Peto MacCallum Ltd.
CONSULTING ENGINEERS

# SUPPLEMENTAL GEOTECHNICAL INVESTIGATION
# PROPOSED CONDOMINIUM BUILDING
# 233 DUNLOP STREET WEST
# BARRIE, ONTARIO

**for**

**MDM DEVELOPMENTS**

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

Distribution:
2 cc: MDM Developments (+email)
1 cc: PML Barrie

PML Ref.: 19BF037
Report: 1
November 2019

Peto MacCallum Ltd.
CONSULTING ENGINEERS

November 21, 2019

PML Ref.: 19BF037
Report: 1

Mr. Luke Wilson
MDM Developments
190 Hotchkiss Street
Gravenhurst, Ontario
P1P 1H6

Dear Mr. Wilson

**Supplemental Geotechnical Investigation**
**Proposed Condominium Building**
**233 Dunlop Street West**
**Barrie, Ontario**

Peto MacCallum Ltd. (PML) is pleased to present the results of the supplemental geotechnical investigation recently completed at the above noted project site. Authorization for this work was provided by Mr. L. Wilson in the signed Engineering Services Agreement, dated September 12, 2019.

An eight-storey slab-on-grade building is prosed for the property at 233 Dunlop Street West in Barrie. A parking garage will be at grade and seven stories of residential space will be constructed above the parking garage. Paved parking and access beyond the building parking garage will also be provided. The current configuration is shown on Drawing 1, appended.

A previous geotechnical investigation was carried out by others in June of 2017, however, the building has shifted to the west onto a recently purchased piece of property. The recently purchased property has a house that will be demolished.

The purpose of this supplemental investigation was to explore the subsurface conditions at the most recent building location, and based on this information, provide geotechnical engineering recommendations for building foundations and pavement design.

Geoenvironmental services (observations, recording, testing or assessment of the environmental conditions of the soil and ground water) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess excavated soils requiring transportation off-site are generated, a program of soil sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate receiving site options, in accordance with the MOECC document; Management of Excess Soil – A Guide for Best Management Practices, January, 2014.

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

*BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO*

The comments and recommendations provided in this report are based on the site conditions at the time of the supplemental 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 reassess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

## INVESTIGATION PROCEDURES

The field work for this supplemental investigation was carried out on October 28, 2019, and consisted of Boreholes 101 to 105 advanced to 6.5 m depth in the latest proposed building location. Borehole locations are shown on Drawing 1, appended.

The approximate location of previous boreholes by others is also shown on Drawing 1, appended. Copies of the borehole logs are provided in Appendix A.

PML laid out the boreholes in the field. The ground surface elevation at the borehole locations was obtained with a Sokkia SHC5000 Global Navigation Satellite System (GNSS). Vertical and horizontal accuracy of this unit are 0.1 m and 0.5 m, respectively.

Co-ordination for clearances of underground utilities was provided by PML with the aid of a private locator. The boreholes were drilled cognizant of the underground utilities.

The boreholes were advanced using continuous flight solid stem augers, powered by a rubber tire mounted CME-750 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.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the substrata. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of water in the open boreholes upon completion, if any.

A piezometer, comprising 19 mm diameter pipe with slots cut in the bottom 1.5 m, filter sand, bentonite seal and an above grade protective cover was installed in Borehole 101 to permit ground water level monitoring. It should be noted that the piezometer becomes the property of the Owner and will have to be decommissioned by the Owner. PML would be pleased to assist in this regard. The four other boreholes were backfilled in accordance with O.Reg. 903

Water levels in the piezometer and one other existing monitoring well were measured on multiple occasions and the results are present herein.

All recovered soil samples were returned to our laboratory for moisture content determinations and detailed examination to confirm field classification.

## 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 N Values, details, ground water observations and the results of laboratory water content determinations.

Due to the soil sampling procedures and limited sample size, the depth demarcations on the borehole logs must be viewed as "transitional" zones between layers, and cannot be construed as exact geologic boundaries between layers. PML would be pleased to assist with this during construction, if required.

Topsoil was present at the surface of Borehole 101 and Borehole 104, being160 mm and 150 mm thick, respectively.

Beneath the topsoil in Boreholes 101 and 104, and at the surface of Boreholes 102, 103 and 105, a fill unit was present to 0.7 to 2.1 m depth (elevation 225.8 to 227.25). The fill consisted of sand, trace silt and trace gravel and graded to gravelly sand, trace silt in two boreholes. Trace organics were noted in Boreholes 101 and 104. N Values in the fill ranged from 2 to 17, indicating variable compactive effort then the fill was placed. The moisture contents ranged from 2 to 15%, typically less than 8%, with the soil being moist.

A major native sand deposit was below the fill in all boreholes, extending to the 6.5 m depth of exploration. The deposit comprised sand with trace to some silt and trace gravel. The sand was loose to dense with depth, typically loose in the upper 0.5 to 1.5 m of the unit becoming compact to dense below the upper 0.5 to 1.5 m (N Values range from 7 to 41). The deposit was moist, becoming wet with depth and moisture contents were 3 to 21%.

The first water strike (ground water first encountered during drilling), the ground water levels measured in the boreholes upon completion of augering, and the ground water levels measured in the piezometer and existing monitoring well are summarized in the table below, on a borehole by borehole basis:

| **BOREHOLE** | **FIRST STRIKE DURING DRILLING DEPTH (m) /ELEVATION** | **UPON COMPLETION OF AUGERING DEPTH (m) /ELEVATION** | **IN PIEZOMETER OR EXISTING WELL** | | |
|---|---|---|---|---|---|
| | | | **SEP.12, 2019** | **OCT.15, 2019** | **NOV.18, 2019** |
| 101 | 4.3/224.1 | 4.0/224.4 | -- | 4.1/224.3 | Blocked |
| 102 | 4.3/223.8 | 3.8/224.3 | -- | -- | -- |
| 103 | 4.3/223.7 | 3.8/224.2 | -- | -- | -- |
| 104 | 4.3/223.6 | 4.0/223.9 | -- | -- | -- |
| 105 | 4.2/223.7 | 4.0/223.9 | -- | -- | -- |
| 4 (existing well) | -- | -- | 4.5/224.6 | 4.5/224.6 | 4.1/225.0 |

Note: Existing Borehole 4 is located in a local elevated area about 0.75 m above the surrounding grade.

Based on the data above and the moisture content profile the ground water is anticipated to stabilize at about 3.0 to 4.5 m depth below grade corresponding to about elevation 223.5 to 225.5.

Ground water levels are subject to seasonal fluctuations, and in response to variations in precipitation.

## GEOTECHNICAL ENGINEERING CONSIDERATIONS

### Site Grading and Engineered Fill

An eight-storey slab-on-grade building is prosed for the property at 233 Dunlop Street West in Barrie. A parking garage will be at grade and seven stories of residential space will be constructed above the parking garage. It is understood that the ground floor slab will be set at elevation 228.5 with surrounding grades at about elevation 228.0. Paved parking and access beyond the building parking garage will also be provided. The current configuration is shown on Drawing 1, appended.

Based on the boreholes for this supplemental investigation, ground surface elevations within the building footprint ranged from elevation 227.9 to 228.35, and only very minor grading adjustments will be required.

The topsoil, existing fill and the upper 0.5 to 2.0 m of loose native are unsuitable to support footings designed for the desired 200 kPa geotechnical bearing resistance at Serviceability Limit State (SLS). The topsoil and existing fill are unsuitable to support the slab-on-grade.

In the area of the existing house on the recently purchased property, the in-situ fill and foundations will have to be removed, such that the extent of the excavation extends to native soil in all directions. It is noted that fill may be deeper around the existing house than indicated at the borehole locations. Further, it is uncertain how the excavations for previously demolished buildings were backfilled and existing fill in these two areas may be deeper than the boreholes indicate.

Two options are provided for construction of the proposed building:

- Option 1: Extend all footings down to native soil capable of supporting 200 kPa at SLS (detailed later in the report). Remove topsoil and existing fill inside the building footprint and replace with engineered fill in order to support the slab-on-grade.
- Option 2: Remove topsoil, existing fill and loose native soil (upper 0.5 to 2.0 m of the native sand deposit) and replace with engineered fill comprising Granular B to the footing founding level, followed by engineered fill comprising site soil to the underside of the slab-on-grade.

Option 1 has less requirement for engineered fill however, footings will need to be deeper than frost depth due to the loose nature of the upper portion of the native soil. If ground water levels rise in the spring then this option could be problematic when trying to achieve the requirement to have a 0.5 m buffer between the high ground water level and the footings (particularly near Boreholes 104 and 105). Option 2 requires more effort for engineered fill, however once engineered fill is constructed there is no limitation for footing depth and footings can be raised to frost depth or other desired levels (provided Granular B is placed accordingly). The 0.5 m buffer between the high ground water level and the footing should not be an issue with raised footings in Option 2.

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

- Strip existing topsoil, existing fill (including house foundations and associated existing fill), upper loose native soil (to depths provided below – Option 2 only) and other deleterious materials down to competent native soil, subject to geotechnical review during construction.

| BOREHOLE | REMOVAL DEPTH OF LOOSE NATIVE SOIL FOR OPTION 2 DEPTH (m)/ELEVATION |
|---|---|
| 101 | 2.3/226.1 |
| 102 | 2.7/225.4 |
| 103 | 1.5/226.5 |
| 104 | 2.8/225.1 |
| 105 | 2.8/225.1 |

- The excavated inorganic soil (excluding topsoil and fill with organics) is predominately suitable for reuse as engineered fill for the floor slab-on-grade. Excavated materials should be segregated and stockpiled separately, based on geotechnical review;

- Proofroll exposed subgrade using a heavy roller to 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. For Option 2, imported Granular B will be utilized from the base of the excavation to the underside of footings (elevations to be determined by designer). For Option 1 or above footing founding elevation for Option 2, on-site inorganic soil can be utilized, subject to geotechnical review. If wet subgrade conditions are present the use of Granular B Type II may be required for the first lift or two of engineered fill (both Option 1 and 2);

- For Option 2, engineered fill pad must extend at least 1 m beyond the structure to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved native subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported. For Option 1, engineered fill is required on the interior of the building below the slab-on-grade;

- 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.

## Foundations

The slab-on-grade is proposed at elevation 228.5. As noted above two, options are provided for footings in order to achieve the desired 200 kPa geotechnical bearing resistance at SLS and the factored bearing resistance at Ultimate Limit State (ULS) of 300 kPa.

For Option 1, footings are to be extended down to native soils capable of providing the desired 200 kPa geotechnical bearing resistance at SLS and the factored bearing resistance at ULS of 300 kPa. The depths are provided in the table below on a borehole by borehole basis.

| **BOREHOLE** | **DEPTH (m)/ELEVATION** |
|---|---|
| 101 | 2.3/226.1 |
| 102 | 2.7/225.4 |
| 103 | 1.5/226.5 |
| 104 | 2.8/225.1 |
| 105 | 2.8/225.1 |

For Option 2, footings founded on engineered fill, comprised of Granular B and constructed as discussed above, and can be designed for a geotechnical bearing resistance at SLS of 200 kPa and a factored bearing resistance at ULS of 300 kPa, at any depth. It is noted that the designer will determine the depth of the footings and therefore the thickness of Granular B.

The geotechnical bearing resistance at SLS is based on 25 mm of settlement in the bearing stratum with differential settlement not exceeding 75% of the value.

Footings subject to frost action should be provided with a minimum 1.2 m of earth cover or equivalent insulation. It is noted that 25 mm of polystyrene insulation is equivalent to 600 mm of earth cover.

Prior to placement of structural concrete, all founding surfaces should be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

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.

## Floor Slab-On-Grade

Floor slab-on-grade construction is feasible on engineered fill, constructed as describe below.

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.

## Excavation and Ground Water Control

Based on the proposed grades, proposed building floor slab elevation and borehole information, excavation for the building foundations or engineered fill is anticipated to extend a maximum 3.0 m below existing grade.

Type 3 soil conditions are present and excavation side walls should be constructed no steeper than three horizontal to one vertical (3H:1V), in accordance with the Occupational Health and Safety Act (OHSA).

The ground water in the boreholes is anticipated to stabilize about 3.0 to 4.5 m below existing grade at elevation 223.5 to 225.5. Excavation is anticipated above the ground water table to slightly below the ground water table. Where excavation is carried out to or slightly below the ground water table it is recommend that excavation and backfilling be carried out in small manageable sections. For excavation as noted above, conventional sump pumping should be sufficient to control ground water seepage for the most part. Greater pumping efforts or pumping from keg wells may be required in areas where excavation is slightly below the ground water table.

Excavation below the depths noted above will be well below the ground water table and dewatering will be required. The ground water level will have to be lowered a minimum 0.5 m below the excavation in order to carry out the work in dry conditions. Dewatering systems should be designed an installed by specialists in this field.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Takings and Transfer Regulation O. Reg. 387/04. Section 34 of the OWRA requires anyone taking more than 50,000 L/d to notify the Ministry of the Environment, Conservation and Parks (MECP). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering, or permanent drainage improvements. Where it is assessed than more than 50,000 L/d but less than 400,000 L/d of ground water taking is required, the Owner can register online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 Permit-To-Take-Water (PTTW) is required.

Based on the boreholes and excavation as described above, a PTTW is not anticipated. Registry on the EASR may be prudent. For excavation below the depth noted above a PTTW will be required.

## Pavement Design and Construction

Currently, it is anticipated that the site grades will only require minor adjustment. Based on this, it is anticipated that the pavement subgrade will typically comprise the sand fill which is considered low to moderately frost susceptible. The following pavement structure thicknesses are recommended and should be reviewed when grading/subgrade soils are determined:

| MATERIAL | LIGHT DUTY (mm) | HEAVY DUTY/FIRE ROUTE (mm) |
|---|---|---|
| Asphalt | 90 | 110 |
| Granular A Base Course | 150 | 150 |
| Granular B Subbase Course | 300 | 450 |
| Total Thickness | 540 | 710 |

In general, it is recommended that following rough grading to the subgrade level, subgrade preparation should include proofrolling and compacting the exposed subgrade with a heavy compactor to minimum 95% Standard Proctor maximum dry density under geotechnical review. Any unstable zones identified during this process should be sub-excavated and replaced with compacted select site material at a suitable moisture content placed in 200 mm thick lifts and compacted to minimum 95% Standard Proctor maximum dry density, subject to geotechnical field review.

The pavement design considering that construction will be carried out during the dry time of the year and that the subgrade is relatively dry and is stable, as determined by proofrolling operations described above. If the pavement subgrade is wet, remediation may include increasing the thickness/depth of the subbase, the use of Granular B Type II and/or the use of geogrid reinforcement, 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, 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 is recommended in conjunction with crowning of the final subgrade to promote drainage towards the pavement edge. Subdrains should be installed at least 300 mm below the subgrade level. Refer to OPSD 216. Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance holes/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.

## 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.

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

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions.

The comments and recommendations provided in the report are based on information revealed in the boreholes. Conditions away from and between boreholes may vary. 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.

## 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.

LICENSED PROFESSIONAL ENGINEER
G. R. WHITE
NOV. 21 2019
PROVINCE OF ONTARIO

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

GRW:jlb

<u>Enclosure(s):</u>
List of Abbreviations
Log of Borehole Nos. 101 to 105
Drawing No. 1 – Borehole Location Plan
Appendix A – Borehole Logs by Others
Appendix B – Engineered Fill

# *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:

| CONSISTENCY | N (blows/0.3 m) | c (kPa) | DENSENESS | N (blows/0.3 m) |
|---|---|---|---|---|
| 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 | | |

**Peto MacCallum Ltd.**
CONSULTING ENGINEERS

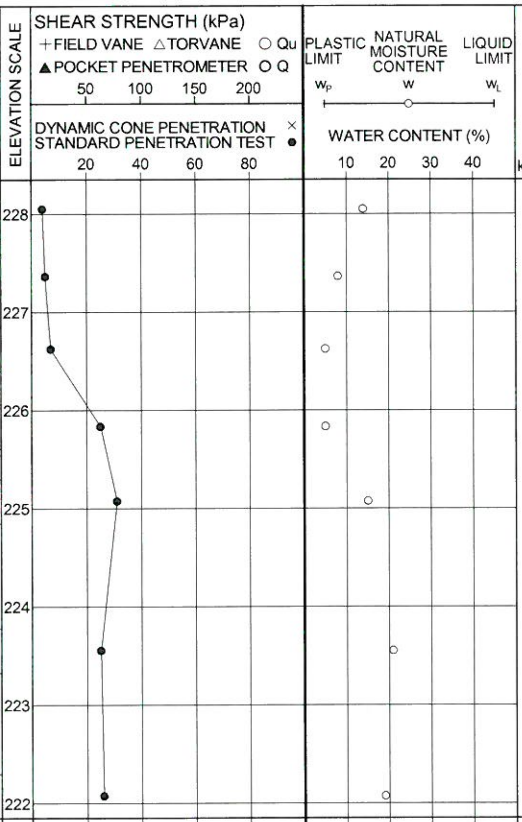
# LOG OF BOREHOLE NO. 101

1 of 1

*17T 4915324E 603383N*

**PROJECT** Proposed Condominium Building
**LOCATION** 233 Dunlop Street West, Barrie, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** October 2, 2019
**PML REF.** 19BF037
**ENGINEER** GW
**TECHNICIAN** AT

| DEPTH<br>ELEV<br>(metres) | SOIL PROFILE<br>DESCRIPTION | SAMPLES<br>NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|
|  | SURFACE ELEVATION 228.35 |  |  |  |
| 0.16<br>228.19 | TOPSOIL: Dark brown, sand, trace silt, trace gravel, moist |  |  |  |
|  | FILL: Brown, sand, trace silt, trace gravel, trace organics, moist | 1 | SS | 4 |
|  |  | 2 | SS | 5 |
| 1.4<br>227.0 | SAND: Loose to dense, brown to light brown, sand, trace to some silt, trace gravel, stratified, moist to wet | 3 | SS | 7 |
|  |  | 4 | SS | 25 |
|  |  | 5 | SS | 31 |
|  |  | 6 | SS | 25 |
|  |  | 7 | SS | 26 |
| 6.5<br>221.9 | BOREHOLE TERMINATED AT 6.5 m |  |  |  |



UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

Stick-up Casing
Concrete

Bentonite seal

19 mm Slotted Pipe
Filter sand

First water strike at 4.3 m

Upon completion of augering
Water at 4.0 m
Cave at 4.6 m
Water Level Readings:

| Date | Depth | Elev. |
|---|---|---|
| 2019-10-15 | 4.1 | 224.3 |
| 2019-11-18 | Blocked |  |

**NOTES**

**PML Peto MacCallum Ltd.**
CONSULTING ENGINEERS

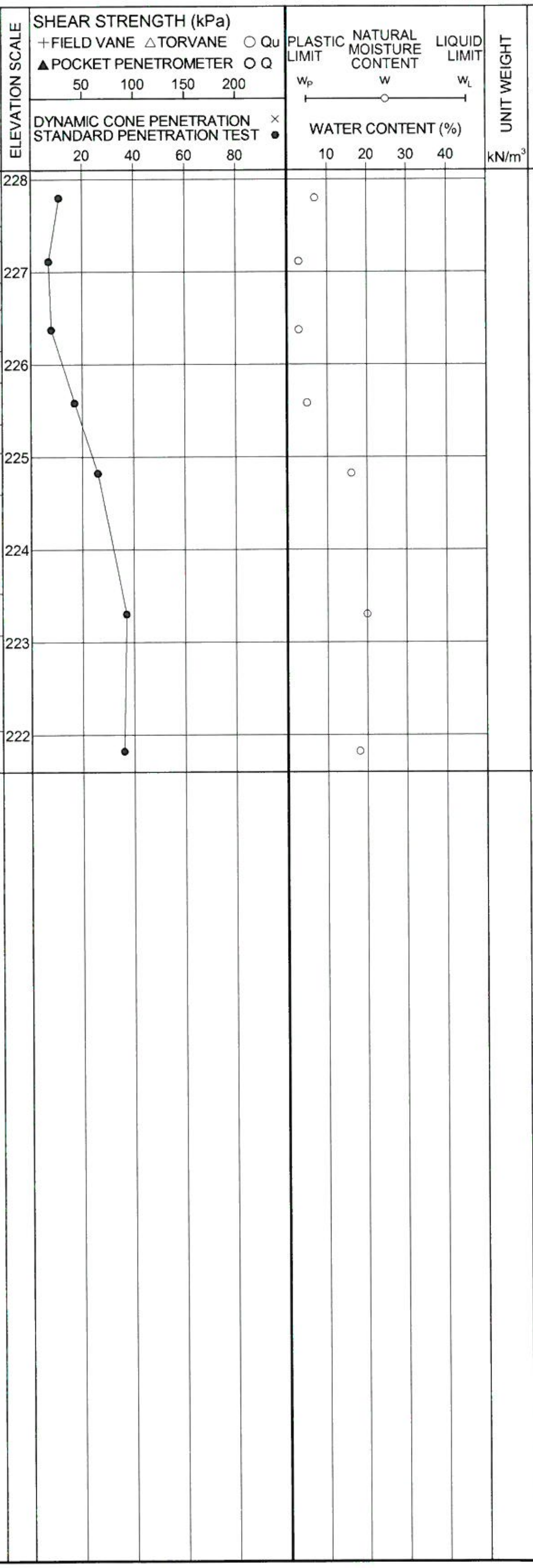
# LOG OF BOREHOLE NO. 102

1 of 1

*17T 4915357E 603429N*

***PROJECT*** Proposed Condominium Building
***LOCATION*** 233 Dunlop Street West, Barrie, Ontario
***BORING METHOD*** Continuous Flight Solid Stem Augers
***BORING DATE*** October 2, 2019
***PML REF.*** 19BF037
***ENGINEER*** GW
***TECHNICIAN*** AT

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|
| DEPTH<br>ELEV<br>(metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | GRAIN SIZE DISTRIBUTION (%)<br>GR SA SI&CL |
| 0.0 | SURFACE ELEVATION 228.10 | | | | | |
| | FILL: Brown, gravelly sand, trace silt, over sand, trace silt, trace gravel, moist | ▨ | 1 | SS | 11 | |
| | | | 2 | SS | 7 | |
| 1.4<br>226.7 | SAND: Loose to dense, brown to light brown, sand, trace to some silt, trace gravel, stratified, moist to wet | ⁘ | 3 | SS | 8 | |
| | | | 4 | SS | 17 | |
| | | | 5 | SS | 26 | |
| | | | 6 | SS | 37 | First water strike at 4.3 m |
| | | | 7 | SS | 36 | |
| 6.5<br>221.6 | BOREHOLE TERMINATED AT 6.5 m | | | | | Upon completion of augering<br>No water<br>Cave at 3.8 m |



DEPTH SCALE: 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

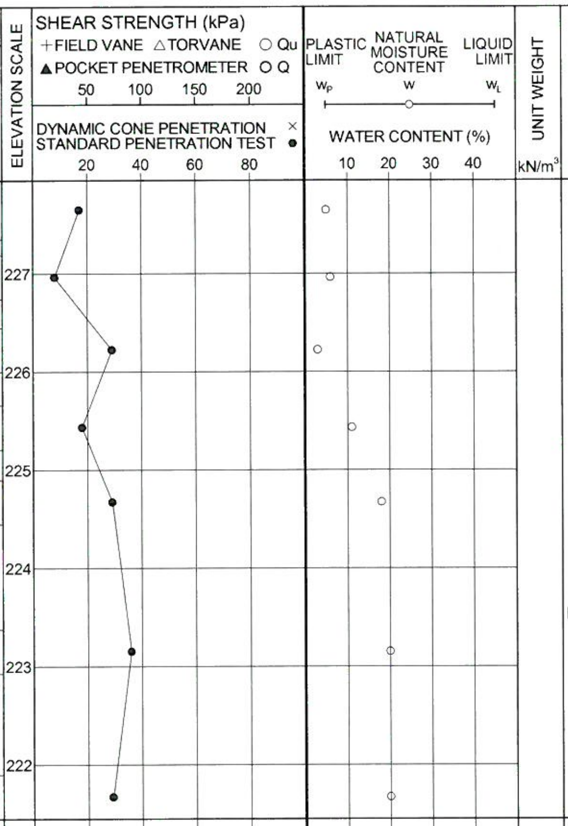
***NOTES***

# LOG OF BOREHOLE NO. 103

17T 4915330E 603414N

**PROJECT** Proposed Condominium Building
**LOCATION** 233 Dunlop Street West, Barrie, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** October 2, 2019
**PML REF.** 19BF037
**ENGINEER** GW
**TECHNICIAN** AT

| DEPTH / ELEV (metres) | SOIL PROFILE DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | TYPE | "N" VALUES | GROUND WATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|
| 0.0 | SURFACE ELEVATION 227.95 | | | | | |
| | FILL: Brown, gravelly sand, trace silt, moist | ☒ | 1 | SS | 17 | |
| 0.70<br>227.25 | SAND: Loose to dense, brown to light brown, sand, trace to some silt, trace gravel, stratified, moist to wet | ⁘ | 2 | SS | 8 | |
| | | | 3 | SS | 29 | |
| | | | 4 | SS | 18 | |
| | | | 5 | SS | 29 | |
| | | | | | | First water strike at 4.3 m |
| | | | 6 | SS | 36 | |
| | | | 7 | SS | 29 | |
| 6.5<br>221.5 | BOREHOLE TERMINATED AT 6.5 m | | | | | Upon completion of augering<br>Water at 3.8 m<br>Cave at 4.0 m |



GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

**NOTES**

**Peto MacCallum Ltd.**
CONSULTING ENGINEERS

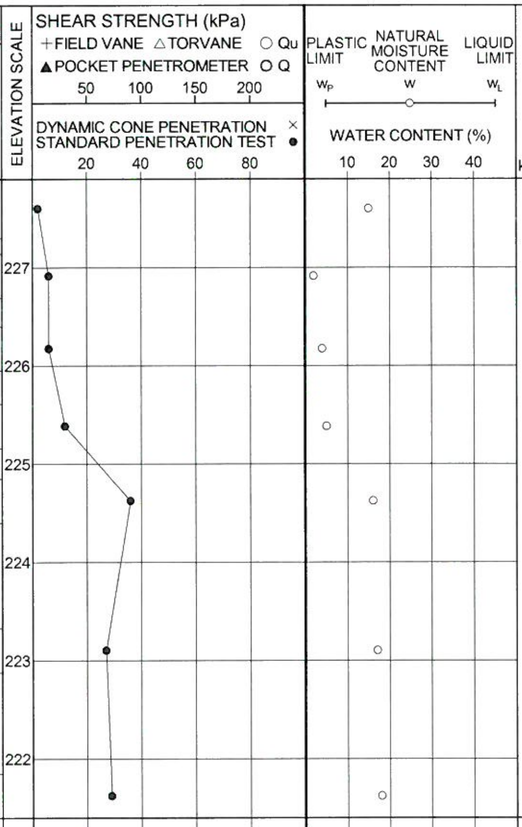
# LOG OF BOREHOLE NO. 104

1 of 1

*17T 4915311E 603390N*

***PROJECT*** Proposed Condominium Building
***LOCATION*** 233 Dunlop Street West, Barrie, Ontario
***BORING METHOD*** Continuous Flight Solid Stem Augers
***BORING DATE*** October 2, 2019
***PML REF.*** 19BF037
***ENGINEER*** GW
***TECHNICIAN*** AT

| SOIL PROFILE | | | SAMPLES | | | UNIT WEIGHT kN/m³ | GROUND WATER OBSERVATIONS AND REMARKS | GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL |
|---|---|---|---|---|---|---|---|---|
| DEPTH / ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | |
| | SURFACE ELEVATION 227.90 | | | | | | | |
| 0.15<br>227.75 | TOPSPOIL: Dark brown, sand, trace silt, trace gravel, moist | | | | | | | |
| | FILL: Brown, sand, trace silt, trace gravel, trace organics, moist | | 1 | SS | 2 | | | |
| | | | 2 | SS | 6 | | | |
| | | | 3 | SS | 6 | | | |
| 2.1<br>225.8 | SAND: Compact to dense, brown to light brown, sand, trace to some silt, trace gravel, stratified, moist to wet | | 4 | SS | 12 | | | |
| | | | 5 | SS | 36 | | | |
| | | | | | | | First water strike at 4.3 m | |
| | | | 6 | SS | 27 | | | |
| | | | 7 | SS | 29 | | | |
| 6.5<br>221.4 | BOREHOLE TERMINATED AT 6.5 m | | | | | | Upon completion of augering<br>Water at 4.0 m<br>Cave at 4.2 m | |



***NOTES***

**Peto MacCallum Ltd.**
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. 105

1 of 1

*17T 4915337E 603442N*

**PROJECT** Proposed Condominium Building
**LOCATION** 233 Dunlop Street West, Barrie, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** October 2, 2019
**PML REF.** 19BF037
**ENGINEER** GW
**TECHNICIAN** AT

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|
| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL |
| | SURFACE ELEVATION 227.90 | | | | | |
| | FILL: Brown, gravelly sand, trace silt, moist | ☒ | 1 | SS | 12 | |
| 0.70<br>227.20 | SAND: Loose to dense, brown to light brown, sand, trace to some silt, trace gravel, stratified, moist to wet | ⁘ | 2 | SS | 9 | |
| | | | 3 | SS | 8 | |
| | | | 4 | SS | 15 | |
| | | | 5 | SS | 29 | |
| | | | | | | First water strike at 4.2 m |
| | | | 6 | SS | 41 | |
| | | | 7 | SS | 29 | |
| 6.5<br>221.4 | BOREHOLE TERMINATED AT 6.5 m | | | | | Upon completion of augering<br>Water at 4.0 m<br>Cave at 4.2 m |

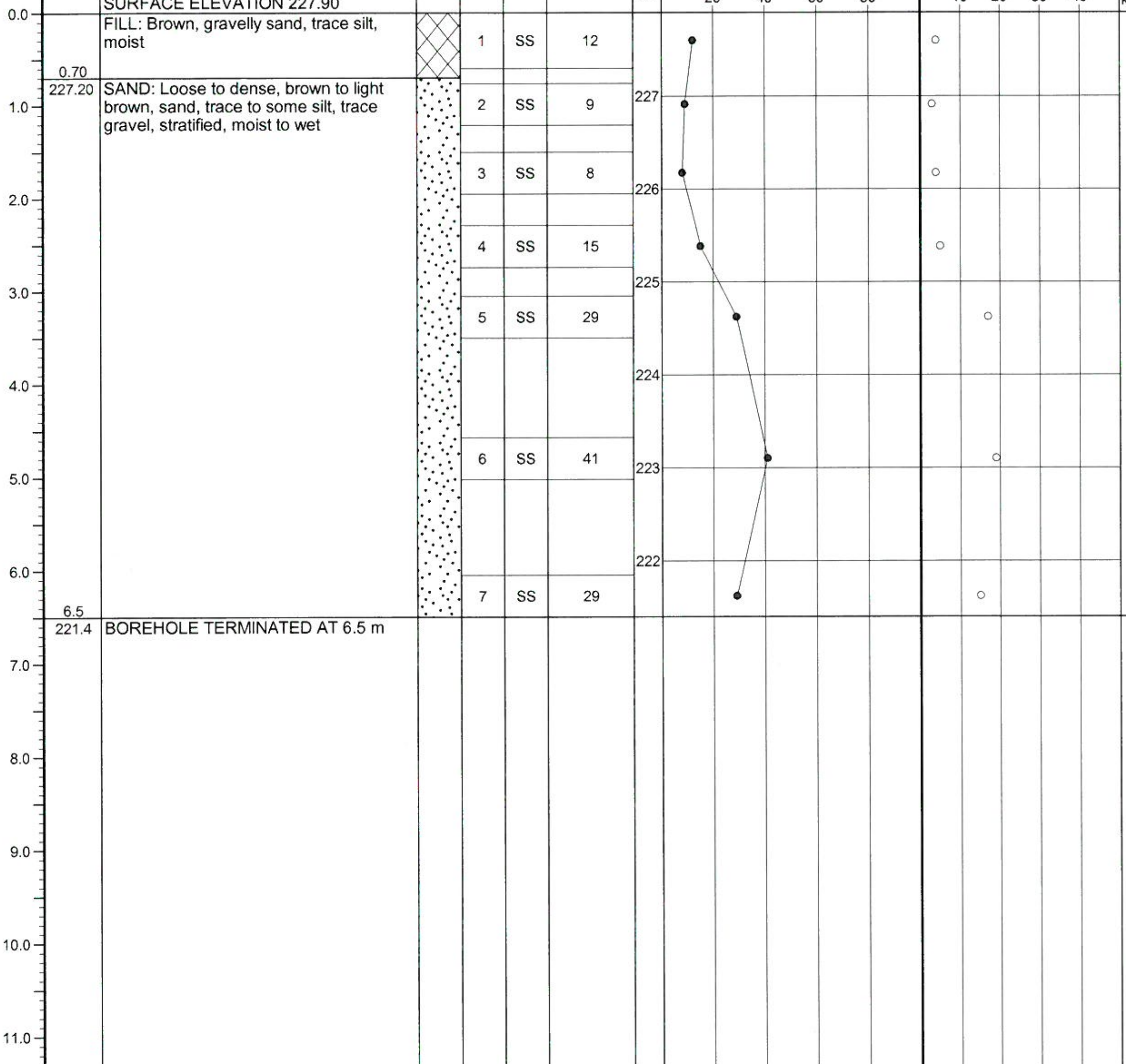
SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200

DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●

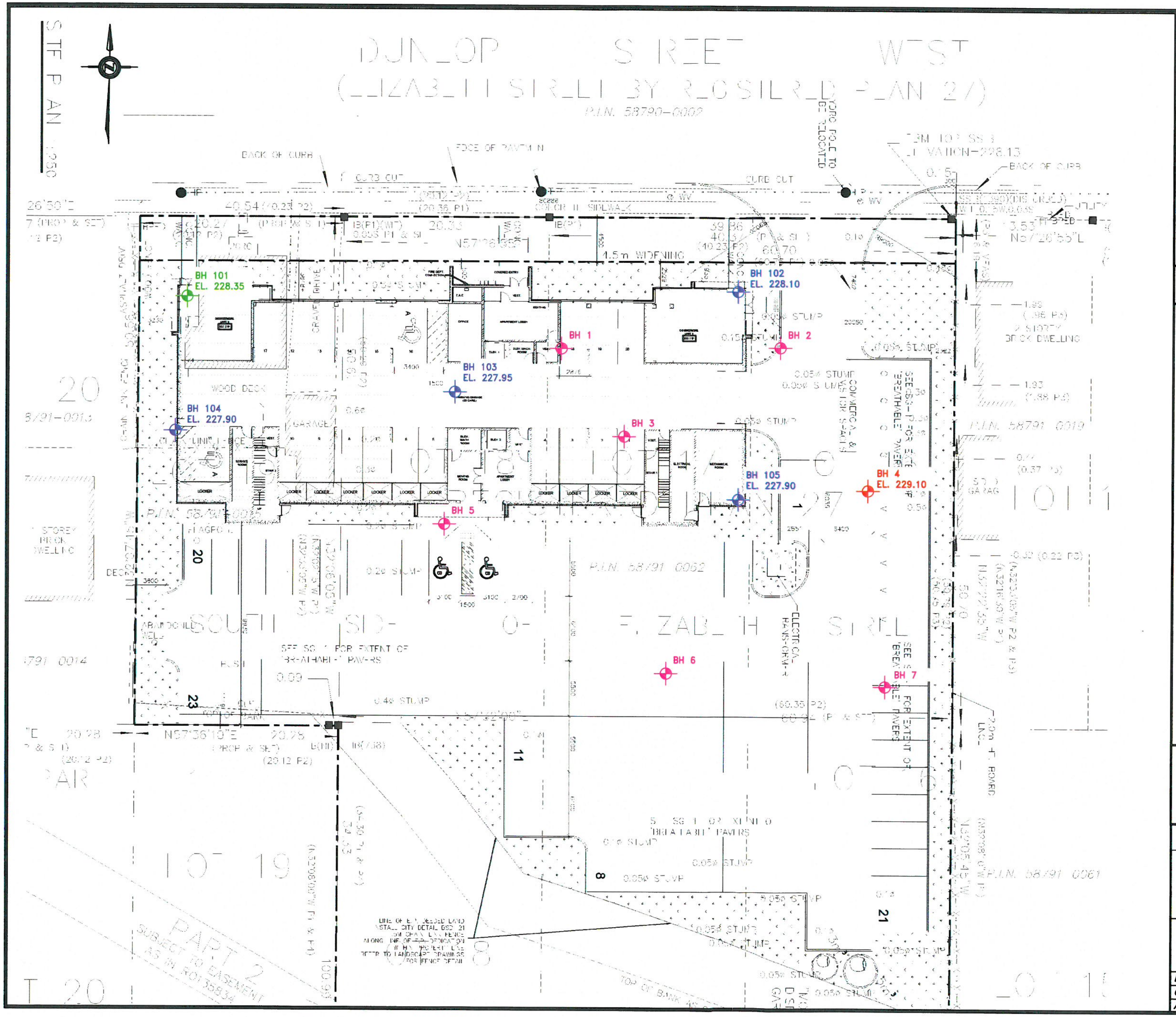
PLASTIC LIMIT $W_P$ — NATURAL MOISTURE CONTENT W — LIQUID LIMIT $W_L$

WATER CONTENT (%)

UNIT WEIGHT kN/m$^3$



**NOTES**



**KEY PLAN**
BARRIE, ONTARIO

**LEGEND:**

| | |
|---|---|
| BH 101<br>EL. 228.35 | BOREHOLE 101 (WITH PIEZOMETER)<br>SURFACE ELEVATION |
| BH 102<br>EL. 228.10 | BOREHOLE 102<br>SURFACE ELEVATION |
| BH 1 | EXISTING BOREHOLE 1 (BY OTHERS) |
| BH 4<br>EL. 229.10 | EXISTING BOREHOLE 4 (BY OTHERS)<br>WITH MONITORING WELL<br>SURFACE ELEVATION |

**REFERENCE:**
BASE PLAN PROVIDED BY CLIENT.

0m 20 40 60 80 100

## BOREHOLE LOCATION PLAN

PROPOSED CONDOMINIUM BUILDING
233 DUNLOP STREET WEST
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

| | | | | | |
|---|---|---|---|---|---|
| DRAWN | KH | DATE | SCALE | PML REF. | DRAWING NO. |
| CHECKED | RB | NOV. 2019 | AS SHOWN | 19BF037 | 1 |
| APPROVED | GW | | | | |

# APPENDIX A

Borehole Logs by Others

CLIENT: Trinity Consultants Ontario Inc

METHOD: Split Spoon Sampling

PROJECT: 233, 237, and 241 Dunlop Street West

PROJECT ENGINEER: VN

ELEV. (m) 99.15

# BH No.: BH1

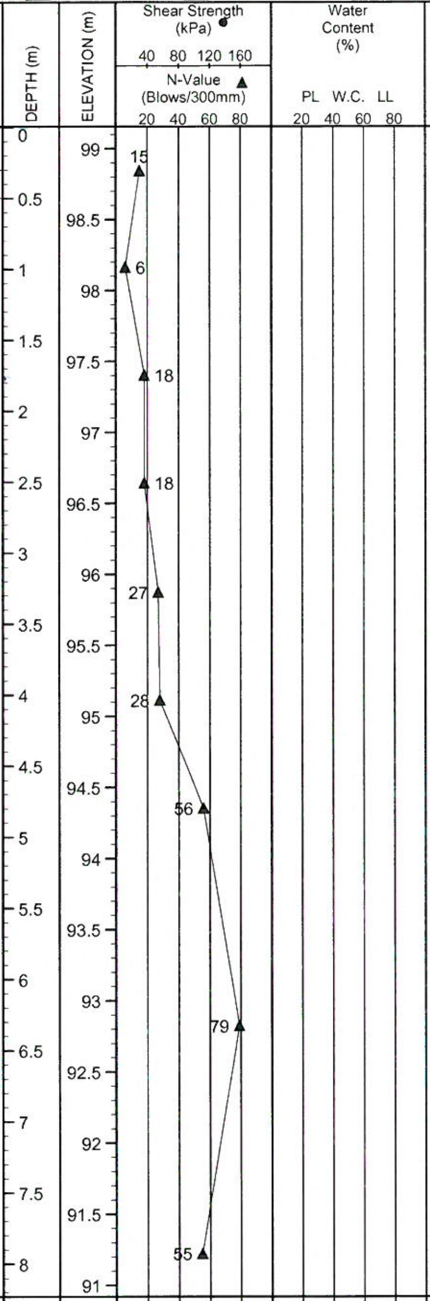
LOCATION: Barrie, Ontario

NORTHING:

EASTING:

PROJECT NO.: 17-048

SAMPLE TYPE ▮ AUGER ◩ DRIVEN ⧓ CORING ⊟ DYNAMIC CONE ▯ SHELBY ‖ SPLIT SPOON



| GWL (m) | SOIL DESCRIPTION | SAMPLE NO. | SPT(N) | REMARKS |
|---|---|---|---|---|
| | Crusher Run Limestone | 1A | 15 | Borehole cave-in at 3.5 m below ground surface. |
| | damp, dark brown, sand, trace silt (FILL) | 1B<br>1C | | |
| | loose | 2 | 6 | |
| | -----<br>damp | 3 | 18 | |
| | compact | 4 | 18 | |
| | -----<br>moist | 5A<br>5B | 27 | |
| | -----<br>brown<br>(with black stained layering)<br>SILTY SAND<br>to<br>SAND, trace silt | 6 | 28 | Wet spoon on retrieval of sample 6. |
| | ----- | 7A<br>7B | 56 | |
| | wet<br>very dense | 8 | 79 | |
| | | 9 | 55 | |

END OF BOREHOLE

**alston associates**

geotechnical division of TERRAPEX

LOGGED BY: SA

DRILLING DATE: May 24, 2017

REVIEWED BY: VN

Page 1 of 1

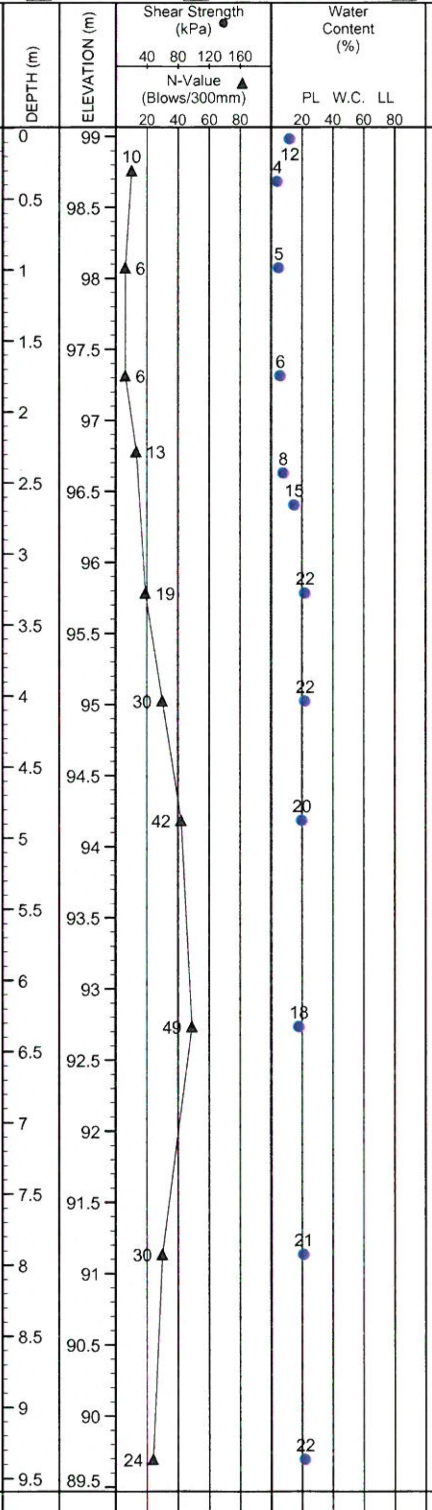
CLIENT: Trinity Consultants Ontario Inc
PROJECT: 233, 237, and 241 Dunlop Street West
LOCATION: Barrie, Ontario
METHOD: Split Spoon Sampling
PROJECT ENGINEER: VN
ELEV. (m) 99.06
NORTHING:
EASTING:

# BH No.: BH2

PROJECT NO.: 17-048

SAMPLE TYPE ▯ AUGER ◩ DRIVEN ⧓ CORING ▤ DYNAMIC CONE ▯ SHELBY ⌶ SPLIT SPOON

| GWL (m) | SOIL SYMBOL | SOIL DESCRIPTION | SAMPLE NO. | SAMPLE TYPE | SPT(N) | Well Construction | REMARKS |
|---|---|---|---|---|---|---|---|
| | | TOP SOIL (150 mm) | 1A | | 10 | | Borehole cave-in at 3.5 m below ground surface. |
| | | | 1B | | | | |
| | | | 2 | | 6 | | |
| | | loose damp | | | | | |
| | | | 3 | | 6 | | |
| | | ----- | | | | | |
| | | | 4A | | 13 | | |
| | | | 4B | | | | |
| | | ----- | | | | | |
| | | compact moist | 5 | | 19 | | |
| | | ----- | | | | | |
| | | | 6 | | 30 | | Wet spoon on retrieval of sample 6. |
| | | ----- | | | | | |
| | | brown<br>(with black stained layering)<br>SILTY SAND<br>to<br>SAND, trace silt | 7 | | 42 | | |
| | | dense wet | | | | | |
| | | | 8 | | 49 | | |
| | | ----- | | | | | |
| | | | 9 | | 30 | | |
| | | compact | | | | | |
| | | | 10 | | 24 | | |
| | | END OF BOREHOLE | | | | | |



**alston associates**
geotechnical division of TERRAPEX

LOGGED BY: SA
REVIEWED BY: VN
DRILLING DATE: May 25, 2017
Page 1 of 1

| | | |
|---|---|---|
| CLIENT: Trinity Consultants Ontario Inc | METHOD: Split Spoon Sampling | **BH No.: BH3** |
| PROJECT: 233, 237, and 241 Dunlop Street West | PROJECT ENGINEER: VN<br>ELEV. (m) 98.96 | |
| LOCATION: Barrie, Ontario | NORTHING:<br>EASTING: | PROJECT NO.: 17-048 |

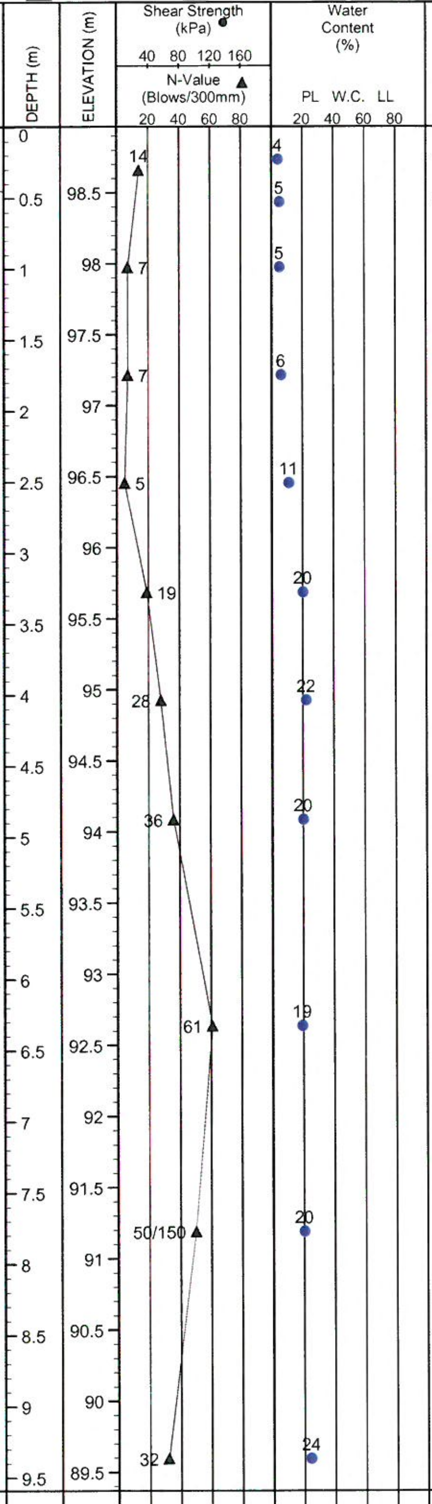
SAMPLE TYPE ▮ AUGER ◢ DRIVEN ⧗ CORING ▬ DYNAMIC CONE ▯ SHELBY Ⅱ SPLIT SPOON

# SOIL DESCRIPTION

| DEPTH (m) | SOIL DESCRIPTION | |
|---|---|---|
| 0 – approx. 0.45 | Crusher Run Limestone | |
| approx. 0.45 – 2.8 | loose | damp |
| approx. 2.8 – 4.4 | compact | moist (to approx. 3.7), then wet |
| approx. 4.4 – 5.5 | dense | wet |
| approx. 5.5 – 8.5 | very dense | wet |
| approx. 8.5 – 9.6 | dense | wet |

brown
(with black stained layering)
SILTY SAND
to
SAND, trace silt

END OF BOREHOLE



| SAMPLE NO. | SAMPLE TYPE | SPT(N) | Water Content (%) | REMARKS |
|---|---|---|---|---|
| 1A | Ⅱ | 14 | 4 | Borehole cave-in at 3.6 m below ground surface. |
| 1B | Ⅱ | | 5 | |
| 2 | Ⅱ | 7 | 5 | |
| 3 | Ⅱ | 7 | 6 | |
| 4 | Ⅱ | 5 | 11 | |
| 5 | Ⅱ | 19 | 20 | Slightly Wet spoon on retrieval of sample 5. |
| 6 | Ⅱ | 28 | 22 | Wet spoon on retrieval of sample 6. |
| 7 | Ⅱ | 36 | 20 | |
| 8 | Ⅱ | 61 | 19 | |
| 9 | Ⅱ | 50/<br>150 | 20 | |
| 10 | Ⅱ | 32 | 24 | |

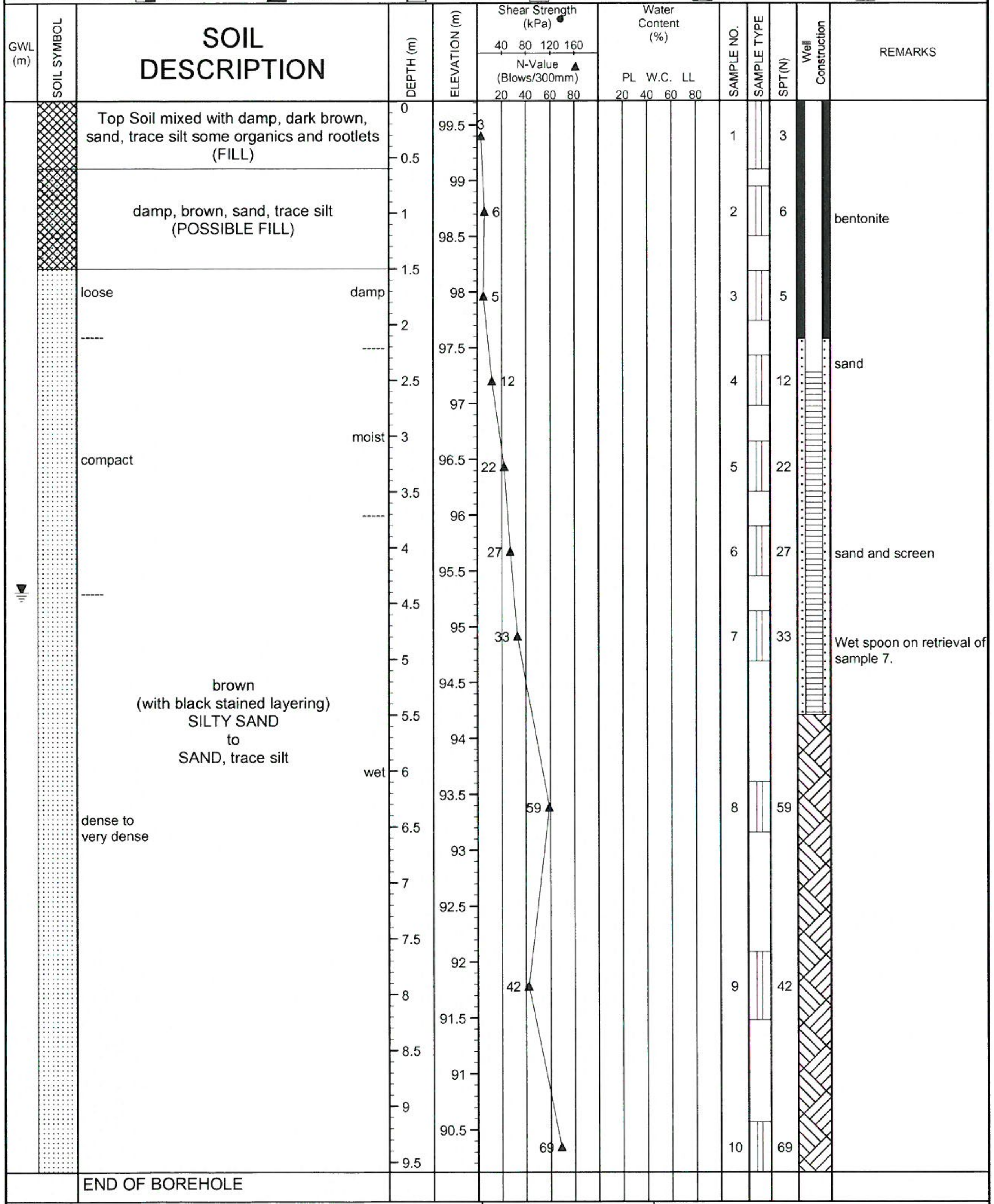
GWL (m) · SOIL SYMBOL · Well Construction

**alston associates**
geotechnical division of TERRAPEX

| | |
|---|---|
| LOGGED BY: SA | DRILLING DATE: May 24, 2017 |
| REVIEWED BY: VN | Page 1 of 1 |

| | | | |
|---|---|---|---|
| CLIENT: Trinity Consultants Ontario Inc | METHOD: Split Spoon Sampling | | **BH No.: MW4** |
| PROJECT: 233, 237, and 241 Dunlop Street West | PROJECT ENGINEER: VN | ELEV. (m) 99.71 | |
| LOCATION: Barrie, Ontario | NORTHING: | EASTING: | PROJECT NO.: 17-048 |

SAMPLE TYPE ▮ AUGER ◢ DRIVEN ⧓ CORING ▀ DYNAMIC CONE ▯ SHELBY ⌶ SPLIT SPOON



# SOIL DESCRIPTION

Top Soil mixed with damp, dark brown, sand, trace silt some organics and rootlets (FILL)

damp, brown, sand, trace silt (POSSIBLE FILL)

loose — damp

compact — moist

brown (with black stained layering) SILTY SAND to SAND, trace silt

dense to very dense — wet

END OF BOREHOLE

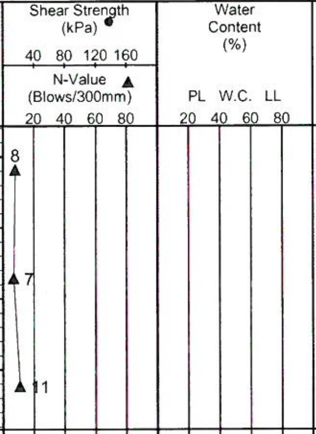
| SAMPLE NO. | SPT(N) | REMARKS |
|---|---|---|
| 1 | 3 | |
| 2 | 6 | bentonite |
| 3 | 5 | |
| 4 | 12 | sand |
| 5 | 22 | |
| 6 | 27 | sand and screen |
| 7 | 33 | Wet spoon on retrieval of sample 7. |
| 8 | 59 | |
| 9 | 42 | |
| 10 | 69 | |

| | | |
|---|---|---|
| **alston associates**<br>geotechnical division of TERRAPEX | LOGGED BY: SA | DRILLING DATE: May 24, 2017 |
| | REVIEWED BY: VN | Page 1 of 1 |

| | | | |
|---|---|---|---|
| CLIENT: Trinity Consultants Ontario Inc | METHOD: Split Spoon Sampling | | **BH No.: BH5** |
| PROJECT: 233, 237, and 241 Dunlop Street West | PROJECT ENGINEER: VN | ELEV. (m) 98.71 | |
| LOCATION: Barrie, Ontario | NORTHING: | EASTING: | PROJECT NO.: 17-048 |

SAMPLE TYPE: AUGER, DRIVEN, CORING, DYNAMIC CONE, SHELBY, SPLIT SPOON

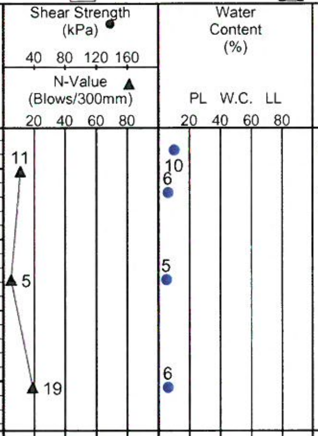
| GWL (m) | SOIL SYMBOL | SOIL DESCRIPTION | DEPTH (m) | ELEVATION (m) | SAMPLE NO. | SAMPLE TYPE | SPT(N) | Well Construction | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | ▩ | TOP SOIL (300 mm) | 0 | 98.5 | 1A | | 8 | | Borehole open and dry on completion. |
| | | | 0.5 | | 1B | | | | |
| | ░ | loose<br>-----<br>compact<br>damp, brown (with black stained layering) SILTY SAND to SAND, trace silt | 1 | 98 | 2 | | 7 | | |
| | | | 1.5 | 97.5 | | | | | |
| | | | 2 | 97 | 3 | | 11 | | |
| | | END OF BOREHOLE | | | | | | | |



| | | |
|---|---|---|
| alston associates<br>geotechnical division of TERRAPEX | LOGGED BY: SA | DRILLING DATE: May 25, 2017 |
| | REVIEWED BY: VN | Page 1 of 1 |

| | | |
|---|---|---|
| CLIENT: Trinity Consultants Ontario Inc | METHOD: Split Spoon Sampling | **BH No.: BH6** |
| PROJECT: 233, 237, and 241 Dunlop Street West | PROJECT ENGINEER: VN<br>ELEV. (m) 98.78 | |
| LOCATION: Barrie, Ontario | NORTHING:<br>EASTING: | PROJECT NO.: 17-048 |

SAMPLE TYPE ▮ AUGER ◢ DRIVEN ⧓ CORING ▬ DYNAMIC CONE ▯ SHELBY Ⅱ SPLIT SPOON



| GWL (m) | SOIL SYMBOL | SOIL DESCRIPTION | DEPTH (m) | ELEVATION (m) | SAMPLE NO. | SAMPLE TYPE | SPT(N) | Well Construction | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | | TOP SOIL (300 mm) | 0 | | 1A | | 11 | | Borehole open and dry on completion. |
| | | compact<br>----- | 0.5 | 98.5 | 1B | | | | |
| | | loose<br>damp, brown<br>(with black stained layering)<br>SILTY SAND<br>to<br>SAND, trace silt | 1 | 98 | 2 | | 5 | | |
| | | -----<br>compact | 1.5<br>2 | 97.5<br>97 | 3 | | 19 | | |
| | | END OF BOREHOLE | | | | | | | |

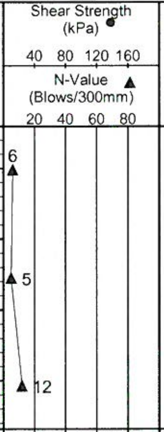
| | |
|---|---|
| LOGGED BY: SA | DRILLING DATE: May 25, 2017 |
| REVIEWED BY: VN | Page 1 of 1 |

CLIENT: Trinity Consultants Ontario Inc
METHOD: Split Spoon Sampling
PROJECT: 233, 237, and 241 Dunlop Street West
PROJECT ENGINEER: VN
ELEV. (m) 98.79

## BH No.: BH7

LOCATION: Barrie, Ontario
NORTHING:
EASTING:
PROJECT NO.: 17-048

SAMPLE TYPE ▮ AUGER ◢ DRIVEN ⧓ CORING ▀ DYNAMIC CONE ▯ SHELBY ⌶ SPLIT SPOON



| GWL (m) | SOIL SYMBOL | SOIL DESCRIPTION | DEPTH (m) | ELEVATION (m) | Water Content (%) PL W.C. LL | SAMPLE NO. | SAMPLE TYPE | SPT(N) | Well Construction | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | ▩ | TOP SOIL (300 mm) | 0 | | | 1A | ⌶ | 6 | | Borehole open and dry on completion. |
| | ▒ | loose<br>damp, brown<br>(with black stained layering)<br>SILTY SAND<br>-----<br>to<br>SAND, trace silt<br>compact | 0.5<br>1<br>1.5<br>2 | 98.5<br>98<br>97.5<br>97 | | 1B<br>2<br>3 | ⌶<br>⌶<br>⌶ | <br>5<br>12 | | |
| | | END OF BOREHOLE | | | | | | | | |

**alston associates**
geotechnical division of TERRAPEX

LOGGED BY: SA
DRILLING DATE: May 25, 2017
REVIEWED BY: VN
Page 1 of 1

# APPENDIX B

Engineered Fill

# *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.