



**Hydrogeological Assessment**  
**217 Dunlop Street East, Barrie, Ontario**

Prepared for:  
2012292 Ontario Limited

Prepared by:  
Azimuth Environmental  
Consulting, Inc.

December 2020

AEC 18-359



Environmental Assessments & Approvals

December 16, 2020

AEC 18-359

2012292 Ontario Limited  
191 John Street  
Barrie, Ontario  
L4N 2L4

Attention: Mr. Phillip Moore  
Property Manager

Re: **Hydrogeological Assessment:  
217 Dunlop Street East, Barrie, Ontario**

Dear Mr. Moore,

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide our Hydrogeological Assessment for the property located at 217 Dunlop Street East, Barrie, ON (the "Site"). This evaluation focused on the existing soil and ground water regime underlying the Site and the potential for the proposed mixed residential development to impact the existing conditions.

Should you have any questions or wish to discuss the report in greater detail, please do not hesitate to contact the undersigned.

Yours truly,

AZIMUTH ENVIRONMENTAL CONSULTING, INC.



Colin Ross, B.Sc, P.Geo.  
Senior Hydrogeologist

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## 1.0 INTRODUCTION

Azimuth Environmental Consulting Inc. (Azimuth) has been retained by 2012292 Ontario Limited to conduct a Hydrogeological Assessment for the property located at 217 Dunlop Street East, Barrie, Ontario (the "Site")(Figure 1).

This assessment addresses development requirements mandated by the Lake Simcoe Region Conservation Authority (LSRCA) under the *Lake Simcoe Protection Act*. This Act provides the authority for the establishment of and amendments to a Lake Simcoe Protection Plan which is addressed in this assessment.

This assessment also addresses Source Water Protection policies developed under the *Clean Water Act* as they pertain to water quantity issues. A separate document titled *Summary of Brownfield Site Redevelopment Requirements* addresses water quality requirements related to the Source Water Protection policies (Appendix J).

Finally, this assessment intends to address all relevant pre-consultation comments received from the City of Barrie (the "City") that pertain to the physical ground water flow at this Site. As noted above, the Summary of Brownfield Site Redevelopment Requirements (Appendix J) addresses the ground water quality issues raised by the City.

In our professional opinion, the proposed Site development plan does not have an adverse impact on the hydrogeologic setting present at this Site.

### 1.1 Background

The Site is rectangular in shape, 0.2 hectares (ha) in size and is to be redeveloped as a 15 storey luxury condominium building. It is noted that the development plan does include connections with the adjacent City owned property to the west which comprises of the Sampson Street right of way (0.0249 ha); however for the purposes of this assessment, including the water balance and phosphorus assessment, only the Site area of 0.2 ha was considered. The Site is located on the south side of Dunlop Street East. The Barrie North Shore Trail is directly south of the Site and south of the trail is the shores of Kempenfelt Bay (Figure 2). Currently, there are no buildings on the Site, however a concrete slab and asphalt parking area remains from a previous building.

As per the proposed development plans, the development will include the following:

- Three parking levels, including one level of underground (basement) parking;
- Excavation of between 3.0 and 5.0 m for construction of basement car parking, the base of which is to be 221.6 masl based on building design plans;



- Residential floors above the ground level; and
- Paved access will be constructed on the east and west sides of the proposed building, with areas north and south of the building comprising landscaped areas.

Site access will continue to be from Dunlop Street East. The proposed Site development plans are provided in Appendix B.

The purpose of this assessment is to characterize the existing physical hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report also incorporates discussion relating to specific pre-consultation comments provided by the City of Barrie (May 2019). Beyond this, the report follows a standard format addressing typical requirements of both the City of Barrie and Lake Simcoe Conservation Authority (LSRCA) for hydrogeological submissions, including Source Water Protection and the Lake Simcoe Protection Plan (LSPP).

## **2.0 ENVIRONMENTAL SETTING**

### **2.1 Soil**

The Soil Map of South Simcoe County (Report No. 29) defines the surficial soil for the Site as the Tioga Series which are loamy sands consisting of grey, calcareous outwash sands. Tioga sands are classified within Soil Group A. Group A soils represent material with low runoff potential and high infiltration rates.

### **2.2 Physiography**

The Ontario Geologic Survey (Chapman and Putnam, 1984) describes the area as being located within the Simcoe Lowlands Physiographic region. The Simcoe Lowlands represent areas that were flooded by glacial Lake Algonquin and are bordered by shorecliffs, beaches, and boulder terraces. This area covers approximately 2,850 square kilometres and is separated into two areas: the Lake Simcoe basin and the Nottawasaga River basin.

### **2.3 Topography and Drainage**

The Site is found at an elevation between approximately 221 and 226 masl, with a southerly aspect and gross slope of 15%. However much of the Site is much flatter owing to the steeper slope close to Dunlop street resulting from the historic land use. The Site is located within the Lake Simcoe Watershed. The current Site drainage is expected to follow the local topography and via surface sheet flow towards the lake.



## 2.4 Bedrock Geology

The Ontario Geologic Survey Earth Database shows that the uppermost bedrock unit at the Site consists of limestone and shale of the Verulam Formation (OGS, 2016). The Verulam Formation is Middle Ordovician in age.

## 2.5 Quaternary Geology

The Quaternary Soil Map of Ontario (Barnett *et al.*, 1991) defines the local surficial soils in the vicinity of the Site as coarse-textured glaciolacustrine deposits consisting of sand, gravel, minor silts and clay.

## 2.6 Hydrogeology

The Ontario Ministry of Environment, Conservation, and Parks (MECP) Water Well Records were referenced for any recorded well information within the vicinity of the Site (500 m)(GIN, 2020). The Site is likely to have been previously serviced with water and sewer utilities; however well records can be used to gain subsurface information which can provide insight into shallow geological formation within the area. The well records found in the vicinity of the Site that are pertinent to this assessment are summarized in Table 1 and are shown on Figure 3.

**Table 1: MECP Water Well Database Summary (GIN, 2020)<sup>1</sup>**

Well No.	Distance from the Site (m)	Direction from Site	Elevation (masl)	Depth (mbgs)	Static Water Level (mbgs)	Depth to Bedrock (mbgs)	Water Use/Status
5700233	200	East	228.6	58.5	-	56.4	Test Hole
7038503	30	North	227.0	5.5	-	-	Unknown
5700235	215	West	220.1	21.3	-	-	Municipal
5700237	215	West	220.1	25.0	-	-	Test Hole
5700236	215	West	220.1	24.1	-	-	Industrial
5700288	330	West	222.5	98.0	-	-	Test Hole
7124832	330	West	223.0	6.1	-	-	Observation
5735507	230	West	219.0	12.2	-	-	Abandoned
5735508	215	West	225.0	7.6	-	-	Abandoned
5700262	215	West	225.0	23.8	0.61	-	Industrial

Notes: <sup>1</sup> - values rounded for presentation purposes

The surrounding wells in the MECP well record were drilled for observation, test holes, municipal and industrial use while one record was listed as unknown and two (2) abandoned. The wells were drilled to depths between 5.5 to 98.0 m with the only recorded static water level being 0.61 m below ground surface (mbgs).



In general, the wells were drilled into sand and bedrock was only encountered in one well record at a depth of 56.4 mbgs. Well records are provided in Appendix C.

The Site is not considered a Highly Vulnerable Aquifer Area (HVA); however, it is located within a Significant Ground Water Recharge Area (SGRA), Wellhead Protection Area (WHPA-C), (WHPA) Q-1, WHPA-Q1/Q2, an Issues Contributing Area (ICA) for chloride and an Intake Protection Zone (IPZ) 3. As such, a Salt Management Plan will be required to address Source Water Protection requirements. The threats assessment identified by the City's Risk Management Official is addressed in the Summary of Brownfield Site Redevelopment Requirements (Appendix J).

Previous environmental studies and reports have been undertaken at this Site with the most recent reporting provided by MTE GlobalTox (2017) and Terraprobe (2006). These documents are referenced for this report as they provide summaries of data collected in the previous environmental studies completed at the Site. In total, forty-eight(48) ground water wells were installed at the Site which indicate that there are two units of ground water as follows:

- A shallow ground water aquifer (GW Unit 1) is generally encountered in the earth fill and native sand zone located below an elevation of approximately 219 masl across the Property.
- A deep ground water aquifer (GW Unit 2) is generally encountered in the glacial till deposit located below 218 masl at the north portion of the Property and below 207.5 masl toward the south portion of the Property.

The direction of the ground water flow in both aquifers below the Property is interpreted to be to south, towards Kempenfelt Bay which is discussed in more detail in subsequent sections.

## **3.0 MONITORING**

### **3.1 Previous Site Investigations**

There have been multiple Site investigations undertaken at the Site over the past 20 years which provide relevant information regarding the local geology and hydrogeology beneath the Site. The following provides a summary of some of these relevant details.

#### **3.1.1 Geotechnical Investigation (Terraprobe, 2005)**

Terraprobe undertook the following works at the Site in January 2005:

- Eight (8) boreholes to depths between 6.6 and 9.6 mbgs;



- Groundwater wells installed in some of the boreholes;
- Groundwater levels measured during BH drilling was between 3.3 and 7.8 mbgs.

### 3.1.2 Phase II Environmental Site Assessment Investigation (Terraprobe, 2006)

Terraprobe completed a Phase II Environmental Site Assessment at the Site in March 2006 which included the following:

- Twenty eight (28) boreholes to depths between 2.0 and 23.3 mbgs;
- Nine (9) ground water wells installed;
- Ninety (90) soil samples and forty eight (48) ground water samples were collected;
- Groundwater levels measured during BH drilling was between 2.8 and 8.8 mbgs (217 – 219.8 masl).

### 3.1.3 Risk Assessment – Revision 6 (MTE GlobalTox and Terraprobe, 2017)

Terraprobe completed a Risk Assessment for the Site in August 2017 which included a *Phase One & Phase Two Environmental Site Assessment Summary Report* detailing the following in relation to the hydrogeological characteristics of the Site:

- All previous drilling works at the Site from 2004 to 2016;
- Water levels from the twenty (20) wells have been measured periodically since September 2004;
- The twenty (20) ground water wells indicate there are two units of ground water as follows:
  - The shallow ground water aquifer (GW Unit 1) is generally encountered in the earth fill and native sand zone located below an elevation of approximately 219 masl across the Property;
  - The deep ground water aquifer (GW Unit 2) is generally encountered in the glacial till deposit located below 218 masl at the north portion of the Property and below 207.5 masl toward the south portion of the Property;
- The direction of the ground water flow in both aquifers below the Property is interpreted to be to south, towards Kempenfelt Bay;
- The hydraulic conductivity of the soils underlying the Site was determined based on the grain size distribution of the soil and using typical values provided in documents by Freeze and Cherry (1979) and the Ministry of the Environment (1997) and is summarized below:
  - GW Unit 1: Earth fill (silty sand) and native soil (medium sand):  $10^{-3}$  m/s to  $10^{-6}$  m/s;
  - GW Unit 2: Native soil (silty clay):  $10^{-7}$  m/s to  $10^{-11}$  m/s;The ground water table is within the native sand layer;
- Based on the available information:



- The horizontal hydraulic gradients of the GW Unit 1 and GW Unit 2 flows are estimated at 0.0065 and 0.08 m/m respectively; and
- The vertical hydraulic gradients of the GW Unit 1 and GW Unit 2 flows are calculated to be 0.056 and 0.049 m/m respectively.

#### 3.1.4 Geotechnical Program (Peto MacCallum Ltd., 2020)

This geotechnical program included advancing three (3) boreholes (BH1 to BH3) to depths between 12.6 to 17.2 mbgs. PetoMacCallum also reviewed two (2) previous boreholes (TP21 and TP25) completed at the Site by others to determine and confirm the underlying geology. The geotechnical investigation (2020) reported the encountered subsurface material as the following:

- Fill - A fill unit was encountered at the surface of all three current boreholes, extending to 2.1 to 4.0 m depth (elevation 218.2 to 220.0 masl). The fill comprised silty sand to sandy silt, trace gravel with trace organics;
- Upper Sand and Gravel - An upper native sand and gravel deposit was revealed below the fill and extending variably to 8.5 to 15.0 m depth (elevation 207.1 to 213.7 masl). The deposit typically comprised sand and gravel with trace silt, varying to gravelly sand, sandy gravel or silty sand;
- Silty Clay to Clayey Silt - Beneath upper sand and gravel deposit a silty clay to clayey silt unit was revealed. The thickness of the unit was variable, 2.0 m to 4.5 m, and the unit was penetrated at 11.5 to 17.0 m depth, (elevation 205.1 to 210.7 masl). The material varied from silty clay to clayey silt and had a till-like appearance in some of the samples. Occasional cobbles and boulders were noted;
- Lower Sand - Underlying the silty clay to clayey silt, a lower sand deposit was encountered to the depth of exploration in all boreholes. The material varied from sand to gravelly sand, with trace silt; and
- A sample from each natural soil unit was submitted for grain size analysis and Moisture content.

The complete geotechnical report can be found in Appendix D, while geological cross-sections illustrating both local and more regional conditions are provided in Appendix H. It is noted that the building foundation footings and potential connection to the underlying aquifer is discussed in more detail in the geotechnical report (Appendix D), as well as the Summary of Brownfield Site Redevelopment Requirements (Appendix J).

## 3.2 Ground Water Monitoring

The water level at each of the monitoring wells was measured by Azimuth staff on April 24<sup>th</sup>, May 21<sup>st</sup> and June 25<sup>th</sup>2020. The ground water table levels are given in the below Table 2 and a Site plan showing well locations is provided as Figure 4 (Appendix A):



**Table 2: Summary of Ground Water Measurements (April, May and June 2020)**

Location ID (masl)	April 24 <sup>th</sup>		May 21 <sup>st</sup>		June 25 <sup>th</sup>	
	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)	Water Level (mbgs)	Water Level (masl)
TRP 1 (S) (223.02)	-	-	3.50	219.52	3.61	219.41
TRP 2 (S) (222.63)	1.65	220.98	1.92	220.71	2.17	220.46
MW 23 (S) (222.40)	3.38	219.02	3.47	218.93	3.55	218.85
MW 24(S) (221.80)	2.33	219.47	2.39	219.41	2.46	219.34
MW 24(D) (222.04)	1.06	220.98	1.55	220.49	1.74	220.30
MW26 (S) (226.05)	6.29	219.76	6.53	219.52	6.76	219.29
MW 27(S) (222.15)	3.14	219.01	3.19	218.96	3.25	218.90
MW27(D) (222.20)	-	-	-0.34 <sup>2</sup>	224.54 <sup>2</sup>	0.0	222.20

**NOTES:** <sup>1</sup> Survey level taken from site survey prepared by Rudy Mak Surveying Ltd File No.:14231ToPo dated 2020 and provided in Appendix B.

<sup>2</sup> Water level measured within stand up pipe and above ground level.

<sup>3</sup> (D) represents a deep well screened within the deep groundwater aquifer while (S) represents a shallow well screened within the shallow aquifer.

The measured water levels in the shallow groundwater aquifer at the Site ranged from 1.65 – 6.76 mbgs, representing 220.98 - 219.29 masl during the 3 months of monitoring being April, May and June of 2020. These levels are expected to fluctuate seasonally, with the highest readings expected between March and June. As such, the April monitoring event is interpreted to represent the seasonal high water table conditions for the Site. The seasonally high water table in the shallow aquifer is also illustrated in Figure 4 which illustrates a southern ground water flow path that follows the local topographic dip towards Lake Simcoe to the south. Ground water flow direction is also noted to be to the south as illustrated in the ground water flow mapping from previous reporting (Appendix G). Although specific design elevations are not established for the base foundation level, the Site design plan indicates a basement elevation of 4.4 m below Dunlop Street, which has an elevation of 226 masl. As such the estimated basement level is 221.6 masl, which is 0.62 m above the highest measured water table elevation (ground water elevation in upper aquifer).



A Site testing plan is provided as Figure 4 with all available referenced borehole logs provided in Appendix I.

Construction footings will extend below the water table. However, it is important to note that no foundation works are planned that will compromise the existing till aquitard which separates the uppermost aquifer from the deeper municipal aquifer system. As such, the works will not create any unacceptable impacts to the underlying aquifer. This is discussed in more detail in the appended geotechnical report and Summary of Brownfield Site Redevelopment Requirements (Appendix J).

### 3.3 Hydraulic Conductivity Testing

In order to understand the hydraulic characteristics of the underlying overburden, a transient slug test can be performed within monitoring wells to determine the average hydraulic conductivity of the screened interval. A slug test involves the instantaneous injection or withdrawal of a volume or slug of water or solid cylinder of known volume. This is accomplished by adding or displacing a known volume to/from a well and measuring water level response time to return to equilibrium.

Hydraulic conductivity testing was completed at the Site by Azimuth staff within two (TRP 2, and MW 23) on-Site monitoring wells on April 24<sup>th</sup> and May 21<sup>st</sup>, 2020. Water level measurements were recorded both manually and with automatic dataloggers, which were programmed to record the pressure of water above the data logger every second. Data was analyzed using the Bower Rice Method for unconfined aquifers, which assumes a homogeneous, isotropic medium in which soil and water are incompressible. Hydraulic testing results for TRP2 and MW23 are summarized in Table 3, and within Appendix E.

**Table 3: Hydraulic Testing Results (May and April, 2020)**

Monitoring Well	Screen Depth (mbgs)	Hydraulic Conductivity (m/s)	Soil Description
TRP 2	3.8 – 6.8	$1.6 \times 10^{-6}$	Silty Sand
MW 23	4.0 - 7.0	$3.7 \times 10^{-6}$	Gravelly Sand

Slug test data indicates that the hydraulic conductivity of the deposits is very similar across the Site and range between  $1.6 \times 10^{-6}$  and  $3.7 \times 10^{-6}$ . The measured hydraulic conductivity is within the published range for a silty sand material (Freeze & Cherry, 1979).



## 4.0 WATER BALANCE

In order to determine the potential changes to the natural ground water recharge conditions, a pre- and post-development water balance assessment has been completed using the Thornthwaite and Mather method (1957). This method evaluates evapotranspiration based on precipitation and temperature. Residual soil saturation is a function of topography and soil type. Monthly data are tabulated from daily average temperature and precipitation, and the water budget is a continuous calculation over the period of record. To clarify, the method and the approach used by many individuals in examining infiltration resets annual conditions (moisture deficit, snow storage, etc) over the winter months because of the general lack of infiltration during the frost period. However, we maintain those records and carry them forward from month to month during the entire period of record.

Values were determined on a monthly basis, compiled from daily Environment Canada meteorological data station located in Barrie (Station 6110557), Ontario between 1974 and 2018. The calculations are based on the average conditions during this period; the average precipitation was 912 mm, rainfall was 657 mm, evapotranspiration was 431 mm and the surplus was 481 mm.

### 4.1 Land Use

#### 4.1.1 Pre-Development

The pre-development Site area was classified according to land use/vegetation type. Approximate pre-development land use classification areas are provided in Table 4.

**Table 4: Pre-Development Area Classification**

Land Use	Land Area (m <sup>2</sup> )
Impervious (Concrete / Asphalt surfaces including parking and former building foundation)	900
Landscaped/undeveloped - Pervious	1,111
<b>TOTAL</b>	<b>2,011</b>

Land within the pre-development scenario is considered 55% impervious. Gravel surfaces are considered impervious for the purpose of this assessment. The pre-development areas are shown on Figure 2.

#### 4.1.2 Post-Development

The land classification in the post-development scenario was classified based on the Site Development Plans (Appendix B). Approximate post-development land use classification areas are provided in Table 5:



**Table 5: Post-Development Area Classification**

Land Use	Land Area (m <sup>2</sup> )
Other Impervious(car park/driveway / walkway)	304
Structures (residential/ commercial combined buildings)	1,300
Landscaped/undeveloped	407
<b>TOTAL</b>	<b>2,011</b>

Land within the post-development scenario is considered 80% impervious. The post-development areas are provided in Appendix B.

## 4.2 Infiltration

Infiltration is generated one of two ways: (1) directly from rainfall impact or snowmelt on pervious surfaces; and (2) indirectly when runoff from impervious surfaces is diverted into adjacent naturalized areas.

Infiltration factors for the Site were estimated based on the underlying soil, local topography, and ground cover as per Table 2 of the Ministry of Environment and Energy (MOEE) Hydrogeological Technical Information Requirements for Land Development Applications (1995).

The soil variable factor was determined by taking into account information obtained from the regional geologic mapping and the field work programs completed for the Site. This information suggests that the surficial material at the Site is primarily composed of a silty sand till. The infiltration factors utilized in the water balance assessment are summarized in Table 6 below.

**Table 6: Summary of Pervious Land Infiltration Factor**

Scenario	Land Use	Infiltration Factor	Assumption
Pre-Development	Former Commercial	0.55	Hilly Land (0.1), sandy loam (0.4), maintained grasses (0.05)
Post-Development	Residential	0.55	Hilly Land (0.1), sandy loam (0.4), maintained grasses (0.05)

### 4.2.1 Pre-Development Infiltration

Pre-development direct infiltration was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The pre-development annual infiltration is therefore 263 m<sup>3</sup>/year (Appendix F).

It is also assumed that no additional infiltration was gained from rainfall runoff from rooftops as there are currently no buildings on the site.



#### 4.2.2 Post-Development Infiltration

Post-development infiltration (without mitigation) was determined by multiplying the annual average surplus amount, the area of each land use, and the infiltration factor for each land use. The post-development annual direct infiltration is therefore 96 m<sup>3</sup>/year. There is therefore a decrease in infiltration of 167 m<sup>3</sup>/year from pre- to post-development without mitigation measures employed.

### 4.3 Water Balance Summary

Using the climate model data and calculations mentioned above, the water balance was completed for pre-development and post-development without mitigation (Appendix F) as no stormwater drainage plans were available at the time of reporting.

The pre-development infiltration volume is 263 m<sup>3</sup>/year. This assumes the Site is composed of the existing driveways, walkways, car parking, previous commercial building pad and landscaped areas. The post-development without mitigation infiltration volume is 96 m<sup>3</sup>/year, which is a deficit of 167 m<sup>3</sup>/year. This is based on the proposed development as described in Section 1.0 of this report and illustrated in Appendix B (Site Development Plans).

Due to the Site's Certificate of Property Use (CPU) and underlying membrane which will be installed as part of the proposed development, typical ground water infiltration LIDs are not able to be implemented at this Site. Therefore, financial compensation will be required which will need to reflect the 167 m<sup>3</sup>/year deficit as per the LSRCA Water Balance Offsetting Policy. Based on the calculated ground water infiltration deficit of 167 m<sup>3</sup>/year resulting from the proposed development, the compensations required is \$8,450 (\$44/m<sup>3</sup> +15% administration fee).

## 5.0 DEWATERING ASSESSMENT

The proposed development will include the construction of a residential complex building, basement level car parking and demolition of the existing foundations, landscaping and associated underground servicing (water, sewer, storm water). The new building will have new service connections to Dunlop Street. Due to the presence of shallow ground water at the Site (i.e. within the shallow ground water aquifer) construction dewatering may be required in area of deeper servicing connections.

Where required, shallow excavations into the ground water table can typically be controlled by conventional sump pump technologies and will likely be appropriate for use at the Site. The CPU mandates that any and all ground waters extracted from the RSC Property must be properly treated prior to discharge. If the required drawdown is greater



than 1.5 m, the use of shallow well points or eductor systems may be required. The exact dewatering methodology will depend on Site specific conditions and will be determined by a specialist contractor. The current intent is not to disturb the water table condition during the building construction. Specialty techniques are being considered which will facilitate this objective.

At present, the intent is to construct the building envelope above the water table condition in order to avoid any potential to have to control ground water in perpetuity as specified by the CPU requirements. Similarly, given CPU requirements and the high cost to dispose of contaminated water, the objective is to ensure no dewatering is required during construction of the proposed development (*i.e.* servicing installation). Therefore, servicing construction works will need to be undertaken during periods of low groundwater levels and outside of high ground water levels. Following receipt of the proposed basement and service plans, we can assess the system (*i.e.* assessment of pipe sizes, locations, depths and lengths), and provide a detailed dewatering assessment, where required.

The current plan for the foundation footings are that they will be constructed in place by soil auguring to the top of the till aquitard and adding solidification amendment to make the equivalent of concrete columns for the slab foundation. Additionally, all service corridors are to be isolated as they enter the RSC Property by a membrane or equivalent (CPU mandated requirement for service corridors). Service corridors entering from Dunlop Street are expected to exist above the water table because of the elevation relief present at the Property, while storm water connections below water table are likely only present in a small area at the southwestern extent of the development. As such, targeting seasonally lower water table conditions would help to alleviate potential dewatering requirements.

## **6.0 SUMMARY AND CONCLUSIONS**

Azimuth was retained by 2012292 Ontario Limited to conduct a Hydrogeological Assessment for the property located at 217 Dunlop Street East, Barrie, Ontario. The purpose of this assessment is to characterize the existing hydrogeological conditions at the Site and the potential for the proposed development to impact the existing environmental / hydrogeological conditions. The report also addresses City of Barrie, LSRCA and Source Water Protection policy requirements, including specific City comments related to hydrogeology. However, it is noted that some hydrogeological comments have been addressed under separate cover in the Summary of Brownfield Site Redevelopment Requirements (Appendix J).



The Site is generally rectangular in shape and is approximately 0.2 hectares (ha) in size. It is located on the south side of Dunlop Street East. The Barrie North Shore Trail is directly south of the Site and south of the trail is the shores of Kempenfelt Bay. Currently, there are no buildings on site; however a concrete slab and asphalt parking area remains from a previous building. The Site is to be redeveloped as a 15 storey condominium building including three levels of parking with one level below grade.

The Site is found at an elevation between 222 and 226 masl, with a south aspect and a gross slope of 15%. The Site is located within the Lake Simcoe Watershed. The existing Site drains south via overland flow towards Kempenfelt Bay. Site soils are composed of silty sand fill atop sand and gravel, underlain by a silty clay aquitard unit.

The inferred groundwater table in the vicinity of the Site is 219 - 220 masl, flowing south, south east towards Kempenfelt Bay. Hydraulic conductivity testing was completed within three of the monitoring wells at the Site by Azimuth staff. Slug test data indicates that the hydraulic conductivity of the deposits is very similar across the Site and range between  $1.6 \times 10^{-6}$  to  $3.7 \times 10^{-6}$  m/s.

The pre-development infiltration volume is 263 m<sup>3</sup>/year. This assumes the Site is composed of the existing hardscaped and landscaped areas. The post-development without mitigation infiltration volume is 96 m<sup>3</sup>/year, which is a deficit of 167 m<sup>3</sup>/year.

Due to the Site's Certificate of Property Use (CPU) and underlying membrane which will be installed as part of the proposed development, ground water infiltration LIDs are not able to be implemented at this Site. Therefore, financial compensation will be required to reflect the 167 m<sup>3</sup>/year deficit as per the LSRCA Water Balance Offsetting Policy. Based on the calculated ground water infiltration deficit of 167 m<sup>3</sup>/year resulting from the proposed development, the compensations required is \$8,450 ( $\$44/\text{m}^3 + 15\%$  administration fee).

The overall deficit is considered small and there are no adjacent wetland features or private wells as the area is municipally serviced. The closest municipal wells (Barrie Heritage Wells 11 & 14) are located approximately 800 m west of the Site. These wells are screened below 177 masl (Golder, 2004) or 45 m below grade at the Site. As such, the small infiltration loss and the vertical separation resulting from the silty clay unit underlying the upper aquifer, limit the development's ability to create a quantitative influence on the municipal wells. Similarly, although the development is located in close proximity to Lake Simcoe, the small scale reduction in infiltration would not likely create a measurable influence on the Lake.



The proposed development will include the construction of a new condominium building, underground basement car parking with associated underground servicing (water, sewer, storm water). It is assumed that new service connections to Dunlop Street will be established as part of the proposed development. At present, the intent is to construct the building envelope above the water table condition in order to avoid any potential to have to control ground water in perpetuity as specified by the CPU requirements.

Due to the impacted soils at the Site, the requirements of the CPU, and the cost to dispose of contaminated water, the objective is to ensure no dewatering is required during construction of the proposed development. Therefore, foundation and servicing construction works will need to be undertaken during periods of low groundwater levels and outside of high ground water levels.

As per City of Barrie requirements, all existing monitoring wells which are no longer required for the CPU, will need to be properly decommissioned as per O.Reg. 903 (Wells Regulation) prior to commencement of building construction.

The proposed development exists above the ground water table condition will not meaningfully influence the hydrogeologic setting. In our professional opinion, the proposed Site development plan does not have an adverse impact on the hydrogeologic setting present at this Site.

In summary and given the preceding assessment, the proposed development is consistent with the Provincial Policy Statement 2020 and conforms to the Growth Plan for the Greater Golden Horseshoe 2020, the Lake Simcoe Protection Plan, the Source Water Protection Policies of the South Georgian Bay Lake Simcoe Source Protection Authority and the City of Barrie Official Plan.



## 7.0 REFERENCES

- Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary Geology of Ontario, Chapman L.J., and D.F. Putnam, 1984. The Physiography of Southern Ontario. 3<sup>rd</sup> Edition, OGS Special Volume 2, Ministry of Natural Resources.
- Golder, 2004. South Simcoe Ground Water Study – WHPA – City of Barrie Appendix E
- Hoffman, D.W. & N.R. Richards, 1962. Soil Survey of Peel County. Report No. 18 of the Ontario Soil Survey.
- MTE GlobalTexand Terraprobe, 2017. 217 Dunlop Street East, Barrie, Ontario – Sixth Revision Risk Assessment.
- Ontario Geological Survey (OGS), 2020. OGS Earth Mapping. Obtained from: <https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearch>
- Ontario Ministry of the Environment and Climate Change (MOECC), 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications.
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- Skelton Brumwell & Associates, 2020. Stormwater Management Report – 217 Dunlop Street East Condominium Development.
- Terraprobe, 2005. Geotechnical Investigation.
- Terraprobe, 2006. Phase II Contamination Investigation.
- Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). 2010. Low Impact Development Stormwater Management Planning And Design Guide. Version 1.



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## APPENDICES

- Appendix A: Figures**
  - Appendix B: Proposed Development Plans and Site Survey**
  - Appendix C: MECP Well Records**
  - Appendix D: Geotechnical Program**
  - Appendix E: Hydraulic Conductivity Testing**
  - Appendix F: Water Balance Information**
  - Appendix G: Site Ground Water Flow Mapping**
  - Appendix H: Geological Cross Sections**
  - Appendix I: Borehole Logs**
  - Appendix J: Summary of Brownfield Site Redevelopment Requirements**
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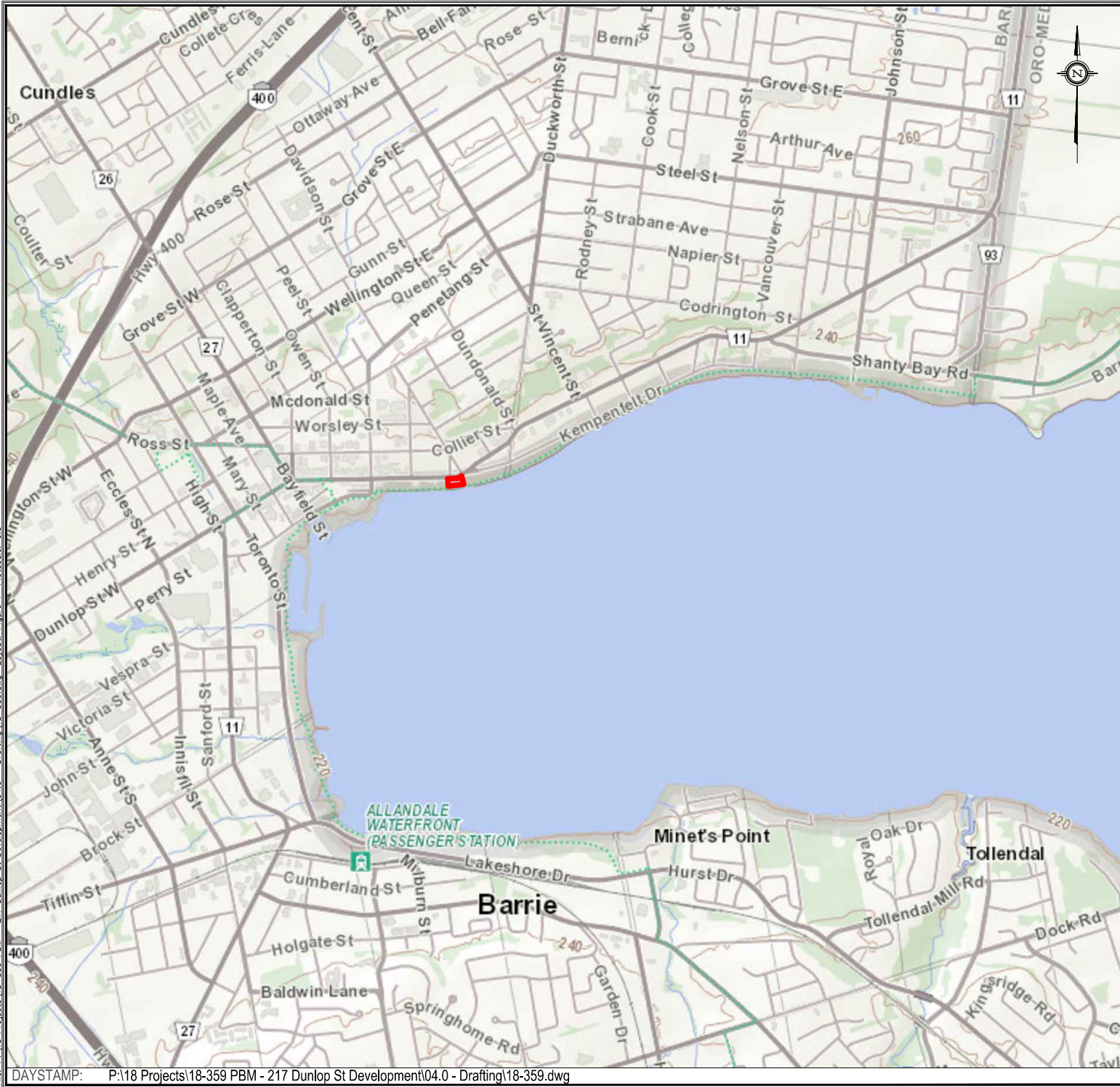
## **APPENDIX A**

### **Figures**

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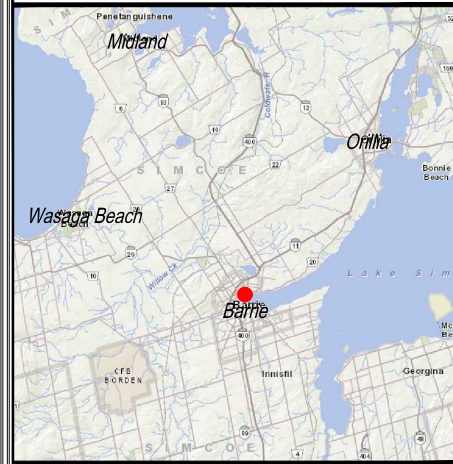
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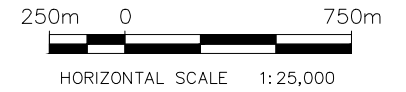


**LEGEND:**

 *Approx. Property Boundary*



REG MAP



Property Location

217 Dunlop St. E.,  
Barrie, ON

DATE ISSUED: <i>May 2020</i>	Figure No.
CREATED BY: <i>JLM</i>	
PROJECT NO.: <i>18-359</i>	
REFERENCE: <i>MNRF</i>	
	<b>1</b>



**LEGEND:**  
— Approx. Property Boundary

N

3m 0 6m  
 HORIZONTAL SCALE 1:250

**AZIMUTH ENVIRONMENTAL CONSULTING, INC.**

**Site Layout**

**217 Dunlop St. E.,  
 Barrie, On**

DATE ISSUED: <i>May 2020</i>	Figure No.
CREATED BY: <i>JLM</i>	<b>2</b>
PROJECT NO.: <i>18-359</i>	
REFERENCE: <i>Simcoe County Maps</i>	

Plotted by: MCCARTNEY on December 16, 2020 at 2:13pm  
 File: P:\18 Projects\18-359 PBM - 217 Dunlop St Development\04.0 - Drafting\18-359.dwg Layout: HYD2 PlotScale: 0.5




**LEGEND:**

- Approx. Property Boundary
- 250m Well Boundary
- 5m OBM Contours
- ⊕ Water Well Locations

*Note:*  
Well locations are based on MECP well records and/or GIN (2020) mapping.

25m    0    75m

HORIZONTAL SCALE 1:2,500



**AZIMUTH ENVIRONMENTAL CONSULTING, INC.**

Surrounding Well Records

217 Dunlop St. E.,  
Barrie, On

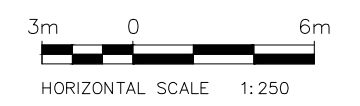
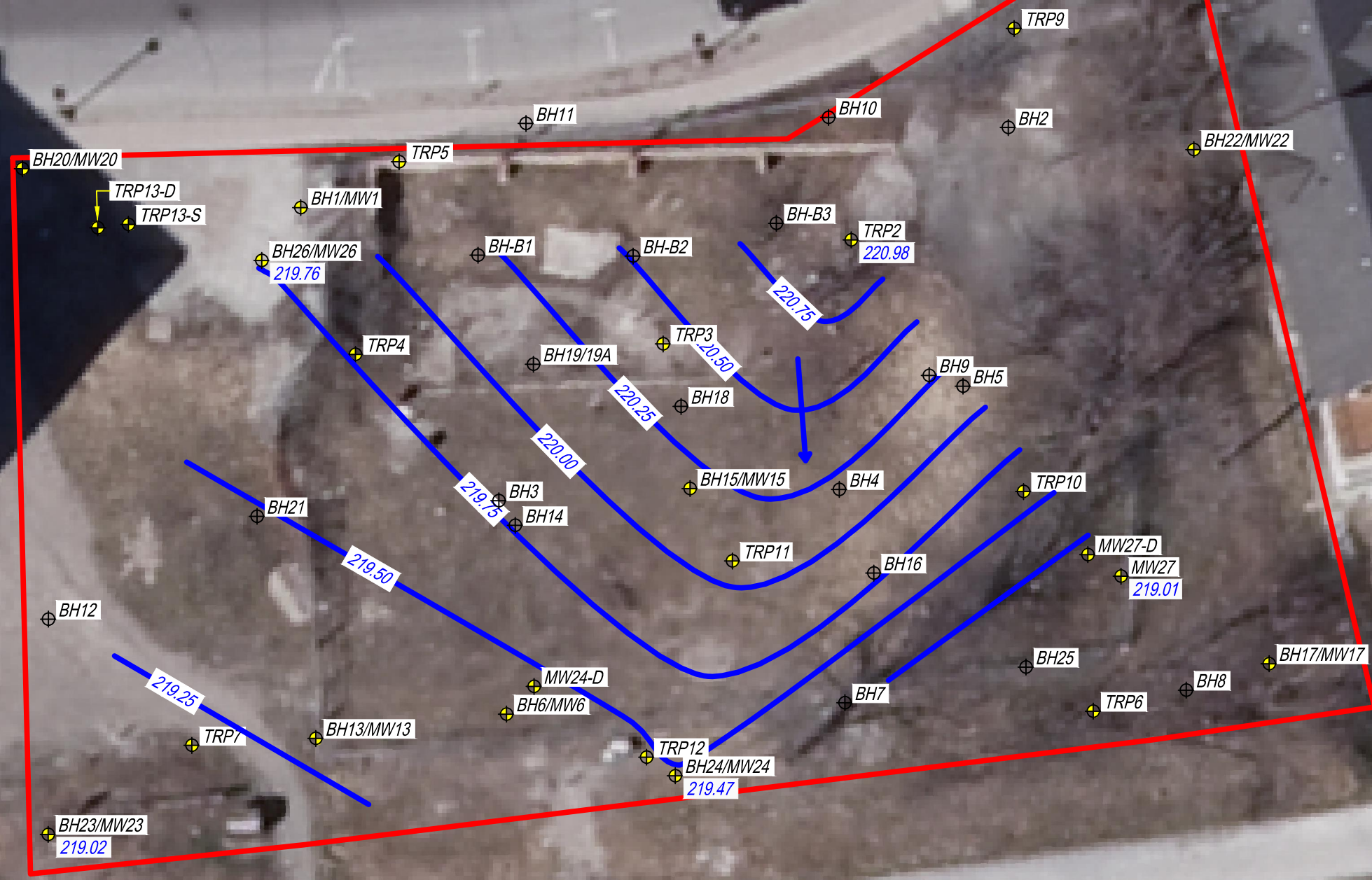
DATE ISSUED: June 2020	Figure No.
CREATED BY: JLM	3
PROJECT NO.: 18-359	
REFERENCE: Simcoe County Maps	

Plotted by: MCCARTNEY on December 16, 2020 at 2:34pm  
 File: P:\18 Projects\18-359 PBM - 217 Dunlop St Development\04.0 - Drafting\18-359.dwg

Dunlop St. E.



- LEGEND:**
- Approx. Property Boundary
  - Soil Borehole Locations
  - Monitoring Well Locations
  - Inferred Direction of Ground Water Flow
  - 293.5 Ground Water Elevation (April 24, 2020)
  - 0.25m Ground Water Contours



Site Testing Plan and  
Ground Water Flow

217 Dunlop St. E.,  
Barrie, On

DATE ISSUED:	June 2020	Figure No.
CREATED BY:	JLM	4
PROJECT NO.:	18-359	
REFERENCE:	Simcoe County Maps	

Plotted by: MCCARTNEY on December 16, 2020 at 2:35pm  
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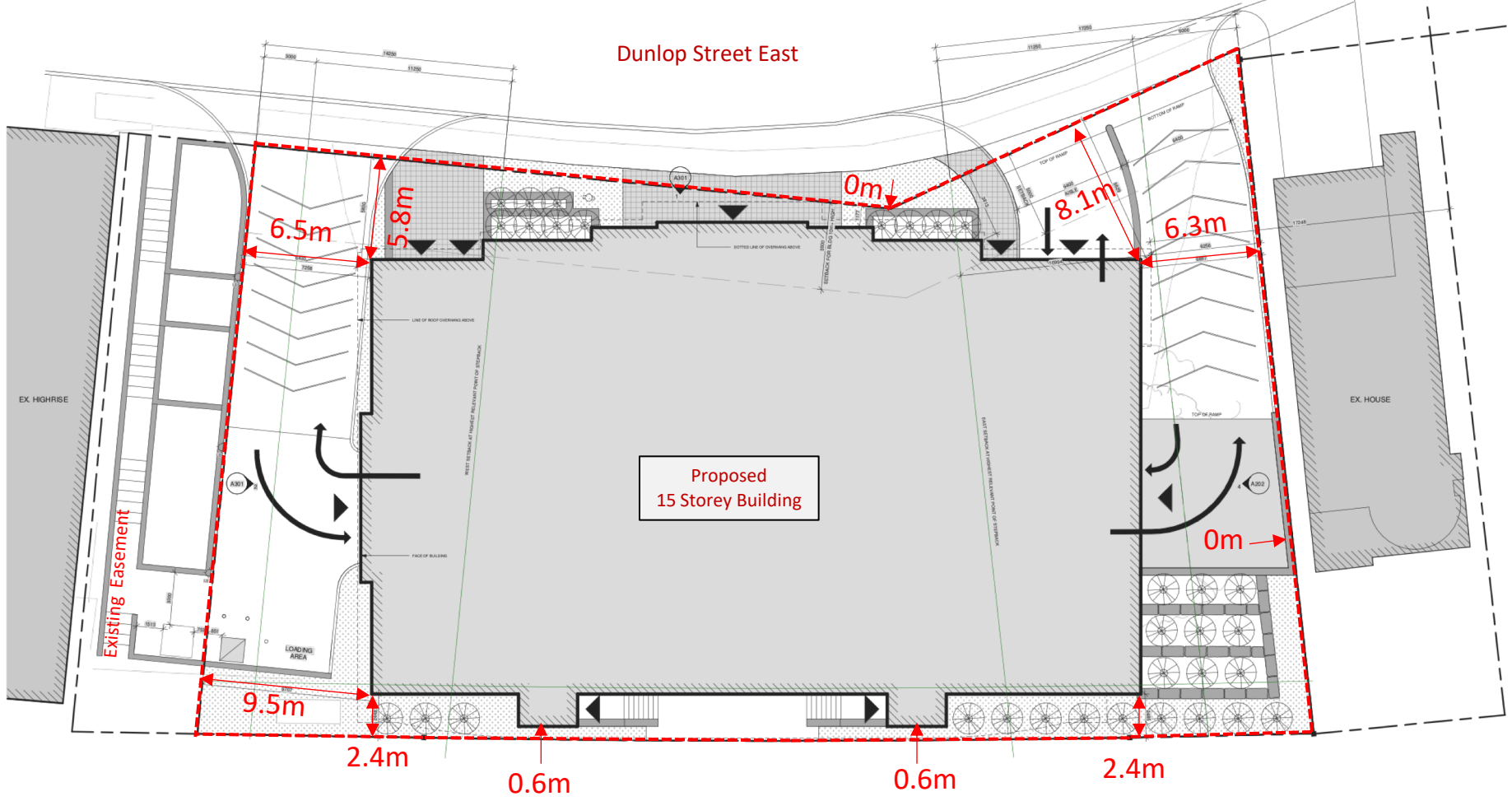
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## **APPENDIX B**

### **Proposed Development Plans and Survey**

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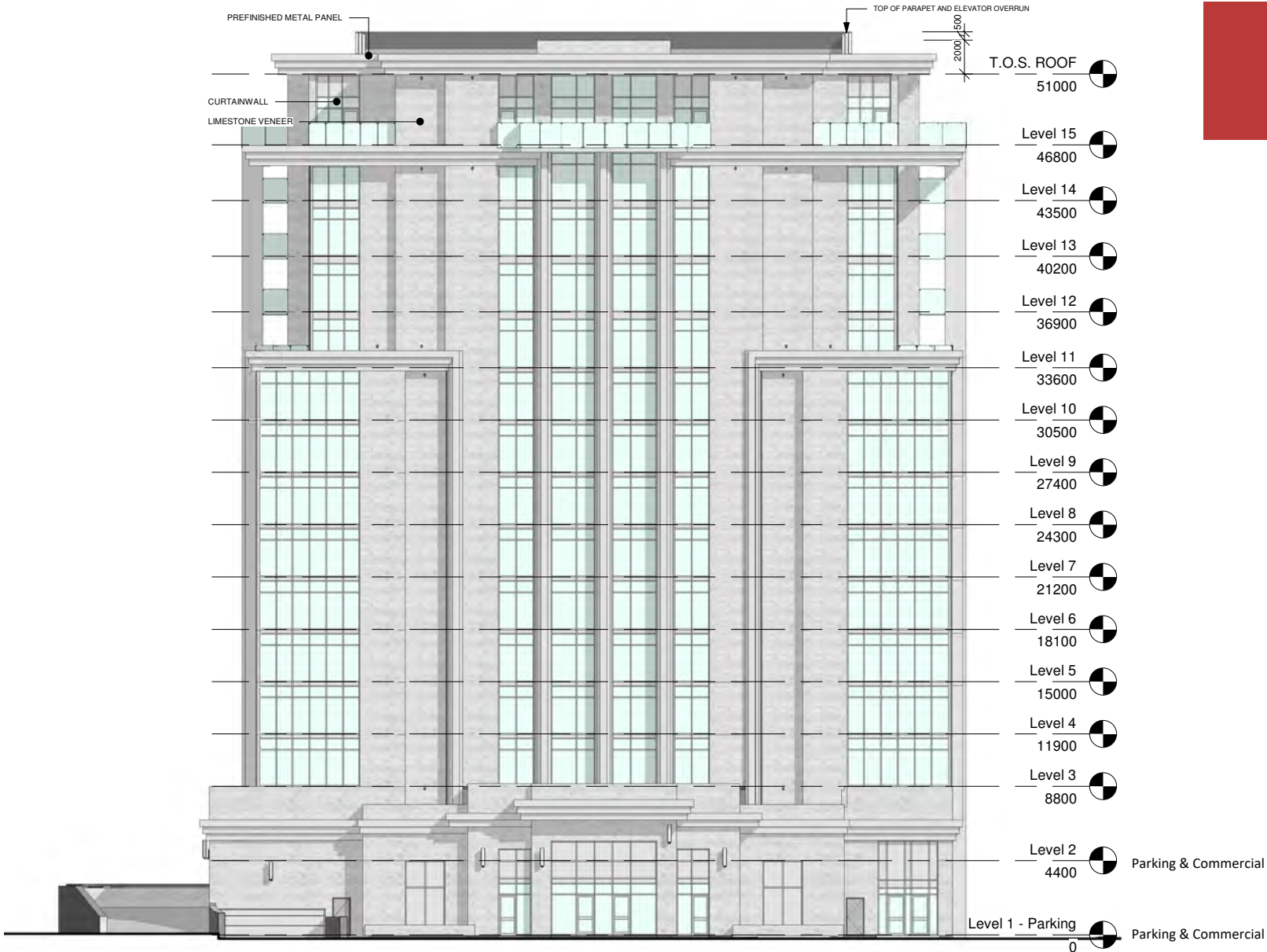


North Shore Trail



# North

## Dunlop Street Elevation



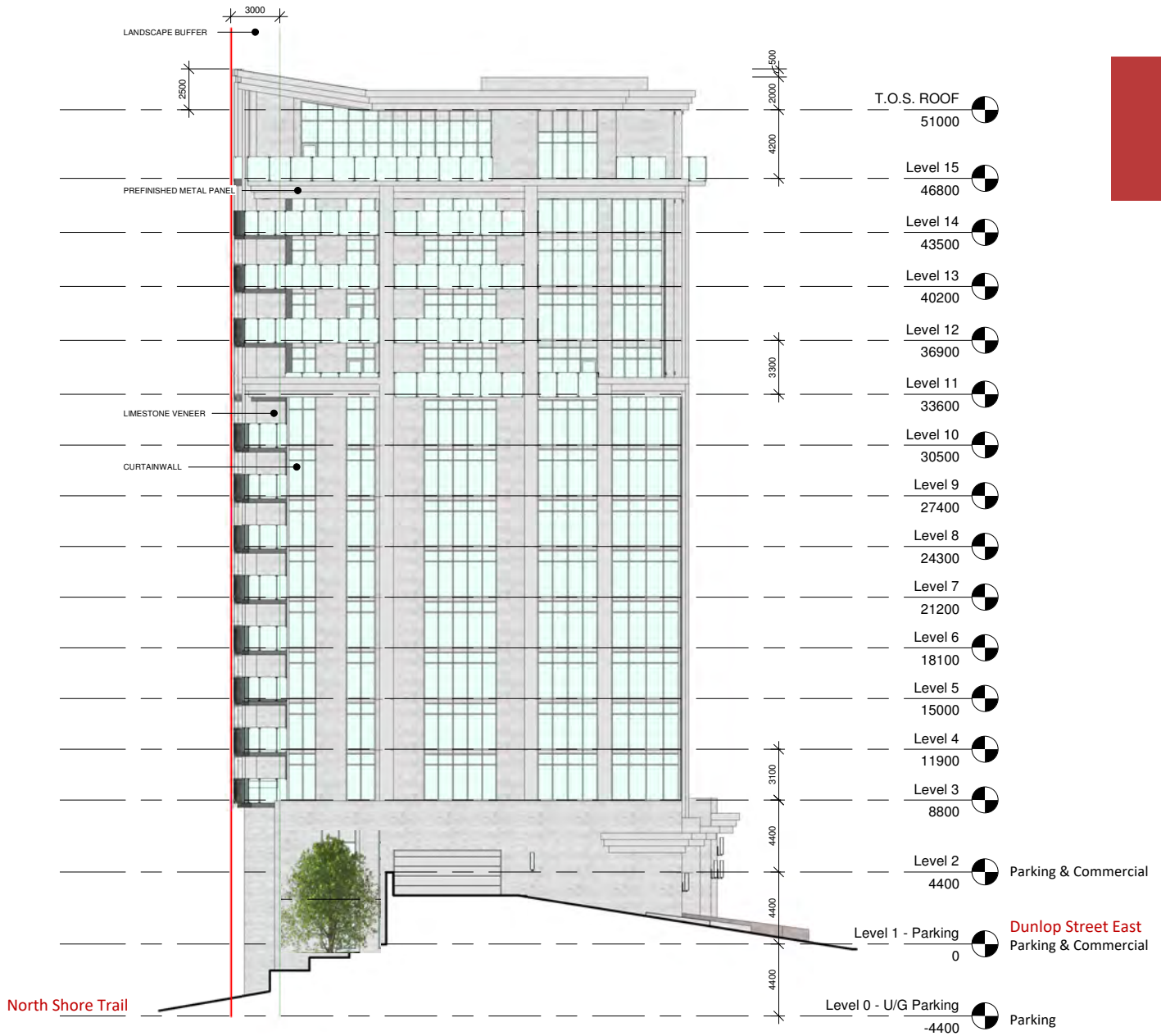
Dunlop Street East



217 Dunlop Street East

salterpilon

# East





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**APPENDIX C**

**MECP Well Records**

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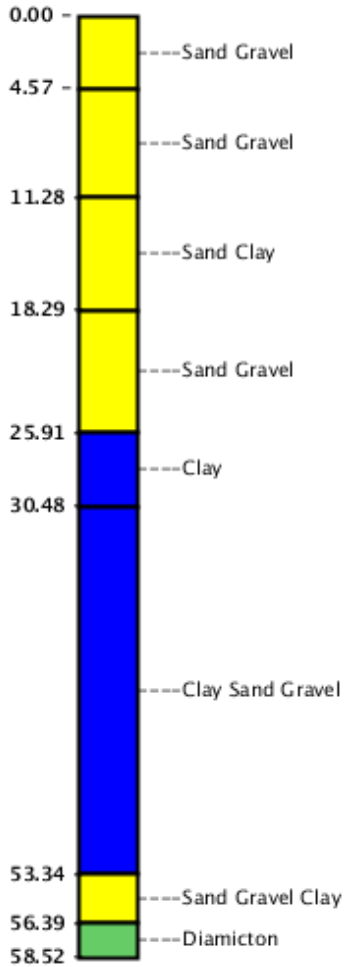
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WARNING - During the covid-19 pandemic, our offices are closed. Please note that the GIN portal may be unstable.

## GIN Log

**GIN borehole Identifier :** ca.on.waterWell.5700233  
**Borehole Data Provider ID :** 5700233  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.676987  
**Latitude :** 44.389974  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1948-01-07  
**Length :** 58.52m  
**Elevation :** 228.60m  
**CDEM Elevation :** 228m  
**CDSM Elevation :** 226.831m  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Test Hole  
**Type :** Unknown

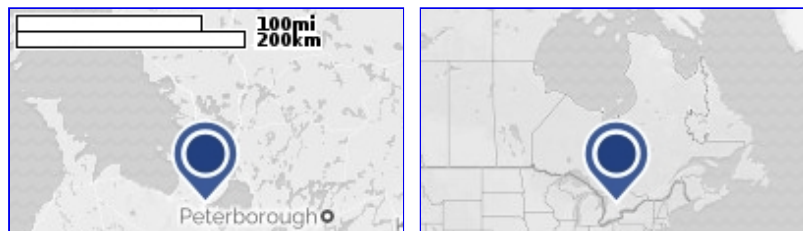
 [Report an error](#)



[View legend](#)

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	4.57	Sand (More Info) Gravel (More Info)	MEDIUM SAND BOULDERS	[26,53] [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
4.57	11.28	Sand (More Info) Gravel (More Info)	MEDIUM SAND GRAVEL	[26,53] [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
11.28	18.29	Sand (More Info) Clay (More Info)	MEDIUM SAND CLAY	[26,53] [34,57]%	[2E-7,6E-3]m/s [1E-11,4.7E-9]m/s
18.29	25.91	Sand (More Info) Gravel (More Info)	MEDIUM SAND BOULDERS	[26,53] [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
25.91	30.48	Clay (More Info)	CLAY	[34,57]%	[1E-11,4.7E-9]m/s
30.48	53.34	Clay (More Info) Sand (More Info) Gravel (More Info)	CLAY MEDIUM SAND GRAVEL	[34,57] [26,53] [24,44]%	[1E-11,4.7E-9]m/s [2E-7,6E-3]m/s [3E-4,3E-2]m/s
53.34	56.39	Sand (More Info) Gravel (More Info) Clay (More Info)	MEDIUM SAND GRAVEL CLAY	[26,53] [24,44] [34,57]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s [1E-11,4.7E-9]m/s
56.39	58.52	Diamicton (More Info)	HARDPAN		

Well log. (\*Notice: Values taken from literature)

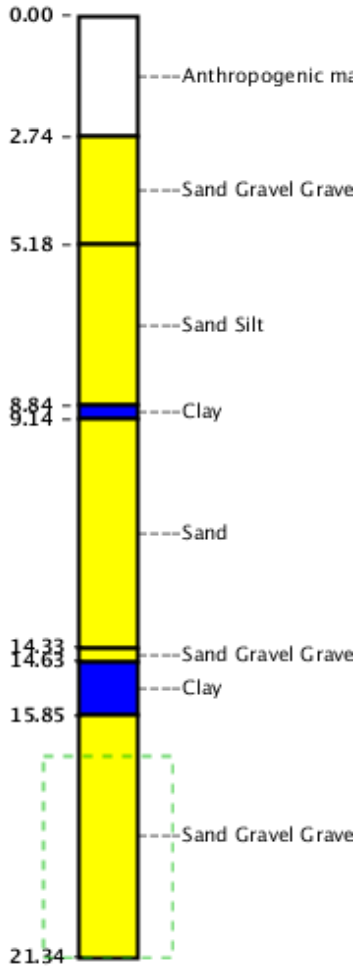


WARNING - During the covid-19 pandemic, our offices are closed. Please note that the GIN portal may be unstable.

## GIN Log

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**Borehole Data Provider ID :** 5700235  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.682811  
**Latitude :** 44.389528  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1948-07-13  
**Length :** 21.34m  
**Elevation :** 220.07m  
**CDEM Elevation :** 228m  
**CDSM Elevation :** 227.994m  
**Water Level :** 3.05m 1948-07-13  
**Water Use :** Municipal  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Water Supply  
**Type :** Unknown

 [Report an error](#)



**Screen :**  
 • From 16.764 to 21.34m

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	2.74	Anthropogenic material (More Info)	FILL		
2.74	5.18	Sand (More Info) Gravel (More Info) Gravel (More Info)	MEDIUM SAND GRAVEL BOULDERS	[26,53%] [24,44%] [24,44%]	[2E-7,6E-3]m/s [3E-4,3E-2]m/s [3E-4,3E-2]m/s
5.18	8.84	Sand (More Info) Silt (More Info)	FINE SAND SILT	[26,53%] [34,61%]	[2E-7,6E-3]m/s [1E-9,2E-5]m/s
8.84	9.14	Clay (More Info)	CLAY	[34,57%]	[1E-11,4.7E-9]m/s
9.14	14.33	Sand (More Info)	MEDIUM SAND	[26,53%]	[2E-7,6E-3]m/s
14.33	14.63	Sand (More Info) Gravel (More Info) Gravel (More Info)	MEDIUM SAND GRAVEL BOULDERS	[26,53%] [24,44%] [24,44%]	[2E-7,6E-3]m/s [3E-4,3E-2]m/s [3E-4,3E-2]m/s
14.63	15.85	Clay (More Info)	CLAY	[34,57%]	[1E-11,4.7E-9]m/s
15.85	21.34	Sand (More Info) Gravel (More Info) Gravel (More Info)	MEDIUM SAND GRAVEL BOULDERS	[26,53%] [24,44%] [24,44%]	[2E-7,6E-3]m/s [3E-4,3E-2]m/s [3E-4,3E-2]m/s

[View legend](#)

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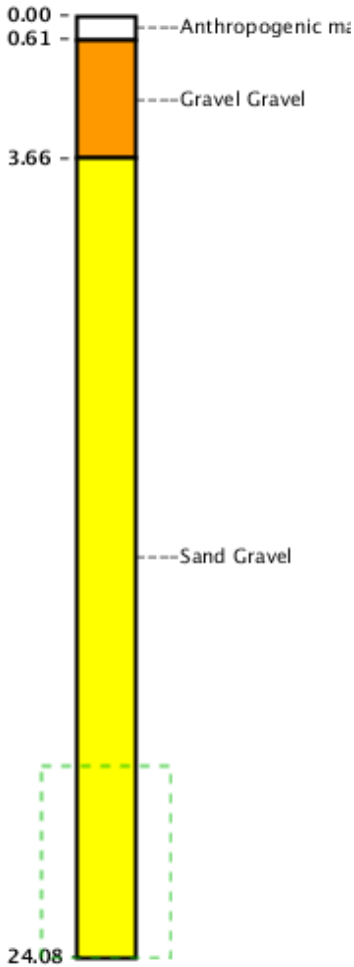
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**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.683577  
**Latitude :** 44.389510  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1952-05-23  
**Length :** 24.08m  
**Elevation :** 220.07m  
**CDEM Elevation :** 228m  
**CDSM Elevation :** 230.108m  
**Water Segment :** 19.5072, FRESH 1952-05-23  
**Water Use :** Industrial  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Water Supply  
**Type :** Unknown

[Report an error](#)

**Screen :**

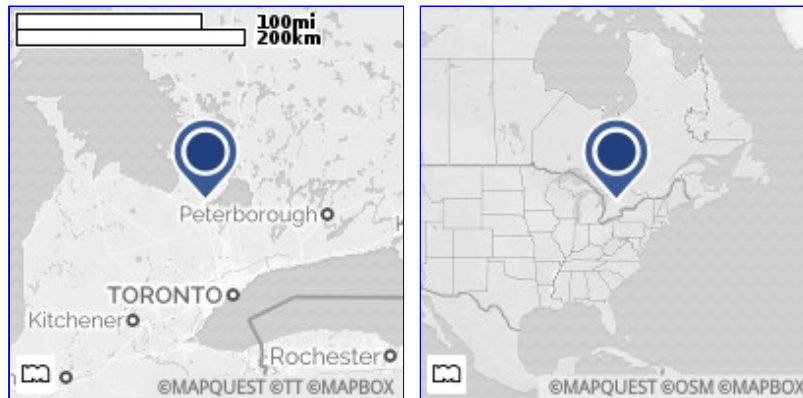
- From 19.2024 to 24.08m



DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	0.61	<a href="#">Anthropogenic material (More Info)</a>	FILL		
0.61	3.66	<a href="#">Gravel (More Info)</a> <a href="#">Gravel (More Info)</a>	GRAVEL STONES	[24,44%] [24,44%]	[3E-4,3E-2]m/s [3E-4,3E-2]m/s
3.66	24.08	<a href="#">Sand (More Info)</a> <a href="#">Gravel (More Info)</a>	MEDIUM SAND GRAVEL	[26,53%] [24,44%]	[2E-7,6E-3]m/s [3E-4,3E-2]m/s

Well log. (\*Notice: Values taken from literature)

[View legend](#)



**XML**

[Important Notices](#)

Please use this citation if this data is used in a publication:

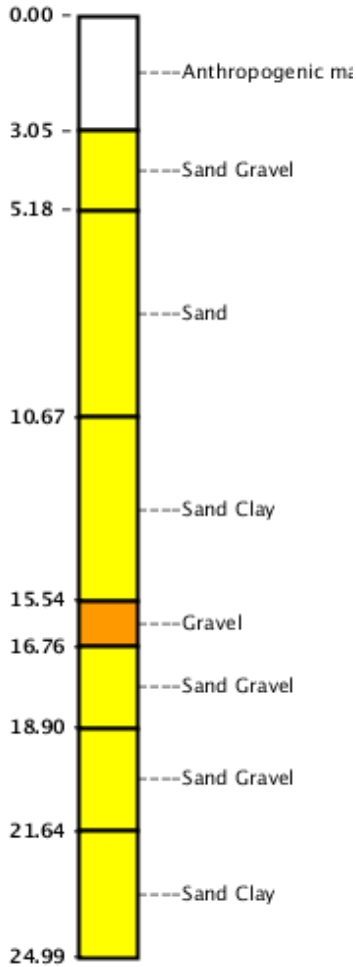
Data from: [Ontario Ministry of Environment](#), provided by GIN (Groundwater Information Network).

WARNING - During the covid-19 pandemic, our offices are closed. Please note that the GIN portal may be unstable.

## GIN Log

**GIN borehole Identifier :** ca.on.waterWell.5700237  
**Borehole Data Provider ID :** 5700237  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.683339  
**Latitude :** 44.389507  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1948-02-25  
**Length :** 24.99m  
**Elevation :** 220.07m  
**CDEM Elevation :** 228m  
**CDSM Elevation :** 229.423m  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Test Hole  
**Type :** Unknown

 [Report an error](#)



[View legend](#)

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	3.05	<b>Anthropogenic material</b> ( <a href="#">More Info</a> )	FILL		
3.05	5.18	<b>Sand</b> ( <a href="#">More Info</a> ) <b>Gravel</b> ( <a href="#">More Info</a> )	MEDIUM SAND BOULDERS	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
5.18	10.67	<b>Sand</b> ( <a href="#">More Info</a> )	MEDIUM SAND	[26,53]%	[2E-7,6E-3]m/s
10.67	15.54	<b>Sand</b> ( <a href="#">More Info</a> ) <b>Clay</b> ( <a href="#">More Info</a> )	MEDIUM SAND CLAY	[26,53]%, [34,57]%	[2E-7,6E-3]m/s [1E-11,4.7E-9]m/s
15.54	16.76	<b>Gravel</b> ( <a href="#">More Info</a> )	BOULDERS	[24,44]%	[3E-4,3E-2]m/s
16.76	18.90	<b>Sand</b> ( <a href="#">More Info</a> ) <b>Gravel</b> ( <a href="#">More Info</a> )	MEDIUM SAND BOULDERS	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
18.90	21.64	<b>Sand</b> ( <a href="#">More Info</a> ) <b>Gravel</b> ( <a href="#">More Info</a> )	MEDIUM SAND GRAVEL	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
21.64	24.99	<b>Sand</b> ( <a href="#">More Info</a> ) <b>Clay</b> ( <a href="#">More Info</a> )	MEDIUM SAND CLAY	[26,53]%, [34,57]%	[2E-7,6E-3]m/s [1E-11,4.7E-9]m/s

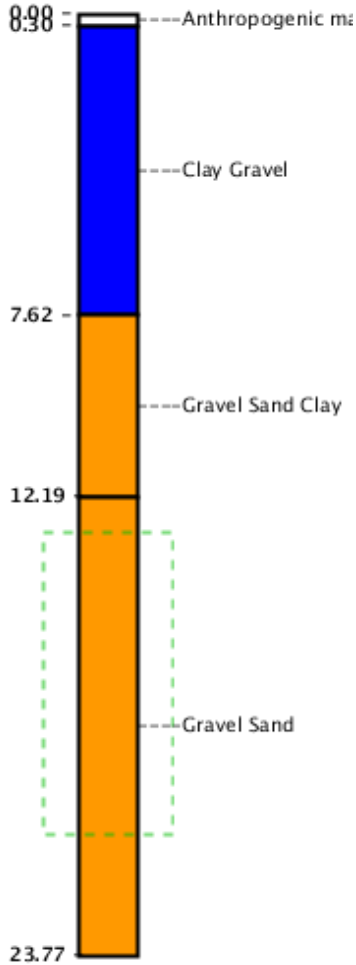
Well log. (\*Notice: Values taken from literature)



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## GIN Log

 [Report an error](#)



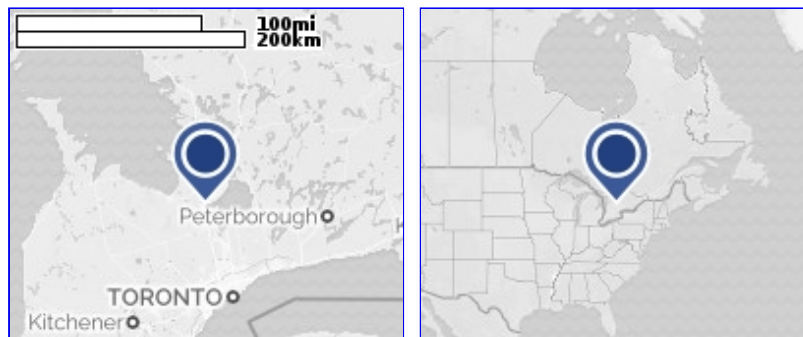
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**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.683219  
**Latitude :** 44.389209  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1962-10-12  
**Length :** 23.77m  
**Elevation :** 220.98m  
**CDEM Elevation :** 225m  
**CDSM Elevation :** 226.224m  
**Water Level :** 0.61m 1962-10-12  
**Water Segment :** 23.7744, FRESH 1962-10-12  
**Water Yield :** 681.91lpm 1962-10-12  
**Water Use :** Industrial  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Water Supply  
**Type :** Unknown

**Screen :**  
 • From 13.1064 to 20.73m

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	0.30	Anthropogenic material <a href="#">(More Info)</a>	FILL		
0.30	7.62	Clay <a href="#">(More Info)</a> Gravel <a href="#">(More Info)</a>	CLAY GRAVEL	[34,57]%, [24,44]%	[1E-11,4.7E-9]m/s [3E-4,3E-2]m/s
7.62	12.19	Gravel <a href="#">(More Info)</a> Sand <a href="#">(More Info)</a> Clay <a href="#">(More Info)</a>	GRAVEL MEDIUM SAND CLAY	[24,44]%, [26,53]%, [34,57]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s [1E-11,4.7E-9]m/s
12.19	23.77	Gravel <a href="#">(More Info)</a> Sand <a href="#">(More Info)</a>	GRAVEL MEDIUM SAND	[24,44]%, [26,53]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s

Well log. (\*Notice: Values taken from literature)

[View legend](#)

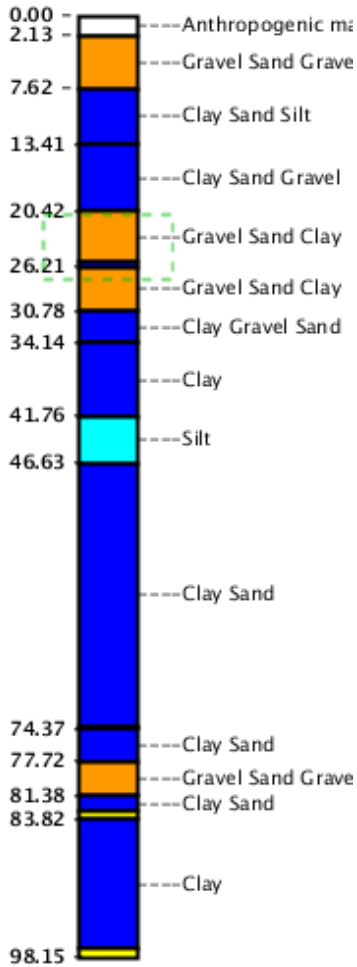


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## GIN Log

**GIN borehole Identifier :** ca.on.waterWell.5700288  
**Borehole Data Provider ID :** 5700288  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.684766  
**Latitude :** 44.389055  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 1966-06-24  
**Length :** 98.15m  
**Elevation :** 222.50m  
**CDEM Elevation :** 223m  
**CDSM Elevation :** 226.77m  
**Water Segment :** 20.4216, FRESH 1966-06-24  
**Water Use :** Not Used  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Test Hole  
**Type :** Unknown

 [Report an error](#)



**Screen :**

- From 20.7264 to 27.43m

[View legend](#)

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	2.13	Anthropogenic material (More Info)	FILL		
2.13	7.62	Gravel (More Info) Sand (More Info) Gravel (More Info)	GRAVEL SAND BOULDERS	[24,44]%, [26,53]%, [24,44]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s [3E-4,3E-2]m/s
7.62	13.41	Clay (More Info) Sand (More Info) Silt (More Info)	CLAY SAND SILT	[34,57]%, [26,53]%, [34,61]%	[1E-11,4.7E-9]m/s [2E-7,6E-3]m/s [1E-9,2E-5]m/s
13.41	20.42	Clay (More Info) Sand (More Info) Gravel (More Info)	CLAY SAND GRAVEL	[34,57]%, [26,53]%, [24,44]%	[1E-11,4.7E-9]m/s [2E-7,6E-3]m/s [3E-4,3E-2]m/s
20.42	25.60	Gravel (More Info) Sand (More Info) Clay (More Info)	GRAVEL SAND CLAY	[24,44]%, [26,53]%, [34,57]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s [1E-11,4.7E-9]m/s
25.60	26.21	Clay (More Info) Gravel (More Info)	CLAY GRAVEL	[34,57]%, [24,44]%	[1E-11,4.7E-9]m/s [3E-4,3E-2]m/s
					[3E-4,3E-2]m/s

26.21	30.78	<a href="#">Gravel (More Info)</a> <a href="#">Sand (More Info)</a> <a href="#">Clay (More Info)</a>	GRAVEL SAND CLAY	[24,44]% [26,53]% [34,57]%	2]m/s [2E-7,6E-3]m/s [1E-11,4.7E-9]m/s
30.78	34.14	<a href="#">Clay (More Info)</a> <a href="#">Gravel (More Info)</a> <a href="#">Sand (More Info)</a>	CLAY GRAVEL SAND	[34,57]% [24,44]% [26,53]%	[1E-11,4.7E-9]m/s [3E-4,3E-2]m/s [2E-7,6E-3]m/s
34.14	41.76	<a href="#">Clay (More Info)</a>	CLAY	[34,57]%	[1E-11,4.7E-9]m/s

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## GIN Log

[View legend](#)

**GIN borehole Identifier :** ca.on.waterWell.5735507

**Borehole Data Provider ID :** 5735507

**Information Source :** Ontario Ministry of Environment

**Metadata :** [Ontario Water Well Information System Metadata](#)

**Longitude :** -79.683411

**Latitude :** 44.388464

**Online resource :** [Ontario Water Wells](#)

**Date of Drilling :** 2000-08-22

**Elevation :** Missing

**CDEM Elevation :** 219m

**CDSM Elevation :** 214.759m

**Location :** County: SIMCOE Township: BARRIE CITY

**Status :** Abandoned-Other

**Type :** Unknown

 [Report an error](#)

### Sealing :

- From 0 to 2.44m
- From 12.19 to 24.08m
- From 2.44 to 12.19m



**XML**

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**Accessed at**

.....

**Timestamp:** 2020-05-15T14:43:11.493-04:00

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### GIN Log

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**GIN borehole Identifier** : ca.on.waterWell.5735508  
**Borehole Data Provider ID** : 5735508  
**Information Source** : Ontario Ministry of Environment  
**Metadata** : [Ontario Water Well Information System Metadata](#)  
**Longitude** : -79.683219  
**Latitude** : 44.389209  
**Online resource** : [Ontario Water Wells](#)  
**Date of Drilling** :2000-08-23  
**Elevation** : Missing  
**CDEM Elevation** : 225m  
**CDSM Elevation** : 226.224m  
**Location** : County: SIMCOE Township: BARRIE CITY  
**Status** : Abandoned-Other  
**Type** : Unknown

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#### Sealing :

- From 0 to 3.05m
- From 3.05 to 7.62m



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Data from: [Ontario Ministry of Environment](#) , provided by GIN (Groundwater Information Network).

Accessed at

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Timestamp: 2020-05-15T14:42:32.535-04:00

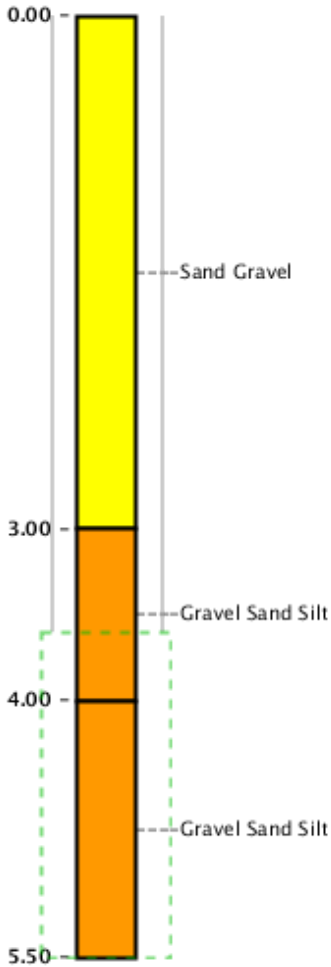
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## GIN Log

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**GIN borehole Identifier :** ca.on.waterWell.7038503  
**Borehole Data Provider ID :** 7038503  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.680343  
**Latitude :** 44.389464  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 2006-10-16  
**Length :** 5.50m  
**Elevation :** Missing  
**CDEM Elevation :** 227m  
**CDSM Elevation :** 226.947m  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Type :** Unknown

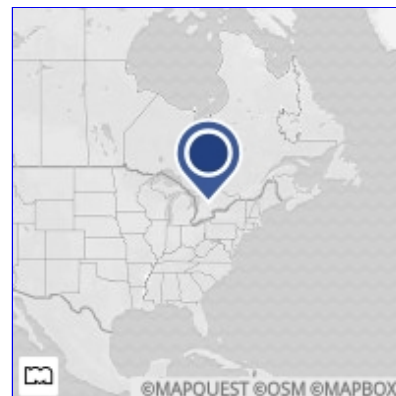
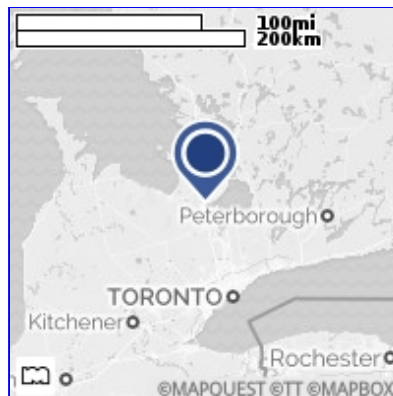
- Well casing :**
- From 0 to 3.6m, material: PLASTIC
- Screen :**
- From 3.6 to 5.5m PLASTIC
- Sealing :**
- From 0 to 0m
  - From 2.4 to 2.4m



DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	3.00	Sand (More Info) Gravel (More Info)	SAND GRAVEL	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
3.00	4.00	Gravel (More Info) Sand (More Info) Silt (More Info)	GRAVEL SAND SILT	[24,44]%, [26,53]%, [34,61]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s [1E-9,2E-5]m/s
4.00	5.50	Gravel (More Info) Sand (More Info) Silt (More Info)	GRAVEL SAND SILT	[24,44]%, [26,53]%, [34,61]%	[3E-4,3E-2]m/s [2E-7,6E-3]m/s [1E-9,2E-5]m/s

Well log. (\*Notice: Values taken from literature)

[View legend](#)



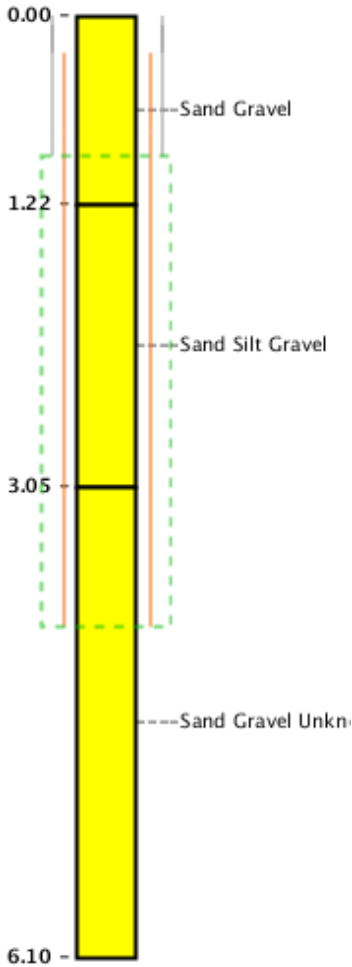
[XML](#)

[Important Notices](#)

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## GIN Log

 [Report an error](#)



**GIN borehole Identifier :** ca.on.waterWell.7124832  
**Borehole Data Provider ID :** 7124832  
**Information Source :** Ontario Ministry of Environment  
**Metadata :** [Ontario Water Well Information System Metadata](#)  
**Longitude :** -79.684799  
**Latitude :** 44.388948  
**Online resource :** [Ontario Water Wells](#)  
**Date of Drilling :** 2009-04-21  
**Length :** 6.10m  
**Elevation :** Missing  
**CDEM Elevation :** 223m  
**CDSM Elevation :** 226.77m  
**Water Segment :** 2.1336, Not stated 2009-04-21  
**Water Use :** Monitoring  
**Location :** County: SIMCOE Township: BARRIE CITY  
**Status :** Observation Wells  
**Type :** Unknown

**Well casing :**

- From 0 to 0.24m, material: STEEL
- From 0.06 to 0.91m, material: PLASTIC

**Screen :**

- From 0.9144 to 3.96m PLASTIC

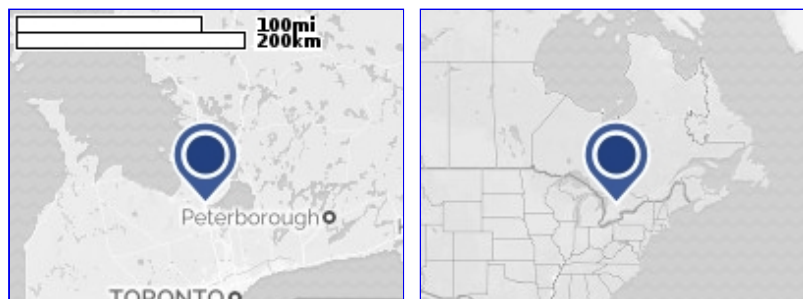
**Sealing :**

- From 0.24 to 0.76m
- From 0.76 to 3.96m

DEPTH FROM (METERS)	DEPTH TO (METERS)	GIN LITHOLOGY	ORIGINAL LITHOLOGY	POROSITY*	HYDRAULIC CONDUCTIVITY*
0.00	1.22	<a href="#">Sand (More Info)</a> <a href="#">Gravel (More Info)</a>	SAND GRAVEL	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s
1.22	3.05	<a href="#">Sand (More Info)</a> <a href="#">Silt (More Info)</a> <a href="#">Gravel (More Info)</a>	SAND SILT GRAVEL	[26,53]%, [34,61]%, [24,44]%	[2E-7,6E-3]m/s [1E-9,2E-5]m/s [3E-4,3E-2]m/s
3.05	6.10	<a href="#">Sand (More Info)</a> <a href="#">Gravel (More Info)</a> <a href="#">Unknown material (More Info)</a>	SAND GRAVEL WATER-BEARING	[26,53]%, [24,44]%	[2E-7,6E-3]m/s [3E-4,3E-2]m/s

Well log. (\*Notice: Values taken from literature)

[View legend](#)





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**APPENDIX D**

**Geotechnical Program**

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**GEOTECHNICAL INVESTIGATION  
PROPOSED LUXURY CONDOMINIUM  
217 DUNLOP STREET EAST  
BARRIE, ONTARIO**

**for**

**PBM REALTY HOLDINGS INC.**

PETO MacCALLUM LTD.  
19 CHURCHILL DRIVE  
BARRIE, ONTARIO  
L4N 8Z5  
PHONE: (705) 734-3900  
FAX: (705) 734-9911  
EMAIL: [barrie@petomacallum.com](mailto:barrie@petomacallum.com)

Distribution:

1 cc: Client (email only)  
1 cc: Salter Pilon Architecture Inc. (email only)  
1 cc: PML Barrie

PML Ref.: 19BF032  
Report: 1  
April 2020

April 16, 2020

PML Ref.: 19BF032  
Report: 1

Mr. Peter Moore  
PBM Realty Holdings Inc.  
191 John Street  
Barrie, Ontario  
L4N 8Y7

Dear Mr. Moore

**Geotechnical Investigation  
Proposed Luxury Condominium  
217 Dunlop Street East  
Barrie, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the scope was provided by Mr. P. Moore in the signed Engineering Services Agreement, dated July 25, 2019.

The property at 217 Dunlop Street East is to be redeveloped as a 12 to 15 storey luxury condominium building. The site is located on the south side of Dunlop Street East and grades drop abruptly about 3 to 4 m below the road grade, just inside the property line, in the eastern part of the site. In the western part of the site, the grade drops more gently and a ramp along the west edge of the site allows access to the lower eastern area. The Barrie North Shore Trail is directly south of the site. South of the trail the grades drop down abruptly again about 3 to 4 m to the shores of Kempenfelt Bay. Currently, there are no buildings on the site but the remains of a former building are present including a basement wall along the north edge of the site (currently holding part of the higher ground to the north) and a basement slab-on-grade floor. The proposed building will comprise a parking level at the road/ground level and one level of underground parking, with residential floors above the ground level. Paved access will be constructed on the east and west sides of the proposed building, with areas north and south of the building comprising landscaped areas. A deep foundation is anticipated due to environmental implications noted below. A general concept plan is shown in Drawing 1, attached.

It is noted that the site has environmental issues relating to contamination from previous land uses. Reference is made to previous environmental studies by others. It is understood that a Record of Site Condition (RSC) and Certificate of Property Use (CPU) have been issued for the Site by the Ontario Ministry of Environment, Conservation and Parks (MECP). Cognizant of the environmental conditions of the site, excessive earthworks are undesirable. In general, the subsurface conditions comprise upper pervious sand/gravel soils overlying a somewhat impervious silty clay to clayey silt layer underlain by a lower sand deposit. It is understood that the reported contamination is currently only within the upper pervious material, with the impervious layer providing a level of protection for the lower sand layer that is under artesian pressure. The City of Barrie operates a nearby water well that draws water from the lower sand unit. There is concern that a deep foundation will puncture/penetrate the impervious layer providing a potential pathway for contamination to spread to the lower aquifer.

It is noted that current environmental assessment/caretaking for the site is being carried out by others, and is not part of PML's terms of reference for this assignment (no work has been carried out in this regard). As such, the recommendations contained in this report should be reviewed by the Owner and the project environmental consultant to confirm compatibility with any site-specific Risk Management Measures (RMM) that may need to be implemented to be in compliance with the CPU and the intended ongoing and future use of the property.

19 Churchill Drive, Barrie, Ontario L4N 8Z5  
Tel: (705) 734-3900 Fax: (705) 734-9911  
E-mail: barrie@petomacallum.com



A geotechnical investigation has been requested to further explore the subsurface conditions at the site, and based on some of the previous data and this recent investigation, provide comments and geotechnical engineering recommendations for building foundations, basements, site servicing and pavement design.

Specialized drilling techniques were utilized to seal the boreholes upon completion and mitigate the potential for contaminant migration. Three boreholes were drilled to 12.6 to 17.2 m depth below existing grades and revealed fill and sand and gravel soils over a silty clay to clayey silt layer over lower sand soils. Ground water at the site was about 3 to 4 m below existing grade at the boreholes, corresponding closely to the water level in neighbouring Kempenfelt Bay.

A deep foundation comprising pipe piles is discussed in the report. The pile depths and resulting capacities are restricted to the upper sand/gravel layer and upper portion of the silty clay to clayey silt deposit so that the integrity of the silty clay to clayey silt layer is not compromised.

It is understood that ground improvement techniques for the building foundation are being considered and that a specialist design/build firm has been engaged to implement one of their proprietary ground improvement systems.

Further discussion, details and recommendations are provided in the attached report.

We trust the information presented in the attached report will be sufficient for your present purposes. If you have any questions please do not hesitate to contact our office.

Peto MacCallum Ltd.

Sincerely

A handwritten signature in blue ink, appearing to read 'Geoffrey White', is written over a light blue circular stamp.

Geoffrey White, P.Eng.  
Director  
Manager, Geotechnical and Geoenvironmental Services

GRW:tc



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Figure 6 – Lateral Earth Pressure Distribution – Multi Braced Cuts in Cohesionless Soils



Figure 7 – Lateral Earth Pressure Distribution – Singly Braced Cuts in Cohesionless Soils

Figure 8 – General Recommendations Regarding Underpinning for Foundations/utilities Located Close to Excavations

List of Abbreviations

Log of Borehole Nos. 1 to 3

Drawing 1 – Borehole Location Plan

Appendix A – Statement of Limitations

Appendix B – Boreholes by Others

Appendix C – Engineered Fill



## **1. INTRODUCTION**

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the scope was provided by Mr. P. Moore in the signed Engineering Services Agreement, dated July 25, 2019.

The property at 217 Dunlop Street East is to be redeveloped as a 12 to 15 storey luxury condominium building. The site is located on the south side of Dunlop Street East and grades drop abruptly about 3 to 4 m below the road grade, just inside the property line, in the eastern part of the site. In the western part of the site, the grade drops more gently and a ramp along the west edge of the site allows access to the lower eastern area. The Barrie North Shore Trail is directly south of the site. South of the trail the grades drop down abruptly again about 3 to 4 m to the shores of Kempenfelt Bay. Currently, there are no buildings on the site but the remains of a former building are present including a basement wall along the north edge of the site (currently holding part of the higher ground to the north) and a basement slab-on-grade floor. The proposed building will comprise a parking level at the road/ground level and one level of underground parking, with residential floors above the ground level. Paved access will be constructed on the east and west sides of the proposed building, with areas north and south of the building comprising landscaped areas. A deep foundation is anticipated due to the environmental implications noted below. A general concept plan is shown in Drawing 1, attached.

It is noted that the site has environmental issues relating to contamination from previous land uses. Reference is made to previous environmental studies by others. It is understood that a Record of Site Condition (RSC) and Certificate of Property Use (CPU) have been issued for the site by the Ontario Ministry of Environment, Conservation and Parks (MECP). Cognizant of the environmental conditions of the site, excessive earthworks are undesirable. In general, the subsurface conditions comprise upper pervious sand/gravel soils overlying a somewhat impervious silty clay to clayey silt layer, underlain by a lower sand deposit that is under artesian pressure. It is understood that the reported contamination is currently only within the upper pervious material, with the impervious layer providing a level of protection for the lower sand layer. The City of Barrie operates a nearby water well that draws water from the lower sand unit. There is concern that a deep foundation will puncture/penetrate the impervious layer providing a potential pathway for contamination to spread to the lower aquifer. It is noted that current environmental assessment/caretaking for the site is being carried out by others, and is not part of



PML's terms of reference for this assignment (no work has been carried out in this regard). As such, the recommendations contained in this report should be reviewed by the Owner and the project environmental consultant to confirm compatibility with any site-specific Risk Management Measures (RMM) that may need to be implemented to be in compliance with the CPU and the intended ongoing and future use of the property.

A geotechnical investigation has been requested to further explore the subsurface conditions at the site, and based on some of the previous data and this recent investigation, provide comments and geotechnical engineering recommendations for building foundations, basements, site servicing and pavement design.

The comments and recommendations provided in this report are based on the site conditions at the time of the current investigation and a previous investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

This report is subject to the Statement of Limitations that is included in Appendix A and must be read in conjunction with the report.

## **2. INVESTIGATION PROCEDURES**

The field work for the geotechnical investigation was carried out from January 9 to 17, 2020 and consisted of Boreholes 1 to 3 advanced to 12.6 to 17.2 m depth below existing grade within the building envelope. The borehole locations are shown on Drawing 1, attached.

As noted earlier previous investigations were carried out by others for environmental purposes. Boreholes 21 and 25 from a previous investigation were reviewed in conjunction with the boreholes from this investigation (herein referred to as Borehole TP 21 and Borehole TP 25). Copies of the Borehole logs are provided in Appendix B and the approximate locations are shown on Drawing 1, appended.



PML laid out the boreholes in the field for this current investigation. The ground surface elevations at the borehole locations were obtained with a Sokkia SHC5000 GPS System equipped with a GCX3 (network RTK rover) Global Navigation Satellite System (GNSS) Receiver. Vertical and horizontal accuracy of this unit are 0.1 m and 0.5 m, respectively. All elevations in this report are expressed in metres.

Co-ordination for clearances of underground utilities was provided by PML with the aid of a private locating service. Boreholes were advanced cognizant of underground utilities.

The boreholes were advanced using a track mounted CME-55 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PML's engineering staff. In order to comply with environmental restrictions of the CPU, special "telescopic drilling procedures" were utilized on the site. The boreholes were advanced with casing and a tri-cone, utilizing drilling mud. Gas emanating from the borehole was monitored during drilling. The boreholes were advanced through the fill and upper sand/gravel unit to the top of the impervious layer (silty clay to clayey silt) at various depths. The borehole was then fully grouted/cemented and allowed to set overnight. The next day the borehole was extended through the grout/cement and the impervious soil down to the top of the lower sand deposit. The borehole was terminated one sample into the lower sand deposit. The borehole was fully grouted/cemented upon completion. All cuttings and drilling fluids/mud were drummed for proper removal from the site at a later date. Following completion of the work, all equipment was cleaned prior to leaving the site.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional 51 mm OD split spoon sampler. The split spoon sampler excludes particles less than 38 mm in size. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground water conditions in the boreholes were not measured due to the use of drilling mud during the drilling operation.



All recovered samples were returned to our laboratory for moisture content determination and detailed examination to confirm field classification. Grain size analyses were carried out on three representative samples of the major soil types. Atterberg Limits testing was conducted on one of the soil samples. The laboratory testing results are presented in Figures 1 to 4, attached.

### **3. SUMMARIZED SUBSURFACE CONDITIONS**

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including soil classifications, inferred stratigraphy, Standard Penetration test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), ground water observations, and the results of laboratory moisture content determinations and Atterberg limits testing.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

Two previous boreholes were reviewed along with the information from this investigation. Geotechnical information (borehole logs) received from third parties/others has been assumed to be accurate and PML assumes no responsibility for the accuracy or completeness of the information. PML shall bear no liability whatsoever for any incidental, indirect or consequential damages arising out of the use of the information from third parties.

#### **3.1 Fill**

A fill unit was encountered at the surface of all three current boreholes, extending to 2.1 to 4.0 m depth (elevation 218.2 to 220.0). The fill comprised silty sand to sandy silt, trace gravel with trace organics. Topsoil 200 mm thick was at the top the fill in Borehole 2. The fill had N Values of 10 to greater than 50 indicating variable compactive effort was applied to the fill during placement. The fill was frozen to wet with moisture contents of 5 to 37%.



### **3.2 Upper Sand and Gravel**

An upper native sand and gravel deposit was revealed below the fill and extending variably to 8.5 to 15.0 m depth (elevation 207.1 to 213.7). The deposit typically comprised sand and gravel with trace silt, varying to gravelly sand, sandy gravel or silty sand. A sample of the deposit was submitted for grain size analysis and the results are presented on Figure 1, appended. The deposit was typically very dense (N Values of greater than 50 to as high as 129), locally compact or dense with N Values of 22, 23, 38 and 46. The soil was wet with moisture contents of 7 to 15%.

### **3.3 Silty Clay to Clayey Silt**

Beneath upper sand and gravel deposit a silty clay to clayey silt unit was revealed. The thickness of the unit was variable, 2.0 m to 4.5 m, and the unit was penetrated at 11.5 to 17.0 m depth, (elevation 205.1 to 210.7). The material varied from silty clay to clayey silt and had a till-like appearance in some of the samples. Occasional cobbles and boulders were noted. A sample of the material from Borehole 1 was submitted for grain size analysis and Atterberg Limits testing and the results are provided in Figures 2 and 3, appended. The testing showed the sample to have a liquid limit of 41% and a plastic limit 17%. The material had a hard consistency with N Values ranging from 37 to 123. The moisture contents were 14 to 25%, and the soil was typically described as about plastic limit to drier than plastic limit.

### **3.4 Lower Sand**

Underlying the silty clay to clayey silt, a lower sand deposit was encountered to the depth of exploration in all boreholes. The material varied from sand to gravelly sand, with trace silt. A sample of the soil from Borehole 1 was submitted for grain size analysis and the results are presented in Figure 4, appended. Moisture contents were 9 to 21% and the material was wet. The density was typically very dense with N Values of 95 and 123, locally compact with an N Value of 16.



### **3.5 Ground Water**

Due to the drilling method, accurate ground water level measurements could not be taken during or upon completion of the boreholes.

Based on the moisture content profile, considering the pervious nature of the upper sand and gravel deposit and the proximity to Kempenfelt Bay the ground water level at the site will correspond closely to the water level in Kempenfelt Bay at elevation 219. Local perched water can be expected at higher elevations.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

### **3.6 Previous Boreholes**

Previous Boreholes TP 21 and TP 25 by others (2005) were reviewed in conjunction with the current investigation and encountered similar subsurface conditions as the current boreholes. Copies of the logs are provided in Appendix B. Some time has passed since the previous boreholes by others were drilled and near surface conditions may have changed since that time.



#### **4. GEOTECHNICAL ENGINEERING CONSIDERATIONS**

##### **4.1 General**

The property at 217 Dunlop Street East is to be redeveloped as a 12 to 15 storey luxury condominium building. The site is located on the south side of Dunlop Street East and grades drop abruptly about 3 to 4 m below the road grade, just inside the property line, in the eastern part of the site. In the western part of the site, the grade drops more gently and a ramp along the west edge of the site allows access to the lower eastern area. The Barrie North Shore Trail is directly south of the site. South of the trail the grades drop down abruptly again about 3 to 4 m to the shores of Kempenfelt Bay. Currently, there are no buildings on the site but the remains of a former building are present including a basement wall along the north edge of the site (currently holding part of the higher ground to the north) and a basement slab-on-grade floor. The proposed building will comprise a parking level at the road/ground level and one level of underground parking, with residential floors above the ground level. Paved access will be constructed on the east and west sides of the proposed building, with areas north and south of the building comprising landscaped areas. A general concept plan is shown in Drawing 1, attached.

It is understood that a single basement level below the ground floor/road grade is being proposed. The road grade on Dunlop Street East is about elevation 226, and for purposes of this report the street level ground floor is assumed to be at about elevation 226 (or slightly higher) and the underground parking level is anticipated to be established at about elevation 223.0.

It is noted that the site has environmental issues relating to contamination from previous land uses. Reference is made to previous environmental studies by others. It is understood that a RSC and a CPU have been issued for the site by the MECP. It is understood that the contamination is currently only within the upper pervious material, with the impervious layer providing a level of protection for the lower sand layer. The City of Barrie operates a nearby water well that draws water from the lower sand unit. There is concern that a deep foundation will puncture/penetrate the impervious layer providing a potential pathway for contamination to spread to the lower aquifer. Further, due to the contamination it is understood that excessive excavation and/or soil removal is undesirable due to the anticipated high cost of disposal. Similarly, excessive pumping of contaminated ground water is also undesirable due to the cost of treatment.



It is noted that current environmental assessment/caretaking for the site is being carried out by others, and is not part of PML's terms of reference for this assignment (no work has been carried out in this regard). The recommendations provided in this report have attempted to take the considerations noted above into account but do not identify all the environmental protocols, requirements, constraints, or restrictions imposed on the site by the CPU. It is assumed that the environmental consultant will review this report and provide the necessary protocols, requirements, constraints, or restrictions that are required by the CPU for design and construction of the project.

#### **4.2 Site Grading and Engineered Fill**

Based on the current concept, the building will occupy the majority of the site. The current concept plan also fits well with the existing site grades with the site cut down to the approximate basement level in most areas.

Based on the environmental condition of the site, excessive removal of existing site soil and replacement with imported soil is undesirable, as such full recommendations for removal of in-situ fill and replacement with engineered fill to support the building are not provided in this report.

Locally, grades will need to be raised or areas of poor soil will need to be removed and replaced with engineered fill to properly support structures, utilities or pavements. In general, it is envisioned that excavated native upper sand and gravel can be reused on-site for engineered fill, subject to environmental considerations. Also, excavated in-situ fill, free of organics can be reused as engineered fill and imported material should comprise OPSS Granular B.

Regarding the basement floor slab, the in-situ fill typically had N Values greater than 20. Provided the upper organic material is removed down the inorganic soil and the exposed surface is proofrolled thoroughly, with any poor areas removed and replaced (as described below), the remaining in-situ fill can remain in-place and is considered acceptable to support the basement floor slab.



Reference is made to Appendix C for guidelines for engineered fill construction. The following general highlights are provided:

- Strip all existing topsoil, fill with organics, and other deleterious materials. The excavated soil should be segregated and stockpiled for reuse or disposal, as is appropriate;
- Proofroll exposed subgrade using a heavy roller to a targeted 100% Standard Proctor maximum dry density, under geotechnical review;
- Following geotechnical review and approval of the subgrade, spread approved material in maximum 200 mm thick lifts and uniformly compacted to 100% Standard Proctor maximum dry density in building slab areas and 95% Standard Proctor maximum dry density in pavement and utility areas. A compaction standard of 90% Standard Proctor maximum dry density can be utilized in landscaped areas. The exposed subgrade is not expected to be wet; however, where wet subgrade conditions are present, the first lift or two of engineered fill should comprise OPSS Granular B Type II;
- As noted above, subject to geotechnical review during construction, the excavated inorganic fill and native soil is generally suitable for reuse as engineered fill, subject to geoenvironmental considerations. If imported fill is required, it should comprise OPSS Granular B. Other sources of imported material should be reviewed by our office to ensure suitability;
- Engineered fill construction must be carried out under full time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

#### **4.3 Foundations**

As noted above, removal of all existing fill and replacement with engineer fill to support the building is not being considered due to the anticipated cost of soil disposal. As such, deep foundations or site improvement techniques were sought. General recommendations for piles have been requested; however, ultimately it is understood that site improvement technique(s) by a design/build contractor will be implemented at the site.



#### 4.3.1 Piles

As requested, the option of driven pile foundations has been considered; however, it should be noted that advancing driven piles in close proximity to surrounding development has the potential to impart significant construction related ground vibrations and potential damage; therefore, the feasibility of this option would require further evaluation. The possibility of encountering cobbles or boulders during pile installation should also not be overlooked. For preliminary evaluation, the table below provides the vertical capacities for two types of pipe piles, driven closed ended to the depths noted, on a borehole by borehole basis. It is noted that the variable density/consistency and depths and thickness of the fill, upper sand and gravel and underlying silty clay to clay silt contributed to the wide range of values. It has been assumed that the pile cap will be at elevation 222.0. It is noted that piles cannot be driven below the depth noted, due to the potential for fully puncturing the silty clay to clayey silt unit and allowing a potential pathway for migration of the site contamination to the lower sand deposit.

<b>BOREHOLE</b>	<b>PILE TIP DEPTH (m)/ELEVATION</b>	<b>GEOTECHNICAL RESISTANCE AT SLS (kN)</b>	<b>FACTORED RESISTANCE AT ULS (kN)</b>
Pipe Pile 324 mm Diameter with 9.5 mm wall thickness			
1	10.0/212.0	375	550
2	13.0/209.5	600	800
3	15.0/207.0	750	1050
TP 21	16.0/206.0	750	1050
TP 25	18.0/203.9	900	1250
Pipe Pile 356 mm Diameter with 9.5 mm wall thickness			
1	10.0/212.0	425	625
2	13.0/209.5	650	900
3	15.0/207.0	850	1200
TP 21	16.0/206.0	900	1250
TP 25	18.0/203.9	1000	1425

SLS – Serviceability Limit State  
ULS – Ultimate Limit State



The required pile set should be established when the pile section is selected, and based on the pile hammer to be used by the piling contractor. The pile capacities should be verified in the field by Pile Dynamic Analysis (PDA). A geotechnical resistance factor of 0.5 was utilized for the ULS values, in anticipation that values would be verified via PDA testing. Settlement of less than 25 mm is anticipated for the SLS values.

Pipe piles should be driven closed ended and filled with 20 MPa concrete.

Resistance to lateral loads may be provided in part by mobilization of passive resistance in the soil along the pile. As an estimate, lateral loads can be assumed to be about 10% of the vertical loads. A load test should be carried out to verify the pile lateral design capacity. Lateral resistance at SLS is based on lateral movement of 10 mm. Alternatively, battered piles are recommended where lateral resistance is required.

The piling installation operations should be inspected on a full-time basis by qualified geotechnical personnel to check that the required set and capacity are achieved, and to document founding elevation, alignment and plumbness.

#### 4.3.2 Alternative Foundation

It is understood that a design/build contractor has been consulted to implement an aggregate pier or other proprietary system at the site to support the building.

As provided during consultation with the design build contractor, a bearing resistance of at least 300 kPa at SLS and 450 kPa at ULS is available in the native soil about 3 m below the ground surface (below elevation 219) at the borehole locations.

#### 4.3.3 Seismic Considerations

Based on the soil profile (N Values) revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site there is a low potential for liquefaction of soils to occur.



#### 4.4 Basement

It is understood that a single basement level below the street level/ground floor is being proposed. In general, it is recommended that basements be established a minimum 0.5 m above the high ground water level. The site ground water level is considered to be close to the water level in Kempenfelt Bay, at about elevation 219, with local perched water at slightly higher elevations. The road grade on Dunlop Street East is about elevation 226, and based on this the underground parking level has been assumed at about elevation 223.0, which is about 4 m above the ground water at the site. An underfloor drainage system is not considered necessary.

Basement perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls. The lateral earth pressure,  $P$ , may be computed using the following equation and assuming a triangular pressure distribution:

$$P = K (\gamma h + q) + C_p$$

Where

- $P$  = lateral pressure at depth  $h$  (m) below ground surface (kPa)
- $K$  = lateral earth pressure coefficient of compacted granular backfill = 0.5
- $h$  = depth below grade (m) at which lateral pressure is calculated
- $\gamma$  = unit weight of compacted granular backfill = 21.0 kN/m<sup>3</sup>
- $q$  = surcharge loads (kPa)
- $C_p$  = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, foundation wall backfill should comprise free draining granular material conforming to OPSS Granular B. Alternatively, a proprietary drainage board product can be utilized with on-site native sand and gravel soil, subject to geotechnical review. A weeping tile system should be installed to prevent the build-up of hydrostatic pressure behind the wall. The weeping tiles should be protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet.

Basement wall backfill should be placed in thin lifts compacted to a minimum 95% Standard Proctor maximum dry density. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.



Based on discussion earlier in the report, the basement floor slab construction is feasible on engineered fill over in-situ fill. In general, a minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. A polyethylene sheet vapour barrier should be incorporated under the ground floor slab if a vapour sensitive floor finish is planned.

Exterior grades should be established to promote surface drainage away from the building.

Reference is made to the appended Figure 5 for general recommendations regarding drainage and backfill requirements for basement walls and floor slabs.

#### **4.5 Site Servicing**

Design details were not finalized at the time of this report. For purposes of this report, inverts are assumed to be a maximum 4.0 m below the Dunlop Street East road grade which is at about elevation 226. This corresponds to excavation down to about elevation 222, which is about 0 to 4 m below the site grades.

##### **4.5.1 Trench Excavation and Ground Water Control**

Trench excavation and ground water control are described later in the report under Excavation and Ground Water Control.

##### **4.5.2 Pipe Bedding**

Based on the boreholes, the subgrade at the assumed invert level is expected to comprise fill or native sand and gravel. Where fill or other deleterious materials are encountered at the proposed invert level, it may be necessary to sub-excavate and provide an increased bedding thickness, subject to geotechnical field review.

Standard Granular A bedding, in accordance with OPSS, compacted to 95% Standard Proctor maximum dry density should be satisfactory. For flexible pipes, bedding and cover material should comprise OPSS Granular A. For rigid pipes, bedding and cover material should comprise



OPSS Granular A and cover material may comprise select native soil free of oversized material (greater than 150 mm).

#### 4.5.3 Trench Backfill

Trench backfill should comprise select inorganic soil placed in maximum 200 mm thick lifts compacted to minimum 95% Standard Proctor maximum dry density, to minimize post construction settlement. Asphalt, excessively wet, frozen, organic, oversized (greater than 150 mm diameter), or otherwise deleterious material should not be incorporated as trench backfill. The moisture content should be within 2% of optimum in order to achieve the specified compaction, and should be closer to the optimum moisture content in the upper 1 m to prevent instability issues. Ideally the backfill should comprise excavated site soil in order to minimize the potential for differential frost heave.

The excavated soils will comprise fill and native sand and gravel, typically above the ground water table. Excavated inorganic soils should generally be suitable for reuse as trench backfill, subject to moisture content control and environmental conditions. It is noted that the fill has organics and this material should be separated during excavation. Weather will also impact the moisture conditions of the soil and the suitability for reuse unless allowed to dry out, subject to geotechnical review during construction. Geotechnical review of the excavated soil (moisture content and suitability) and approval for use as backfill will be necessary during construction.

All earthworks operations should be inspected by PML to approve subgrade preparation, backfill materials, placement, and compaction efforts and ensure the specified degree of compaction is achieved throughout.

#### 4.6 Excavation and Ground Water Control

The depth of excavation for the site servicing has not been confirmed at the time of this report; however, it has been assumed to be a maximum 4.0 m below existing site grades (down to about elevation 222).

The basement floor has been assumed at elevation 223 and excavation for the building foundations is assumed to be required about 2.0 m below this level to elevation 221.0.



In general, excavation as described above will encounter the fill and the underlying native sand and gravel deposit. Harder digging can be expected in the fill and upper sand and gravel deposit, due to very dense conditions noted. Excavation is generally anticipated to be above the ground water table. Local perched water should be anticipated.

Subject to adequate ground water control as discussed below, for open cut excavations, the soils encountered at the site should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

Excavation side slopes should be continuously examined and reviewed for evidence of instability, particularly following periods of heavy rain or thawing. When required, remedial action must be taken to ensure the continued stability of the excavation slope and the safety of the workers.

If space limitations do not permit properly inclined slopes (possibly along the north and east limits of the site), then braced or shored excavations will be required to support the wall of the excavation and maintain the integrity of the existing facilities. The magnitude and distribution of the lateral earth pressures acting on a braced excavation wall is dependant upon the support system used, the number of supports, the allowable movements and the construction sequence.

The recommended design earth pressure distributions for multi and singly braced walls for the conditions that exist at the site, are presented in Figures 6 and 7, attached. Recommendations concerning design and construction of the braced excavation support systems are also presented on the Figures.

The ground surface adjacent to a brace excavation is expected to experience some inward movement and vertical settlement. The magnitude of which can be limited by proper selection of the design parameters and provided good quality and workmanship is employed.

Foundation of heavy loaded/settlement sensitive structures and/or utilities located within close proximity to the excavation may require underpinning to preserve the integrity of these structures. Further, assessment for this requirement can be made utilizing Figure 8, attached.



As noted above, the depth of excavation for construction is generally anticipated to be above the ground water level at the site. Conventional sump pumping techniques should be able to control normal seepage from surface water or local perched ground water.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation O.Reg. 387/040, Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the MECP. This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering or permanent drainage improvements. Projects assessed to be taking more than 50,000 L/d but less than 400,000 L/d of ground water can obtain a permit/permission online via the Environmental Activity and Sector Registry (EASR) system. If it is assessed that more than 400,000 L/d is required, then a Category 3 Permit-to-Take-Water (PTTW) will be required.

Based on the depth of excavation as discussed above, registering on the EASR system or a PTTW are not anticipated. Once design details are finalized the project should be reviewed to confirm the MECP requirements.

It is noted that excavation below the ground water table will require a dewatering system designed and installed by specialist in this field, and in this case, a PTTW or registry on the EASR system will likely be required.

It is recommended that a test excavation be undertaken to allow prospective contractors an opportunity to observe and evaluate the conditions likely to be encountered and to assess preferred means of excavation and ground water control measures based on their own experience.



#### **4.7 Pavement Design and Construction**

The near surface soil at the site comprise fill consisting of silty sand to sandy silt. This soil has a variable susceptibility (moderate to high). The following pavement thicknesses are recommended. When grading and the subgrade soils are confirmed the pavement thicknesses below should be reviewed.

<b>MATERIAL</b>	<b>LIGHT DUTY (mm)</b>	<b>HEAVY DUTY (mm)</b>
Asphalt	90	120
Granular A Base	150	150
Granular B Type I Subbase	350	500
Total Thickness	590	770

Rough grading will involve excavation to the subgrade. It is not intended to remove all of the existing fill from under the pavement. However, in order to minimize potential settlement issues, it is recommended that following rough grading to the proposed subgrade level, the exposed subgrade soil should be compacted to minimum 95% Standard Proctor maximum dry density, under geotechnical review by PML. Any unstable zones identified during this process should be sub-excavated and replaced with select site material placed in 200 mm thick lifts and compacted to a minimum 95 % Standard Proctor maximum dry density.

The pavement design considers the construction will be carried out during the dry time of the year and that the subgrade is stable and not heaving under construction traffic. If wet or unstable conditions are encountered, additional sub-excavation, granular subbase and/or the use of Granular B Type II may be required, subject to geotechnical review during construction.

Imported material for the granular base and subbase should conform to OPSS gradation specifications for Granular A and Granular B Type I, respectively, and should be compacted to 100% Standard Proctor maximum dry density. Asphalt should be compacted in accordance with OPSS 310.



For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. The incorporation of subdrains at the pavement edge is recommended in conjunction with crowning of the final subgrade to promote drainage away from the pavement structure. Subdrains should be installed 300 mm below the subgrade level. Refer to OPSD 216 Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Any manhole/catchbasins should be backfilled with free draining Granular B. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement.

#### **4.8 Geotechnical Review and Construction Inspection and Testing**

It is recommended that the final design drawings be submitted to PML for geotechnical review for compatibility with site conditions and recommendations of this report.

The piling installation operations should be inspected on a full-time basis by qualified geotechnical personnel to check that the required set and capacity are achieved, and to document founding elevation, alignment and plumbness.

Service installation, pavements or earthworks operations should be carried out under the supervision of PML to approve subgrade preparation, backfill materials, placement, compaction procedures, and check the specified degree of compaction is achieved throughout.

The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary, particularly where service trenches exist. Geotechnical review during construction should be ongoing to confirm the subsurface conditions are substantially similar to those encountered in the boreholes, which may otherwise require modification to the original recommendations.



## 5. CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

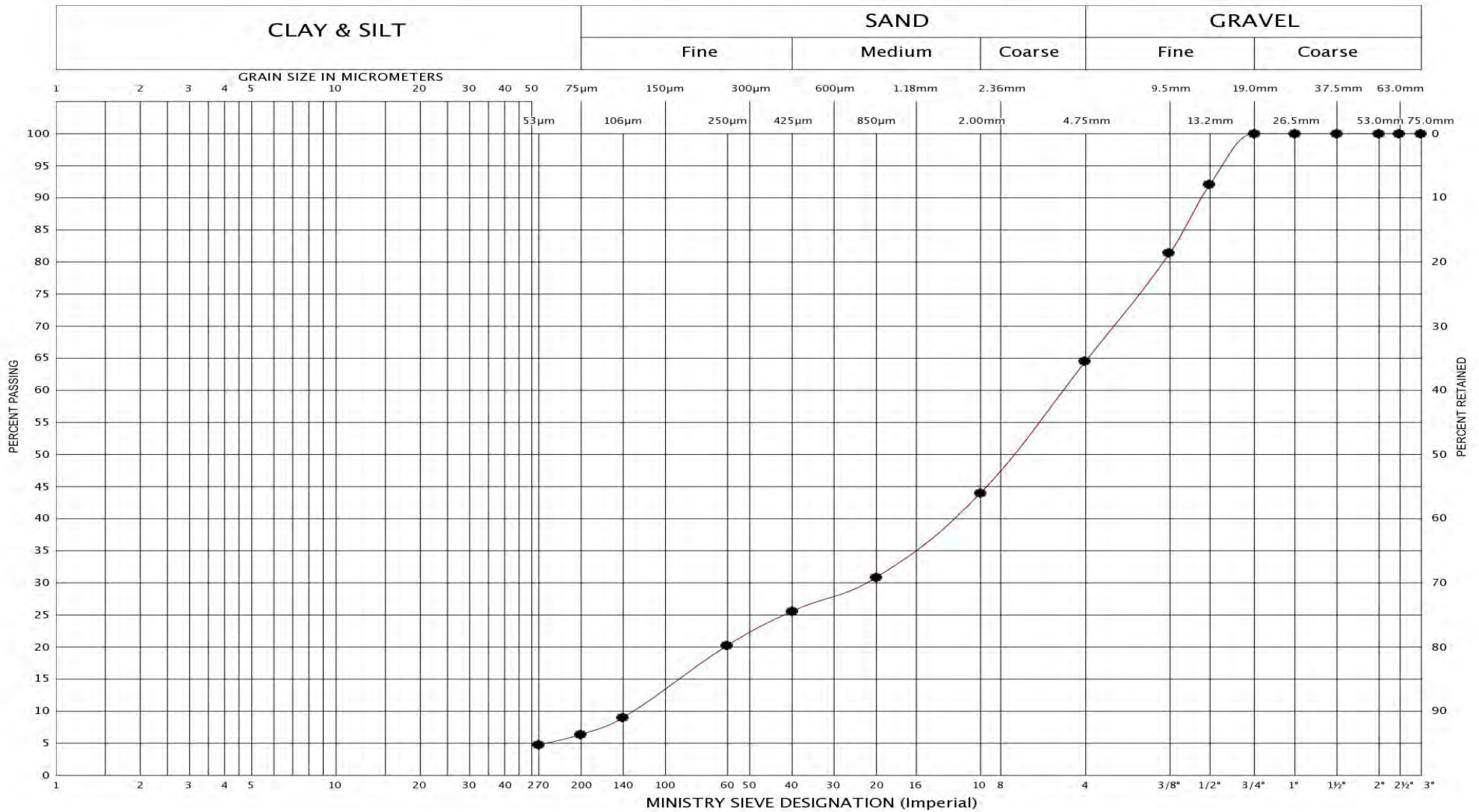
Peto MacCallum Ltd.



Geoffrey R. White, P.Eng.  
Director  
Manager, Geotechnical and Geoenvironmental Services

SJ/GRW:tc

# UNIFIED SOIL CLASSIFICATION SYSTEM



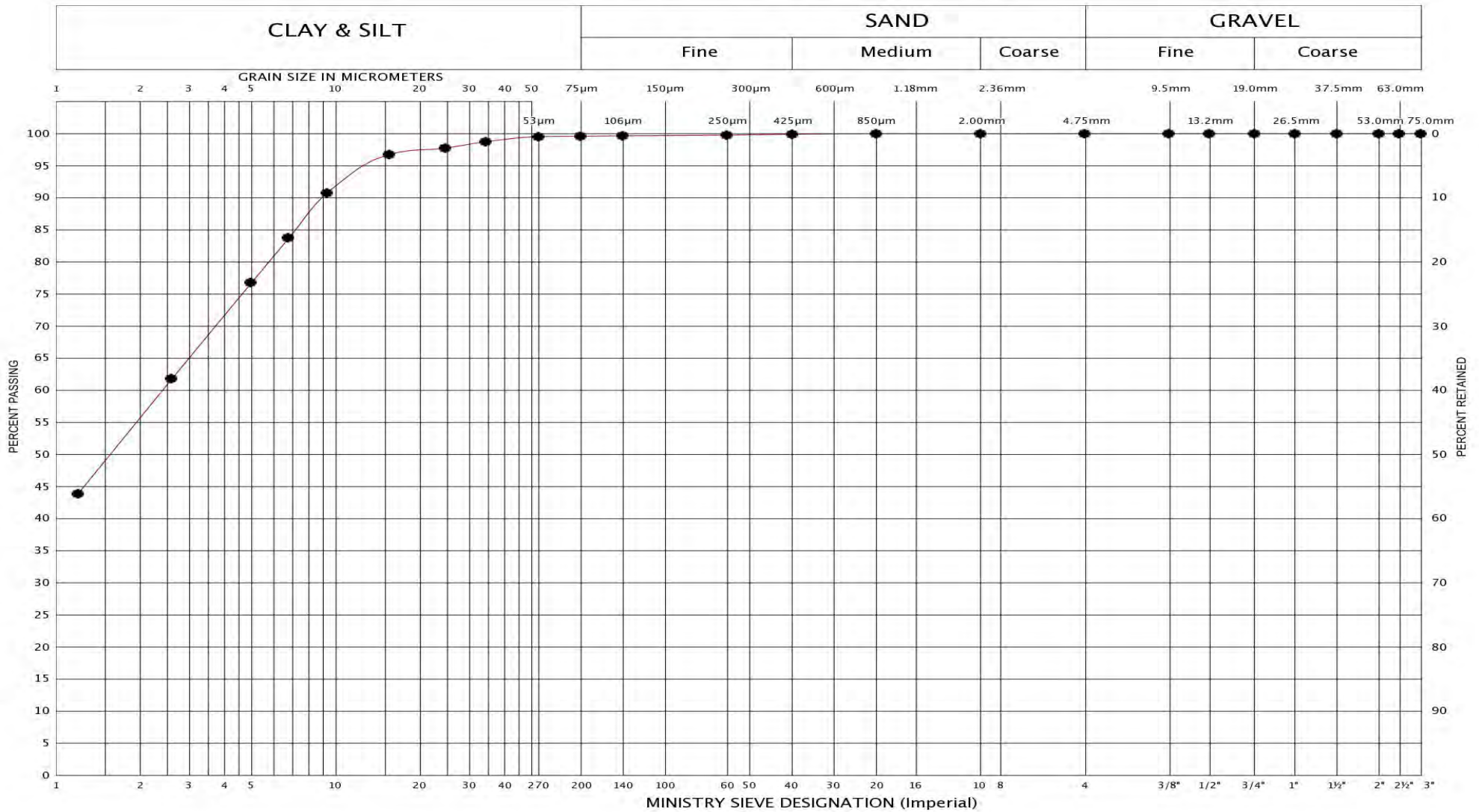
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	<b>SYMBOL</b>	●

**GRAIN SIZE DISTRIBUTION**  
SAND AND GRAVEL, Trace Silt

FIG No.:	1
Project No.:	19BF032



# UNIFIED SOIL CLASSIFICATION SYSTEM

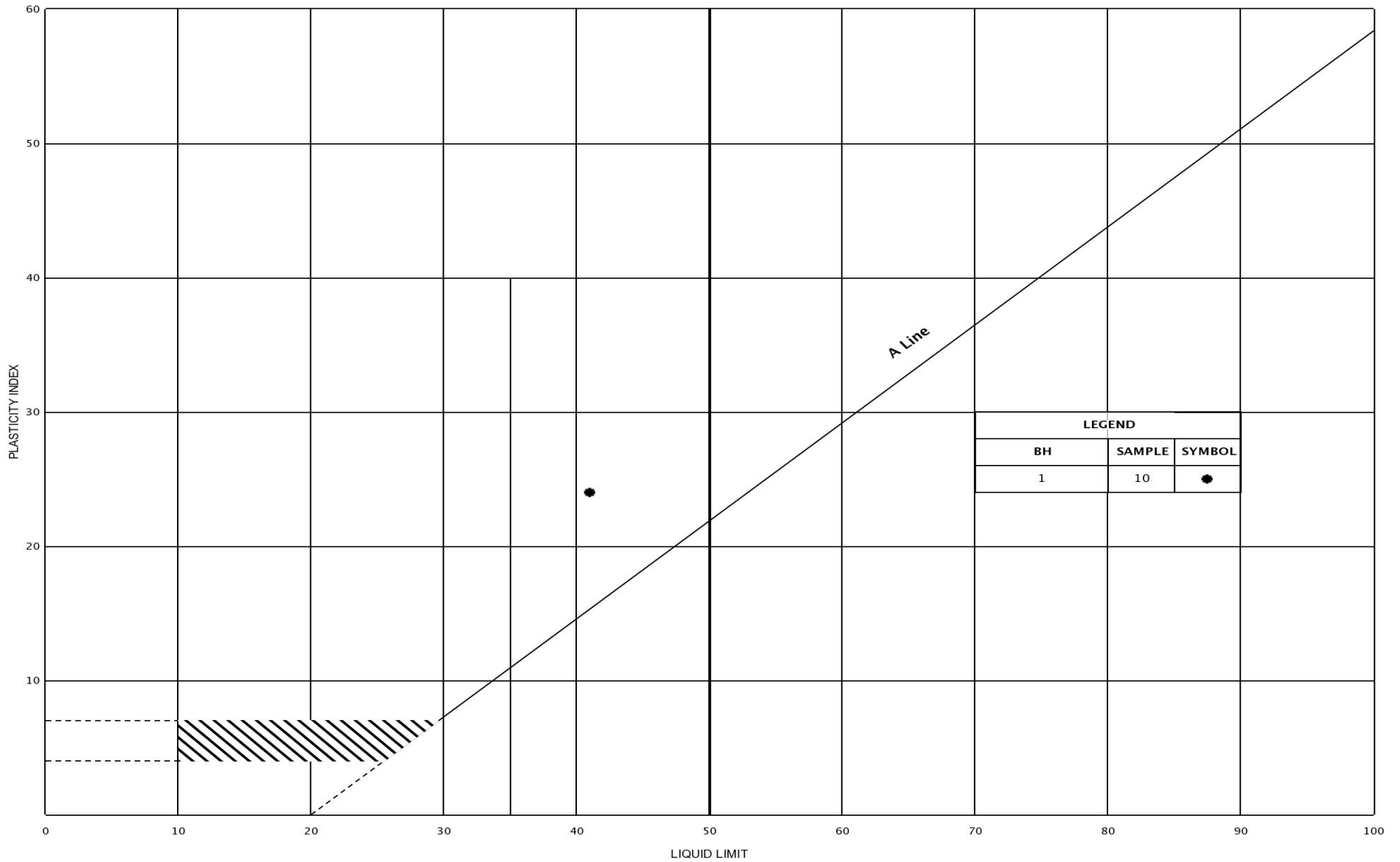


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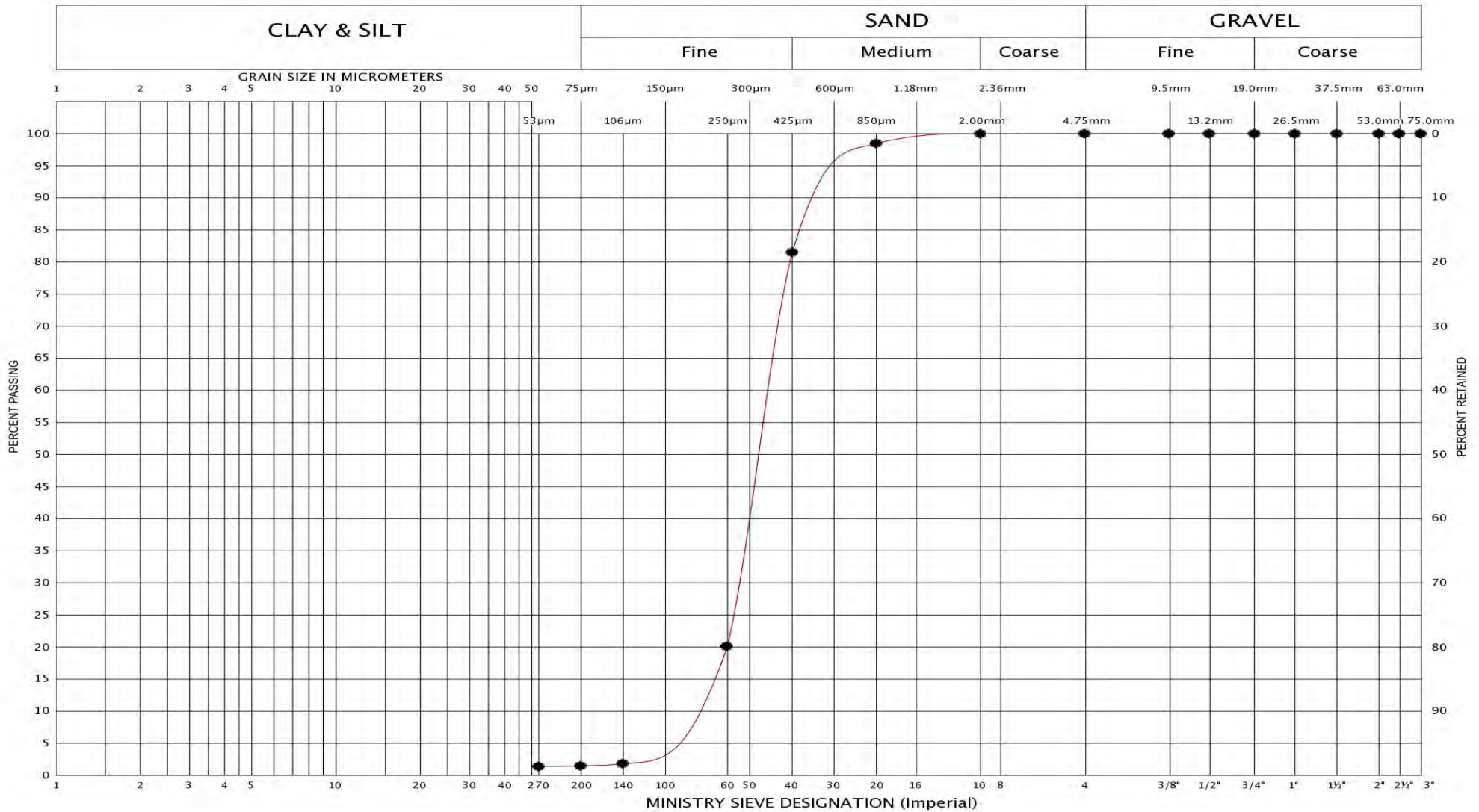
**GRAIN SIZE DISTRIBUTION**  
SILTY CLAY TO CLAYEY SILT

FIG No.: 2

Project No.: 19BF032



# UNIFIED SOIL CLASSIFICATION SYSTEM



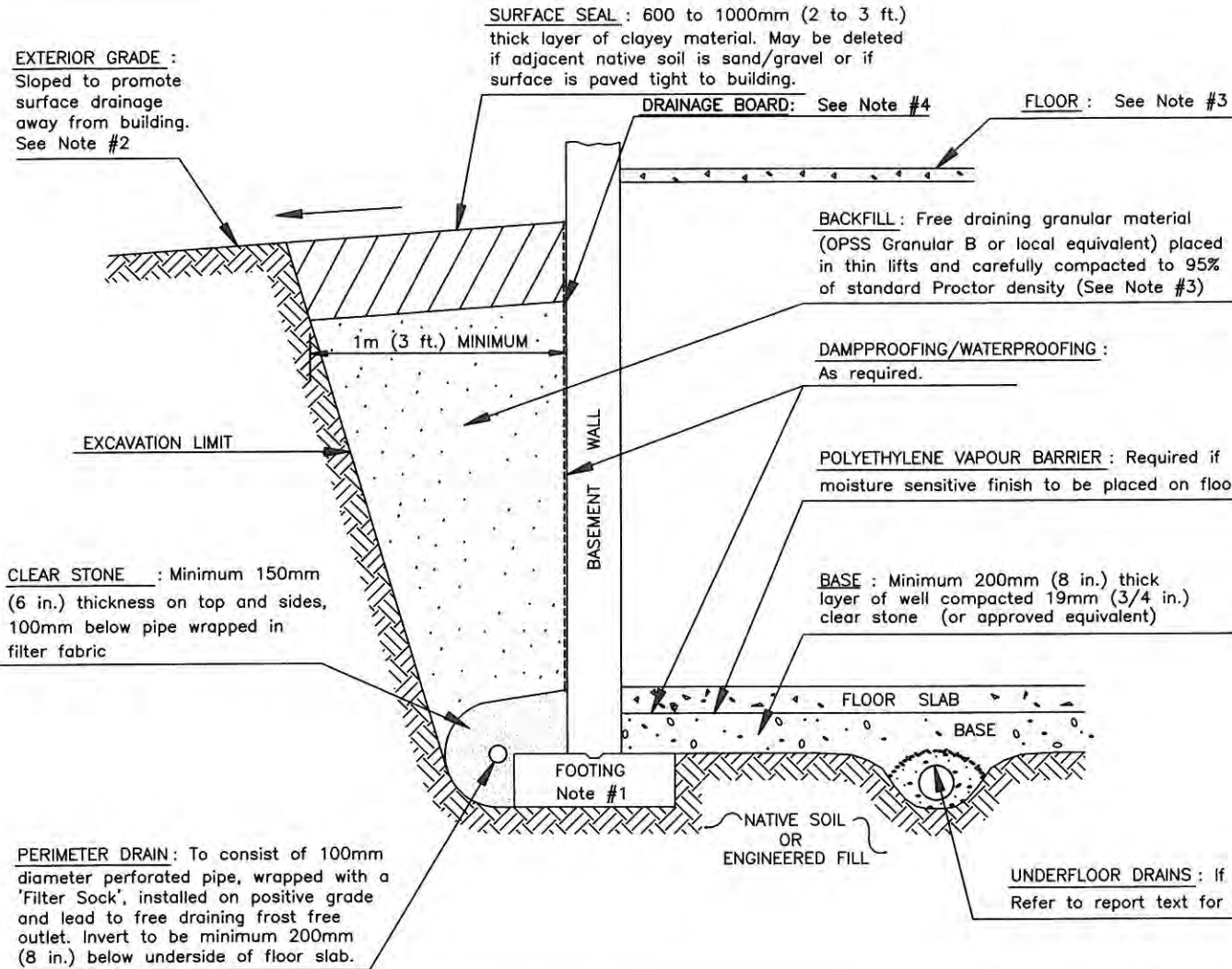
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	<b>SYMBOL</b>	●

## GRAIN SIZE DISTRIBUTION

SAND, Trace Silt

FIG No.: 4

Project No.: 19BF032



**NOTES**

1. Footing may be constructed by placement of structural concrete neat against natural soil. Drain to be installed in a similar manner immediately above footing maintaining 200mm (8 in.) distance between top of drain and underside of floor slab.
2. Exterior grade to be minimum 300mm (12 in.) below interior floor slab, or other means established to prevent entry of surface water into building through building openings.
3. Basement wall to be supported by floor system or interior bracing prior to commencement of backfill placement. Heavy construction equipment should not be permitted within a distance from the foundation wall equivalent to half the wall height. Overcompaction of backfill to be avoided as excessive lateral earth pressure may result.
4. A proprietary drainage board product may be used with compacted native soil as backfill against the wall.
5. Refer to text for details regarding founding levels, competent bearing material and construction details specific to particular site.

STANDARD DRAWING

GENERAL RECOMMENDATIONS REGARDING DRAINAGE AND BACKFILL REQUIREMENTS FOR BASEMENT WALL AND FLOOR SLAB CONSTRUCTION



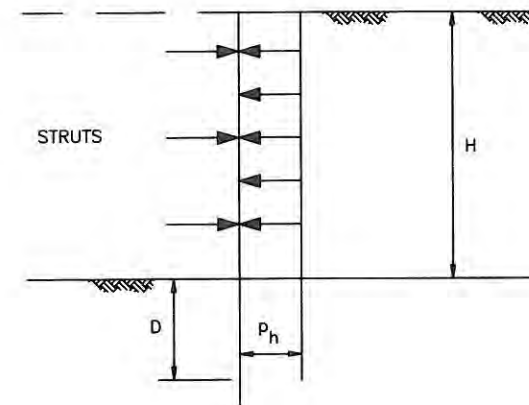
**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DRAWN:	N/A	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	APR. 2019	N.T.S.	19BF032	5
APPROVED:	GW				

NOTES

1. The actual magnitude and distribution of the horizontal earth pressures which will act on the bracing system are dependent upon the permissible lateral/vertical movements adjacent to the excavation, the soil type, groundwater conditions, drainage provisions, temporary/permanent surcharge loads, the type of bracing system adopted, weather conditions, quality of workmanship and length of time the excavation will be supported. Hence, the recommended pressure diagram and design parameters should be reviewed when construction details, schedule and type of support system are established.
2. Stability of base of excavation must be confirmed when bracing system design, excavation geometry and surcharge loads are established. If groundwater table is well above base of excavation and/or artesian conditions exist, local lowering of the groundwater level will be necessary to prevent bottom heave/piping of the base of the excavation.
3. Earth pressure diagram is applicable to maximum depth of cut of 12m (40 ft.).
4. Structural components of bracing system should be confirmed adequate for each level of excavation.
5. If sheeting will not permit drainage, bracing system must be designed to resist water pressure.
6. Surcharge loads such as street/construction traffic, supported utilities, adjacent foundations, temporary stockpiles and other loads carried by bracing system are not included in earth pressure diagram.
7. Temporary surcharge loading should not be closer to the face of the excavation than half the depth of excavation unless accounted for in bracing design.
8. If settlement sensitive structures are located near the excavation, special measures should be undertaken to control settlements. A condition survey should be conducted prior to construction and appropriate monitoring (surface and in situ) carried out during construction.
9. Earth pressure diagram is applicable for relatively short construction periods. If excavation is to be open for long periods, monitoring of deformation is essential, earth pressure diagram must be reviewed, and remedial works may be required.
10. Earth pressure diagram does not account for extended periods of exposure of the excavation to freezing temperatures.
11. Bracing system should be regularly examined for signs of distress.
12. All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.
13. This sheet should be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.

EARTH PRESSURE DIAGRAM



$P_h$  = design lateral earth pressure  
 $= 0.65K\gamma H$   
 $K$  = lateral earth pressure coefficient  
 $\gamma$  = unit weight of soil  
 $H$  = depth of excavation  
 $D$  = depth of embedment of soldier piles (if used).

RECOMMENDED DESIGN PARAMETERS

$K = 0.30$  (movement of retained soil acceptable)  
 $= 0.50$  (movement of adjacent structures/facilities unacceptable)  
 $\gamma = 20.0 \text{ kN/m}^3$

LATERAL EARTH PRESSURE DISTRIBUTION

MULTI-BRACED CUTS IN COHESIONLESS SOILS



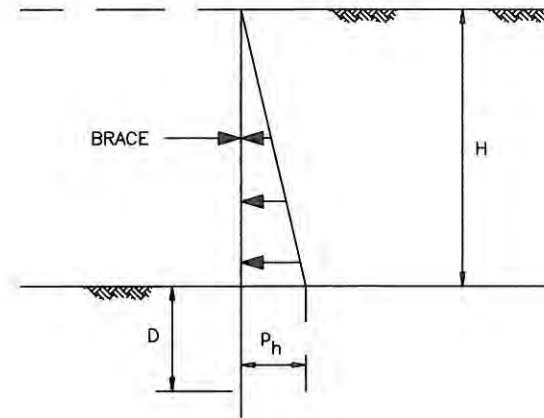
**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DRAWN:	DP	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	APR. 2020	N.T.S.	19BF032	6
APPROVED:	GW				

NOTES

1. The actual magnitude and distribution of the horizontal earth pressures which will act on the bracing system are dependent upon the permissible lateral/vertical movements adjacent to the excavation, the soil type, groundwater conditions, drainage provisions, temporary/permanent surcharge loads, the type of bracing system adopted, weather conditions, quality of workmanship and length of time the excavation will be supported. Hence, the recommended pressure diagram and design parameters should be reviewed when construction details, schedule and type of support system are established.
2. Stability of base of excavation must be confirmed when bracing system design, excavation geometry and surcharge loads are established. If groundwater table is well above base of excavation and/or artesian conditions exist, local lowering of the groundwater level will be necessary to prevent bottom heave/piping of the base of the excavation.
3. Earth pressure diagram is applicable to maximum depth of cut of 12m (40 ft.).
4. Structural components of bracing system should be confirmed adequate for each level of excavation.
5. If sheeting will not permit drainage, bracing system must be designed to resist water pressure.
6. Surcharge loads such as street/construction traffic, supported utilities, adjacent foundations, temporary stockpiles and other loads carried by bracing system are not included in earth pressure diagram.
7. Temporary surcharge loading should not be closer to the face of the excavation than half the depth of excavation unless accounted for in bracing design.
8. If settlement sensitive structures are located near the excavation, special measures should be undertaken to control settlements. A condition survey should be conducted prior to construction and appropriate monitoring (surface and insitu) carried out during construction.
9. Earth pressure diagram is applicable for relatively short construction periods. If excavation is to be open for long periods, monitoring of deformation is essential, the earth pressure diagram must be reviewed, and remedial works may be required.
10. Earth pressure diagram does not account for extended periods of exposure of the excavation to freezing temperatures.
11. Bracing system should be regularly examined for signs of distress.
12. All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.
13. This sheet should be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.

EARTH PRESSURE DIAGRAM



$p_h$  = design lateral earth pressure  
 $= K\gamma H$

$K$  = lateral earth pressure coefficient

$\gamma$  = unit weight of soil

$H$  = depth of excavation

$D$  = depth of embedment of soldier piles (if used).

RECOMMENDED DESIGN PARAMETERS

- $K = 0.30$  (movement of retained soil acceptable)
- $= 0.50$  (movement of adjacent structures/facilities unacceptable)
- $\gamma = 20.0 \text{ kN/m}^3$

LATERAL EARTH PRESSURE DISTRIBUTION

SINGLY-BRACED CUTS IN COHESIONLESS SOILS



**Peto MacCallum Ltd.**  
 CONSULTING ENGINEERS

DRAWN:	DP	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	APR. 2020	N.T.S.	19BF032	7
APPROVED:	GW				

NOTES

1. The need to underpin existing footings/utilities is dependent upon soil type, proximity of the existing facility to the face of the excavation, loads imposed on the foundation and permissible movements.

ZONE A:

Foundations of relatively heavy and/or settlement sensitive structures/utilities located in Zone A generally require underpinning.

ZONE B:

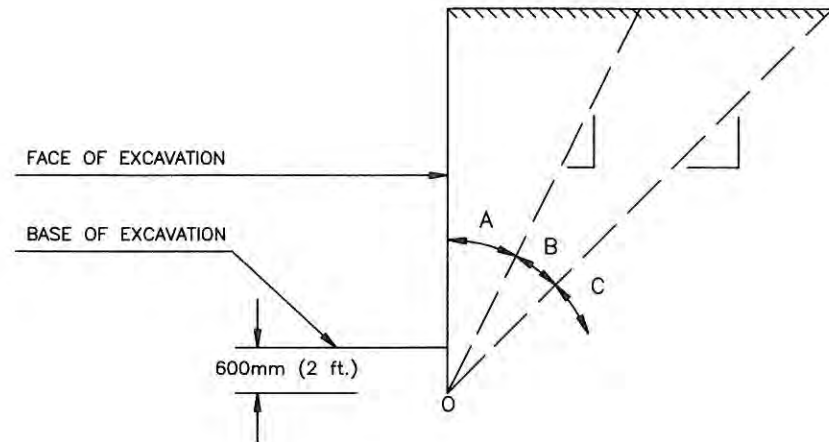
Foundations of structures located within Zone B generally do not require underpinning. Consideration should be given to underpinning of settlement sensitive utilities or heavy foundation units located in this zone.

ZONE C:

Utilities and foundations located within Zone C do not normally require underpinning.

Underpinning of foundations located in Zones A and B should extend at least into Zone C.

2. As an alternative to underpinning, it may be possible to control movement of existing utilities and foundations by supporting the face of the excavation with bracing/tiebacks or a rigid (caisson) wall. Horizontal and vertical earth pressures imposed on the excavation wall by non-underpinned foundations must be considered in the design of the support system.
3. A condition survey should be conducted prior to construction and appropriate monitoring (surface and insitu) carried out during construction to monitor any movement which may occur.
4. All work should be carried out in accordance with the Occupational Health and Safety Act and local regulations. Good quality workmanship and construction practices are to be employed.
5. This sheet is to be read in conjunction with text of report for this project. Additional comments and recommendations concerning these general guidelines will be provided if required.



If the base of excavation is in bedrock, point "O" is drawn through the intersection point of the wall and the surface of sound bedrock.

GENERAL GUIDELINES REGARDING UNDERPINNING OF FOUNDATIONS/UTILITIES LOCATED CLOSE TO EXCAVATION



**Peto MacCallum Ltd.**  
CONSULTING ENGINEERS

DRAWN:	DP	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	APR. 2020	N.T.S.	19BF032	8
APPROVED:	GW				

# LIST OF ABBREVIATIONS



## PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

## DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

<u>CONSISTENCY</u>	<u>N (blows/0.3 m)</u>	<u>c (kPa)</u>	<u>DENSENESS</u>	<u>N (blows/0.3 m)</u>
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		
WTLL	Wetter Than Liquid Limit			
WTPL	Wetter Than Plastic Limit			
APL	About Plastic Limit			
DTPL	Drier Than Plastic Limit			

## TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core
	PH	Sample Advanced Hydraulically	
	PM	Sample Advanced Manually	

## SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

## LOG OF BOREHOLE NO. 1

17T 586514E 4954206N

**PROJECT** Proposed Luxury Condominium - 217 Dunlop Street East

**LOCATION** Barrie, Ontario

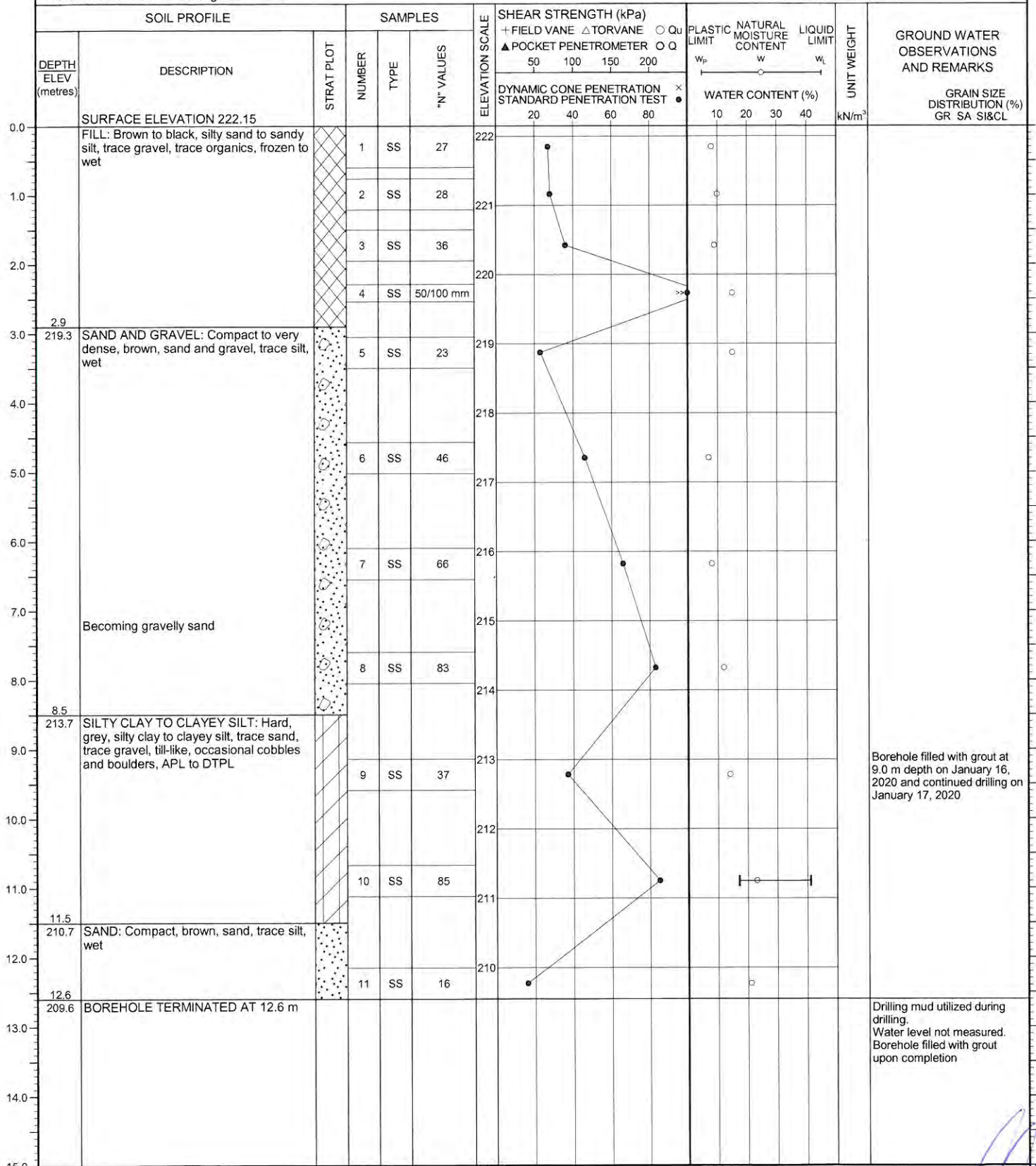
**BORING METHOD** 3" Casing and Tricone

**BORING DATE** January 15, 16, 17, 2020

**PML REF.** 19BF032

**ENGINEER** GW

**TECHNICIAN** DP



Borehole filled with grout at 9.0 m depth on January 16, 2020 and continued drilling on January 17, 2020

Drilling mud utilized during drilling.  
Water level not measured.  
Borehole filled with grout upon completion

**NOTES**

## LOG OF BOREHOLE NO. 2

**PROJECT** Proposed Luxury Condominium - 217 Dunlop Street East

**LOCATION** Barrie, Ontario

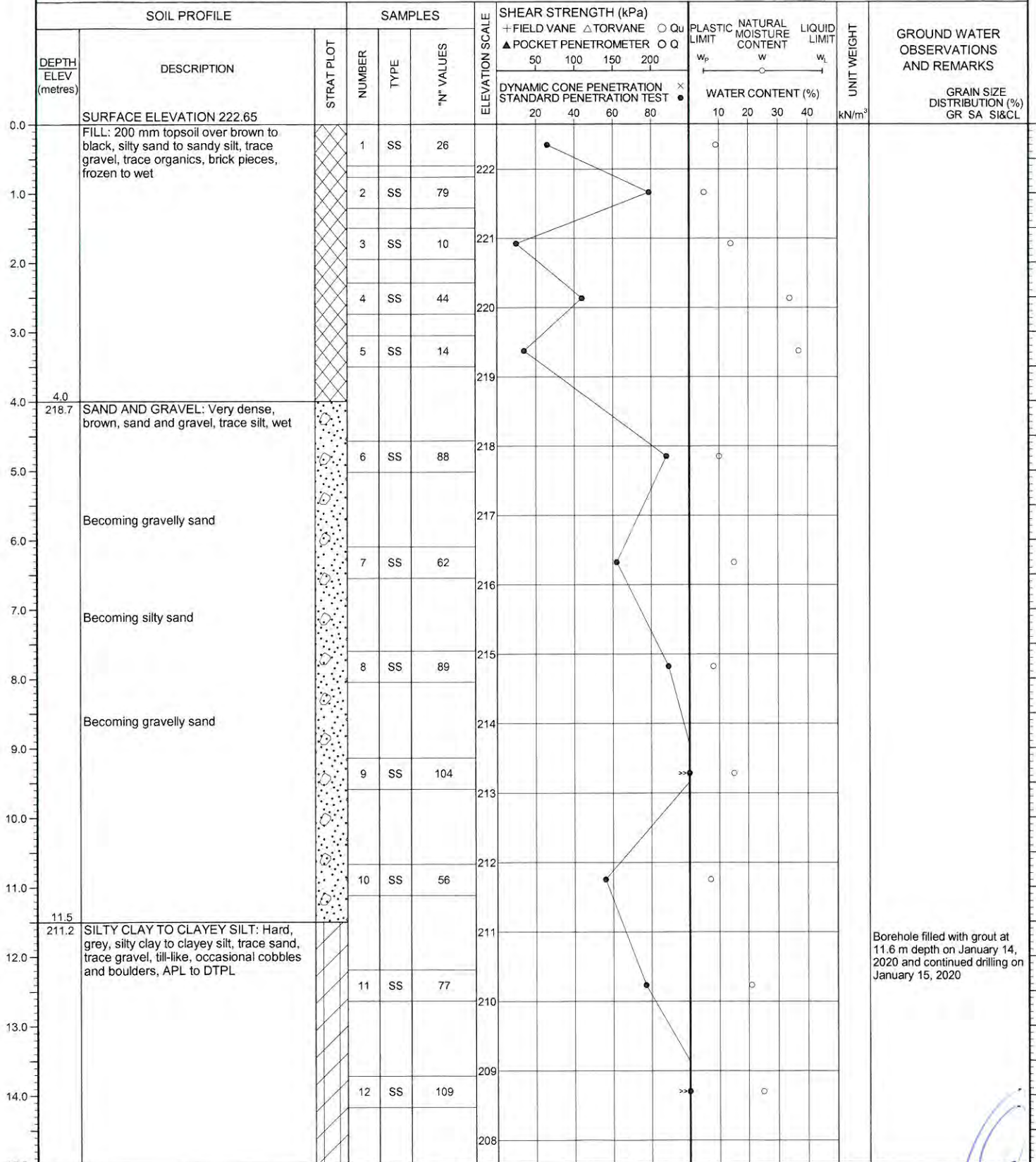
**BORING METHOD** 3" Casing and Tricone

**BORING DATE** January 13, 14, 15, 2020

**PML REF.** 19BF032

**ENGINEER** GW

**TECHNICIAN** DP



Borehole filled with grout at 11.6 m depth on January 14, 2020 and continued drilling on January 15, 2020

**NOTES**

## LOG OF BOREHOLE NO. 2

17T 586482E 4954272N

**PROJECT** Proposed Luxury Condominium - 217 Dunlop Street East

**PML REF.** 19BF032

**LOCATION** Barrie, Ontario

**BORING DATE** January 13, 14, 15, 2020

**ENGINEER** GW

**BORING METHOD** 3" Casing and Tricone

**TECHNICIAN** DP

SOIL PROFILE			SAMPLES			SHEAR STRENGTH (kPa)		PLASTIC NATURAL LIQUID			UNIT WEIGHT	GROUND WATER OBSERVATIONS AND REMARKS	
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	+ FIELD VANE    Δ TORVANE    ○ Qu		LIMIT	MOISTURE CONTENT			LIMIT
							▲ POCKET PENETROMETER    ○ Q						
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST		WATER CONTENT (%)			kN/m <sup>3</sup>	GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL	
						x                      ●		10    20    30    40					
15.0	CONTINUED FROM PREVIOUS PAGE												
16.0	SILTY CLAY TO CLAYEY SILT: Hard, grey, silty clay to clayey silt, trace sand, trace gravel, till-like, occasional cobbles and boulders, APL to DTPL		13	SS	107	207							
16.0	SAND: Very dense, brown to grey, sand, trace silt, wet					206							
17.0			14	SS	95								
17.2	BOREHOLE TERMINATED AT 17.2 m												
205.5													Drilling mud utilized during drilling. Water level not measured. Borehole filled with grout upon completion
18.0													
19.0													
20.0													
21.0													
22.0													
23.0													
24.0													
25.0													
26.0													
27.0													
28.0													
29.0													
30.0													

**NOTES**

## LOG OF BOREHOLE NO. 3

17T 605084E 4915943N

**PROJECT** Proposed Luxury Condominium - 217 Dunlop Street East

**PML REF.** 19BF032

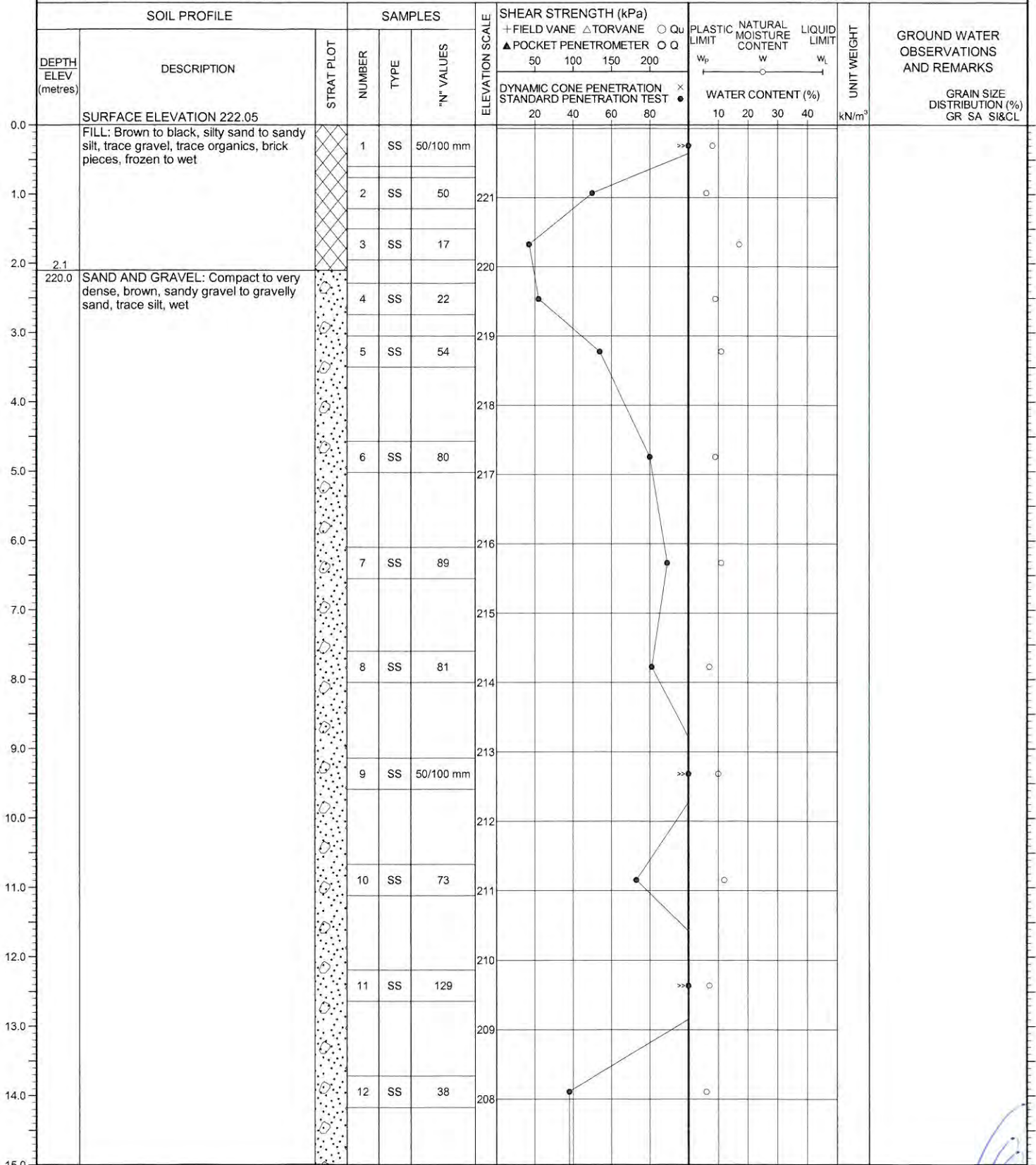
**LOCATION** Barrie, Ontario

**BORING DATE** January 9, 10, 13, 2020

**ENGINEER** GW

**BORING METHOD** 3" Casing and Tricone

**TECHNICIAN** DP



**NOTES**

## LOG OF BOREHOLE NO. 3

17T 605084E 4915943N

**PROJECT** Proposed Luxury Condominium - 217 Dunlop Street East

**PML REF.** 19BF032

**LOCATION** Barrie, Ontario

**BORING DATE** January 9, 10, 13, 2020

**ENGINEER** GW

**BORING METHOD** 3" Casing and Tricone

**TECHNICIAN** DP

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa)				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT kN/m <sup>3</sup>	GROUND WATER OBSERVATIONS AND REMARKS
DEPTH ELEV (metres)	DESCRIPTION		NUMBER	TYPE	"N" VALUES		+ FIELD VANE	△ TORVANE	○ Qu	▲ POCKET PENETROMETER					
						50	100	150	200						
						DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST									
						20	40	60	80						
15.0	CONTINUED FROM PREVIOUS PAGE														
207.1	SILTY CLAY TO CLAYEY SILT: Hard, grey, silty clay to clayey silt, trace sand, trace gravel, till-like, occasional cobbles and boulders, APL to DTPL		13	SS	38										
16.0															
17.0															
17.2	GRAVELLY SAND: Very dense, brown-grey, gravelly sand, trace silt, wet		14	SS	123										
204.9	BOREHOLE TERMINATED AT 17.2 m														
18.0															
19.0															
20.0															
21.0															
22.0															
23.0															
24.0															
25.0															
26.0															
27.0															
28.0															
29.0															
30.0															




Borehole filled with grout at 15.6 m depth on January 10, 2020 and continued drilling on January 13, 2020

Drilling mud utilized during drilling. Water level not measured. Borehole filled with grout upon completion

**NOTES**



**KEY PLAN**  
CITY OF BARRIE, ONTARIO

- LEGEND:**
-  **BH 1**  
**EL 222.15** BOREHOLE 1 LOCATION  
SURFACE ELEVATION
  -  **BH TP 21**  
**EL 223.50** BOREHOLE TP 21 LOCATION (BY OTHERS)  
SURFACE ELEVATION  
(DRILLED SEPT. 2005)
  -  APPROXIMATE CURRENT SITE LIMITS

**REFERENCE:**  
BASE PLAN PROVIDED BY SALTER PILON ARCHITECTURE



**BOREHOLE LOCATION PLAN**

PROPOSED LUXURY CONDOMINIUM  
217 DUNLOP STREET EAST  
CITY OF BARRIE, ONTARIO



DRAWN	DP	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	APR. 2020	AS SHOWN	19BF032	1
APPROVED	GW				



## **APPENDIX A**

### Statement of Limitations



## **STATEMENT OF LIMITATIONS**

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.



## **STATEMENT OF LIMITATIONS (continued)**

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may affect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.



## **APPENDIX B**

Boreholes by Others



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East

CLIENT: 2012292 Ontario Limited

LOCATION: Barrie, Ontario

# LOG OF BOREHOLE ..21..

PROJECT No.: 3-04-0185

BORING DATE: December 18, 2005

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\chi_x$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)			
							20	40	60	80	10	20	30	
0	GROUND SURFACE		223.5											
0	TOPSOIL - 300mm Brown		0.0	1	SS	8	x							
	Loose to Compact	Moist												
1	SILTY SAND, some gravel			2	SS	22	x							
				3	SS	23	x							
2				4	SS	5	x							
3	Stone/gravel		220.0	5	SS	74		x						
4	Brown	Compact to Very Dense	3.5											
5	GRAVELLY SAND,			6	SS	77		x						
		Wet												
6				7	SS	36	x							
7														
8				8	SS	55		x						
9				9	SS	47		x						

Continued



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East

CLIENT: 2012292 Ontario Limited

LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..21..

PROJECT No.: 3-04-0185

BORING DATE: December 21, 2005

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $X_x$				WATER CONTENT (%)	INSTALLATION INFORMATION				
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80						
							SHEAR STRENGTH kPa				10			20		
CME55 Crawler-mounted Drill Rig / 108mm Diameter Hollow Augers / Casing & Wash Boring	Continued		213.5													
	Grey Dense Wet		10.0													
	GRAVELLY SAND			10	SS	37										
					11	SS	46									
				210.5												
	Grey Hard Wet		13.5													
	SILTY CLAY to CLAYEY SILT, some gravel (TILL)				12	SS	41									
					13	SS	50/150mm									
					14	SS	50/100mm									
					15	SS	50/125mm									



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..21..

PROJECT No.: 3-04-0185  
 BORING DATE: December 22, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $\times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa								
							20	40	60	80					
20	Continued Grey CLAYEY SILT	Hard Moist	203.5 20.0 203.4	16	SS	50	150mm								1. Borehole advanced to 6m using hollow stem augers; casing and wash boring then continued.  2. Water level at approximately 5.5m (elev. 218.0m).
	End of Borehole		20.1												
21															
22															
23															
24															
25															
26															
27															
28															
29															



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East

CLIENT: 2012292 Ontario Limited

LOCATION: Barrie, Ontario

# LOG OF BOREHOLE ..25..

PROJECT No.: 3-04-0185

BORING DATE: December 18, 2005

ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			STRATA PLOT	SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION				ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	20	40	60	80	SHEAR STRENGTH $kPa$ nat.V - +    0 - 0 rem.V - @    u - 0		
0	GROUND SURFACE			221.9											
0	Brown	Loose	Moist	0.0	1	SS	9	x							
1	SAND, some gravel, trace brick fragments (FILL)				2	SS	5	x							
2	Brown    Very Dense to Compact    Moist			219.9	3	SS	6	x							
2				2.0	4	SS	54		x						
3	SAND, fine to medium, some gravel				5	SS	40		x						
4															
5			Wet		6	SS	50		x						
6															
7					7	SS	22		x						
8					8	SS	20		x						
8	Brown    Very Dense    Wet			213.4											
8				8.5											
9	GRAVELLY SAND				9	SS	77			x					
	Continued														



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..25..

PROJECT No.: 3-04-0185  
 BORING DATE: December 18, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES		PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)			INSTALLATION INFORMATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	SHEAR STRENGTH kPa				WATER CONTENT (%)				
						20	40	60	80	10	20	30		
CME55 Crawler-mounted Drill Rig / 108mm Diameter Hollow Stem Augers / Casing & Wash Boring	Continued		211.9											
	Brown Compact to Very Dense Wet		10.0											
	GRAVELLY SAND			10	SS	J2	x							
					11	SS	73		x					
	Brown Compact Wet		208.6											
	13.3													
	SAND, some gravel and some clay			12	SS	14	x							
	Brown Compact to Very Dense Wet		207.4											
	14.5													
	GRAVELLY SAND				13	SS	20	x						
					14	SS	64		x					
	Grey Hard Moist		204.1											
	17.8													
	CLAYEY SILT, some gravel (TILL)				15	SS	88			x				
Continued														



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

# LOG OF BOREHOLE ..25..

PROJECT No.: 3-04-0185  
 BORING DATE: December 16, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT $X_x$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa							
							20	40	60	80	20	40	60	
20	Continued Grey Very Dense Wet		201.9 20.0	16	SS	50	125mm							1. Water level at approximately 4m (elev. 218.0m).
21	SILTY FINE SAND, trace gravel			17	SS	50	125mm							
22														
23				18	SS	91				x				
23	End of Borehole		198.6 23.3											
24														
25														
26														
27														
28														
29														



## **APPENDIX C**

Engineered Fill

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

## 1. Purpose

The site-specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

## 2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

## 3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three-dimensional extent of filling.

## 4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and, in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

## 5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

## 6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

## 7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full-time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

## 8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

## 9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

## 10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

## 11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.



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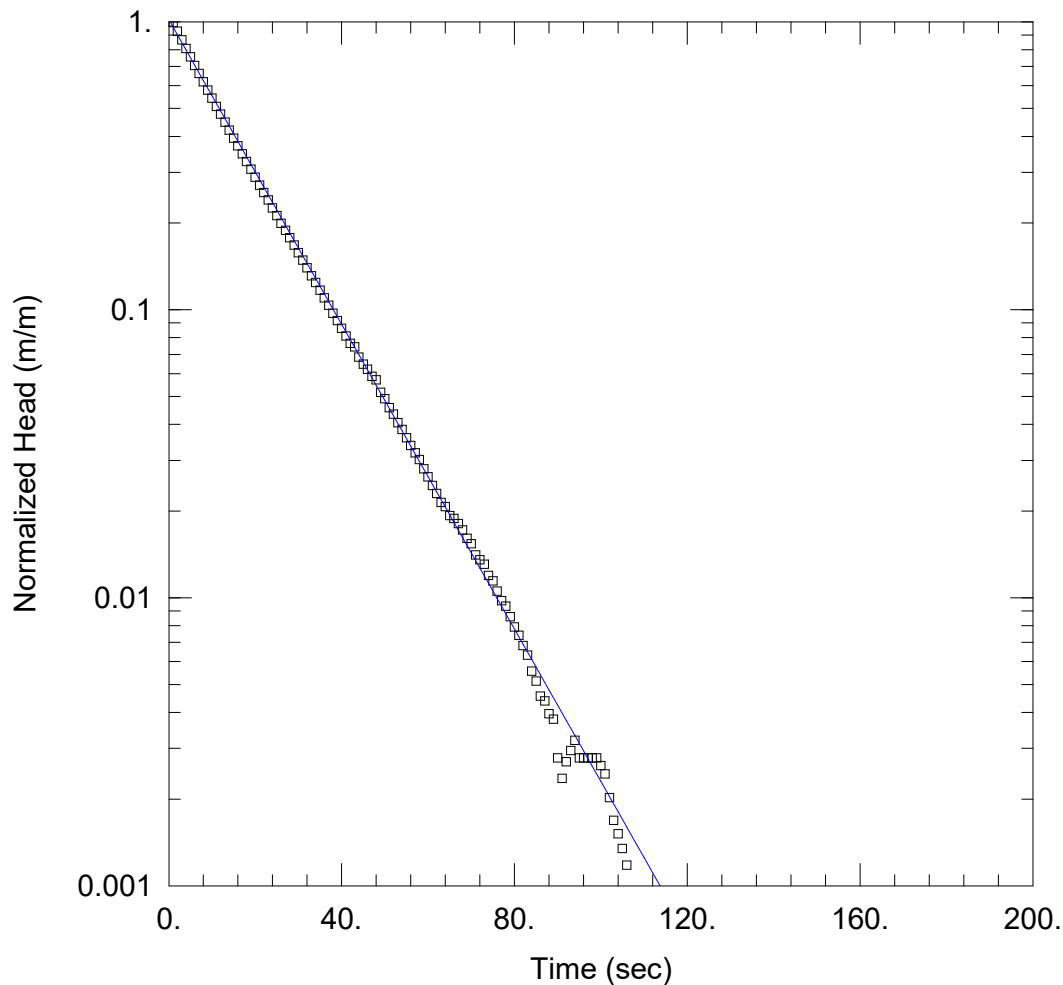
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**APPENDIX E**

**Hydraulic Conductivity Testing**

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### WELL TEST ANALYSIS

Data Set: L:\...MW24.aqt

Date: 06/26/20

Time: 10:23:59

### PROJECT INFORMATION

Company: Azimuth Environmental

Client: PBM Realty

Project: 18-359

Location: Barrie

Test Well: MW-24

Test Date: April 24, 2020

### AQUIFER DATA

Saturated Thickness: 4.33 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (MW-24)

Initial Displacement: -1.187 m

Static Water Column Height: 4.33 m

Total Well Penetration Depth: 4.33 m

Screen Length: 2.5 m

Casing Radius: 0.025 m

Well Radius: 0.1 m

Gravel Pack Porosity: 0.

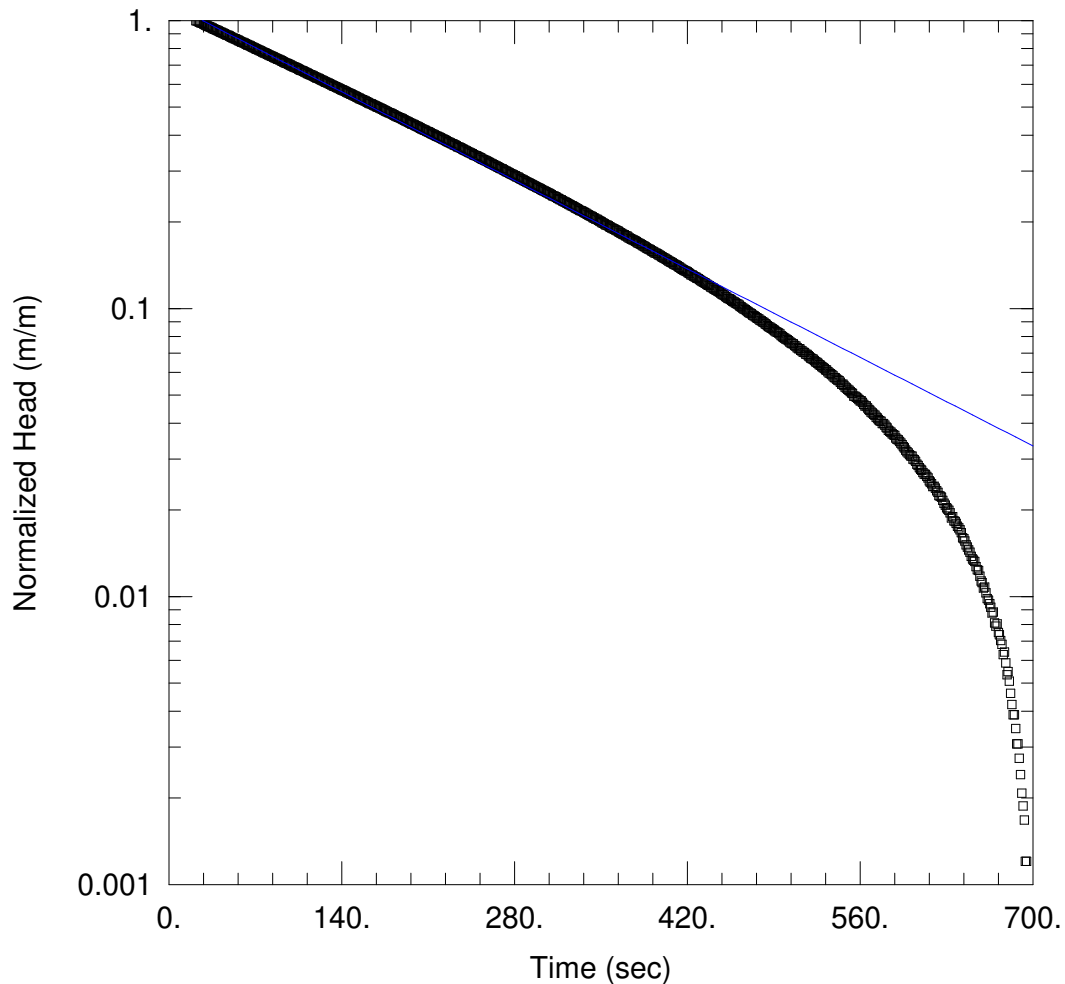
### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bower-Rice

K = 2.089E-5 m/sec

y0 = -1.209 m



### WELL TEST ANALYSIS

Data Set: L:\...\18-359 TRP2 Falling Head Test.aqt

Date: 11/09/20

Time: 13:18:41

### PROJECT INFORMATION

Company: Azimuth Environmental

Client: PBM Reality

Project: 18-359

Location: 217 Dunlop Street East

Test Well: TRP2

Test Date: May 2020

### AQUIFER DATA

Saturated Thickness: 5.3 m

Anisotropy Ratio (Kz/Kr): 1.

### WELL DATA (TRP2)

Initial Displacement: -1.494 m

Static Water Column Height: 5.3 m

Total Well Penetration Depth: 6.8 m

Screen Length: 3. m

Casing Radius: 0.025 m

Well Radius: 0.1 m

Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 1.614E-6 m/sec

y0 = -1.715 m



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## **APPENDIX F**

### **Water Balance Information**

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**Table A: Pre-Development**

Catchment Designation	Landscaped Grass	Impervious (parking, driveway and former foundation)	Total
Area (m <sup>2</sup> )	1,111	900	2,011
Pervious Area (m <sup>2</sup> )	1,111	0	1,111
Impervious Area (m <sup>2</sup> )	0	900	900
<b>Infiltration Factors</b>			
Topography Infiltration Factor	0.1	0	
Soil Infiltration Factor	0.4	0	
Land Cover Infiltration Factor	0.05	0	
Infiltration Factor	0.55	0	
Run-Off Coefficient	0.45	1	
Run-Off From Impervious Surfaces	0.8	0.8	
<b>Inputs (Per Unit Area)</b>			
Precipitation (mm/yr)	912	912	912
Rainfall (mm/yr)	657	657	657
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
<b>Total Inputs (mm/yr)</b>	<b>912</b>	<b>912</b>	<b>912</b>
<b>Outputs (Per Unit Area)</b>			
Precipitation Surplus (mm/yr)	431	730	565
Net Surplus (mm/yr)	431	730	565
Evapotranspiration (mm/yr)	481	182	347
Infiltration (mm/yr)	237	0	131
Surplus Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	237	0	131
Run-Off Pervious Areas (mm/yr)	194	0	107
Run-Off Impervious Areas (mm/yr)	0	730	327
Total Run-Off (mm/yr)	194	730	434
<b>Total Outputs (mm/yr)</b>	<b>912</b>	<b>912</b>	<b>912</b>
<b>Difference (Inputs - Outputs)</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Inputs (Volumes)</b>			
Precipitation (m <sup>3</sup> /yr)	1,013	821	1,834
Run-On (m <sup>3</sup> /yr)	0	0	0
Other Inputs (m <sup>3</sup> /yr)	0	0	0
<b>Total Inputs (m<sup>3</sup>/yr)</b>	<b>1,013</b>	<b>821</b>	<b>1,834</b>
<b>Outputs (Volumes)</b>			
Precipitation Surplus (m <sup>3</sup> /yr)	479	657	1,135
Net Surplus (m <sup>3</sup> /yr)	479	657	1,135
Evapotranspiration (m <sup>3</sup> /yr)	534	164	699
Infiltration (m <sup>3</sup> /yr)	263	0	263
Surplus Infiltration (m <sup>3</sup> /yr)	0	0	0
<b>Total Infiltration (m<sup>3</sup>/yr)</b>	<b>263</b>	<b>0</b>	<b>263</b>
Run-Off Pervious Areas (m <sup>3</sup> /yr)	215	0	215
Run-Off Impervious Areas (m <sup>3</sup> /yr)	0	657	657
Total Run-Off (m <sup>3</sup> /yr)	215	657	872
<b>Total Outputs (m<sup>3</sup>/yr)</b>	<b>1,013</b>	<b>821</b>	<b>1,834</b>
<b>Difference (Inputs - Outputs)</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Table B: Post-Development (no mit)**

Catchment Designation	Landscaped Grass	Parking, Driveway, Other Imperivous	Rooftop	Total
Area (m <sup>2</sup> )	407	304	1,300	2,011
Pervious Area (m <sup>2</sup> )	407	0	0	407
Impervious Area (m <sup>2</sup> )	0	304	1,300	1,604
<b>Infiltration Factors</b>				
Topography Infiltration Factor	0.1	0	0	
Soil Infiltration Factor	0.4	0	0	
Land Cover Infiltration Factor	0.05	0	0	
Infiltration Factor	0.55	0	0	
Run-Off Coefficient	0.45	1	1	
Run-Off From Imperivous Surfaces	0.8	0.8	0.8	
<b>Inputs (Per Unit Area)</b>				
Precipitation (mm/yr)	912	912	912	912
Rainfall (mm/yr)	657	657	657	657
Run-On (mm/yr)	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0
<b>Total Inputs (mm/yr)</b>	<b>912</b>	<b>912</b>	<b>912</b>	<b>912</b>
<b>Outputs (Per Unit Area)</b>				
Precipitation Surplus (mm/yr)	431	730	730	669
Net Surplus (mm/yr)	431	730	730	669
Evapotranspiration (mm/yr)	481	182	182	243
Infiltration (mm/yr)	237	0	0	48
Surplus Infiltration (mm/yr)	0	0	0	0
Total Infiltration (mm/yr)	237	0	0	48
Run-Off Pervious Areas (mm/yr)	194	0	0	39
Run-Off Imperivous Areas (mm/yr)	0	730	730	582
Total Run-Off (mm/yr)	194	730	730	621
<b>Total Outputs (mm/yr)</b>	<b>912</b>	<b>912</b>	<b>912</b>	<b>912</b>
<b>Difference (Inputs - Outputs)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Inputs (Volumes)</b>				
Precipitation (m <sup>3</sup> /yr)	371	277	1,186	1,834
Run-On (m <sup>3</sup> /yr)	0	0	0	0
Other Inputs (m <sup>3</sup> /yr)	0	0	0	0
<b>Total Inputs (m<sup>3</sup>/yr)</b>	<b>371</b>	<b>277</b>	<b>1,186</b>	<b>1,834</b>
<b>Outputs (Volumes)</b>				
Precipitation Surplus (m <sup>3</sup> /yr)	175	222	948	1,346
Net Surplus (m <sup>3</sup> /yr)	175	222	948	1,346
Evapotranspiration (m <sup>3</sup> /yr)	196	55	237	488
Infiltration (m <sup>3</sup> /yr)	96	0	0	96
Surplus Infiltration (m <sup>3</sup> /yr)	0	0	0	0
<b>Total Infiltration (m<sup>3</sup>/yr)</b>	<b>96</b>	<b>0</b>	<b>0</b>	<b>96</b>
Run-Off Pervious Areas (m <sup>3</sup> /yr)	79	0	0	79
Run-Off Imperivous Areas (m <sup>3</sup> /yr)	0	222	948	1,170
Total Run-Off (m <sup>3</sup> /yr)	79	222	948	1,249
<b>Total Outputs (m<sup>3</sup>/yr)</b>	<b>371</b>	<b>277</b>	<b>1,186</b>	<b>1,834</b>
<b>Difference (Inputs - Outputs)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Table C: Water Balance Summary Table**

Characteristic	Site			
	Pre-Development	Post-Development	Change (Pre to Post)	
<b>Inputs (Volume)</b>				
Precipitation (m <sup>3</sup> /yr)	1,834	1,834	0	0%
Run-On (m <sup>3</sup> /yr)	0	0	0	NA
Other Inputs (m <sup>3</sup> /yr)	0	0	0	NA
<b>Total Inputs (m<sup>3</sup>/yr)</b>	<b>1,834</b>	<b>1,834</b>	<b>0</b>	<b>0%</b>
<b>Outputs (Volume)</b>				
Precipitation Surplus (m <sup>3</sup> /yr)	1,135	1,346	210	19%
Net Surplus (m <sup>3</sup> /yr)	1,135	1,346	210	19%
Evapotranspiration (m <sup>3</sup> /yr)	699	488	-210	-30%
Infiltration (m <sup>3</sup> /yr)	263	96	-167	-63%
Rooftop Infiltration (m <sup>3</sup> /yr)	0	0	0	NA
<b>Total Infiltration (m<sup>3</sup>/yr)</b>	<b>263</b>	<b>96</b>	<b>-167</b>	<b>-63%</b>
Run-Off Pervious Areas (m <sup>3</sup> /yr)	215	79	-137	-63%
Run-Off Impervious Areas (m <sup>3</sup> /yr)	657	1,170	514	78%
Total Run-Off (m <sup>3</sup> /yr)	872	1,249	377	43%
<b>Total Outputs (m<sup>3</sup>/yr)</b>	<b>1,834</b>	<b>1,834</b>	<b>0</b>	<b>0%</b>



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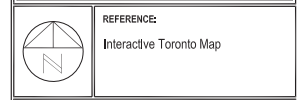
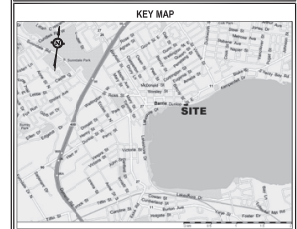
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**APPENDIX G**

**Site Ground Water Flow Mapping**

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NOTES:

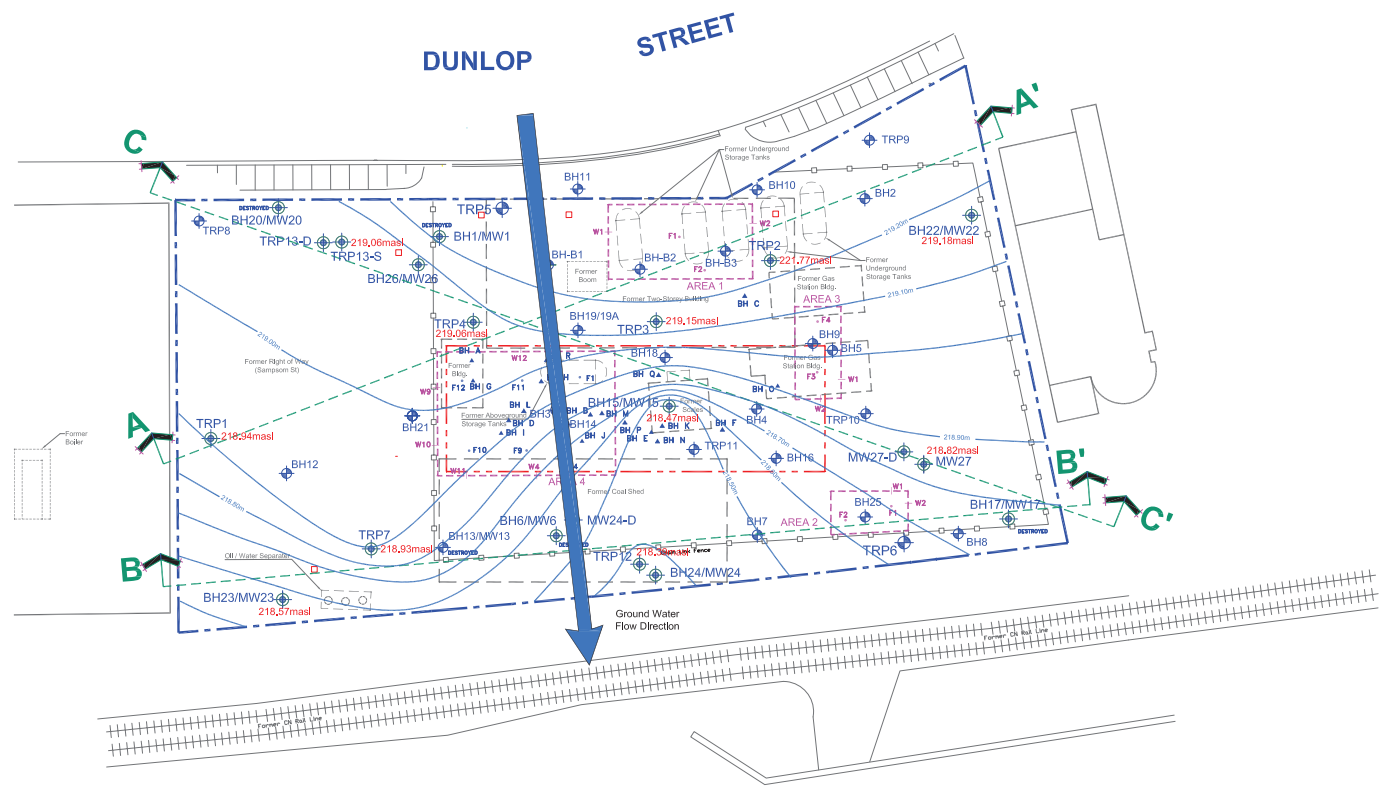
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- Phase One Property
  - Terraprobe BH
  - Terraprobe BH/MW
  - Confirmatory Samples
  - Floor Samples Borehole
  - Samples Wall Samples
  - Approximate Cross Section Location
  - In Situ Treatment Area
  - Ground Water Elevation Contours (GW Unit 1)

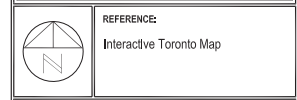
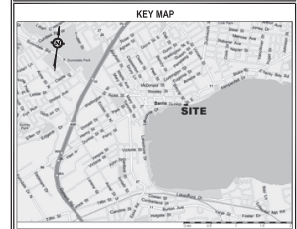
**PROJECT TITLE:**  
Phase Two Conceptual Site Model

**SITE LOCATION:**  
217 Dunlop Street East, Barrie, ON

**FIGURE TITLE:**  
Ground Water Contour Elevations (GW Unit 1)

REV NO: 0	FILE NO: 31-04-0185
SCALE: As Shown	FIGURE NO.: <b>5</b>
DATE: May 2016	





NOTES:

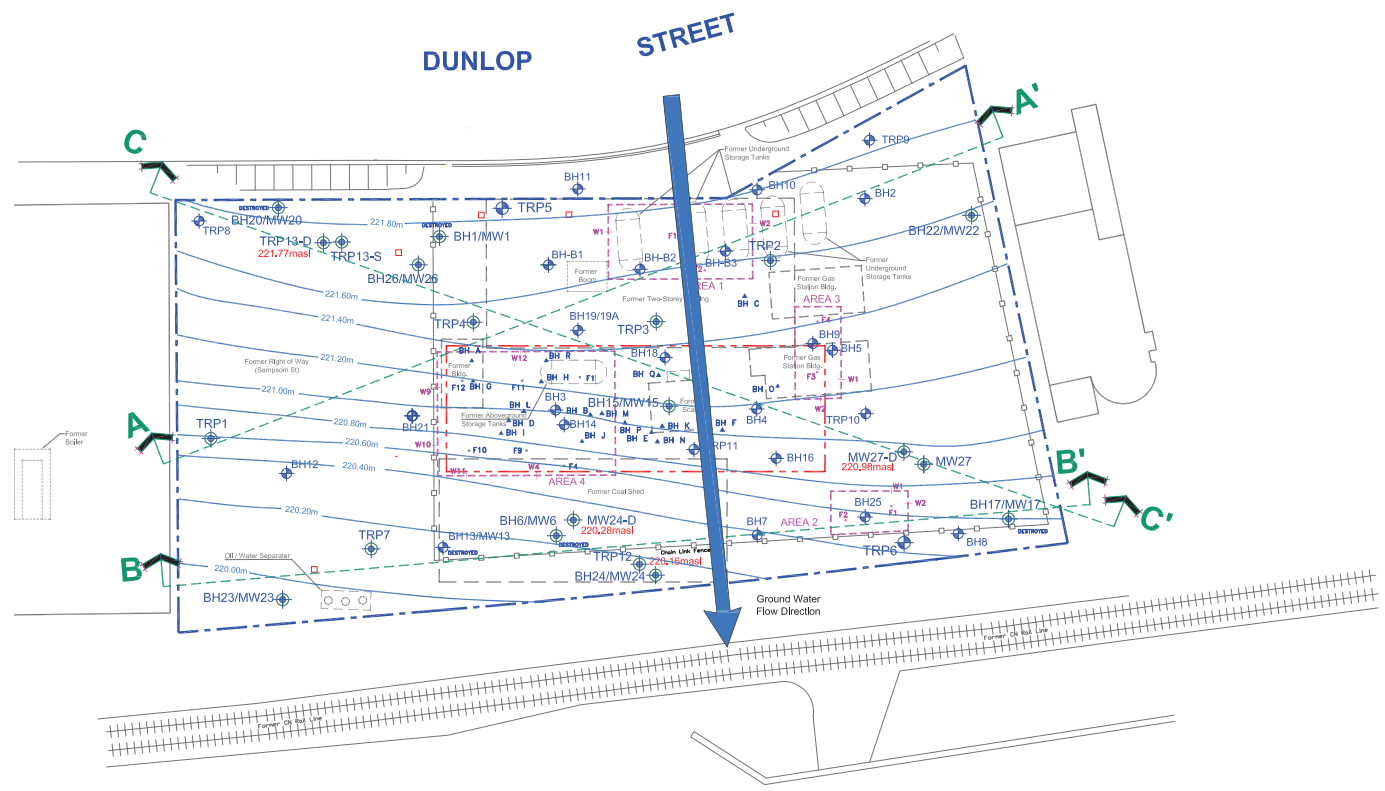
- LEGEND:**
- Phase One Property
  - Terraprobe BH
  - Terraprobe BH/MW
  - F1 Confirmatory Samples
  - BH Floor Samples Borehole
  - W1 Samples Wall Samples
  - Approximate Cross Section Location
  - In Situ Treatment Area
  - Ground Water Elevation Contours (GW Unit 2)

**PROJECT TITLE:**  
Phase Two Conceptual Site Model

**SITE LOCATION:**  
217 Dunlop Street East, Barrie, ON

**FIGURE TITLE:**  
Ground Water Contour Elevations (GW Unit 2)

REV NO: 0	FILE NO: 31-04-0185
SCALE: As Shown	FIGURE NO.: <b>6</b>
DATE: May 2016	





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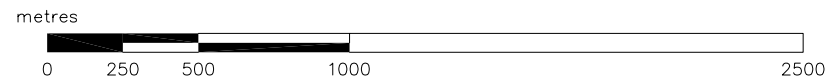
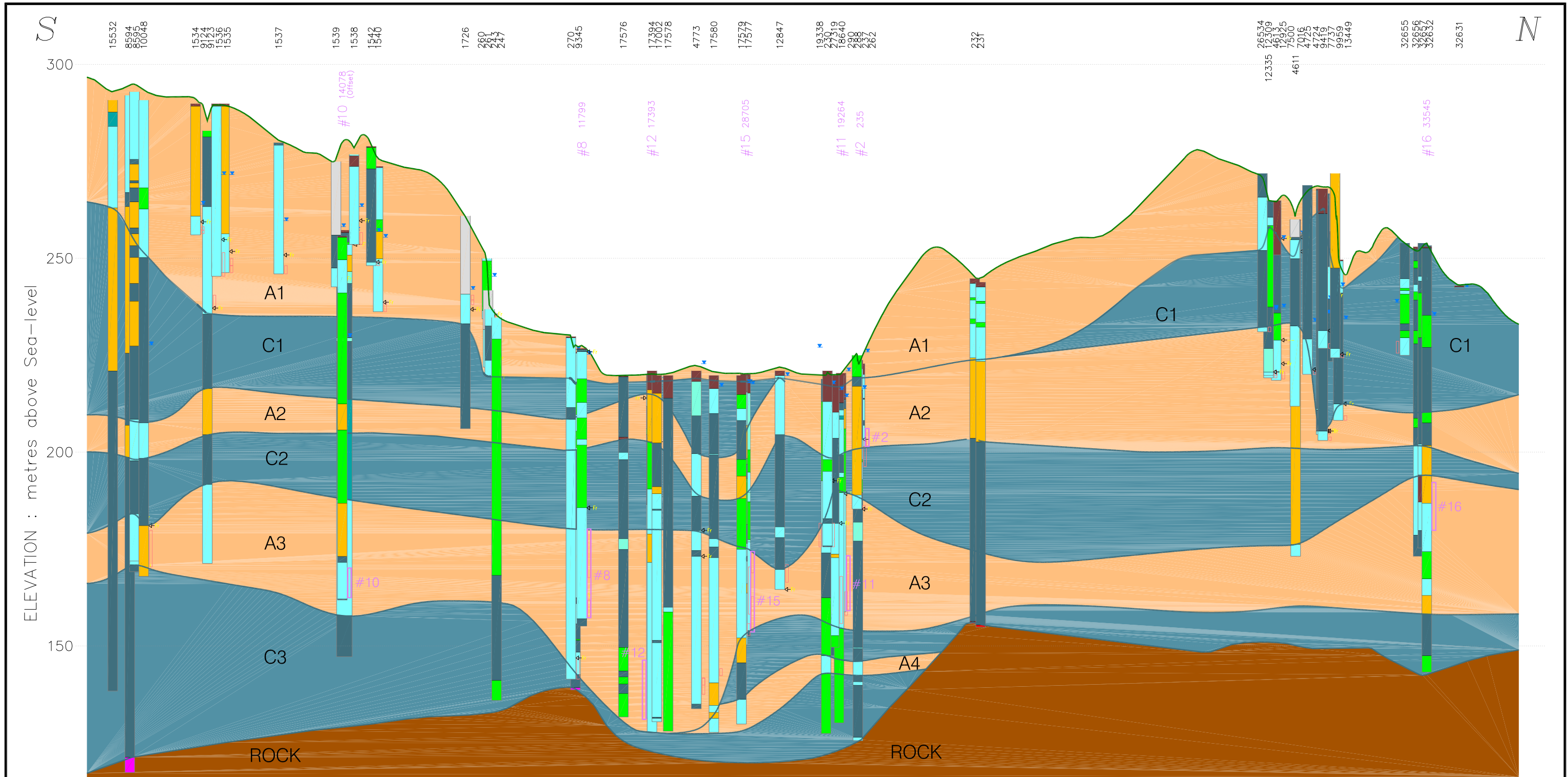
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## **APPENDIX H**

### **Geological Cross Sections**

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SCALE 1:25000

Refer to Figure 3.5 for Legend and Notes



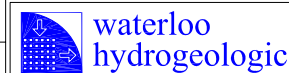
SOUTH SIMCOE GROUNDWATER STUDY  
WELLHEAD PROTECTION AREA REPORT  
CITY OF BARRIE

Drawn: J Regier

File: MDLBARRIE:E3

Job No. S41 W01

Date: 13 May 03



# SECTION E3 - E3'

Figure 3.3





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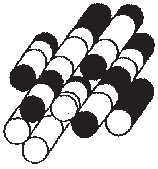
**APPENDIX I**

**Borehole Logs**

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# Terraprobe

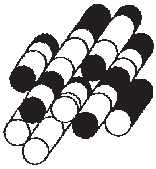
PROJECT NAME: 217 Dunlop Street East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..1..

PROJECT No.: 3-04-0185  
 BORING DATE: November 16, 2004  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)			
							20 40 60 80 nat.V - + Q - ● rem.V - ⊕ U - ○ 20 40 60 80				10 20 30 W P L			
0	GROUND SURFACE 60mm Asphalt Brown		226.2 0.0	1	SS	33	x							 Bentonite Seal
1	SAND, some silt to silty, trace to some gravel, with gravelly seams/layers, some organic layers/inclusions, trace coal, trace brick  (FILL)			2	SS	6	x							
2				3	SS	10	x							
3				4	SS	6	x							
4				5	SS	9	x							
5				6	SS	55		x						
6	Brown	Very Dense to Compact	220.7 5.5	7	SS	50/150mm								
7	SAND, gravelly to trace gravel, some silt													
8	Brown	Compact to Dense	218.5 7.7	8	SS	18	x							
9	SANDY SILT, TO SILTY SAND, some clay, to till		216.6 9.6	9	SS	32	x							
	End of Borehole													

1. Borehole remained open upon completion of drilling.  
 2. Water level noted at 7m during drilling.  
 3. Water level measured November 17, 2004 at 7.8m depth (elev. 218.4)m.



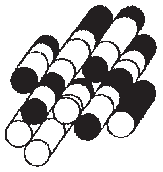
# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..12..

PROJECT No.: 3-04-0185  
 BORING DATE: September 2, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE		SAMPLES			PENETRATION RESISTANCE PLOT $X_x X$				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa				WATER CONTENT (%)		
							not.V - +	Q - ●					
							rem.V - ⊕	U - ○					
0	GROUND SURFACE		223.0										1. Water level noted at 4.6m during drilling.
	175mm - SAND, some gravel, FILL 300mm - BRICK & SAND, trace wood, FILL		0.0										
	Brown Moist to Wet			1	SS								
	SAND, some silt to silty, some organics, trace brick, trace gravel, FILL			2	SS								
	Brown Moist to Wet		219.7 3.3	3	SS								
	SAND, some gravel to gravelly, trace silt			4	SS								
				5	SS								
6	End of Borehole		216.9										
			6.1										
7													
8													
9													



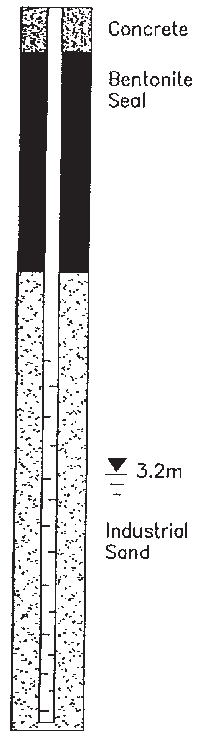
# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

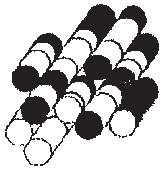
## LOG OF BOREHOLE ..13..

PROJECT No.: 3-04-0185  
 BORING DATE: September 2, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)			INSTALLATION INFORMATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	"N" VALUE	SHEAR STRENGTH kPa		X <sub>s</sub>		WATER CONTENT (%)			
							net.V - +	rem.V - ⊕	q - ●	U - ○	10	20	30	
0	GROUND SURFACE		221.6											
0	50mm - GRAVELLY SAND, FILL Brown		0.0											
1	SAND, some to trace silt, trace to some gravel, trace brick & organics			1	SS									
2				2	SS									
2	Brown		219.4											
3			2.2											
3	SAND, some gravel to gravelly, trace silt, trace organics			3	SS									
4				4	SS									
5	End of Borehole		216.7											
5			4.9											
6														
7														
8														
9														



1. 50mm Diameter Schedule 40 monitoring well installed with 2.4m screen tip at 4.8m.  
 2. Water level on September 7, 2004 measured at 3.2m (elev. 218.4)m.



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East

CLIENT: 2012292 Ontario Limited

LOCATION: Barrie, Ontario

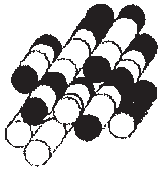
## LOG OF BOREHOLE ..23..

PROJECT No.: 3-04-0185

BORING DATE: December 18, 2005

ELEVATION DATUM: Geodetic

BORING METHOD	DEPTH SCALE IN METRES	SOIL PROFILE		STRATA PLOT	SAMPLES			PENETRATION RESISTANCE PLOT				WATER CONTENT (%)	INSTALLATION INFORMATION
		DESCRIPTION	ELEV. DEPTH (m)		NUMBER	TYPE	"N" VALUE	20	40	60	80		
D50 Crawler-mounted Drill Rig / 108mm Diameter Hollow Augers	0	GROUND SURFACE	222.8										
	0.0	Brown Compact Moist Becoming Loose	0.0	1	SS	26	x						
	1	SAND, some silt and gravel; occasional small brick fragments (FILL)		2	SS	12	x						
	2			3	SS	8	x						
	3			4	SS	9	x						
	3.7			5	SS	8	x						
	4	Brown Compact Wet	219.1										
3.7	GRAVELLY SAND		6	SS	30	x							
5			7	SS	20	x							
7	End of Borehole	215.8	7.0									1. Borehole casing below 4.0m. 2. Water level measured December 22, 2005 at 2.1m (elev. 220.7m).	



# Terraprobe

PROJECT NAME: 217 Dunlop Street, East  
 CLIENT: 2012292 Ontario Limited  
 LOCATION: Barrie, Ontario

## LOG OF BOREHOLE ..24..

PROJECT No.: 3-04-0185  
 BORING DATE: December 18, 2005  
 ELEVATION DATUM: Geodetic

BORING METHOD DEPTH SCALE IN METRES	SOIL PROFILE			STRATA PLOT	SAMPLES			PENETRATION RESISTANCE PLOT $\times \times \times$				WATER CONTENT (%)	INSTALLATION INFORMATION
	DESCRIPTION	ELEV. DEPTH (m)	NUMBER		TYPE	"N" VALUE	SHEAR STRENGTH kPa						
							20	40	60	80			
0	GROUND SURFACE	221.7											
0.0	Brown Compact Moist	0.0	1	SS	12	x							
1	SAND, some silt to SANDY SILT, occasional brick or glass inclusion (FILL)		2	SS	23	x							
2			3	SS	11	x							
2.2	Brown Compact to Dense Moist	219.5											
2.2		2.2	4	SS	23	x							
3	GRAVELLY SAND		5	SS	14	x							
5			6	SS	62		x						
7			7	SS	34		x						
7.6	End of Borehole	214.1											
7.6		7.6											



1. Borehole coving at 2.7m.
2. Schedule 40, 50mm diameter monitoring well installation as shown with locking steel protective casing.
3. Water level measured December 22, 2005 at 3.4m (elev. 218.3m).



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**APPENDIX J**

**Summary of Brownfield Site Redevelopment Requirements**

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Environmental Assessments & Approvals



December 11, 2020

AEC 18-359

2012292 Ontario Limited  
191 John Street  
Barrie, Ontario  
L4N 2L4

Attention: Mr. Phillip Moore  
Property Manager

Re: **Summary of Brownfield Site Redevelopment Requirements  
217 Dunlop Street East, Barrie, Ontario**

Dear Mr. Moore,

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide a summary of the environmental condition present at 217 Dunlop Street East, Barrie, ON (the "Site"). This Site has been evaluated for over a decade and based on this thorough investigation has received a "Record of Site Condition (RSC)" acknowledgement from the Ontario Ministry of the Environment, Conservation and Parks (MECP) for the residential redevelopment of this Brownfield property.

This Site is a former dry cleaning establishment and before that a retail gasoline service station. Residual contaminants associated with these past enterprises were discovered and have been delineated as required by the MECP for the RSC process. The MECP has a rigorous vetting process to gain acceptance of a proposed Brownfield redevelopment proposal. This process culminates in the issuance of an RSC acknowledgement. It is acknowledged by the Province that the property redevelopment as described in the RSC application would not endanger the natural environment or those using the property in the manner present in the RSC application.

## **BACKGROUND**

This summary addresses regulatory requirements under the *Environmental Protection Act* for Brownfield site redevelopment. This summary also addresses the Source Protection Policy requirements under the *Clean Water Act* for source water protection. Finally, this summary has reviewed comments provided by the City of Barrie in their 2019 pre-



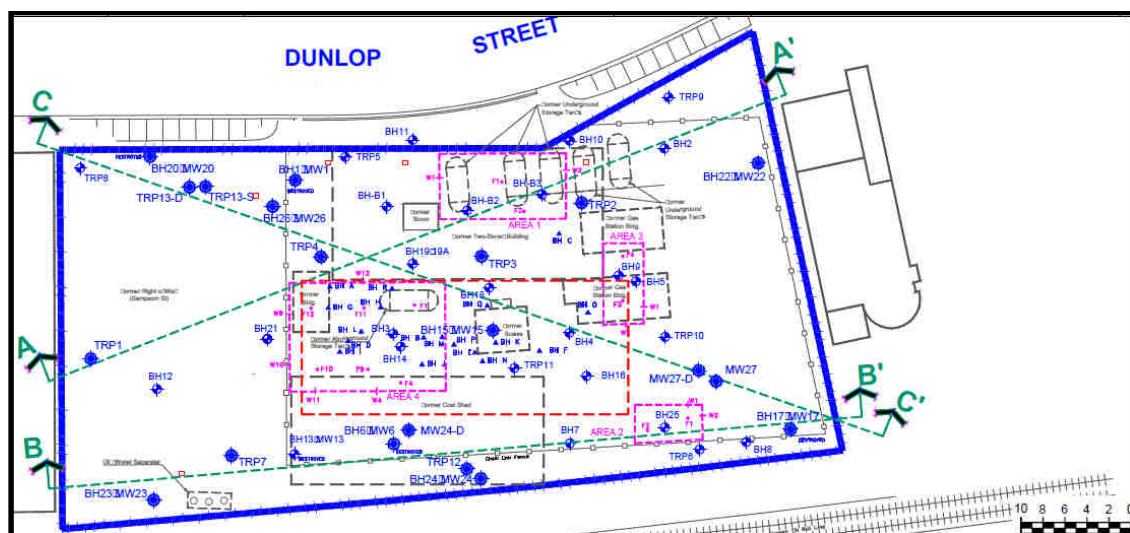
consultation documentation and has addressed those concerns dealing with the residual impacted soils that exist under this property.

In our professional opinion, the proposed Site development plan does not have an adverse impact on the hydrogeologic setting present at this Site.

## PROVINCIAL APPROVAL PROCESS

The RSC process starts with a Site evaluation of the environmental condition present at the property. The Phase One ESA is a background research project intended to discover past property and surrounding land uses which could be construed to be a potential environmental concern at the Site. It was this study that determined the past property use as a retail gasoline service station before being used as a dry cleaning establishment. The presence of these concerns initiated the next phase of investigation being an intrusion Site assessment (*i.e.*, Phase Two ESA). The "areas of potential environmental concern (APECs)" assessed for the Site in the Phase One ESA report can be found in the Brownfield Registry for this Site (RSC No.: 225398)<sup>1</sup>.

The goal of the Phase Two ESA program is to determine whether contaminants of potential concern (COPCs) are present on the Site. If discovered, then the next step in the process is to establish their lateral and vertical distribution across the property. In this instance, over 45 soil excavations (*i.e.*, boreholes) were used to characterize this property (see graphic - below).



<sup>1</sup> <https://www.lrcsde.lrc.gov.on.ca/BFISWebPublic/pub/viewDetail?submissionId=225398>



Many of these borehole excavations were instrumented as monitoring wells so that ground water samples could be collected and analysed.

As can be expected, several field programs were completed in order to gain a full understanding of the subsurface condition. These programs were conducted in 2001, 2004, 2005 (September & December), 2006 and a final program in 2016.

The Phase Two ESA program recorded several COPCs associated with the past Site uses including: petroleum hydrocarbons (PHCs); heavy metals; volatile organic compounds (VOCs) associated with the dry cleaning operations; and polycyclic aromatic hydrocarbons (PAHs). A summary of this work (*i.e.*, Phase Two Conceptual Site Model) can be found in the Brownfield Registry (No.: 225398)<sup>1</sup>.

The next issue was whether the concentrations of the COPCs would be detrimental to the redevelopment of this Brownfield Site. A site specific risk assessment (SSRA) was performed to evaluate this issue. The SSRA is conducted using the concentration data collected during the Phase Two ESA programs. It assesses whether the maximum observed concentration for each identified parameter poses a concern to the natural environment and people using the Site. In this instance, risk mitigation measures (RMMs) were considered to abate the exposure pathways of certain compounds. The RMM to be employed for the Site development plan is a vapour barrier using a thick impervious membrane sheet that will cover the Site and separate the subsurface ground condition from the surface soil condition (*i.e.*, landscaping plan) and proposed building envelope.

The MECP agreed that the proper deployment of this RMM would be sufficient to permit the proposed residential redevelopment plan to proceed safely. A SSRA is a detailed evaluation of the Site condition and how the contaminants present could possibly result in an unacceptable impact. The MECP has numerous exposure pathways to be considered; but a SSRA only evaluates those that have merit for the actual Site condition.

The SSRA determined a set of property specific standards (PSS)<sup>1</sup> applicable to the Site condition which were accepted by the MECP through a rigorous one-year vetting process. The Site condition must conform to these property specific standards and monitoring continues annually to ensure these standards are maintained.

The MECP having accepted the SSRA issued a Certificate of Property Use (CPU) which is registered on title. The CPU can also be found in the Brownfield Registry<sup>1</sup>. The CPU is a legal document issued by the MECP which outlines how this Site is to be developed



for the intended residential building. In the CPU are a myriad of conditions that must be met as the development is constructed and how the completed development is to be monitored and maintained to preserve the RMMs and safeguard the environment.

After all of this review by the Provincial authority, the actual RSC application is finally made and the province has the ability to review the file one final time. The MECP filed this RSC acknowledgement on February 21, 2019. This procedure is considered to be the most stringent evaluative process for sites in the Province.

## **CITY OF BARRIE PRE-CONSULTATION COMMENTS**

The City in issuing their May 21, 2019 pre-consultation review comments correctly identified that the Site requires an RSC acknowledgement which has been obtained.

### **Engineering Department**

Comments by the engineering department included the need to decommission any septic systems and water wells present on the property.

In response to these comments:

- there is no septic system present on the property. It was presumably removed years ago; and
- numerous exploration wells exist on the property that are associated with the RSC application. These wells will be properly abandoned in the foreseeable future and prior to any Site development works.

### **Risk Management Official**

The RMO is vested with Source Water Protection matters under the *Clean Water Act*. The City's RMO will evaluate municipal drinking water sources and whether these resources might be impacted by the proposed Brownfield redevelopment. The RMO has identified several Source Protection Policy requirements including:

- Issues Contributing Area [Salt (ICA-2)];

An issues contributing area is the area of land where drinking water threats may contribute to a known drinking water issue. For example, in the City of Barrie sodium and chloride are elevated in municipal drinking water wells and therefore



road salt applications are determined to be an issue, the area from which the source of road salt is determined to result from is called the issues contributing area

### **Salt (ICA-2)**

*With the exception of personal domestic use, the existing and future handling and storage of road salt is designated for the purposes of Section 58 of the Clean Water Act, and therefore requires a risk management plan where the activity is or would be a significant drinking water threat, within WHPA-A of the ICA, and outside of WHPA-A where road salt is stored in quantities equal to or greater than 5 tonnes. The risk management plan, at a minimum, will include terms and conditions that mirror a salt management plan, and comply with contemporary standards to ensure the handling and storage of road salt ceases to be or does not become a significant drinking water threat*

An appropriate salt management plan will be devised in concert with and subject to the approval of the RMO. The proposed development does not have external parking and therefore will only be applying salt for safety uses along the entrance road to the parking garage and at the pedestrian entrances to the building. These applications would follow "Smart About Salt" strategies.

- Dense non-aqueous phase liquids (DNAPL-2);

Dense non-aqueous phase liquids, or DNAPLs, are chemicals that are more dense than water and generally do not dissolve readily in water, but remain as a distinct liquid in surface or ground waters. If spilled, they tend to sink into the ground and can contaminate the deepest ground water resources (and those in between).

### **DNAPL-2**

*Future handling and storage of DNAPLs in any quantity (excluding incidental volumes for personal/ domestic use) is designated for the purposes of Section 57 of the Clean Water Act, and is therefore prohibited where the activity would be a significant drinking water threat*

The proposed development is a mixed residential development with retail commercial enterprises on the street level and residential dwellings above. The commercial enterprises leasing the commercial space will not be permitted to handle or store DNAPL products on the premises. Custodial services will not be permitted to handle or store clean products that have DNAPL chemicals in their



mixtures (ex., degreasing products or equivalent).

- Restricted land use policies (RLU-1);

Restricted land use policies do not eliminate a land use, but ensure that activities in the designated area are assessed for their potential risk. This can be seen as a screening tool for municipalities when reviewing applications, to prevent the unintentional approval of applications that would lead to the creation of significant drinking water threats. This tool is used in conjunction with risk management plans or prohibition.

### **RLU-1**

*All land uses in the zoning by-laws within the Lakes Simcoe and Couchiching-Black River, Nottawasaga Valley and Severn Sound source protection areas are designated for the purpose of Section 59 of the Clean Water Act, with the exception of residential uses, in all areas where the following activities are or would be a significant drinking water threat.*

- 1b. The establishment, operation or maintenance of a waste disposal site within the meaning of Part IV of the Environmental Protection Act, that does not require approval under the Environmental Protection Act (PCB Waste Storage and the storage of hazardous liquid industrial waste, excluding the storage of wastes described in clauses (p),(r),(s),(t) and (u) of the definition of hazardous waste (O.Reg 347).*
- 3. Application of agricultural source material to land*
- 4. Handling and storage of agricultural source material*
- 6. Application of non-agricultural source material*
- 7. Handling and storage of non-agricultural source material*
- 8. Application of commercial fertilizer to land*
- 9. Handling and storage of commercial fertilizer*
- 10. Application of pesticide to land*
- 11. Handling and storage of pesticide*
- 12. Application of road salt*
- 13. Handling and storage of road salt*
- 14. Storage of snow*
- 15. Handling and storage of fuel*
- 16. Handling and storage of DNAPLs*
- 17. Handling and storage of organic solvents*



21. *Use of land as livestock grazing, or pasturing land, an outdoor confinement area of farm animal yard.*

It is acknowledged that the surface landscaping plan could import soil nutrient additions and fertilizers; but this would be an inconsequential use akin to residential needs. The salt management plan noted above would address the salt concerns (as noted below) and the Cosmetic Pesticides Ban Act prevents the use of such chemicals. All other aspects have no applicability.

*Despite the above policy, a Risk Management Official may issue written direction specifying the situations under which a planning authority or building official may be permitted to make the determination that a site specific land use is not designated for the purposes of Section 59. Where such direction has been issued, a site-specific land use is not designated for the purposes of Section 59, provided that the planning authority or building official, as the case may be, is satisfied that:*

- a) The application complied with circumstances specified in the written direction from the Risk Management Official; and*
- b) The applicant has demonstrated that a significant drinking water threat activity designated for the purposes of Section 57 or 58 will not be engaged in, or will not be affected by the application*

- Land use planning policies (LUP-1)

These are policies that affect land use planning decisions. These could fall under the Planning Act and Condominium Act. These policies may be to manage or eliminate (through prohibiting it from being established) a threat activity through a land use policy that is implemented through land use planning decisions (such as Official Plans, Zoning By-laws and Site Plan Controls).

**LUP-1**

*Planning Approval Authorities shall amend their planning documents to prohibit future:*

- 1) waste disposal sites within the meaning of Part V of the Environmental Protection Act (excluding storage of wastes described in clauses (p), (q), (r), (s), (t), or (u) of the definition of hazardous waste (O.Reg 347) and storage of hazardous or liquid industrial waste)*
- 2c) large (more than 10, 000 L) on-site sewage systems*
- 4) agricultural source material storage facilities*
- 7) non-agricultural source material storage facilities in WHPA-A/IPZ-1*



- 9) *commercial fertilizer storage facilities*
- 11) *pesticide storage facilities*
- 13) *road salt storage facilities*
- 14) *snow storage facilities*
- 15) *fuel storage*
- 16) *DNAPL storage*
- 17) *organic solvent storage*
- 21) *outdoor confinement or farm animal yard in WHPAA/IPZ-1 in vulnerable areas where the activity would be a significant drinking water threat*

None of these are applicable for the intended development

In summary, the majority of these Source Water Protection Policies are not applicable for this proposed development. Where potentially applicable, an appropriate risk management plan will be devised to address the threat (winter safety products). Site specific policies will be enforced to ensure issues like DNAPL use will be prohibited.

### **Site Contaminants**

The existing residual contaminant source present at this Site is considered to be a "Condition" under the Source Water Protection legislation. A Condition or potential Condition that has not been identified would potentially be a Significant, Moderate, or Low Threat to Drinking Water based on the combination of Hazard Rating and Vulnerability Rating.

The Hazard Rating is dependent on whether there is evidence the Condition is causing off-Site contamination, and whether the Condition is located on the same property as the supply well. In this case, the Site is located 800 m east of the municipal supply well.

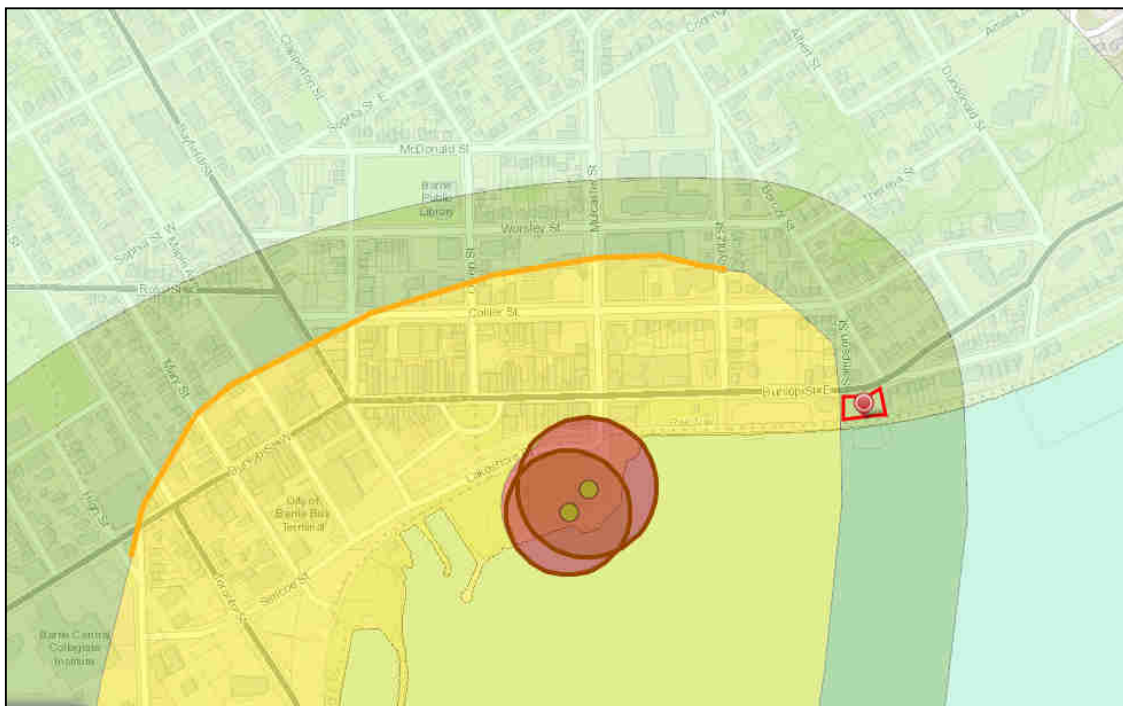
A Condition would be a threat to municipal drinking water in the following situations:

- *Significant Threat:*  
where the Vulnerability Score is  $\geq 8$  and there is evidence that the Condition is causing off-Site contamination, and/ or that the Condition is located on the same property as the supply well;
- *Moderate Threat:*  
where the Vulnerability Score  $\geq 6$  and  $< 8$ , and there is evidence that the Condition is causing off-Site contamination, and/ or that the Condition is located on the same property as the supply well; or  
where the Vulnerability Score is 10, and there is no evidence of off-Site contamination;



- **Low Threat:**  
where the Vulnerability Score  $\geq 8$  and  $< 10$  and there is no evidence of off-Site contamination.

The vulnerability rating for the Site is displayed below and is related to the Heritage wellfield located in Heritage Park south of Lakeshore Drive and west of Mulcaster Street (*i.e.*, the two brown dots in the graphic):



This mapping was taken from the Simcoe County Interactive Map site. The Site property is outlined in red. The Site resides in the "green" vulnerability zone which has a wellhead vulnerability score of 4. As such, the residual contaminant Condition at the Site has a Low Threat potential to the Heritage wellfield located in Heritage Park.

#### **Other Miscellaneous Comments**

The RMO has also identified proposed LIDs features. The discussion on LIDs features can be found in the Hydrogeologic Report (Azimuth, 2020).

Similar to the engineering department, the RMO has requested that any existing wells are to be properly decommissioned. Numerous exploration wells exist on the property and



will be properly abandoned in the foreseeable future and prior to any Site development works.

The RMO has also identified hydrogeologic comments related to "... construction activities that have the potential to impact or intercept the municipal supply aquifer ...". The details regarding the foundation requirement for this proposed building are addressed in the Geotechnical Report by Peto McCallum Limited (2020). However, it is important to note that no foundation works are planned that will compromise the existing till aquitard which separates the uppermost aquifer from the deeper municipal aquifer system.

At present there is no expectation of temporary dewatering requirements. However, if or when this becomes necessary, then it is noted that a dewatering plan will be provided that among other issues would address the proper handling of the Site waters. This plan would address the potential contaminant signature of these waters and how they would need to be handled to properly dispose of the excess water including the potential for pre-treatment prior to discharge into the City's sanitary sewers. Owing to the potential contamination, it is expected that no discharge would occur to the storm sewer system.

Finally and as noted above, no deep drilling is being proposed for the Site development including deep piles, caissons, excavations, and/ or underground parking that has the potential to create a transport pathway. All foundation/ construction works are planned in the upper surficial aquifer down to the uppermost till surface; but not beyond that depth.

## **CLOSURE**

Considerable care has been taken by the proponent to safeguard the environmental setting at and surrounding the Site. A safe and appropriate redevelopment plan has been devised in accordance with provincial and municipal regulatory requirements.

The MECP is the designated authority to address the environmental impacts associated with past and present land uses. The MECP has completed a rigorous environmental evaluation of the proposed Brownfield redevelopment of this Site and issued a Record of Site Condition acknowledgement (RSC No.: 225398)<sup>1</sup>. It is the opinion of the MECP that there is no adverse impact(s) associated with this redevelopment plan and the proponent is permitted to proceed with this endeavour in accordance with the CPU. The CPU addresses both the Site development requirements and post-development maintenance of the property in perpetuity.



The City has expressed concerns with construction matters related to the proposed development. While the majority of these concerns are addressed by the MECP in their CPU document, it is acknowledged that an appropriate level of care will be vested in the construction management of the development to prevent any potential adverse impacts. Of particular concern to the City is any impact threat to the confining till aquitard. The proposed Site development plan has addressed these concerns such that there will be no impact to the underlying municipal water resources. Specific details with the building foundation design are presented by others (Peto McCallum Limited, 2020).

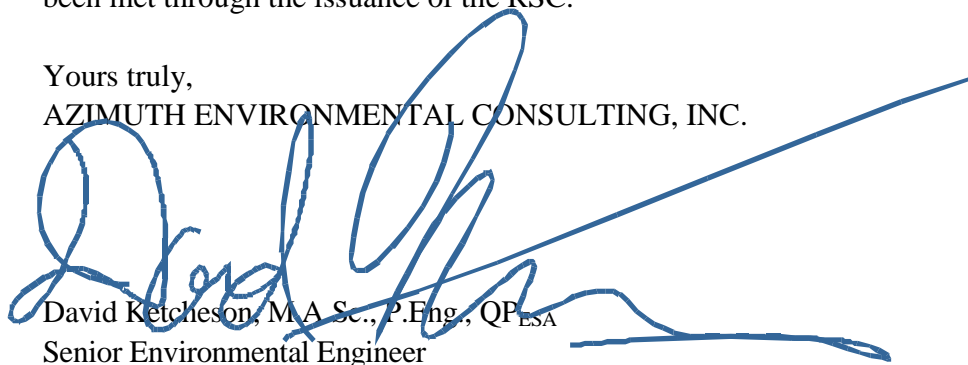
Source Water Protection issues raised by the City will be addressed as outlined above. Appropriate handling/ application of winter safety salt will conform with "Smart About Salt" protocols and applied by practitioners certified in "Smart About Salt" practices.

Specific chemicals of concern (*i.e.*, DNAPLs) will not be permitted in any commercial establishments on this property. Furthermore, care will be taken to ensure support services such as cleaning/ maintenance staff do not use such chemicals on this property which should address this Source Water Protection policy concern.

An evaluation of the Condition at the Site has revealed that it represents a Low Threat Potential to the City's Heritage wellfield based on the available vulnerability mapping for the City.

Based on all of the preceding, the proponent has addressed the potential environmental concerns/ threats associated with the Site and its future development. Pre-consultation issues raised by the City have been acknowledged and addressed. The stringent environmental due diligence required by the Province for Brownfield redevelopment has been met through the issuance of the RSC.

Yours truly,  
AZIMUTH ENVIRONMENTAL CONSULTING, INC.



David Ketcheson, M.A.Sc., P.Eng., QP<sub>ESA</sub>  
Senior Environmental Engineer

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