**
	Total Runoff (m^3)		**458.97**	**447.24**	**525.15**	**576.20**	**476.05**	**560.59**	**599.61**	**524.33**	**698.61**	**606.44**	**638.81**	**502.13**	**6614.13**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

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TABLE E-4
WATER BUDGET SUMMARY
17-27 Jacob's Terrace , Barrie, ON.

Total Site	Month												Total
	March	April	May	June	July	August	September	October	November	December	January	February	
Pre-Development													
Total ET (m^3)	73	74	91	101	84	99	106	89	112	96	102	80	**1108**
Total AET (m^3)	0	45	109	165	160	146	118	58	14	0	0	0	**816**
Total Infiltration (m^3)	58	32	7	0	0	0	0	8	67	77	81	64	**395**
Total Runoff (m^3)	453	443	523	575	475	559	598	512	680	598	630	495	**6541**
Post-Development without Mitigation													
Total ET (m^3)	73	75	92	102	84	99	106	90	112	97	102	80	**1111**
Total AET (m^3)	0	44	108	159	132	129	117	57	14	0	0	0	**760**
Total Infiltration (m^3)	52	29	6	0	0	0	0	19	72	68	72	57	**374**
Total Runoff (m^3)	459	447	525	576	476	561	600	524	699	606	639	502	**6614**
Post-Development Deficit (-ve value implies a net gain)													
Total ET (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	**-3**
Total AET (m^3)	0	1	2	6	28	17	2	1	0	0	0	0	**56**
Total Infiltration (m^3)	7	4	1	0	0	0	0	-11	-5	9	9	7	**20**
Total Runoff (m^3)	-6	-4	-2	-2	-1	-2	-2	-12	-18	-8	-9	-7	**-73**