- **Watersand Development**

# Geotechnical Investigation
# Proposed Residential Development
# McKay Road West & Veterans Drive, Barrie, Ontario and 5th Sideroad & 9th Sideroad, Innisfil, Ontario

BRM-00038305-B0

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# 1. Introduction

This report presents the results of a geotechnical investigation carried out for a proposed residential development on the southwest and southeast corners of McKay Road West and Veterans Drive in Barrie, Ontario and on the northwest and northeast corner of 5th Sideroad and 9th Line in Innisfil, Ontario. Concurrently with this work, EXP has undertaken the Hydrogeological Investigation (reported under separate cover) to provide details regarding the groundwater conditions at the site and its associated impacts on the proposed development. The parcel of land occupying the property west of 5th Sideroad bound to the north by McKay Road West and to the south by 9th Line is approximately 239 hectares (~590 acres) in size while the parcel of land occupying the property east of 5th Sideroad bound to the north by McKay Road West and to the south by 9th Line is approximately 73 hectares (~180 acres) in size. The land described form two (2) contiguous properties on the east and west sides of Veterans Drive/5th Sideroad straddling the City of Barrie and Town of Innisfil border. The work was authorized by Mr. Jordan Archer of Watersand Development.

The project involves the design and construction of residential dwellings together with the necessary municipal infrastructure such as roads, sewers, water and other services including three (3) stormwater management pond, amenity blocks (parks and school blocks) and employment lands.

The purpose of the geotechnical investigation was to determine the subsurface soil and groundwater conditions at the site and, based on this information, to provide an engineering report with geotechnical recommendations pertaining to the design and construction of the proposed residential development.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

# 2. Site Description

The Site occupies an area on the southwest and southeast corners of McKay Road West and Veterans Drive in Barrie, Ontario and on the northwest and northeast corner of 5th Sideroad and 9th Line in Innisfil, Ontario, as shown on Figure 1. The Site is rectangular in shape and occupies an area of approximately 312 hectares (~770 acres).

The majority of the Site consists of an open field, largely covered in soya bean and corn plants with small forested areas. The Site west of Veterans Drive / 5th Sideroad generally slopes downward towards the south with a localized depression in the general area of the creek which flows from north to south through the site. The area east of Veterans Drives / 5th Sideroad generally slopes down towards the south and east. The property comprises mainly farmland and is currently undeveloped with the exceptions of remnants of the historic farmsteads.

# 3. Fieldwork

The field work comprised drilling of two hundred and forty-four (244) sampled boreholes designated Boreholes 1 to 13, 15 to 17, 19 to 24, 26 to 41, 43 to 46, 48 to 51, 53, 54, 56 to 68, 70 to 82, 84 to 89, 91, 93 to 109, 111, 112, 114, 115, 117 to 159, 139A to 149A, 139B to 149B, 139C to 149C, 138D, A1 to A3, B1, B2, C1 to C3 and E1 to E55. 50 mm diameter monitoring wells were installed in Boreholes 17, 54, 62, 68, 82, 96, 101, 119, 122, 136, 137, 144C, 146A, 151, 157, E4, E8, E10, E33, E40 and E44. Nested configurations comprising deep and shallow monitoring wells were installed at locations of Boreholes 64, A2, A3, B1, B2, C2 and C3. The deep and shallow monitoring well logs were assigned the suffixes D and S respectively, following the borehole numbers. The fieldwork was carried out between May 29 to July 31, 2017. The two hundred and forty-four (244) sampled boreholes were drilled to depths of approximately 6 to 25 m below existing grades at the approximate locations shown on the attached Borehole Location Plans (Drawing No. 1, 2, 81, 145, 183, 210, 223, 238 and 244).

The site was subdivided by municipal boundaries and topographic regions into six (6) subsections and two (2) sections of roads. The layout and numbering of the boreholes was provided by the client. Locations, section numbers and borehole numbers are summarized in the following table:

**Table 1: Site Section Summary**

| Section No. | Location | Borehole No. |
|---|---|---|
| 1 | South of McKay Road West and West of site creek, Municipality of Barrie, Ontario. | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 43, 44, 45, 46, 48, 49, 50, 51, 53, 54, 56, 57, 58, 59, 60, 61, 62, 64-D, 64-S, 65, 66, 70, B1-D, B1-S, B2-D, B2-S, C1, C2-D, C2-S, C3-D and C3-S |
| 2 | South of McKay Road West, East of site creek, West of 5th Sideroad, Municipality of Barrie, Ontario. | 67, 68, 71, 72, 73, 74, 75, 77, 79, 80, 81, 82, 84, 85, 86, 87, 88, 89, 91, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 111, 112, 114, 115, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, A1, A2-D, A2-S, A3-D and A3-S |
| 3 | South of McKay Road West, East of 5th Sideroad, Municipality of Barrie, Ontario. | 138B, 138C, 138D, 139A, 139B, 139C, 140A, 140B, 140C, 141A, 141B, 141C, 142A, 142B, 142C, 143A, 143B, 143C, 144A, 144B, 144C, 145, 145A, 145B, 145C, 146, 146A, 146B, 147, 147A, 147B, 147C, 148A, 148B, 148C, 149B and 149C |
| 4 | North of 9th Line and West of site creek, Municipality of Innifil, Ontario. | E1, E2, E3, E9, E10, E11, E12, E19, E20, E21, E22, E27, E28, E29, E30, E31, E37, E38, E39, E40, E41, E46, E47, E48, E49 and E50 |

| Section No. | Location | Borehole No. |
|---|---|---|
| 5 | North of 9th Line and East of site creek, Municipality of Innifil, Ontario. | E4, E5, E5, E13, E14, E15, E23, E32, E33, E42, E51 and E52 |
| 6 | North of 9th Line, East of 5th Sideroad, Municipality of Innifil, Ontario. | E8, E16, E17, E18, E25, E26, E34, E35, E36, E44, E45, E53, E54 and E55 |
| McKay Road West | McKay Road West, Barrie, Ontario | 32, 63, 76, 117 and 137 |
| 5th Sideroad / Veterans Drive | 5th Sideroad North of 9th Line, Municipality of Innisfil to Veterans Drive South of Salem Road intersection, Municipality of Barrie, Ontario | E7, E24, E43, 136, 146C, 149A, 150, 151, 152, 153, 154, 155, 156, 157, 158 and 159 |

The boreholes were advanced using continuous flight solid and hollow stem auger equipment owned and operated by a specialist drilling contractor. In each borehole, samples were recovered using conventional split spoon equipment in conjunction with the standard penetration test method.

Water levels were observed in the open boreholes during the course of the fieldwork and in monitoring wells as described earlier for subsequent groundwater level measurement, testing and sampling for hydrogeological purposes.

The fieldwork was supervised throughout by an EXP Services Inc. (EXP) geotechnical technologists who directed the drilling and sampling operations, prepared borehole logs, made groundwater observations during and upon completion of drilling, and processed the recovered samples. In the laboratory, the samples were classified as to their olfactory, visual and textural characteristics. Natural moisture content and density tests were carried out for selected recovered samples, with results presented on the Log of Borehole sheets.

The locations of the boreholes were established in the field by J.D. Barnes Limited, Ontario Land Surveyors, who were retained by the Client. The top of borehole elevations (Geodetic) were provided to EXP by J.D. Barnes Limited through the Client.

# 4. Laboratory Testing

The laboratory testing program comprised the following:

- Moisture content and unit weight determination on selected recovered soil samples, with results presented on the Log of Borehole sheets.

- Grain Size Analysis on the following twenty-three (23) selected soil samples:

  Section 1:

  - 3 SS7 Borehole 3 – 3.8 to 4.4 m depth
  - 7 SS1 Borehole 7 – 0.2 to 0.4 m depth
  - 20 SS2 Borehole 20 – 0.8 to 1.1 m depth
  - 30 SS7 Borehole 30 – 3.8 to 4.1 m depth
  - 53 SS2 Borehole 53 – 0.8 to 1.4 m depth
  - 54 SS8 Borehole 54 – 6.1 to 6.2 m depth

  Section 2:

  - 79 SS6 Borehole 79 – 3.8 to 4.4 m depth
  - 86 SS9 Borehole 86 – 7.6 to 7.8 m depth
  - 99 SS2 Borehole 99 – 0.8 to 1.4 m depth
  - 109 SS8 Borehole 109 – 6.1 to 6.5 m depth
  - 118 SS12 Borehole 118 – 12.2 to 12.5 m depth
  - 125 SS2 Borehole 125 – 0.8 to 1.2 m depth

  Section 3:

  - 140B SS2 Borehole 140B – 0.8 to 1.4 m depth

  Section 4:

  - E12 SS2 Borehole E12 – 0.8 to 1.4 m depth
  - E20 SS2 Borehole E20 – 0.8 to 1.2 m depth
  - E31 SS8 Borehole E31 – 6.1 to 6.7 m depth

- ❖ E37 SS6 Borehole E37 – 3.8 to 4.4 m depth
- ❖ E41 SS8 Borehole E41 – 6.1 to 6.5 m depth

Section 5:

- ❖ E15 SS2 Borehole E15 – 0.8 to 1.4 m depth
- ❖ E42 SS2 Borehole E42 – 0.8 to 1.2 m depth
- ❖ E52 SS5 Borehole E52 – 3.2 to 3.6 m depth

Section 6:

- ❖ E35 SS2 Borehole E35 – 0.8 to 1.2 m depth

McKay Road West:

- ❖ 76 SS5 Borehole 76 – 3.5 to 4.1 m depth

- Forty-five (45) soil samples analyzed for selected general and inorganic parameters in accordance with land use criteria listed in Table 2 and 3 of the Ministry of the Environment standards (Ontario Regulation 153), dated July 1, 2011, with results presented in Appendix B. The following samples were submitted:

Section 1:

- ❖ 1 SS1 Borehole 1 – 0.0 to 0.6 m depth
- ❖ 1 SS5 Borehole 1 – 3.1 to 3.7 m depth
- ❖ 8 SS1 Borehole 8 – 0.0 to 0.6 m depth
- ❖ 8 SS8 Borehole 8 – 4.3 to 5.5 m depth
- ❖ 33 SS1 Borehole 33 – 0.0 to 0.6 m depth
- ❖ 33 SS8 Borehole 33 – 6.1 to 6.4 m depth
- ❖ 40 SS2 Borehole 40 – 0.8 to 1.4 m depth
- ❖ 40 SS8 Borehole 40 – 6.1 to 6.3 m depth
- ❖ 48 SS1 Borehole 48 – 0.0 to 0.6 m depth
- ❖ 48 SS8 Borehole 48 – 6.1 to 6.4 m depth
- ❖ 61 SS2 Borehole 53 – 0.8 to 1.4 m depth
- ❖ 61 SS8 Borehole 54 – 6.1 to 6.4 m depth

- B2 SS1 Borehole B2 – 0.0 to 0.6 m depth
- B2 SS10 Borehole B2 – 9.1 to 9.3 m depth
- C2 SS1 Borehole 54 – 0.0 to 0.6 m depth
- C2 SS8 Borehole 54 – 6.1 to 6.4 m depth

Section 2:

- 81 SS1 Borehole 81 – 0.0 to 0.6 m depth
- 81 SS8 Borehole 81 – 6.1 to 6.8 m depth
- 108 SS1 Borehole 108 – 0.0 to 0.6 m depth
- 108 SS8 Borehole 108 – 6.1 to 6.6 m depth
- 112 SS2 Borehole 112 – 0.8 to 1.4 m depth
- 112 SS8 Borehole 112 – 6.1 to 6.6 m depth
- 135 SS1 Borehole 135 – 0.0 to 0.6 m depth
- 135 SS8 Borehole 135 – 6.1 to 6.5 m depth
- A3 SS1 Borehole A3 – 0.0 to 0.6 m depth
- A3 SS8 Borehole A3 – 6.1 to 6.7 m depth

Section 3:

- 147 SS2 Borehole 147 – 0.8 to 1.4 m depth
- 144C SS1 Borehole 144C – 0.0 to 0.6 m depth
- 146B SS1 Borehole 146B – 0.0 to 0.6 m depth

Section 4:

- E48 SS1 Borehole E48 – 0.0 to 0.6 m depth

Section 5:

- E23 SS1 Borehole E23 – 0.0 to 0.6 m depth
- E52 SS1 Borehole E52 – 0.0 to 0.6 m depth

Section 6:

- E54 SS1 Borehole E54 – 0.0 to 0.6 m depth

McKay Road West:

- 76 SS2 Borehole 76 – 0.8 to 1.4 m depth
- 76 SS8 Borehole 76 – 6.1 to 6.7 m depth
- 117 SS2 Borehole 76 – 0.8 to 1.4 m depth
- 117 SS6 Borehole 76 – 3.1 to 3.7 m depth

Veterans Drive:

- 150 SS2 Borehole 150 – 0.8 to 1.4 m depth
- 150 SS6 Borehole 150 – 3.8 to 4.4 m depth
- 154 SS2 Borehole 154 – 0.8 to 1.4 m depth
- 154 SS8 Borehole 154 – 6.1 to 6.6 m depth

5th Sideroad:

- 136 SS2 Borehole 136 – 0.8 to 1.4 m depth
- 136 SS7 Borehole 136 – 4.6 to 4.9 m depth
- E43 SS2 Borehole 43 – 0.8 to 1.4 m depth
- E43 SS8 Borehole 43 – 6.1 to 6.4 m depth

- Four (4) soil samples analyzed for OC pesticides parameters in accordance with land use criteria listed in Table 2 and 3 of the Ministry of the Environment standards (Ontario Regulation 153), dated July 1, 2011, with results presented in Appendix B. The following samples were submitted:

Section 2:

- 99 SS1 Borehole 99 – 0.0 to 0.6 m depth

Section 3:

- 146B SS1 Borehole 146B – 0.0 to 0.6 m depth

Section 4:

- E11 SS1 Borehole E11 – 0.0 to 0.6 m depth

Section 6:

- E44 SS1 Borehole E44 – 0.0 to 0.6 m depth

- Ontario Regulation 558 leachate analysis of TCLP VOCs, TCLP metals, TCLP PCBs, TCLP benzo(a)pyrene, TCLP extractables and ignitability on one (1) soil sample (99 SS1). The laboratory Certificates of Analysis is included in Appendix B.

# 5. Subsurface Conditions

## 5.1 Soil

The detailed profiles encountered in each borehole and the results of laboratory moisture content and unit weight are indicated on the attached borehole logs. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones, for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs are an integral part of and should be read in conjunction with this report.

The stratigraphy encountered at the site, as revealed in the boreholes, generally comprised surficial topsoil and ploughed soil, native deposits of sand, silty sand, silty clay, clayey silt, silt and silty sand till. The stratigraphy encountered along the roadways, as revealed in the boreholes, generally comprised surficial asphalt and granular fill, sand fill, native deposits of sand, peat, silty sand, silty clay, silt and silty sand till.

A brief description of the soil profiles follows.

***Topsoil / Ploughed Soil***

A surficial layer of topsoil 50 to 380 mm thick was encountered in all Boreholes. However, given use of the property for agricultural purposes disturbed (ploughed) soil should be expected to typical ploughing depths of up to 600 to 800 mm.

Grain size analysis on one (1) topsoil sample from Borehole 7 indicated 91% sand, 9% silt and clay.

*It should be noted that topsoil and disturbed (ploughed) soil measurements were carried out at the borehole locations only and could differ at other locations on the site. Consequently, topsoil and disturbed (ploughed) soil quantities should not be established from the information provided at the borehole locations. If required, a more detailed test pit program should be carried out to more accurately quantify the amount of topsoil and disturbed (ploughed) soil to be removed for construction purposes.*

***Pavement Structure***

All boreholes advanced within the traveled roadway of Veterans Drive and 5th Sideroad encountered a pavement structure comprised of an asphaltic layer with a thickness ranging from 75 to 200 mm overlying a 200 to 330 mm thick granular layer and within the road shoulder of Veterans Drive and 5th Sideroad encountered a pavement structure comprised of a surficial granular layer approximately 50 to 600 mm with the exception of Boreholes 152 and 157. The borehole advanced within the shoulder of McKay Road West encountered a pavement structure comprised of a surficial granular layer approximately 180 to 870 mm. The granular layer typically consisted of a sand and grave with trace to some silt. The granular fill is in a generally moist condition. A detailed summary of the pavement structure and subgrade are provided below:

**Table 2: Pavement Structure Summary McKay Road West**

| Borehole Location | Pavement Structure | | |
|---|---|---|---|
| | Asphalt Thickness | Base / Subbase Material | Granular Thickness* |
| 32 | -- | Granular | 700 mm |
| 63 | -- | Granular | 600 mm |
| 76 | -- | Granular | 860 mm |
| 117 | -- | Granular | 870 mm |
| 137 | -- | Granular | 180 mm |

** May include granular fills below the pavement structure.*

**Table 3: Pavement Structure Summary Veterans Drive**

| Borehole Location | Pavement Structure | | |
|---|---|---|---|
| | Asphalt Thickness | Base / Subbase Material | Granular Thickness* |
| 150 | 75 mm | Granular | 200 mm |
| 151 | -- | Granular | 75 mm |
| 153 | -- | Granular | 50 mm |
| 154 | 200 mm | Granular | 300 mm |
| 155 | -- | Granular | 200 mm |
| 156 | 200 mm | Granular | 300 mm |
| 158 | 180 mm | Granular | 250 mm |
| 159 | 180 mm | Granular | 250 mm |

** May include granular fills below the pavement structure.*

**Table 4: Pavement Structure Summary 5th Sideroad**

| Borehole Location | Pavement Structure | | |
|---|---|---|---|
| | Asphalt Thickness | Base / Subbase Material | Granular Thickness* |
| 136 | -- | Granular | 600 mm |
| 146C | 180 mm | Granular | 250 mm |
| 149A | 180 mm | Granular | 330 mm |
| E7 | -- | Granular | 180 mm |
| E24 | -- | Granular | 600 mm |
| E43 | -- | Granular | 100 mm |

** May include granular fills below the pavement structure.*

***Sand Fill***

Sand fill underlies the pavement structures in Boreholes 63, 117, 137, 146C, 149A, 150, 151, 152, 153, 154, 155, 157, 158 and 159. The fill extends to depths of approximately 0.7 to 3.2 m (~Elevation 306.2 to 311.3 m). Typically, the thickness of fill ranged from approximately 0.5 to 2.9 m depth. The fill typically comprises of brown to reddish brown sand, trace to some silt, trace to some gravel and occasional organics were observed. Moisture contents in the fill ranged from approximately 6 to 28 %.

Grain size analysis on one (1) sand fill sample from Borehole 63 indicated 3% gravel, 84% sand, 13% silt and clay.

***Native Soils***

The native soils were intersected below the topsoil or fill at all borehole locations. The native soils comprise sand, silty sand, silty clay, clayey silt, silt, silty sand till, and peat and exist in various thicknesses, sequences, degrees of compactness and consistencies depending on location.

***Silty Sand Till***

The predominant soil deposit at this site is glacial silty sand till. A silty sand till deposit was encountered in all of the boreholes with the exception of Boreholes 58, 106, 124, 142A, E27, E28, 150, 152 and 154. The till contained trace gravel and was embedded with occasional cobbles and boulders. These deposits existed in a compact to very dense state of compactness. Moisture contents of the silty sand till deposit ranged from 4 to 32 %, but were typically about 9 to 11%.

Grain size analysis on ten (10) silty sand till samples was completed, the grain size distribution is summarized in the following table:

**Table 5: Particle Size Distribution Summary**

| Borehole No. / Sample No. | Depth Interval below Grade (m) | Elevation Interval (m) | Percentage | | |
|---|---|---|---|---|---|
| | | | Gravel | Sand | Silt & Clay |
| 3 SS7 | 3.8 – 4.4 | 305.8 – 306.4 | 1 | 84 | 15 |
| 20 SS2 | 0.8 – 1.1 | 309.7 – 309.4 | 2 | 64 | 34 |
| 30 SS7 | 3.8 – 4.1 | 306.0 – 305.7 | 5 | 80 | 15 |
| 53 SS2 | 0.8 – 1.4 | 308.8 – 308.2 | 9 | 76 | 15 |
| E12 SS2 | 0.8 – 1.4 | 307.1 – 307.7 | 11 | 52 | 37 |
| E15 SS2 | 0.8 – 1.4 | 307.6 – 308.2 | 10 | 51 | 39 |
| E31 SS8 | 6.1 – 6.7 | 300.8 – 301.4 | 6 | 58 | 36 |
| E41 SS8 | 6.1 – 6.5 | 300.2 – 300.6 | 2 | 65 | 33 |
| E42 SS2 | 0.8 – 1.2 | 307.1 – 307.5 | 11 | 55 | 34 |
| E52 SS5 | 3.2 – 3.6 | 304.3 – 304.7 | 11 | 54 | 35 |

***Silty Sand***

In Boreholes 99, 104, 118, 133 and E44, discontinuous deposits of silty sand were encountered. Borehole 133 was terminated within this deposit at a depth of 6.5 m below existing grade. It typically contained trace gravel, trace clay with occasional silt inclusions and interbedded silt seams. These deposits existed in a very loose to very dense state of compactness. Moisture contents of these moist to wet deposits varied from 7 to 19%.

Grain size analysis on one (1) silty sand sample from Borehole 76 indicated 5% gravel, 60% sand, 26% silt and 9% clay.

***Silt***

Discontinuous deposits of silt were encountered in all sections with the exception of Section 5. It typically contained some to with clay, some sand, trace gravel with occasional clayey silt / silty clay inclusions and interbedded sand layers. The silt typically had a hard consistency. Locally in Boreholes E43 and E24, a silt contained with organics and was found to be in a soft consistency. Borehole 77 wet silt deposit was also found to be in a very soft to soft consistency. Moisture contents of the moist to wet silt ranged from 7 to 24%.

Grain size analysis on one (1) silt sample from Borehole 109 indicated 22% sand, 52% silt and 26% clay.

Locations, depths below grade and elevations where silt was noted are summarized in the following tables.

**Table 6: Silt Summary – Section 1**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 4 | 6.3 – 7.2 | 303.0 – 303.9 |
| 12 | 13.0 – 14.2 | 295.8 – 297.0 |
| 21 | 9.7 – 13.3 | 297.7 – 300.3 |
| 35 | 5.7 – 6.6 | 302.7 – 303.6 |
| 43 | 4.3 – 5.5 | 304.8 – 306.0 |
| 46 | 4.8 – 6.4 | 303.3 – 304.9 |

**Table 7: Silt Summary – Section 2**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 73 | 4.7 – 5.6 | 303.8 – 304.7 |
| 77 | 4.1 – 5.8 | 304.9 – 306.6 |
| 88 | 5.7 – 7.1 | 303.8 – 305.2 |
| 89 | 5.6 – 7.0 | 303.8 – 305.2 |
| 94 | 11.7 – 14.0 | 298.0 – 300.3 |
| 106 | 2.6 – 3.0 | 307.1 – 307.5 |
| 109 | 5.6 – 6.5 | 305.4 – 306.3 |
| 115 | 2.2 – 5.6 | 305.8 – 309.2 |
| 121 | 5.6 – 7.5 | 304.0 – 305.9 |
| 127 | 5.5 – 10.2 | 301.0 – 305.7 |
| 129 | 7.0 – 7.9 | 302.3 – 303.2 |
| 132 | 1.1 – 1.4 | 309.7 – 310.0 |
| 134 | 3.0 – 4.5 | 306.3 – 307.8 |
| A2-D | 11.7 – 13.1 | 294.2 – 295.6 |
| A3-D | 14.8 – 16.2 | 291.8 – 293.2 |

**Table 8: Silt Summary – Section 3**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 142A | 4.6 – 6.7 | 299.0 – 301.1 |
| 144A | 4.5 – 6.3 | 298.5 – 300.3 |
| 145B | 2.9 – 3.7 | 301.0 – 301.8 |
| 145C | 3.0 – 4.5 | 303.9 – 305.4 |

**Table 9: Silt Summary – Section 4**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| E1 | 1.1 – 2.2 | 308.1 – 309.2 |
| E28 | 5.5 – 6.6 | 303.1 – 304.2 |

**Table 10: Silt Summary – Section 6**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| E45 | 0.9 – 1.4 | 305.3 – 305.8 |

**Table 11: Silt Summary – McKay Road West**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 117 | 11.5 – 13.8 | 298.7 – 298.0 |
| 137 | 11.5 – 14.6 | 295.4 – 298.5 |

**Table 12: Silt Summary – Veterans Drive**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 159 | 2.2 – 3.1 | 307.4 – 308.3 |

**Table 13: Silt Summary – 5th Sideroad**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 136 | 0.6 – 1.7 | 308.2 – 309.2 |
| E24 | 1.3 – 1.5<br>2.2 – 2.9<br>5.0 – 5.5 | 302.3 – 302.8<br>304.9 – 305.6<br>306.3 – 306.5 |
| E43 | 0.1 – 1.5 | 305.1 – 306.4 |

***Silty Clay***

Discontinuous deposits of silty clay were encountered in Sections 1, 2, 3 and within McKay Road West and Veterans Drive roadways. It typically contained trace sand and trace gravel. The silty clay typically had a hard consistency. Locally in Boreholes 150 and 137, a silty clay was found to be in a very soft and soft condition. Moisture contents of the moist to wet silt ranged from 8 to 26%.

Grain size analysis on one (1) silty clay sample from Borehole 118 indicated 1% gravel, 14% sand, 42% silt and 43% clay.

Locations, depths below grade and elevations where silt was noted are summarized in the following tables.

**Table 14: Silty Clay Summary- Section 1**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 1 | 13.9 – 24.5 | 283.4 – 294.1 |
| 13 | 5.6 – 7.9 | 303.1 – 304.4 |
| 16 | 1.8 – 2.9<br>5.6 – 7.1 | 302.5 – 303.9<br>306.6 – 307.7 |
| C3-D | 11.6 – 18.5 | 296.0 – 298.2 |

**Table 15: Silty Clay Summary – Section 2**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 91 | 7.7 -8.7 | 302.0 – 303.0 |
| 96 | 3.7 – 4.5 | 306.6 – 307.5 |
| 118 | 8.1 – 9.4<br>10.8 – 13.8 | 299.0 – 301.3<br>302.7 – 304.0 |

**Table 16: Silty Clay Summary – Section 3**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 141C | 0.3 – 0.7<br>2.1 – 2.2 | 300.8 – 301.0<br>302.3 – 302.7 |

**Table 17: Silt Summary – McKay Road West**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 137 | 1.4 – 2.2 | 307.8 – 308.6 |

**Table 18: Silt Summary – Veterans Drive**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 150 | 1.5 – 2.2 | 310.4 – 311.1 |

***Clayey Silt***

Locally in Borehole 103, a discontinuous clayey silt deposit was encountered below the sand deposit at a depth of about 4.5 m below existing grade, and extended to a depth of 4.9 m below existing grade. The consistency of this deposit was hard and its moisture content was about 14%.

***Peat***

Peat was encountered locally in Boreholes 31 and 76 in the southeastern portion of the site. Locations, depths below grade and elevations where peat was noted are summarized in the following table.

**Table 19: Peat Summary**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 31 | 0.7 – 0.9 | 307.4 – 307.6 |
| 76 | 0.8 – 2.2 | 306.0 – 307.4 |

***Fine to Medium Sand***

Deposits of fine to medium grained sand were encountered overlaying, intersecting and beneath the predominate silty sand till deposit. The sand contained trace to some gravel and trace to with silt. The compactness condition of the sand was generally found to be very loose to loose near surface and increasing to dense to very dense with depth. Moisture contents of these dry to moist deposits varied from approximately 1 to 11%.

Grain size analysis on six (6) dry sand samples was completed, the grain size distribution is summarized in the following table:

**Table 20: Particle Size Distribution Summary**

| Borehole No. / Sample No. | Depth Interval below Grade (m) | Elevation Interval (m) | Percentage | | |
|---|---|---|---|---|---|
| | | | Gravel | Sand | Silt & Clay |
| 99 SS2 | 0.8 – 1.4 | 308.8 – 309.4 | 5 | 66 | 29 |
| 125 SS2 | 0.8 – 1.2 | 310.8 – 311.2 | 4 | 76 | 20 |
| 140B SS2 | 0.8 – 1.4 | 301.8 – 302.4 | 6 | 81 | 13 |
| E20 SS2 | 0.8 – 1.2 | 308.7 – 309.1 | 29 | 63 | 8 |
| E35 SS2 | 0.8 – 1.2 | 306.4 – 306.8 | 0 | 85 | 15 |
| E37 SS6 | 3.8 – 4.4 | 304.0 – 304.6 | 4 | 91 | 5 |

### *Water Bearing Sand*

Water bearing sand was interpreted to be typically present in boreholes in Section 1 and 2 of the site. No significant wet sand layers were encountered in Section 4 While Section 3 5 and 6 had a single location. Locations, depths below grade and elevations where wet sand was noted are summarized in the following tables.

**Table 21: Wet Sand Summary – Section 1**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) | Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|---|---|---|
| 1 | 5.5 – 11.5 | 296.5 – 302.5 | 39 | 0.5 – 2.2 | 307.5 – 309.2 |
| 3 | 1.5 – 3.5<br>4.4 – 5.6 | 304.6 – 305.8<br>306.7 – 308.8 | 41 | 0.5 – 2.9 | 306.5 – 308.9 |
| 4 | 2.4 – 6.3<br>7.2 – 8.8 | 301.4 – 303.0<br>303.9 – 307.8 | 44 | 0.5 – 2.8<br>3.7 – 4.5 | 304.7 – 305.5<br>306.4 – 308.7 |
| 6 | 3.9 – 5.7 | 302.6 – 304.4 | 45 | 0.5 – 3.3 | 306.1 – 308.9 |
| 12 | 1.5 – 3.4 | 306.6 – 308.5 | 46 | 1.2 – 2.7 | 307.0 – 308.5 |
| 13 | 1.5 – 5.6 | 304.4 – 308.5 | 48 | 1.5 – 3.0 | 306.6 – 308.1 |
| 15 | 0.5 – 3.5 | 305.4 – 308.4 | 54 | 4.1 – 4.3<br>5.7 – 6.2 | 303.7 – 304.2<br>305.6 – 305.8 |
| 16 | 0.3 – 1.8 | 307.7 – 309.2 | 56 | 2.2 – 3.8 | 306.0 – 307.6 |
| 21 | 1.5 – 3.0 | 307.0 – 308.5 | 60 | 1.5 – 2.2 | 307.2 – 307.9 |
| 24 | 0.5 – 1.0 | 307.7 – 308.2 | 62 | 10.0 – 10.9 | 298.4 – 299.3 |
| 30 | 4.3 – 5.5 | 304.3 – 305.5 | 64-D<br>64-S | 2.9 – 3.4<br>17.4 – 18.9 | 289.7 – 291.2<br>305.2 – 305.7 |
| 31 | 7.0 – 9.2 (end of borehole) | 301.5 – 303.7 | C2-D<br>C2-S | 2.2 – 7.2 | 299.5 – 304.5 |
| 37 | 0.5 – 1.5 | 308.0 – 309.0 | C3-D | 10.0 – 11.6<br>13.8 – 16.3 | 293.5 – 296.0<br>298.2 – 299.8 |
| 38 | 0.5 – 1.5 | 307.8 – 308.8 | | | |

**Table 22: Wet Sand Summary – Section 2**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) | Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|---|---|---|
| 77 | 5.8 – 6.4 | 304.3 – 304.9 | 89 | 3.8 – 5.6 | 305.2 – 307.0 |
| 79 | 3.1 – 4.3 | 306.5 – 307.7 | 94 | 6.3 – 7.1 | 304.9 – 305.7 |
| 80 | 3.8 – 4.4 | 306.3 – 306.9 | 95 | 11.4 – 12.4 | 299.7 – 300.7 |
| 81 | 3.1 – 4.8 | 305.2 – 306.9 | 106 | 3.8 – 6.7 | 303.4 – 306.3 |
| 86 | 7.1 – 9.3 | 299.6 – 301.8 | A2-D | 13.1 – 18.45 | 288.8 – 294.2 |
| 88 | 3.8 – 5.7 | 305.2 – 307.0 | A3-D | 16.2 – 18.9 | 289.1 – 291.8 |

**Table 23: Wet Sand Summary – Section 3**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 142A | 2.2 – 4.6 | 301.1 – 303.5 |

**Table 24: Wet Sand Summary – Section 5**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| E52 | 2.7 – 3.3 | 304.6 – 305.2 |

**Table 25: Wet Sand Summary – Section 6**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| E44 | 5.5 – 5.7 | 301.4 – 301.6 |

**Table 26: Wet Sand Summary – McKay Road**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 32 | 0.9 – 2.7 | 305.6 – 307.4 |
| 63 | 10.5 – 11.3 | 297.4 – 298.2 |
| 76 | 4.5-5.6<br>8.5 – 20.0 | 288.2 – 299.7<br>302.6 – 303.7 |

**Table 27: Wet Sand Summary – Veterans Drive**

| Borehole No. | Depth Interval below Grade (m) | Elevation Interval (m) |
|---|---|---|
| 151 | 7.2 – 8.4 | 304.6 – 305.8 |

Note: Seasonal variations in the interpreted wet sand intervals should be anticipated.

Grain size analysis on three (3) wet sand samples was completed, the grain size distribution is summarized in the following table:

**Table 28: Particle Size Distribution Summary**

| Borehole No. / Sample No. | Depth Interval below Grade (m) | Elevation Interval (m) | Percentage | | |
|---|---|---|---|---|---|
| | | | Gravel | Sand | Silt & Clay |
| 54 SS8 | 6.1 – 6.2 | 303.7 – 303.8 | 25 | 68 | 7 |
| 79 SS6 | 3.8 – 4.4 | 306.4 – 307.0 | 3 | 92 | 5 |
| 86 SS9 | 7.6 – 7.8 | 301.1 – 301.3 | 5 | 62 | 33 |

## 5.2 Groundwater

Groundwater conditions were observed in the open boreholes during the course of the fieldwork and in the monitoring wells installed at twenty-eight (28) selected borehole locations for subsequent groundwater measurements. Detailed groundwater conditions are presented in the hydrogeological study which will be submitted under separate cover. The information are summarized below.

Upon completion of drilling, free water was detected at depths of approximately 0.3 to 13.1 m in Boreholes 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 44, 45, 46, 48, 49, 51, 53, 54, 56, 59, 60, 61, 62, 63, 64-D, 64-S, 65, 66, 68, 73, 74, 75, 76, 77, 79, 80, 81, 82, 85, 86, 88, 89, 91, 93, 94, 95, 100, 106, 108, 199, 127, 135, 142A, 144C, 151, E4, E14, E44, E52, A1, A2-D, A2-S, A3-D, A3-S, C1, C2-D, C2-S, C3-D and C3-S. All other boreholes were dry upon completion of drilling. A summary of groundwater observations in the monitoring wells is presented in the following tables.

Detailed groundwater information are presented in the Hydrogeological study which will be submitted under separate cover.

**Table 29: Section 1 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| 17 | After 48 days | 1.88 | 308.88 |
| 54 | After 1 days | 0.67 | 309.25 |
| | After 49 days | 1.88 | 308.03 |
| 62 | After 20 Days | 6.59 | 302.68 |
| | After 36 days | 7.50 | 301.77 |
| | After 44 days | 7.82 | 301.45 |
| 64-D | After 3 Days | 3.86 | 304.70 |
| | After 51 days | 4.95 | 303.61 |
| | After 60 days | 4.98 | 303.58 |
| 64-S | After 3 days | 1.37 | 307.19 |
| | After 51 days | 2.42 | 306.15 |
| B1-D | After 20 days | Dry | -- |
| | After 44 Days | Dry | -- |
| B1-S | After 19 days | Dry | -- |
| | After 43 Days | Dry | -- |
| B2-D | After 19 days | Dry | -- |
| | After 43 Days | Dry | -- |
| B2-S | After 19 days | Dry | -- |
| | After 43 Days | Dry | -- |
| C2-D | After 19 days | 4.34 | 302.37 |
| | After 43 Days | 4.45 | 302.27 |
| C2-S | After 26 days | 4.31 | 302.40 |
| | After 33 Days | 4.39 | 302.33 |
| C3-D | After 27 days | 4.93 | 304.84 |
| | After 34 Days | 5.07 | 304.70 |
| C3-S | After 27 days | 4.49 | 305.28 |
| | After 34 days | 4.63 | 305.14 |

**Table 30: Section 2 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| 68 | After 13 Days | 4.04 | 302.40 |
| | After 29 days | 5.59 | 300.85 |
| | After 37 days | 6.08 | 300.35 |
| 82 | After 43 Days | 5.91 | 304.29 |
| 96 | After 35 days | Dry | -- |
| | After 43 days | Dry | -- |
| 101 | After 34 days | Dry | -- |
| | After 42 days | Dry | -- |
| 119 | After 17 days | 8.36 | 303.29 |
| | After 34 days | 8.88 | 302.77 |
| 122 | After 17 days | Dry | -- |
| | After 34 days | Dry | -- |
| A2-D | After 20 Days | 12.01 | 295.24 |
| | After 36 Days | 14.04 | 293.21 |
| | After 44 Days | 13.97 | 293.28 |
| A2-S | After 20 Days | 1.95 | 305.30 |
| | After 36 Days | 2.38 | 304.87 |
| | After 44 Days | 2.54 | 304.71 |
| A3-D | After 18 days | 12.86 | 295.12 |
| | After 34 Days | 13.36 | 294.62 |
| A3-S | After 18 days | 12.86 | 295.12 |
| | After 34 Days | 13.36 | 294.62 |

**Table 31: Section 3 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| 144C | After 17 days | 5.18 | 302.53 |
| | After 66 days | 5.80 | 301.92 |
| 146A | After 22 days | Dry | -- |
| | After 79 days | Dry | -- |

**Table 32: Section 4 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| E10 | After 8 days | Dry | -- |
| | After 65 days | Dry | -- |
| E40 | After 13 days | Dry | -- |
| | After 70 days | Dry | -- |

**Table 33: Section 5 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| E4 | After 14 days | 4.58 | 304.39 |
| | After 71 days | Dry | -- |
| E33 | After 15 days | Dry | -- |
| | After 73 days | Dry | -- |

**Table 34: Section 6 Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| E8 | After 16 days | Dry | -- |
| | After 73 days | Dry | -- |
| E44 | After 16 days | 5.54 | 301.54 |
| | After 73 days | Dry | -- |

**Table 35: McKay Road Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| 137 | After 24 Days | 19.87 | 290.09 |

**Table 36: 5th Sideroad Groundwater Level Readings**

| Borehole No. | Elapsed Time | Water Level (m) | Elevation (m) |
|---|---|---|---|
| 136 | After 6 days | Dry | -- |
| | After 22 days | Dry | -- |
| 151 | After 23 Days | 7.79 | 305.16 |
| 157 | After 23 Days | Dry | -- |

Based on the information observed in the boreholes, the groundwater originates from the wet silty sand/sand and the more pervious seams within the glacial silty sand till.

The groundwater elevations reflect the conditions at the time of the investigation. Groundwater elevations are subject to seasonal fluctuations. Detailed groundwater conditions are presented in the hydrogeological study by EXP which will be issued under separate cover.

*The monitoring wells were installed in general accordance with the Ontario Water Resources Act-R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03 by CSD, by a licensed well contractor. When the use of the monitoring wells is no longer required, they must be decommissioned in accordance with the procedure outlined in the Ontario Water Resources Act – R.R.O. 1990, Regulation 903 – Amended to O. Reg. 128/03.*

# 6. Engineering Discussion and Recommendations

## 6.1 General

The project involves the design and construction of single family residential dwellings together with the necessary municipal infrastructure such as roads, sewers, water and other services and a potential stormwater management pond.

The following subsections provide geotechnical engineering guidelines for the design and construction of the proposed residential development.

## 6.2 Site Grading

Final site grades have not been established at the time of this investigation. However, in view of the relief of approximately 9.6 m measured at the borehole locations excluding those on the existing roads, it is anticipated that regrading (cut and fill operations) will be carried out. The following procedures are recommended for the construction of structural fill for building lots and pavement areas, where required.

- All vegetation, topsoil, disturbed (ploughed) soil, loose fill, peat, loose native soil, gravel pavement structure and building floor slabs/foundations should be removed from proposed building and pavement areas. Any existing septic tile field should also be removed. Potable water wells and all monitoring wells installed for this investigation should be properly decommissioned.

- The exposed subgrade surface should be proof-rolled with a heavy roller and examined by a geotechnical engineer from EXP. Any soft or loose spots encountered during the process should be sub-excavated and replaced with approved on-site or imported materials, compacted to 100 % standard Proctor maximum dry density (SPMDD).

- Low areas can then be brought up to final subgrade level with approved on-site or imported material placed in lifts not exceeding 200 mm and compacted to 100% SPMDD within building areas ("engineered fill") and 95% SPMDD to within 600 mm of final subgrade level and 98% SPMDD for the upper 600 mm in pavement areas. The moisture content of the fill to be placed should be at or near its optimum moisture content in order to assure the specified densities can be achieved with reasonable compactive effort. Some of the on-site soils, particularly from the lower elevations, will require partial drying before they can be properly compacted. Any organic or excessively wet or otherwise deleterious material should not be used for backfilling purposes.

- Fill and cut slopes should not be steeper than two horizontal to one vertical and should be protected from surface erosion.

- All imported borrow fill material from local sources should be free from organic material and foreign objects (i.e. trees, roots, debris, etc.) and should be tested geotechnically by EXP prior to transport to the site. In addition, the chemical quality of the borrow fill material should be assessed by EXP in accordance with applicable soil criteria listed in the Ministry of the Environment and Climate Change Standards (Ontario Regulation 153), dated April 15, 2011.

- All excavation, backfilling and compaction operations should be monitored on a full-time basis by qualified geotechnical staff to approve materials and to confirm that the specified degrees of compaction have been obtained.

- The requirements for engineered fill are presented in Figure 1 (next page).

## 6.3 Site Servicing

### 6.3.1 Watermain and Sewer Installation

#### 6.3.1.1 Open Cut Excavation

The sewer and watermain invert levels have not yet been determined at the time of investigation, but based on the specified borehole depths, they are expected to typically expected to extend to depths of approximately 5 to 12 m below existing grades. Based on the results of the investigation, excavation will generally be carried out within the native deposits of sand and silty sand till.

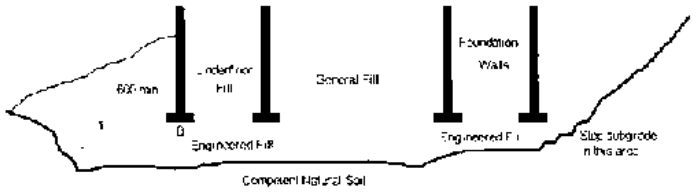
Subject to groundwater control measures discussed in the following sub-section, excavation may be carried out in open cuts using conventional equipment. Side slopes of temporary excavation must conform to the Occupational Health and Safety Act (OHSA) and local regulations. Within the meaning of OHSA, the fills and non water bearing compact sandy silt till deposit are classified as Type 2 soil. The water bearing silty sand can be classified as Type 4 soil and if dewatered, it can be classified as Type 3 soil.

In areas where localized seepage of groundwater is encountered it may be necessary to flatten the side slopes. Locally, due to spatial restrictions, vertical trenching may be required. It is our opinion that steeper temporary slopes may be permitted if a trench box is utilized, subject to on-site inspection.

Foundations placed on engineered fill comprising native soil from the site - or imported materials - may be designed for an SLS geotechnical reaction of 150 kPa (ULS factored geotechnical resistance of 225 kPa).

Additional comments with regard to engineered fill are as follows:

- The area must be stripped of all topsoil, existing fill material or other deleterious material and proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a geotechnical engineer prior to placement of fill.
- The approved engineered fill must be placed in loose lifts not exceeding 200 mm and compacted to 100% Standard Proctor dry density throughout. Granular fill is preferred.
- Full time geotechnical inspection during placement of engineered fill is required.
- The fill must be placed such that the specified geometry is achieved as follows:




**Foundations on Engineered Fill (schematic)**

- A minimum footing width of 500 mm (20 inches) is suggested. It is recommended that poured concrete basement walls should be reinforced with 2 - 15M rebars above the footings and below the window sill.
- All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

| | | |
|---|---|---|
| N/A | CLIENT: WATERSANDS DEVELOPMENT | exp Services Inc. |
| SEPTEMBER 2017 | PROJECT: PROPOSED WATERSANDS RESIDENTIAL DEVELOPMENT | |
| LHK | | |
| BAR 00038305 B0 | TITLE: ENGINEERED FILL REQUIREMENTS SKETCH | |
| SKETCH 1 | | |

It should also be noted that occasional boulders were noted within the till deposits and their presence may influence the progress of excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by boulder obstructions.

#### 6.3.1.2 Groundwater Control

A hydrogeological report for this site has been prepared by EXP (reported under separate cover). The report contains detailed findings with respect to groundwater levels and their potential impact on the proposed construction activities. The report also addresses the need for positive dewatering and the appropriate methods, if required.

Several deposits of wet sand were encountered during the investigation (see Wet Sands in Section 5 above and Drawing No. 261 for detailed information). Generally, these areas were concentrated in Section 1 and the west side of Section 2 with some isolated, scattered locations in Sections 3, 5 and 6 as well as along McKay Road where it is adjacent to Section 1. The wet sand deposits were either found to be part of a surficial sand deposit or were located between or underneath relatively impervious layers (very dense till, silts and clays, etc.).

In general, where services are required to be installed into the water bearing deposits, the groundwater level should be lowered to at least 0.5 m below service trench base elevations and maintenance hole structures prior to construction and be maintained until backfill above the groundwater table has been completed. Any residual localized seepage of groundwater into the trenches can be handled using conventional sump pumping techniques. Grain Size Analyses of representative samples of the subsurface soils to assist with design of the groundwater control measures are compiled in Appendix A.

Above the groundwater table, seepage into the trenches is expected to primarily originate from perched conditions in the fill and wet sand seams and layers in the silty sand till. The quantity of water from these sources will vary depending upon the extent and thickness of individual wet seams and layers. It should be recognized that groundwater levels are also influenced by the effects of precipitation as well as seasonal fluctuations. It is our opinion that the seepage produced by these sources can be handled using conventional sump pumping in conjunction with oversized excavations.

#### 6.3.1.3 Pipe Bedding

It is anticipated that the sewer and watermain pipes will be founded on competent native soils or on engineered fill. Provided adequate groundwater control measures are implemented, no bearing capacity problems are envisaged.

In general, the pipe bedding may consist of a minimum thickness of 150 mm of compacted OPSS Granular "A" material. Where wet conditions are encountered, the pipe bedding may comprise 150 mm of 19 mm clear stone, High Performance Bedding (HPB) or HL-6 stone material. However, these types of bedding must be completely wrapped in a geotextile filter fabric to prevent the migration of fines from the surrounding soils, which may result in settlement of the pipes. The chosen geotextile should be compatible with the existing soils on site. It is anticipated Terrafix 270R or similar should suffice.

The base of the excavations in the competent compact to very dense soils should remain stable provided excavations are not left open for extended periods of time and the work is done in accordance with good construction practice.

The Granular A type bedding material should be placed in 150 mm lifts and compacted to at least 98% SPMDD. Particular attention should be given to ensure material placed beneath the bottom quadrants of the pipe is adequately compacted. Compaction is not required for clear stone, HPB or HL-6 stone bedding.

Pipe cover material should consist of fine sand which can be more readily compacted with light equipment to avoid damaging the pipes. The cover material should be placed in 150 mm lifts, compacted to 98% SPMDD and extend to 300 mm above the top of the pipe.

#### 6.3.1.4 Backfilling Operations

The existing native soils which are not contaminated with topsoil and other obviously unsuitable material may be reused as trench backfill if the moisture contents are within 2% of their optimum values. In this regard, the sands identified in Section 5.1 above (wet sands) and a portion of the silty sand till soils would be wet and will require drying for proper compaction.

Excavated topsoil and peat should not be used for trench backfilling purposes. These materials may be used in landscaping areas. Any organic or excessively wet or otherwise deleterious material should not be used for backfill purposes. Any shortfall of suitable on-site excavated material can be made up with imported clean approved fill or granular material, OPSS Granular 'B' or equivalent.

With the exception of the sands, the majority of the on-site native soils are not free draining and therefore should not be used where this characteristic is required, or in confined areas. Imported granular material conforming to OPSS Granular 'B' would also be suitable for these purposes.

In areas where substantial cutting and filling is required, the compaction of the fill should be monitored on a full-time basis by qualified geotechnical personnel.

All backfilling and compaction operations must be closely examined by qualified geotechnical personnel to confirm that uniform compaction to specification requirements is achieved, especially in the vicinity of sewer maintenance holes and catchbasins, near the ends of compaction runs, and in all areas that are not readily accessible to compaction equipment, etc. All backfilling should be placed in maximum 300 mm horizontal lifts and uniformly compacted to 95% SPMDD. Within the upper 600 mm of road subgrade, the fill material should be compacted to at least 98% SPMDD. Smaller lifts may be required depending on the size of compaction equipment used by the contractor and the moisture content of fill at the time of construction.

To minimize potential problems, backfilling operations should follow closely after excavation so that only minimal length of trench slope is exposed. This will minimize wetting of the subgrade material. Should construction extend to the winter season, particular attention should be given to ensure that frozen material is not used as backfill.

### 6.3.2 Pavement Design and Construction

The pavement subgrade is expected to comprise native sandy silt till, sand, clayey silt till and compacted engineered fill. Grain Size Analyses of representative near surface soils used to assist in assessment of frost susceptibility are compiled in Appendix A. Based on estimated soil parameters, the frost susceptibility of the anticipated subgrade materials, expected traffic loading, and assuming adequate drainage, the following minimum pavement structure component thicknesses which comply with the specifications for the City of Barrie and Town of Innisfil (the Municipalities) (Table 3) are considered satisfactory. Other thickness combinations can be used provided the Granular Base Equivalency (GBE) is maintained and any minimum component thickness specified by the Municipalities is met.

**Table 36: Recommended Pavement Structure Thicknesses**

| Pavement Layer | Compaction Requirements | Local Roadway | Collector Roadway | Driveway |
|---|---|---|---|---|
| Asphaltic Concrete (OPSS 310) | Minimum 92 % MRD | 40 mm HL3<br>70 mm HL8 | 40 mm HL3<br>100 mm HL8 | 65 mm HL3 (placed in 2 lifts) |
| OPSS Granular A Base (OPSS 1010) | 100% SPMDD* | 150 mm | 150 mm | 150 mm |
| OPSS Granular B Subbase (OPSS 1010) | 100% SPMDD* | 400 mm | 500 mm | - |

* Denotes standard Proctor maximum dry density, ASTM-D698

The foregoing design assumes construction is carried out during dry periods and the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather and heaving or rolling of the subgrade is experienced, additional thickness of subbase course material may be required.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and sloped to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas.

Additional comments on the construction of proposed roadways are as follows:

1. As part of the subgrade preparation, proposed roadways should be stripped of topsoil and other obviously unsuitable material. Soft or spongy subgrade areas identified during proofrolling should be subexcavated and replaced with suitable approved backfill. Fill required to raise the grades to design elevations should be organic-free and at a moisture content which will permit compaction to 98% SPMDD. The final subgrade surface should be properly shaped and crowned.

2. The location and extent of subdrainage required within the paved areas should be reviewed by this office in conjunction with the proposed site grading. In view of the silty nature of the subgrade soils, we recommend subdrains be installed on both sides of the roadways at least 300 m below the granular subbase. This will ensure no water collects in the granular courses which could result in pre-mature pavement failure during the spring thaw.

3. To minimize problems of differential movement between the pavement and catchbasins/sewer maintenance holes due to frost action, backfill around these structures should consist of free-draining granular material. The granular material should be compacted to 98% SPMDD with a small tamper to avoid damaging the structures. In addition, catchbasins should be perforated just above the drain and the holes screened with filter cloth.

4. The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavorable weather.

## 6.4 Existing Roads

New municipal servicing (watermains, sanitary sewers, etc.) for the proposed subdivision will be brought to the site along the existing roads (McKay Road, Veterans Drive and 5th Sideroad) from their current termination point on Veterans Drive at Salem Road. For the majority of the construction on Veterans/5th Sideroad and the eastern half of McKay Road, standard construction methods (open cut) should be suitable for the installation of the underground services. No significant groundwater issues are expected and below 2 m of excavation the soils should mainly consist of a dense to very dense till and/or sand deposits. There were some organics encountered within the upper 1.5 m of soil at the south end of the 5th Sideroad. The soil deposits that contain some organics are not suitable for re-use as trench backfill and will need to be removed and replaced with acceptable inorganic fill. Where these deposits continue underneath the existing roadway, they will also require removal to allow for the construction of a stable road platform.

The western half of McKay Road will present some additional challenges during the installation of underground utilities. Peat was encountered underneath the granular fill at Boreholes 32 and 76 ranging in thickness from 200 to 1400 mm. This peat will need to be removed for the full width of the road platform prior to the reconstruction of the road after utility installation. Saturated sands were encountered in Boreholes 32 and 63 extending to depths of 2.5 to 2.7 m below grade. These sand deposits will require positive dewatering to allow for the installation of underground utilities.

Borehole 76 was advanced adjacent to an existing culvert that conveys the stream that bisects the subject property from the north side of McKay Road onto the site. Utility construction in this section of the road will require additional measures such as increased bedding thickness and/or change in bedding materials. Positive dewatering will also be required in the saturated silty sand and sand deposits, which extend to 5.6 m below grade. The flow of the creek in this area is very low and a combination coffer dams and bypass pumping should be sufficient to allow for the installation utilizing conventional open cut methods in conjunction with positive dewatering, with the approval of the appropriate regulatory agencies. Once detailed design is completed for the utilities and road reconstruction in this area, EXP can provide additional design recommendations as required.

## 6.5 Residential Dwelling Construction

### 6.5.1 Foundation Considerations

Soil conditions on the site are considered suitable for construction of single family dwellings. Since final site grades have not yet been established, two (2) foundation schemes are being presented for consideration; namely footings on native soils and footings on engineered fill.

#### 6.5.1.1 Footings on Native Soil

The proposed structures may be supported on conventional spread and strip footings founded on the compact to very dense sand and/or silty sand till below all existing topsoil, fill, peat and loose soils. Footings founded on the native sand and/or silty sand till may be designed for a Geotechnical Reaction of 150 kPa at Serviceability Limit States (SLS), subject to adequate groundwater control and inspection during construction. The factored Geotechnical Resistance at Ultimate Limit States (ULS) is 225 kPa. Given the presence of basements it is anticipated that founding levels would be at or below approximately 2.5 m depth. In almost all the boreholes advanced within the proposed development area, this bearing is available at depths of 2.0 m. There are isolate locations where the recommended bearing capacity is located at a greater depth. The following tables show the highest depth at these borehole locations where the above mentioned geotechnical reactions/resistances can be applied, along with the Geotechnical Resistance that is available at 2.0 m depth.

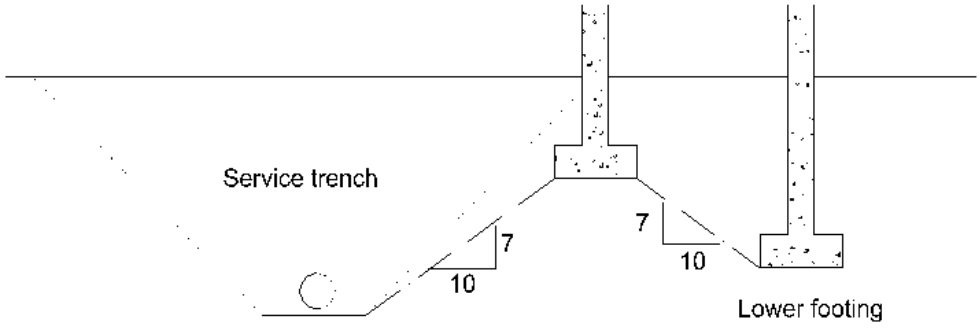
**Table 37: Highest Depth at Isolated Borehole Locations Where Recommended Geotechnical Reactions/Resistances is Below 2.0 m**

| Section No. | Borehole Number | Depth/Elevation where 150 kPa Bearing (SLS) is Available (m) |
|---|---|---|
| 1 | 21 | 2.5/307.5 |
| 1 | 60 | 2.5/306.9 |
| 2 | 72 | 2.5/306.9 |
| 2 | 81 | 2.5/307.5 |
| 2 | 96 | 2.5/308.7 |
| 3 | 146B | 2.0/303.4 |
| 3 | 148C | 2.0/304.1 |
| 4 | E2 | 2.0/308.0 |
| 4 | E22 | 2.5/304.3 |

Footing can be placed at a higher elevation if the soils in the area are sub-excavated and re-compacted as engineered fill.

#### 6.5.1.2 Foundations General

Footings which are to be placed at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services. This concept is illustrated in the following sketch:




FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m of soil cover or equivalent insulation, depending on the final design requirements.

The on-site soils are susceptible to disturbance. It is therefore recommended that a concrete skim coat be placed over the founding surface as soon as possible after approval to protect it from disturbance from construction traffic.

The total and differential settlements of well designed and constructed footings placed in accordance with the above recommendations, are expected to be less than 25 mm and 20 mm, respectively.

It should be noted that the recommended bearing capacities have been calculated by EXP from the borehole information for the design stage only. The investigation and comments are necessarily ongoing as new information on underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if final design decisions differ from those assumed in this report. For this reason, this office should be retained to review final foundation drawings and to examine footing conditions.

### 6.5.2 Excavation and Groundwater Control

Excavation for single family dwellings with a basement will extend to about 1.8 to 2.0 m below the final finished grade. Where excavations will be undertaken in water bearing deposits and below the groundwater table, the groundwater must be lowered to at least 0.5 m below foundation base elevations prior to construction and be maintained until permanent perimeter and underfloor drainage systems for the structures as may be required, have been installed and commissioned. Where possible, all foundations and basement floors should be placed above the groundwater table.

Subject to implementation of proper groundwater control measures where required, excavation should be relatively straightforward and must be carried out in accordance with the latest edition of the OHSA and local regulations. For preliminary guidance, side slopes of one vertical to one horizontal may be used, subject to geotechnical inspection. Where loose soil is encountered, it may be necessary to locally flatten the side slopes.

Even with implementation of proper groundwater control measures as required, residual groundwater seepage from trapped pockets in the fill and native soils into the excavation(s) should be anticipated during construction. It should be possible to control and remove residual seepage water entering the excavation(s), using conventional construction dewatering techniques, i.e., pumping from sumps.

It should be noted boulders frequently occur in till deposits and their presence may influence the progress of excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by the presence of boulders.

### 6.5.3 Floor Slab Construction and Permanent Drainage

The floor slab may be constructed as a slab-on-grade on a properly prepared subgrade (i.e., on native undisturbed soils or engineered fill). In this regard, all topsoil, fill and other obviously unsuitable material should be removed from the entire underfloor area and the exposed subgrade thoroughly proofrolled. Any soft spots detected should be sub-excavated and the area brought up to design grades using approved clean fill in the manner described in the "Site Grading" section of this report.

A 200 mm layer of 19 mm clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

It is recommended that the foundation walls be covered with a bituminous damp-proofing spray and a drainage sheet. In addition, a weeping tile surrounded with 300 mm of 19 mm clear stone and wrapped with a filter cloth should be installed around the perimeter of the basement and connected to a frost-free outlet.

In areas where the subgrade consists of wet/saturated soil (below the groundwater table) or where persistent groundwater seepage is encountered during excavation, underfloor subdrains and sump pump should also be installed. The subdrains should consist of 100 mm diameter perforated pipe surrounded by 150 mm of 19 mm clear stone all wrapped in Terrafix 270R or equivalent. The trench should be backfilled with concrete sand. The drainage system should lead to frost-free sumps inside the structure or to outlets from which the water can be removed. The need for underfloor subdrains should be further assessed upon basement excavation.

### 6.5.4 Earth Pressure on Subsurface Walls

The lateral earth pressure acting on subsurface walls (i.e., basement walls) may be calculated from the following equation:

$$p = k(\gamma h + q)$$

where:

- $p$ = the pressure in kPa acting against any subsurface wall at depth, h, below the ground surface;
- $k$ = the earth pressure coefficient considered to be appropriate for the subsurface walls, for this case, 0.4;
- $\gamma$ = the bulk unit weight of the backfill, use 22.5 kN/m$^3$;
- $h$ = the depth in m below the ground surface at which the pressure, p, is to be computed; and,
- $q$ = the value of any adjacent surcharge in kPa which may be acting close to the wall.

The above expression assumes an effective perimeter tile drain system will be incorporated to prevent the build-up of hydrostatic pressure behind the subsurface wall. All subsurface walls should be waterproofed. To minimize infiltration of surface water, the upper 600 mm of backfill should comprise compacted relatively impervious material sloped away from the structure.

### 6.5.5 Earthquake Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading are presented below.

#### 6.5.5.1 Subsoil Conditions

The subsoil and groundwater information at this site have been examined in relation to Section 4.1.8.4 of OBC 2012. The subsoil consisted of topsoil, fill, compact to very dense sandy silt till, compact to very dense silty sand and stiff to hard clayey silt till. The foundations will be founded on the competent native soil or on engineered fill. The reported N-values for the soil below the anticipated floor slab level ranged from 4 to greater than 50.

There have been no shear wave velocity measurements carried out at this site and therefore, N-values will be used to determine the site classification.

#### 6.5.5.2 Depth of Boreholes

Table 4.1.8.4.A. Site Classification for Seismic Site Response in OBC 2012 indicated that to determine the site classification, the average properties in the top 30 m are to be used. The boreholes at this site were advanced to depths of about 6.1 to 24.5 m.

#### 6.5.5.3 Site Classification

Based on the soil conditions, the Site Class for this site is "C" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012. We would recommend that shear wave velocity test be carried out to confirm the Site Class for this site.

# 7. Stormwater Management Pond

Three areas were identified as potential stormwater management pond locations. Boreholes A1, A2, A3, B1, B2, C1, C2 and C3 were advanced in these areas.

Boreholes drilled in the areas of the potential stormwater management pond generally encountered a relatively thin layer of sand overlying a silty sand till deposit. The compactness condition of the till ranged from compact to very dense, but was generally dense to very dense. The exception was Borehole C2, which encountered a sand deposit that extended to 7 m below grade before encountering the very dense till. The sand was compact to very dense (very dense below 2.5m).

Based on the results of the boreholes it is EXP's opinion that construction of a stormwater management pond in this area is feasible. If the pond are to be constructed in the vicinity of Borehole C2, a liner will be required. EXP has completed a hydrogeological investigation (reported under separate cover) at the site that contains detailed analysis and recommendation for the construction of the SWM ponds.

# 8. Limited Environmental Soil Testing

Forty-five (5) soil samples from Boreholes 1, 8, 33, 40, 48, 61, 76, 81, 99, 108, 112, 117, 135, 136, 147, 144C, 146B, 150, 154, E11, E23, E43, E44, E48, E52, E54, A3, B2 and C2 were analyzed for selected general inorganic, organochlorine pesticide parameters. The results of these analyses were compared with soil land use criteria listed in Table 2 (Full Depth Generic Site Condition Standards in a Potable Ground Water Condition) and Table 3 (Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition) of the Ministry of the Environment standards (Ontario Regulation 153), dated July 1, 2011. The analytical results (Certificate of Analysis) are compiled in Appendix B.

One (1) soil sample (TCLP) was subjected to Leachate Analysis for Metals, VOCs, PCBs & Benzo(a)pyrene and Ignitability parameters met Schedule 4 criteria under Ontario Regulation 558/00. As such soil represented by this sample analyzed is classified as non-hazardous waste under O. Reg. 558/00. The laboratory Certificates of Analysis are included in Appendix B.

All site soil samples analyzed met all property use standards for fine to medium and coarse textured soils in Table 2 and Table 3 of the Ministry of the Environment standards, dated July 1, 2011 with the following exceptions:

- Cyanide in B2 SS2 (0.06 µg/g), 144C SS1 (0.06 µg/g) were in exceedance of the Table 2 and Table 3 SCS of 0.051 µg/g.

All road soil samples analyzed met all property use standards for fine to medium and coarse textured soils in Table 2 and Table 3 of the Ministry of the Environment standards, dated July 1, 2011 with the following exceptions:

- Conductivity in 76 SS2 (5.2 mS/cm), 154 SS2 (0.85 mS/cm), 150 SS6 (1.4 mS/cm) and E43 SS2 (1 mS/cm) were in exceedance of the Table 2 and Table 3SCS of 0.7 mS/cm.
- Sodium adsorption ratio in 76 SS2(23), 117 SS2 (7.1), 154 SS2 (15), 150 SS2 (5.8), 150 SS6, 136 SS2 (8.4) and E43 SS2 (10) were in exceedance of the Table 2 SCS of 5.

# 9. General Comments

EXP should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, EXP will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, EXP should be contacted to assess the situation, and additional testing and reporting may be required. EXP has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

Yours truly,

**EXP Services Inc.**

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Manager, Geotechnical Services
Barrie Office

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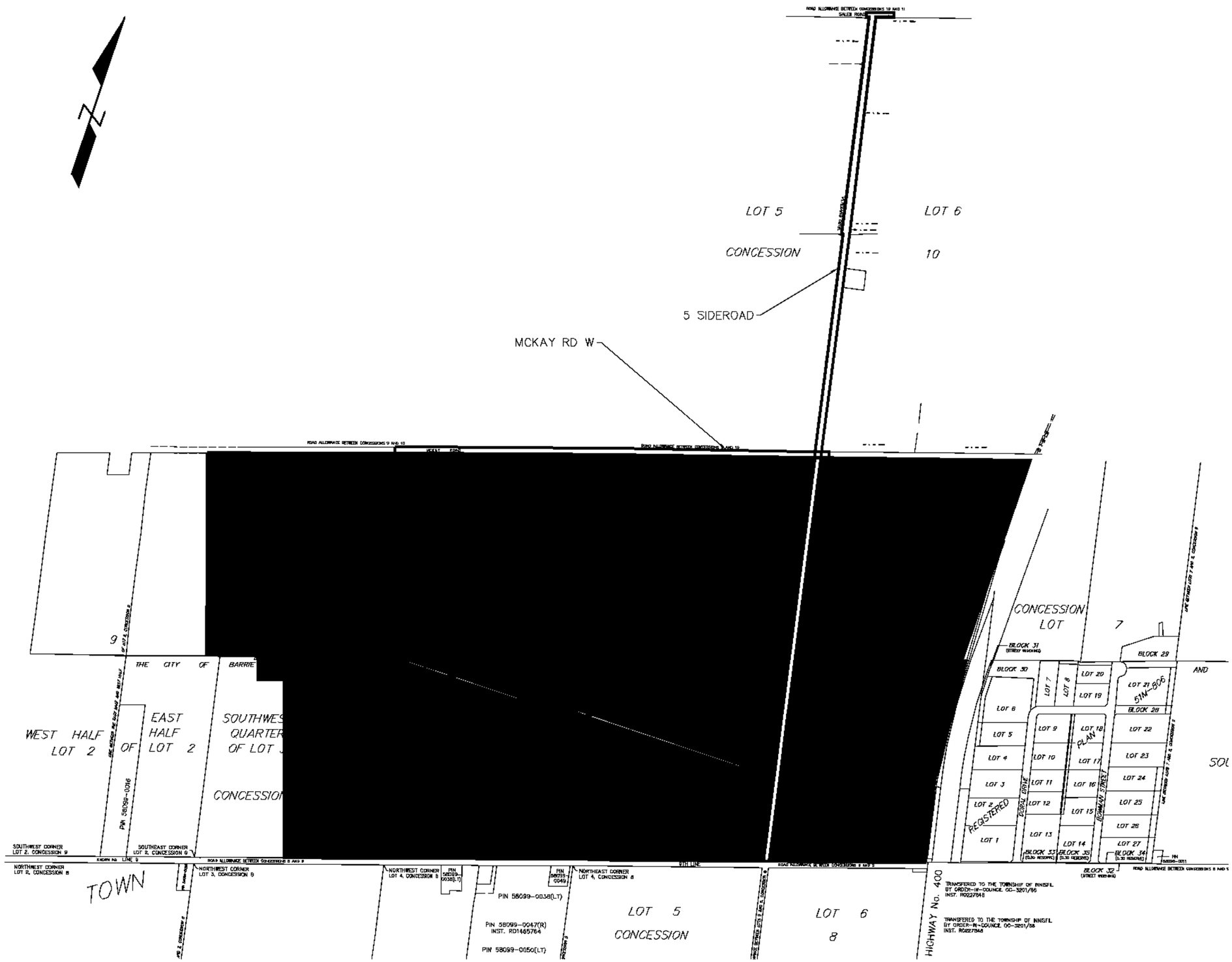
L. H. KNEGT
PROVINCE OF ONTARIO

Stephen S. M. Cheng, P.Eng.
Discipline Manager, Geotechnical Division
Brampton Office

# Drawings:
# Borehole Location Plan
# Notes on Sample Description
# Borehole Logs

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CLIENT: WATERSAND DEVELOPMENT

PROJECT: PROPOSED WATERSAND RESIDENTIAL DEVELOPMENT

TITLE: KEYPLAN

| | |
|---|---|
| scale | 1:12500 |
| date | 9/12/2017 |
| drawn by | M.B. |
| project no. | BRM-00038305-B0 |

DRAWING 1

## Notes on Sample Descriptions and Soil Types — Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** also follow the same system. Others may use different classification systems; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

| CLAY | SILT | | | SAND | | | GRAVEL | | | COBBLES | BOULDERS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | | |

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETERS

| CLAY (PLASTIC) TO SILT (NONPLASTIC) | FINE | MEDIUM | COARSE | FINE | COARSE |
|---|---|---|---|---|---|
| | SAND | | | GRAVEL | |

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of

till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

4. Excerpt from "OHSA Regulations for Construction Projects," Part III, Section 226:

- **Soil Types**

Type 1 Soil

a) is hard, very dense and only able to be penetrated with difficulty by a small sharp object;

b) has a low natural moisture content and a high degree of internal strength;

c) has no signs of water seepage; and

d) can be excavated only by mechanical equipment.

Type 2 Soil

a) is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;

b) has a low to medium natural moisture content and a medium degree of internal strength; and

c) has a damp appearance after it is excavated.

Type 3 Soil

a) is stiff to firm and compact to loose in consistency or is previously excavated soil;

b) exhibits signs of surface cracking;

c) exhibits signs of water seepage;

d) if it is dry, may run easily into a well-defined conical pile; and

e) has a low degree of internal strength.

Type 4 Soil

a) is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;

b) runs easily or flows, unless it is completely supported before excavating procedures;

c) has almost no internal strength;

d) is wet or muddy; and

e) exerts substantial fluid pressure on its supporting system. O. Reg. 213/91, s. 226.

ROAD ALLOWANCE BETWEEN CONCESSIONS 9 AND 10

MCKAY ROAD

LINE BETWEEN LOTS 2 AND 3, CONCESSION 9

CONCESSION

3 AND 4, CONCESSION 9

LINE BETWEEN THE NORTH HALF AND SOUTH HALF OF LOT 3, CONCESSION 9

LINE BETWEEN THE NORTH HALF AND SOUTH HALF OF LOT

BARRIE AND THE TOWN OF INNISFIL

QUARTER OF LOT 3

LINE BETWEEN LOTS

BH #1 307.96
BH #2 310.24
BH #3 310.22
BH #4 310.17
BH #5 310.11
BH #6 308.29
BH #7 309.40
BH #8 310.18
BH #9 311.03
BH #10 310.91
BH #11 310.64
BH #12 309.96
BH #13 310.03
BH #15 308.92
BH #16 309.50
BH #17 310.76
BH #19 310.25
BH #20 310.51
BH #21 310.02
BH #22 310.16
BH #23 310.68
BH #24 308.70
BH #26 309.47
BH #27 309.70
BH #28 309.80
BH #29 309.97
BH #30 309.81
BH #31 310.69
BH #33 308.87
BH #34 308.80
BH #35 309.29
BH #36 309.71
BH #37 309.49
BH #38 309.25
BH #39 309.71
BH #40 310.16
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BH #54 309.91
BH #56 309.76
BH #56 309.80
BH #57 309.70
BH #58 309.80
BH #59 308.83
BH #60 309.41
BH #61 309.62
BH #62 309.27
BH #70 308.32
BH #56 308.92
BH #64D 308.56
BH #64S
BH #B1D 309.80
BH #B1S 309.52
BH #B2D 309.60
BH #B2S
BH #C1 308.37
BH #C2D 306.71
BH #C2S
BH #C3D 309.77
BH #C3S


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CLIENT: WATERSAND DEVELOPMENT

PROJECT: PROPOSED WATERSAND RESIDENTIAL DEVELOPMENT

TITLE: SECTION 1 – BOREHOLE LOCATION PLAN

| | |
|---|---|
| scale | 1:3500 |
| date | 9/12/2017 |
| drawn by | M.B. |
| project no. | BRM-00038305-B0 |

DRAWING 2

# SECTION 1

| BH# | Figure # | Elevation |
|---|---|---|
| BH 1 | 3 | 307.96 |
| BH 2 | 4 | 310.24 |
| BH 3 | 5 | 310.22 |
| BH 4 | 6 | 310.17 |
| BH 5 | 7 | 310.11 |
| BH 6 | 8 | 308.29 |
| BH 7 | 9 | 309.40 |
| BH 8 | 10 | 310.18 |
| BH 9 | 11 | 311.03 |
| BH 10 | 12 | 310.91 |
| BH 11 | 13 | 310.64 |
| BH 12 | 14 | 309.96 |
| BH 13 | 15 | 310.03 |
| BH 15 | 16 | 308.92 |
| BH 16 | 17 | 309.50 |
| BH 17 | 18 | 310.76 |
| BH 19 | 19 | 310.25 |
| BH 20 | 20 | 310.51 |
| BH 21 | 21 | 310.02 |
| BH 22 | 22 | 310.16 |
| BH 23 | 23 | 310.68 |
| BH 24 | 24 | 308.70 |
| BH 26 | 25 | 309.47 |
| BH 27 | 26 | 309.70 |
| BH 28 | 27 | 309.80 |
| BH 29 | 28 | 309.97 |
| BH 30 | 29 | 309.84 |
| BH 31 | 30 | 310.69 |
| BH 33 | 31 | 308.87 |
| BH 34 | 32 | 308.80 |
| BH 35 | 33 | 309.29 |
| BH 36 | 34 | 309.71 |
| BH 37 | 35 | 309.49 |
| BH 38 | 36 | 309.25 |
| BH 39 | 37 | 309.71 |
| BH 40 | 38 | 310.16 |

| BH# | Figure # | Elevation |
|---|---|---|
| BH 41 | 39 | 309.38 |
| BH 43 | 40 | 310.27 |
| BH 44 | 41 | 309.22 |
| BH 45 | 42 | 309.43 |
| BH 46 | 43 | 309.73 |
| BH 48 | 44 | 309.58 |
| BH 49 | 45 | 309.76 |
| BH 50 | 46 | 309.89 |
| BH 51 | 57 | 308.85 |
| BH 53 | 58 | 309.62 |
| BH 54 | 59 | 309.91 |
| BH 56 | 60 | 309.76 |
| BH 57 | 61 | 309.70 |
| BH 58 | 62 | 309.80 |
| BH 59 | 63 | 308.83 |
| BH 60 | 64 | 309.41 |
| BH 61 | 65 | 309.62 |
| BH 62 | 66 | 309.27 |
| BH 64-D | 67 | 308.56 |
| BH 64-S | 68 | 308.56 |
| BH 65 | 69 | 308.92 |
| BH 66 | 70 | 309.80 |
| BH 70 | 71 | 308.32 |
| | | |
| **SWM B** | | |
| BH B1-D | 72 | 309.52 |
| BH B1-S | 73 | 309.52 |
| BH B2-D | 74 | 309.60 |
| BH B2-S | 75 | 309.60 |
| | | |
| **SWM C** | | |
| BH C1 | 76 | 308.37 |
| BH C2-D | 77 | 306.71 |
| BH C2-S | 78 | 306.71 |
| BH C3-D | 79 | 309.77 |
| BH C3-S | 80 | 309.77 |

# Log of Borehole 1

Project No. BRM-00038305-B0 | Drawing No. 3

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

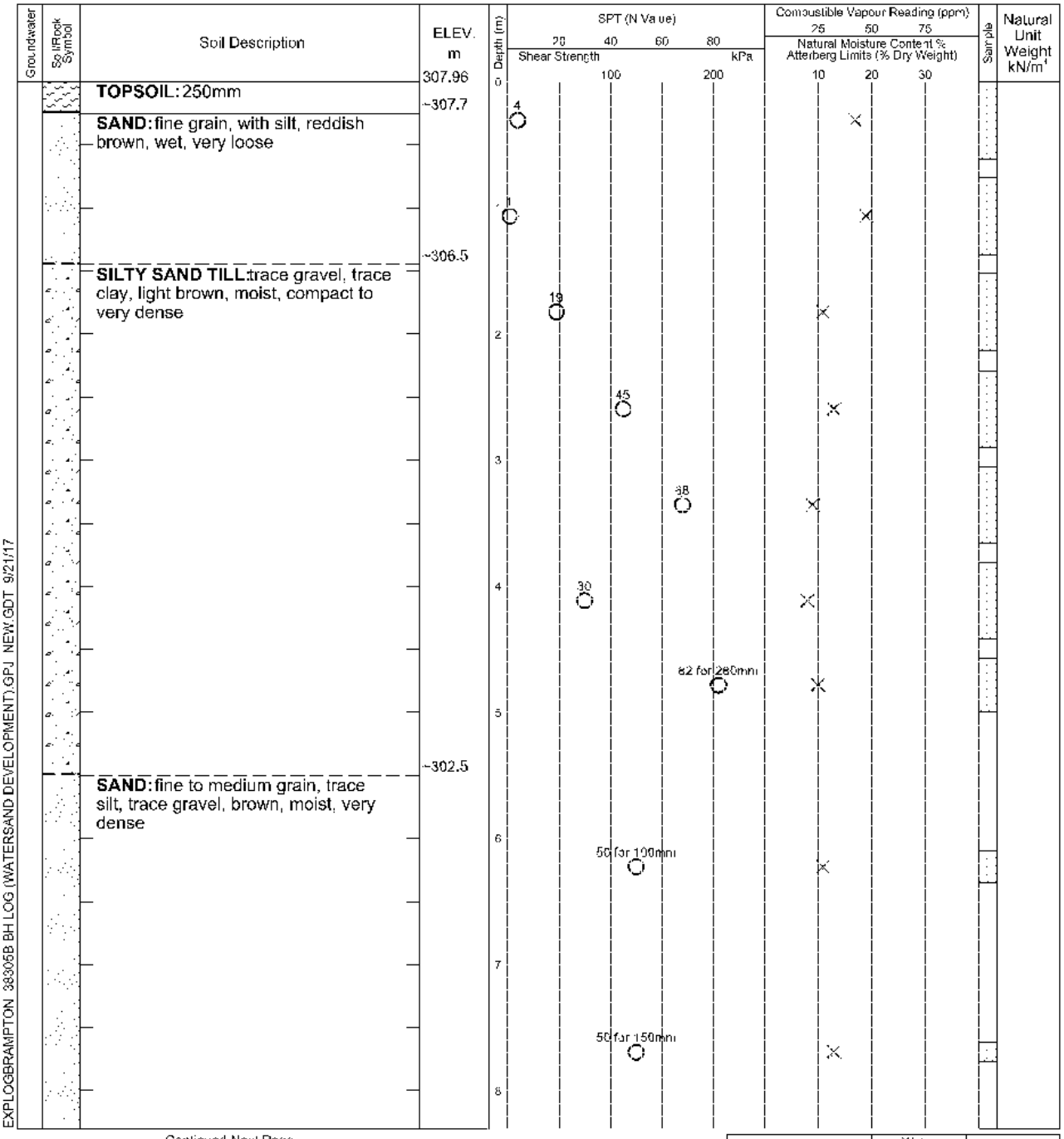
Date Drilled: July 12, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

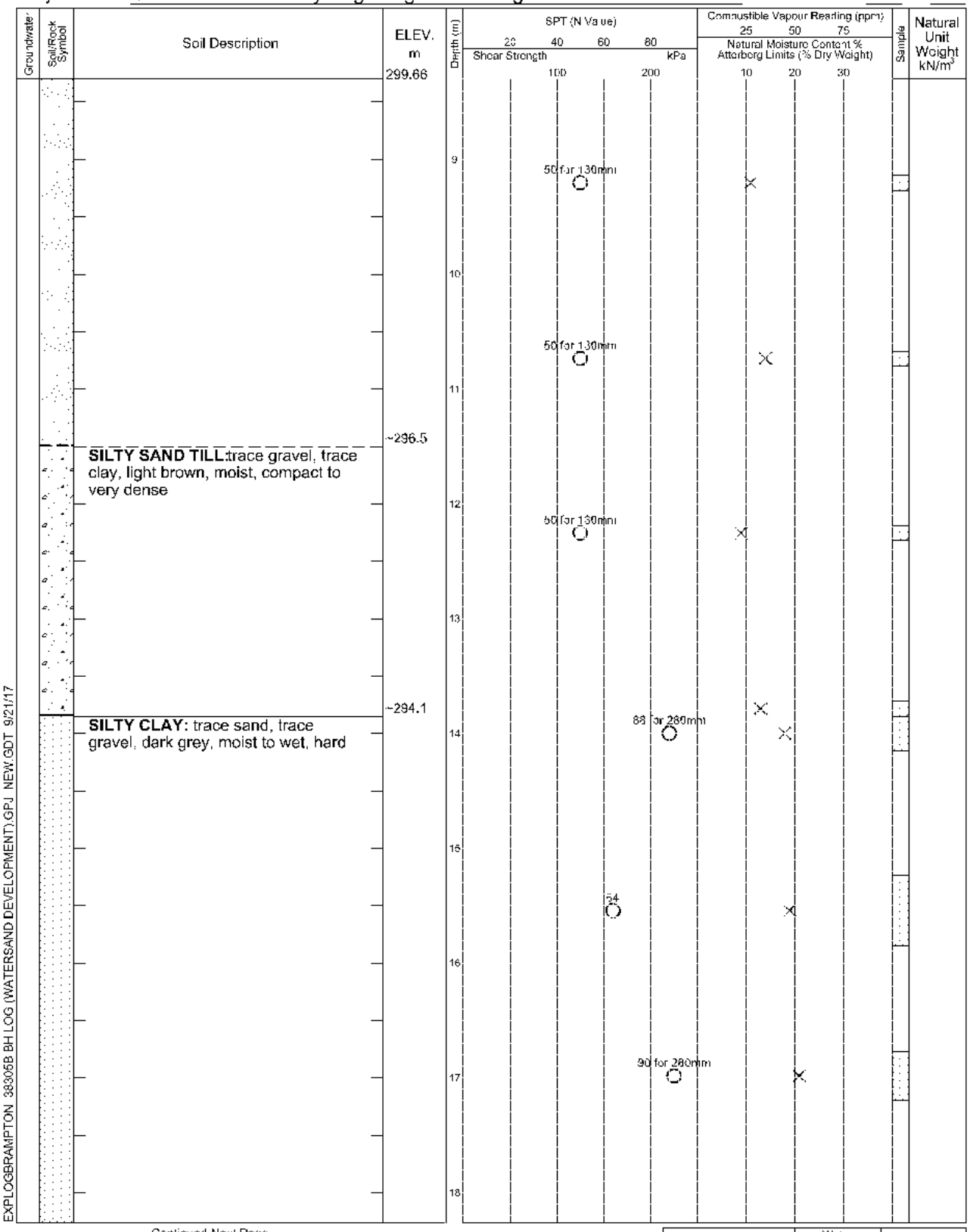
Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.44 | 6.10 |

# Log of Borehole 1

Project No. BRM-00038305-B0 Drawing No. 3

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.44 | 6.10 |

# Log of Borehole 1

Project No. BRM-00038305-B0 Drawing No. 3

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Samples | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 289.70 | 19 | 88 for 280mm | | | |
| | | | | 20 | 50 for 100mm | | | |
| | | | | 21 | 50 for 100mm | | | |
| | | | | 22 | | | | |
| | | | | 23 | 50 for 75mm | | | |
| | | | | 24 | 50 for 150mm | | | |
| | | | ~283.4 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.44 | 6.10 |

exp.

# Log of Borehole 2

Project No. BRM-00038305-B0

Drawing No. 4

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.24 | 0 |
| | | | ~310.0 | |
| | | **SAND:** fine grain, with silt, reddish brown, moist | | |
| | | | ~309.5 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, moist to wet, dense to very dense | | 1 |
| | | | | 2 |
| | | | ~307.5 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~304.0 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight): 10 20 30

4
38
50
58
50 for 150mm
50 for 75mm
50 for 130mm
50 for 150mm

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 1.83 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 3

Project No. BRM-00038305-B0 | Drawing No. 5

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 27, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.22 | 0 |
| | | | ~310.0 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, damp, compact to very dense | | |
| | | ----- wet | | 3 |
| | | | ~306.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | 4 |
| | | | ~305.8 | |
| | | **SAND:** fine grain, some silt, light grey, wet, very dense | | 5 |
| | | | ~304.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark grey, moist, very dense | | 6 |
| | | | | 7 |
| | | | | 8 |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 8, 28, 50 for 150mm, 26, 19, 50 for 150mm, 34, 50 for 75mm, 50 for 130mm

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.44 | 2.44 |

exp.

# Log of Borehole 3

Project No. BRM-00038305-B0 Drawing No. 5

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.92 | | | | | |
| | | | | 9 | 50 for 130mm | | | |
| | | | | 10 | | | | |
| | | | | 11 | 50 for 130mm | | | |
| | | | | 12 | 50 for 50mm | | | |
| | | | | 13 | | | | |
| | | | | | 50 for 150mm | | | |
| | | | ~296.4 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.44 | 2.44 |

exp.

# Log of Borehole 4

Project No. BRM-00038305-B0 | Drawing No. 6

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

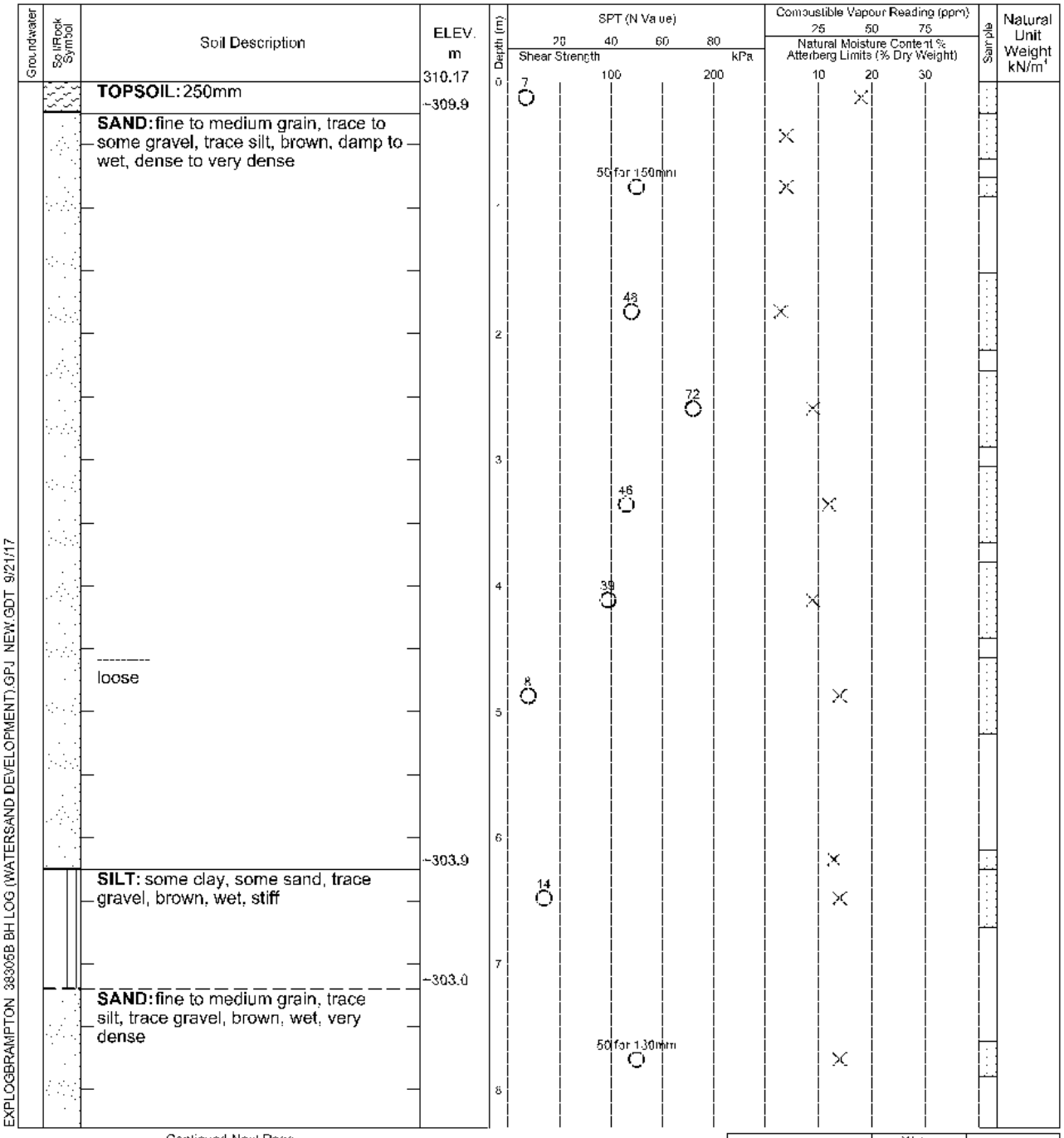
Date Drilled: July 4, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer




Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.83 | 1.83 |

# Log of Borehole 4

Project No. BRM-00038305-B0 Drawing No. 6

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.87 | | | | | |
| | | | ~301.4 | | | | | |
| | | **SILTY SAND TILL**:trace gravel, trace clay, light grey, moist, very dense | | 9 | 50 for 130mm | × | | |
| | | | | 10 | | | | |
| | | | | | 50 for 130mm | × | | |
| | | | ~299.4 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.83 | 1.83 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 5

Project No. BRM-00038305-B0 | Drawing No. 7

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 28, 2017

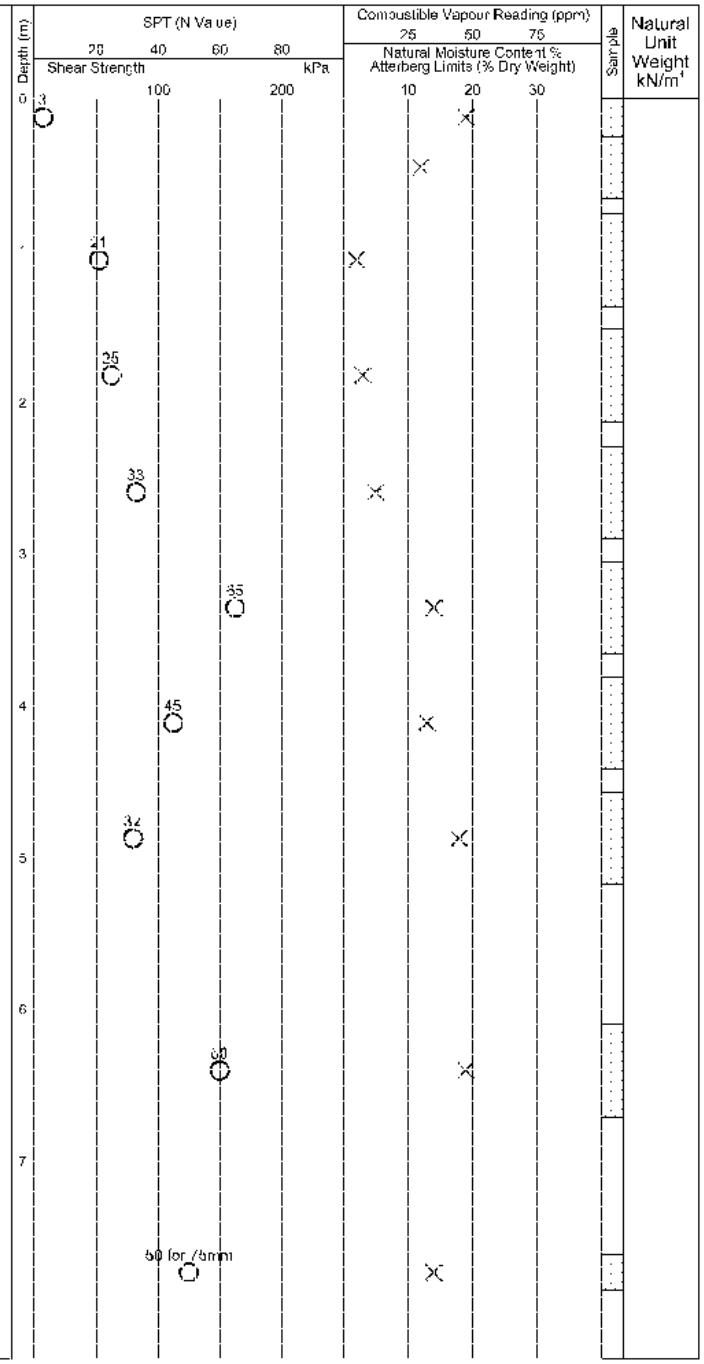
Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.11 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, damp to moist, compact | ~309.9 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, damp to wet, compact to very dense | ~308.7 |
| | | **END OF BOREHOLE** | ~302.3 |




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.66 | 3.66 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 6

Project No. BRM-00038305-B0

Drawing No. 8

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

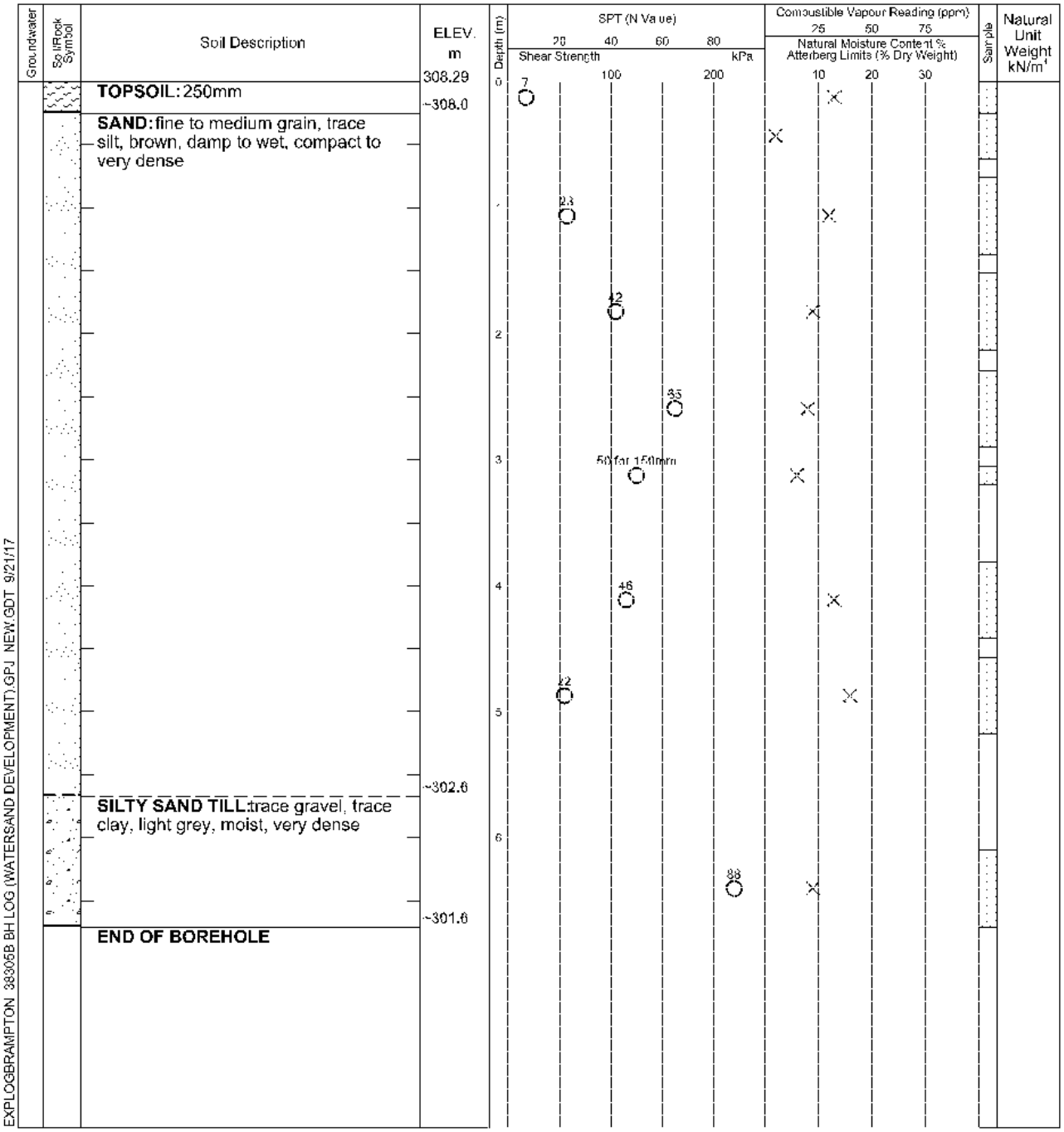
Date Drilled: June 28, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.27 | 5.18 |

# Log of Borehole 7

Project No. BRM-00038305-B0 | Drawing No. 9

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

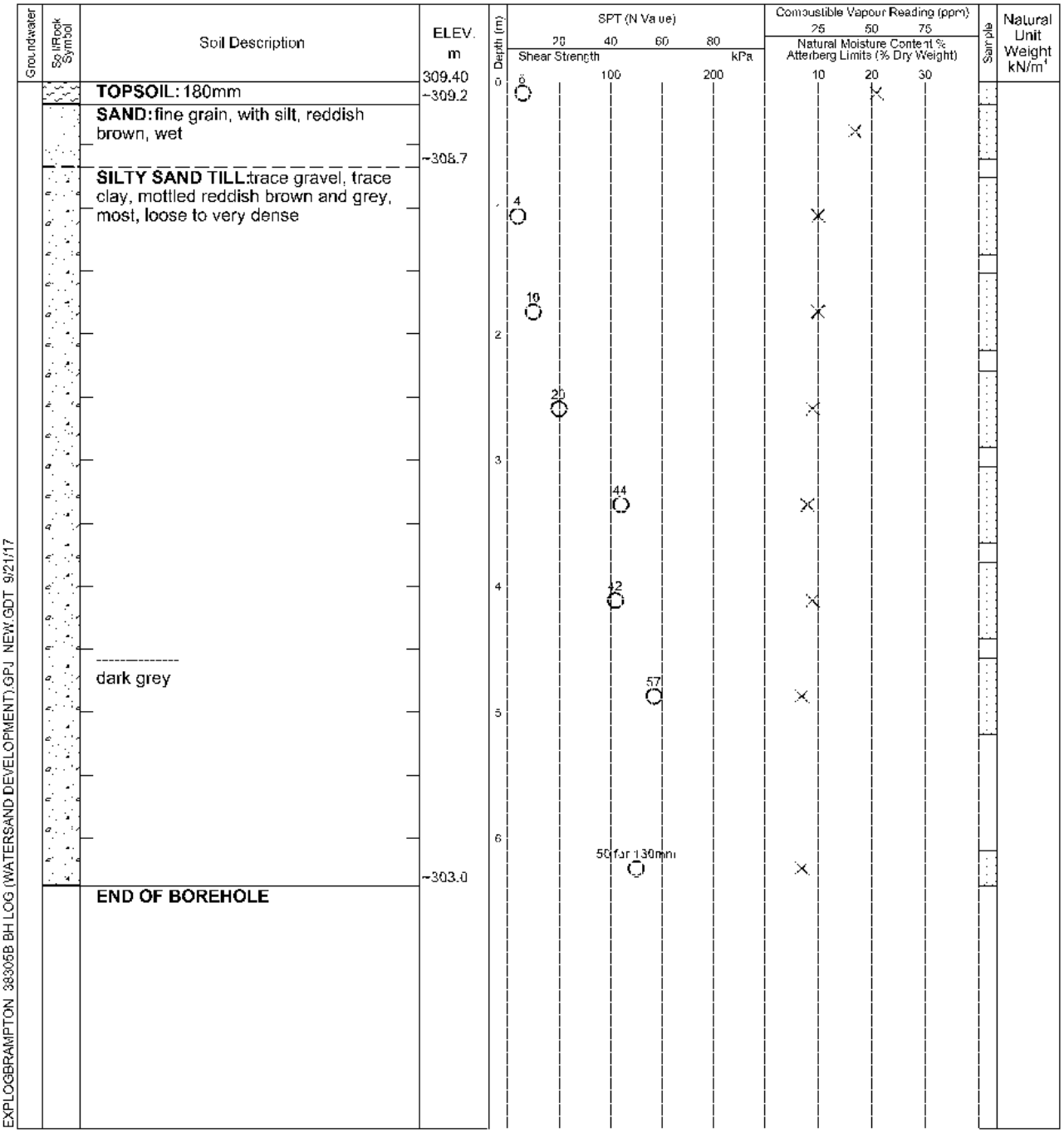
Date Drilled: June 22, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




**TOPSOIL:** 180mm

**SAND:** fine grain, with silt, reddish brown, wet

**SILTY SAND TILL:** trace gravel, trace clay, mottled reddish brown and grey, most, loose to very dense

dark grey

**END OF BOREHOLE**

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.05 | 3.20 |

exp.

# Log of Borehole 8

Project No. BRM-00038305-B0 | Drawing No. 10

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 22, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.18 | 0 |
| | | | ~309.9 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | | |
| | | dark grey | | 3 |
| | | | ~303.8 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80; 100, 200

SPT values: 4, 11, 47, 51, 50 for 150mm, 50 for 150mm, 50 for 150mm, 50 for 130mm

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.88 | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 9

Project No. BRM-00038305-B0 | Drawing No. 11

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 22, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 311.03 | 0 |
| | | | ~310.8 | |
| | | **SAND:** fine grain, with silt, reddish brown, wet | ~310.3 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | |
| | | | ~303.1 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80, 100, 200

53

50 for 150mm

50 for 150mm

50 for 150mm

50 for 100mm

50 for 130mm

90 for 250mm

50 for 150mm

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.94 | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 10

Project No. BRM-00038305-B0 | Drawing No. 12

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

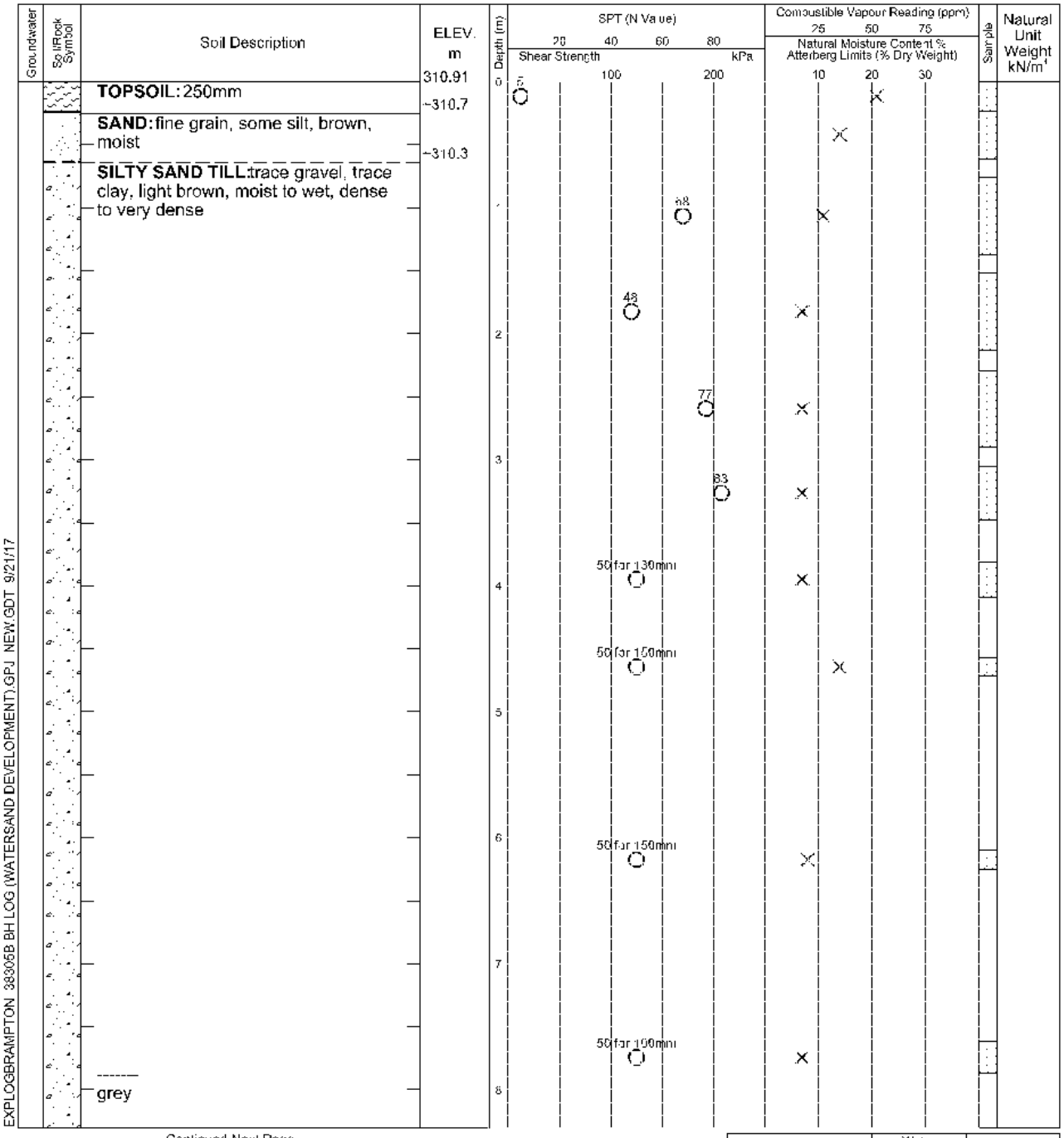
Date Drilled: June 21, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.10 | 7.62 |

# Log of Borehole 10

Project No. BRM-00038305-B0 Drawing No. 12

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.61 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | ~301.5 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.10 | 7.62 |

exp.

# Log of Borehole 11

Project No. BRM-00038305-B0 | Drawing No. 13

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

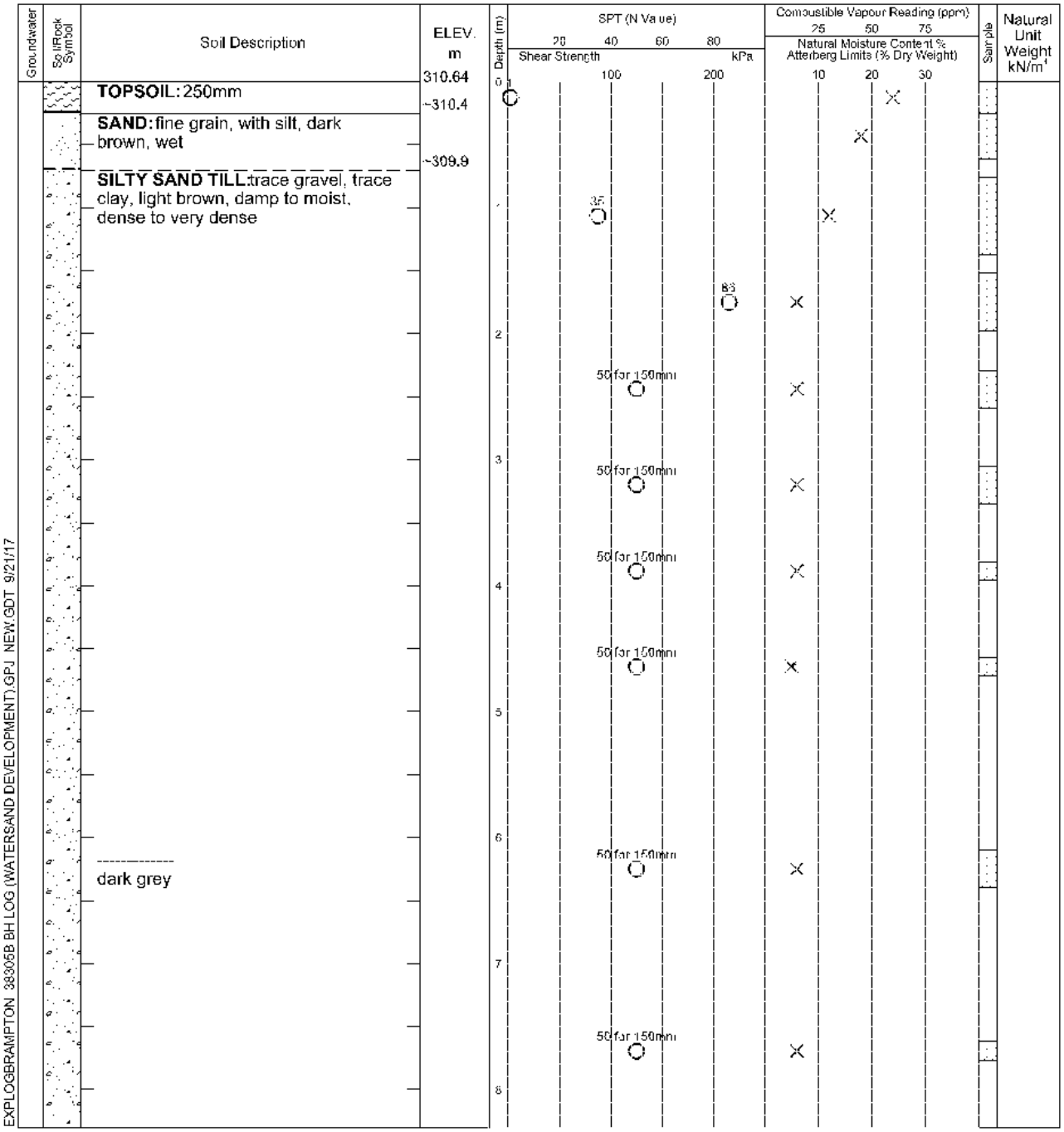
Date Drilled: June 22, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.55 | 7.77 |

# Log of Borehole 11

Project No. BRM-00038305-B0 Drawing No. 13

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.34 | | | | | |
| | | | | 9 | 50 for 75mm | | | |
| | | | ~301.4 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.55 | 7.77 |

exp.

# Log of Borehole 12

Project No. BRM-00038305-B0 | Drawing No. 14

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 27, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 309.96 | 0 |
| | | | ~309.7 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, moist to wet, compact to dense | | |
| | | | ~306.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark grey, moist to wet, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30
Sample
Natural Unit Weight kN/m³

SPT values: 17, 22, 34, 39, 90, 50 for 150mm, 50 for 100mm, 50 for 75mm

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

# Log of Borehole 12

Project No. BRM-00038305-B0 Drawing No. 14

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) / Shear Strength kPa | Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.66 | | 20 40 60 80 / 100 200 | 25 50 75 / 10 20 30 | | |
| | | | | 9 | 86 | | | |
| | | | | 10 | | | | |
| | | | | 11 | 50 for 150mm | | | |
| | | | | 12 | 50 for 150mm | | | |
| | | | ~297.0 | 13 | | | | |
| | | **SILT:** some clay, some sand, dark grey, moist, hard | | | | | | |
| | | | | 14 | 78 | | | |
| | | | ~295.8 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

# Log of Borehole 13

Project No. BRM-00038305-B0 | Drawing No. 15

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

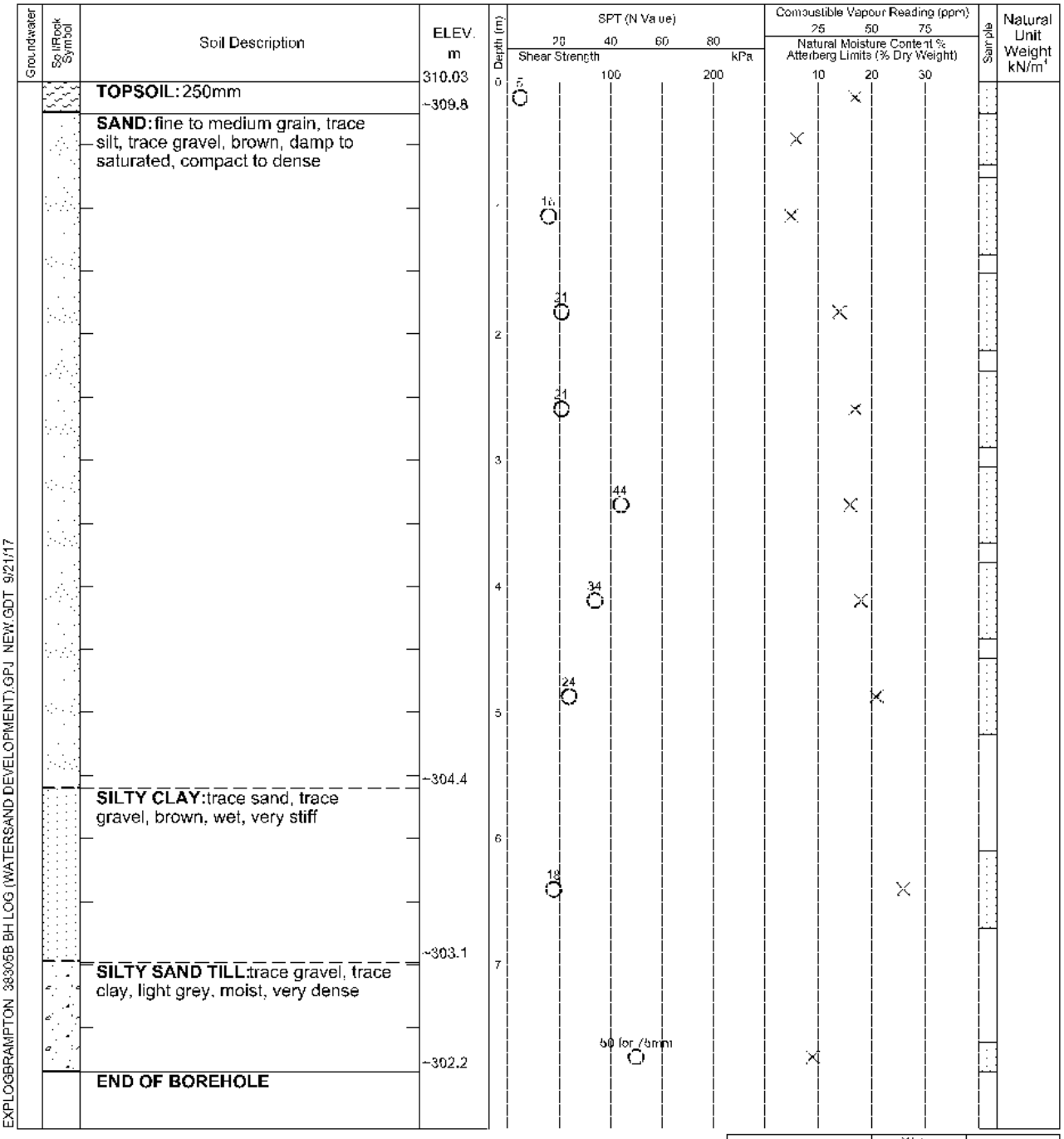
Date Drilled: June 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.05 | 3.05 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 15

Project No. BRM-00038305-B0 | Drawing No. 16

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 26, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 308.92 | 0 |
| | | | ~308.7 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, moist, loose to dense | | |
| | | | ~305.4 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very loose to very dense | | |
| | | wet seam | | |
| | | | ~301.1 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

6, 30, 30, 7, 41, 18, 3, 50 for 150mm, 50 for 50mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.46 | 0.76 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 16

Project No. BRM-00038305-B0 | Drawing No. 17

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

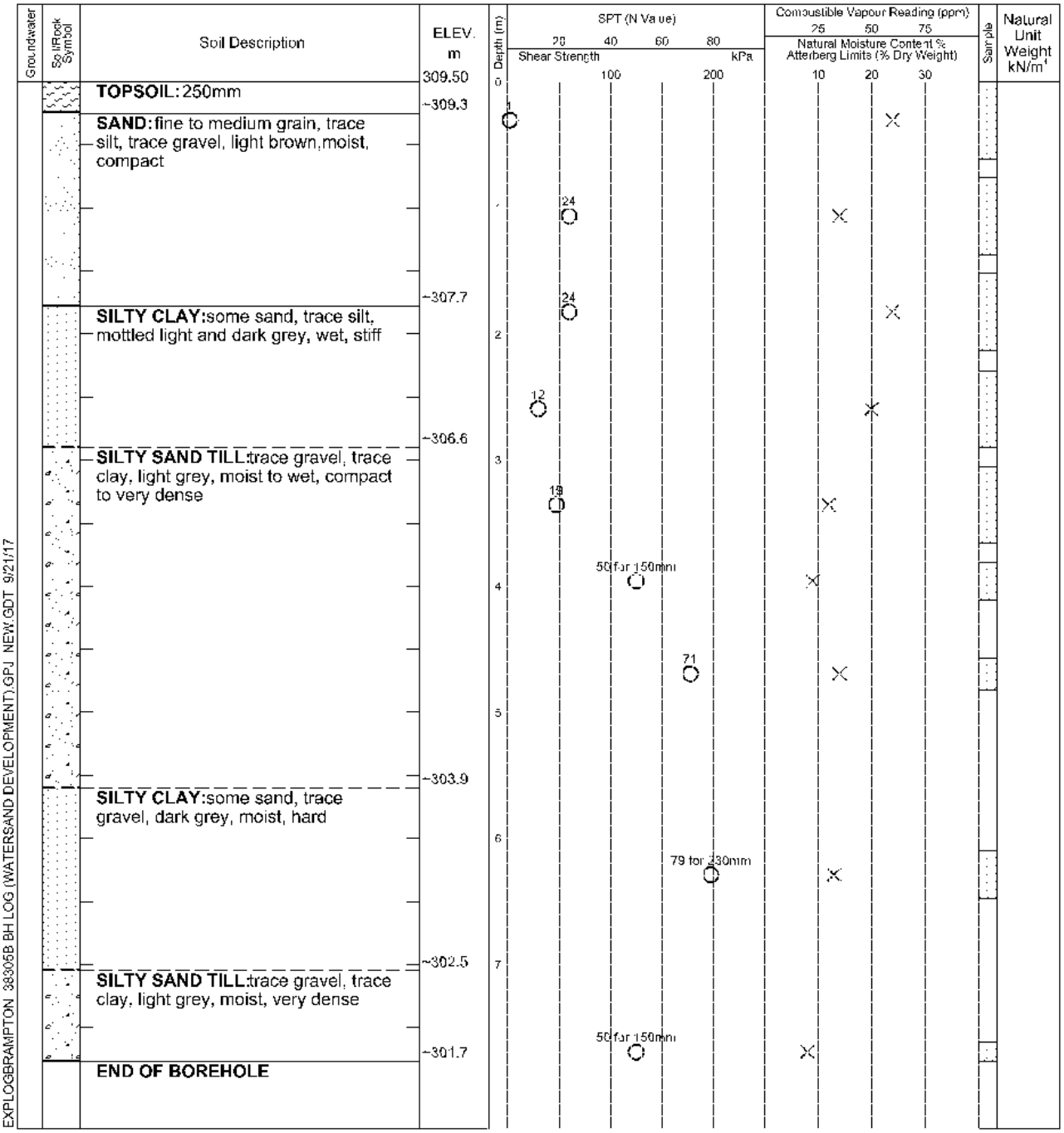
Date Drilled: June 23, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.30 | 1.22 |

# Log of Borehole 17

Project No. BRM-00038305-B0 | Drawing No. 18

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

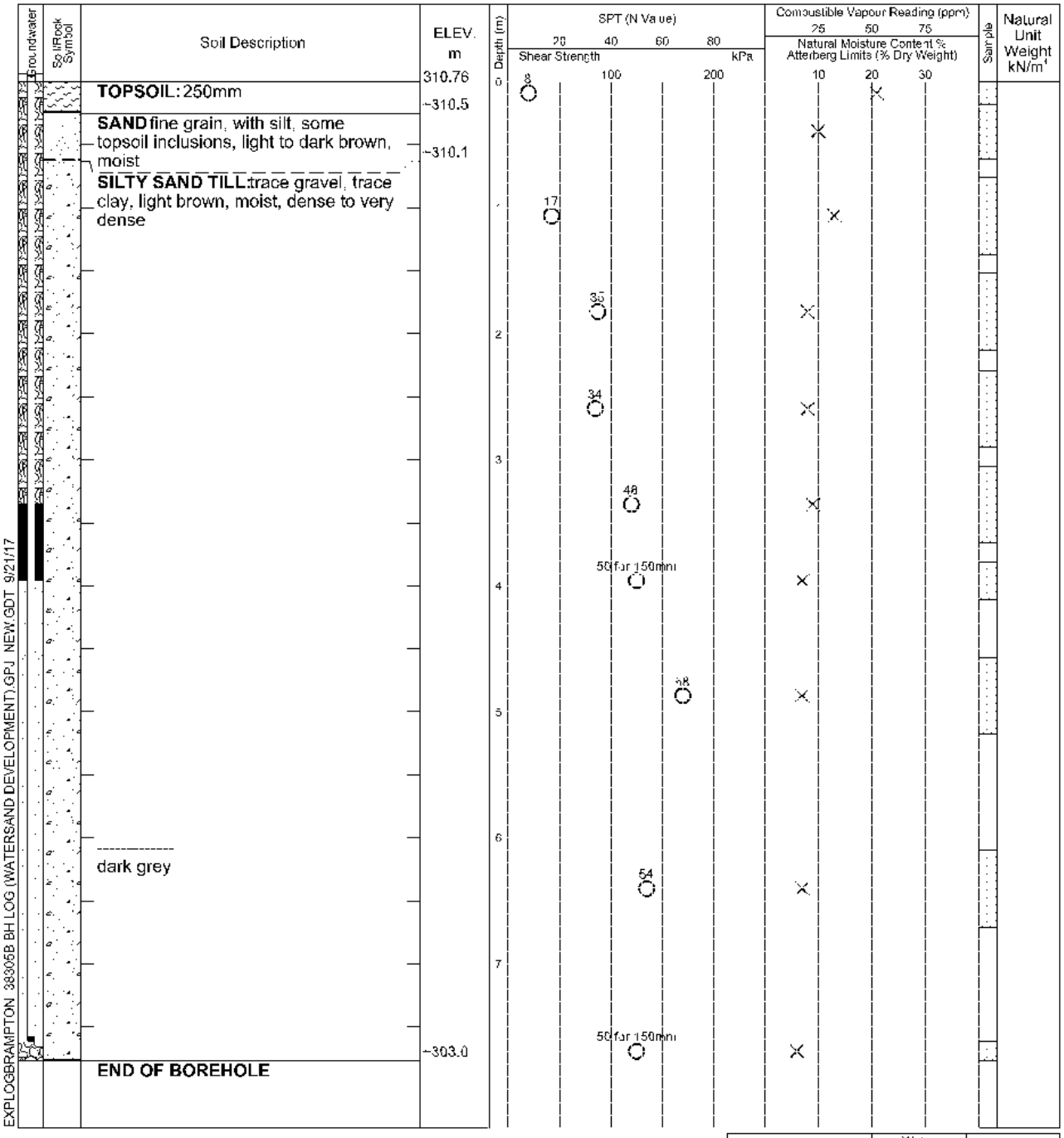
Date Drilled: June 22, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| June 22, 2017 | 0.28 | - |
| August 9, 2017 | 1.88 | - |

# Log of Borehole 19

Project No. BRM-00038305-B0 | Drawing No. 19

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

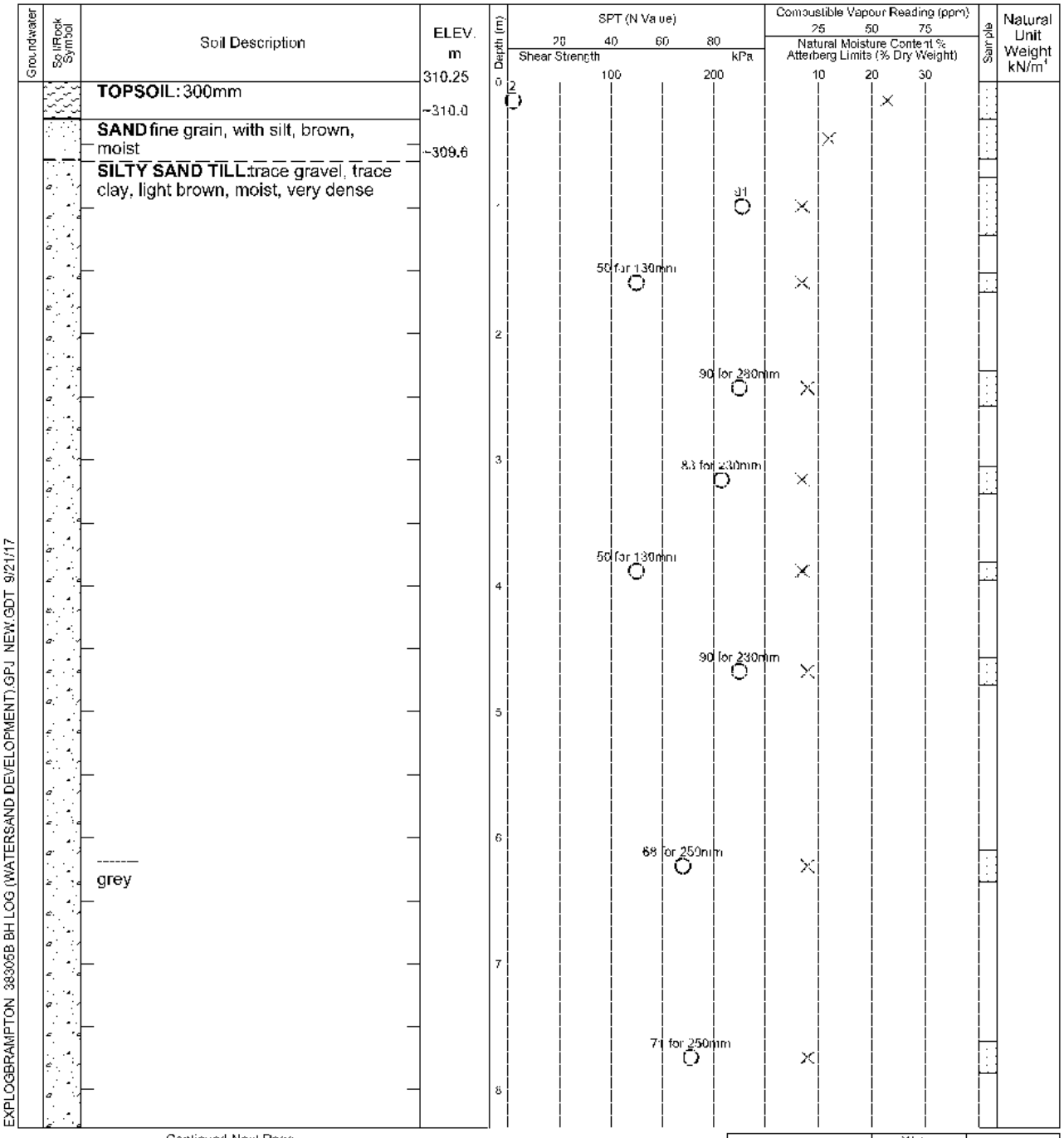
Date Drilled: June 21, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.10 | 9.30 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 19

Project No. BRM-00038305-B0 Drawing No. 19

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.95 | | | | | |
| | | | | 9 | 50 for 130mm | X | | |
| | | END OF BOREHOLE | 301.0 | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.10 | 9.30 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 20

Project No. BRM-00038305-B0 | Drawing No. 20

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 28, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) / Shear Strength kPa | Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 310.51 | 0 | 4 | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, possible cobbles and/or boulders, light brown, moist, very dense | ~310.3 | 1 | 50/0 for 150mm | | | |
| | | | | 2 | 50/0 for 150mm | | | |
| | | | | 3 | 50/0 for 150mm | | | |
| | | | | 4 | 50/0 for 130mm | | | |
| | | | | 5 | 50/0 for 100mm | | | |
| | | | | 6 | 50/0 for 130mm | | | |
| | | | | 7 | 50/0 for 75mm | | | |
| | | | | 8 | 50/0 for 100mm | | | |

Continued Next Page

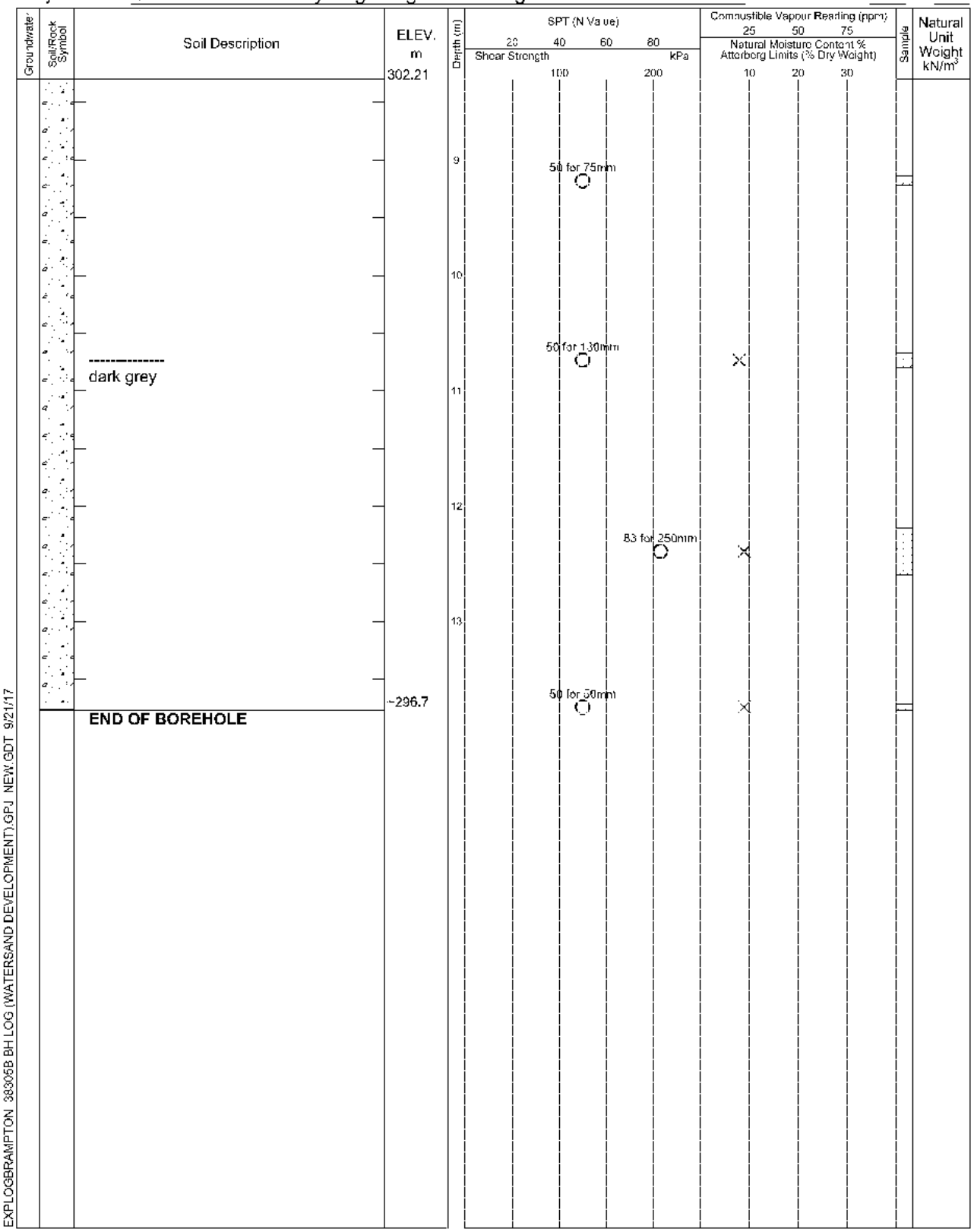
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.81 | 8.38 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 20

Project No. BRM-00038305-B0 Drawing No. 20

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.81 | 8.38 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 21

Project No. BRM-00038305-B0 | Drawing No. 21

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.02 | 0 |
| | | | ~309.8 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, damp to wet, very loose to compact | | |
| | | | ~307.0 | 3 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, compact to very dense | | |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80; 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample | Natural Unit Weight kN/m³

SPT values: 4, 4, 4, 26, 17, 50 for 130mm, 50 for 150mm, 50 for 75mm, 50 for 150mm

Depth (m): 0, 1, 2, 3, 4, 5, 6, 7, 8

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 21

Project No. BRM-00038305-B0 Drawing No. 21

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength 100 200 kPa | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.72 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | ~300.3 | | | | | |
| | | **SILT:** some sand, some clay, trace gravel, dark grey, moist, hard | | 10 | | | | |
| | | | | | 50 for 150mm | | | |
| | | | | 11 | | | | |
| | | | | 12 | 50 for 150mm | | | |
| | | | ~297.7 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

exp.

# Log of Borehole 22

Project No. BRM-00038305-B0 | Drawing No. 22

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 23, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.16 | 0 |
| | | | ~309.9 | |
| | | **SAND:** fine grain, with silt, trace gravel, light brown to mottled dark brown to grey, moist to wet, dense to very dense | | 1 |
| | | | ~308.4 | |
| | | **SAND:** fine to medium grain, trace silt, light brown, moist, very dense | ~308.0 | 2 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | ~304.0 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

38
54
63
50 for 150mm
90
50 for 100mm
50 for 100mm

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.94 | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 23

Project No. BRM-00038305-B0 | Drawing No. 23

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 23, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 280mm | 310.68 |
| | | **SAND:** fine grain, with silt, some gravel, mottled dark to light brown, moist, compact | ~310.4 |
| | | **SAND:** fine to medium, trace silt, trace gravel, light brown, damp, very dense | ~309.6 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, damp to moist, very dense | ~308.5 |
| | | **END OF BOREHOLE** | ~303.0 |

Depth (m): 0, 1, 2, 3, 4, 5, 6, 7

SPT (N Value): 20, 40, 60, 80

Shear Strength: 100, 200 kPa

SPT values: 5, 15, 55, 88, 90, 50 for 150mm, 50 for 150mm, 50 for 75mm, 50 for 75mm

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.01 | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 24

Project No. BRM-00038305-B0 | Drawing No. 24

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

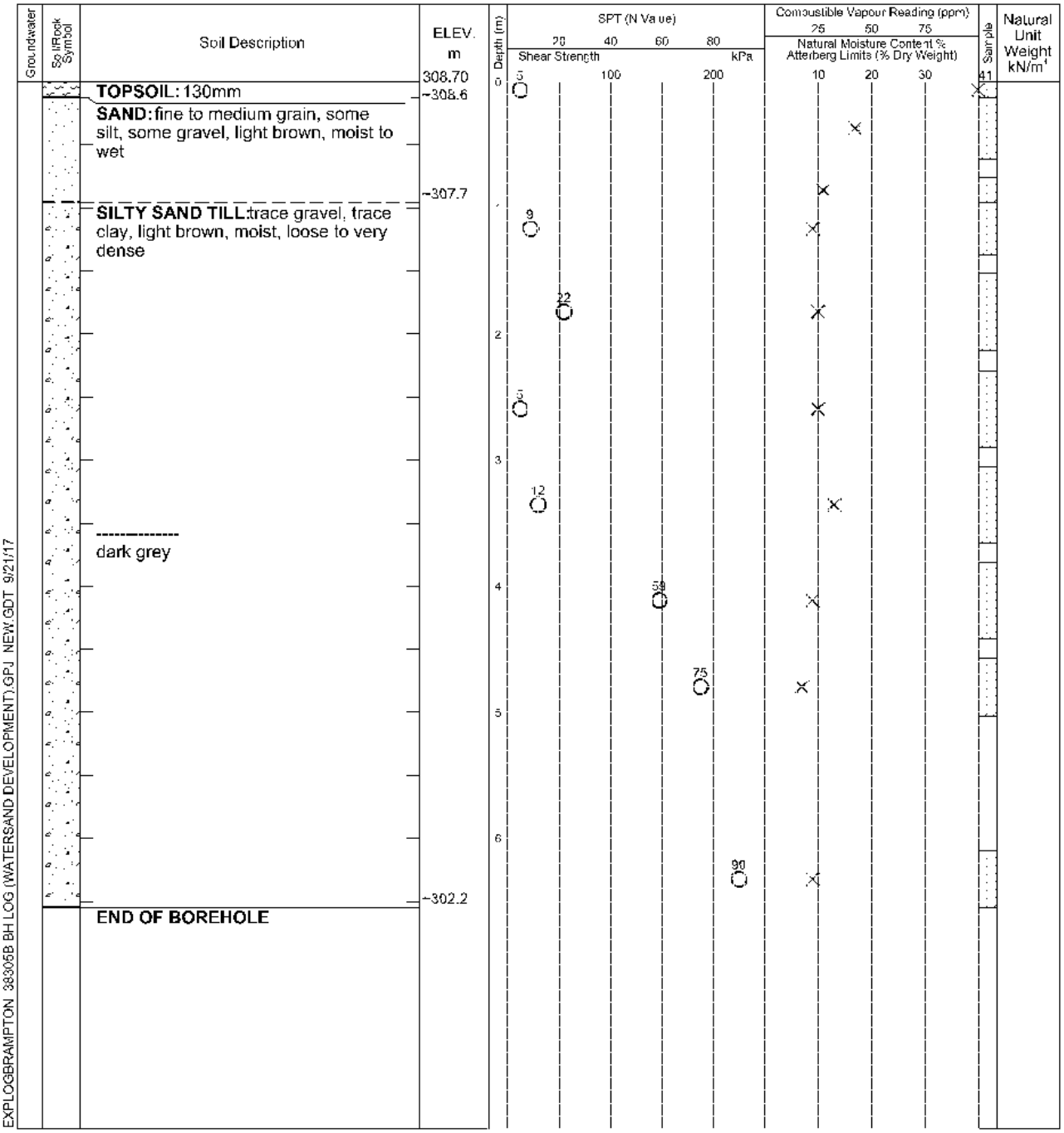
Date Drilled: July 10, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




**TOPSOIL:** 130mm

**SAND:** fine to medium grain, some silt, some gravel, light brown, moist to wet

**SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, loose to very dense

---

dark grey

**END OF BOREHOLE**

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.61 | 0.61 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 26

Project No. BRM-00038305-B0 | Drawing No. 25

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 309.47 | 0 |
| | | | ~309.2 | |
| | | **SAND:** fine grain, with silt, trace gravel, reddish brown, moist | ~308.8 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | ------ grey | | 6 |
| | | | ~303.1 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
29
52
24
50
62
45
50 for 100mm

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.66 | 3.66 |

exp.

# Log of Borehole 27

Project No. BRM-00038305-B0 | Drawing No. 26

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

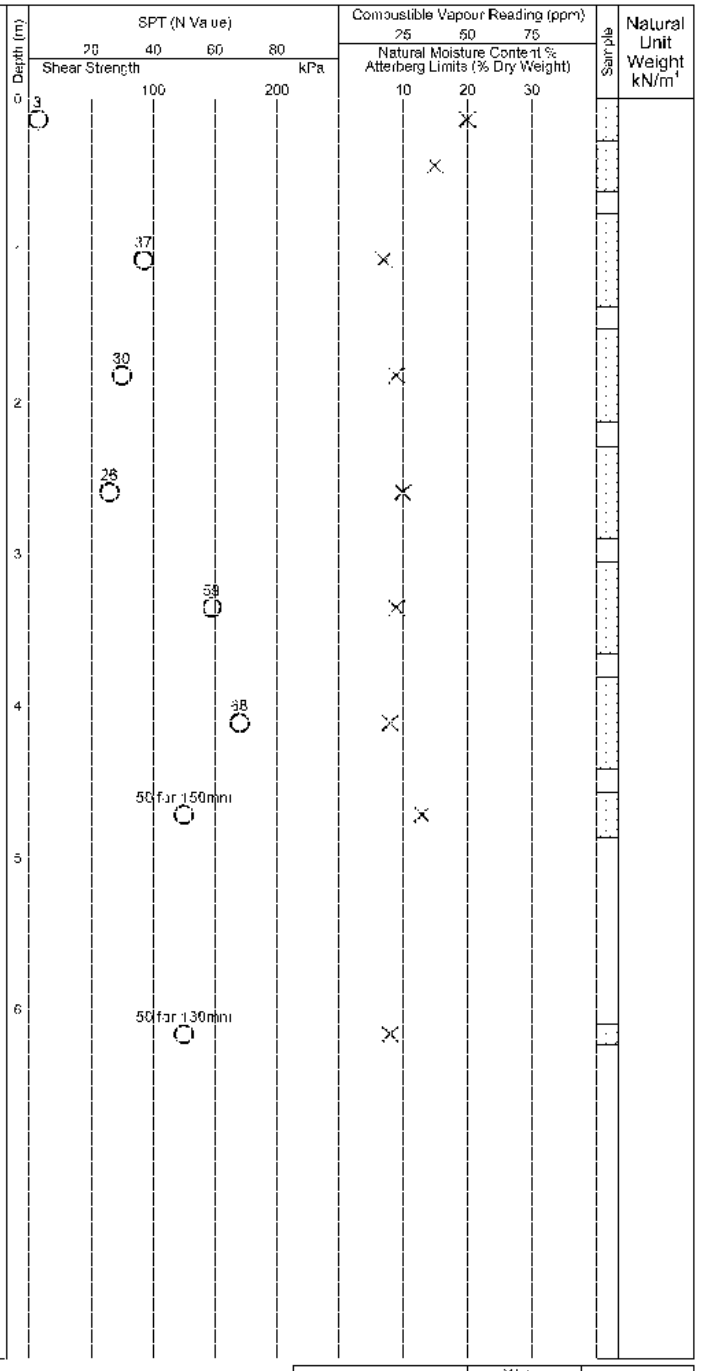
Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.70 |
| | | | ~309.4 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, compact to very dense | |
| | | | ~303.5 |
| | | **END OF BOREHOLE** | |




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.72 | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 28

Project No. BRM-00038305-B0 Drawing No. 27

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

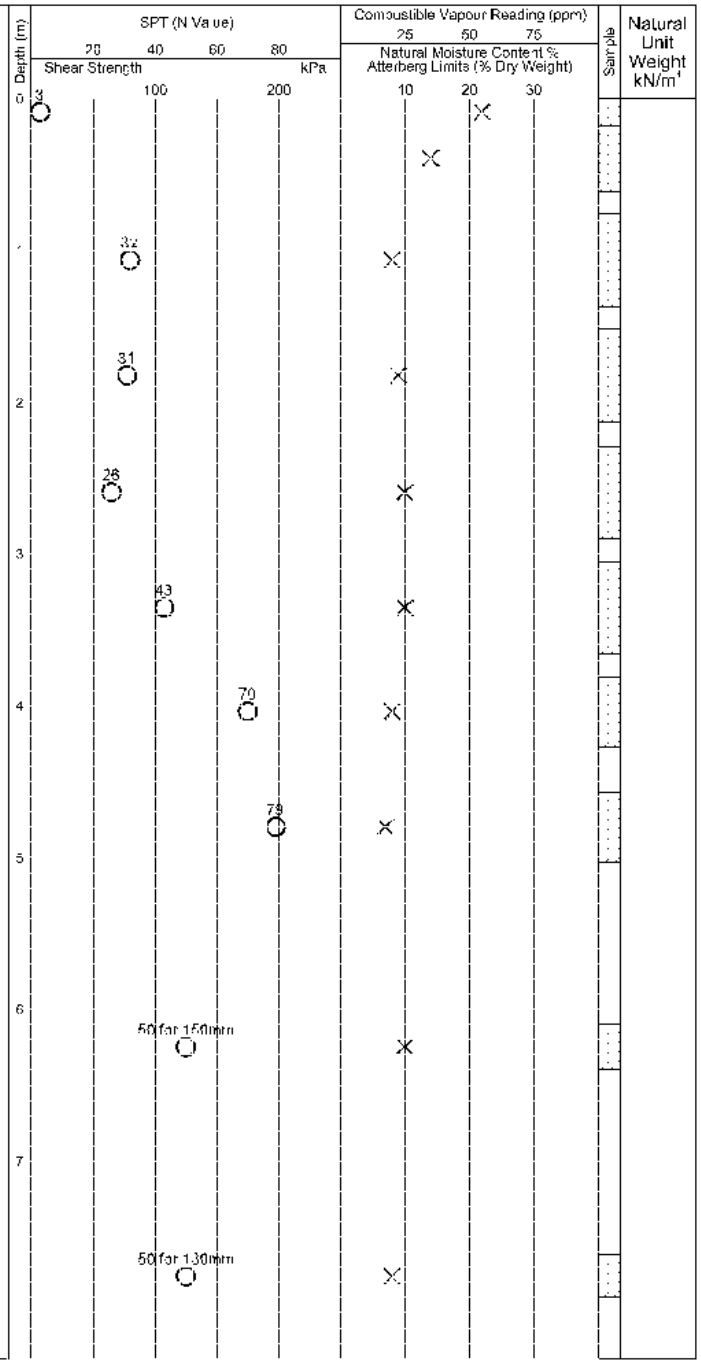
Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.80 |
| | | | ~309.5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | |
| | | ---------- light grey | |
| | | | ~301.9 |
| | | **END OF BOREHOLE** | |




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.49 | 7.01 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 29

Project No. BRM-00038305-B0 | Drawing No. 28

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 309.97 | 0 |
| | | **SILTY SAND:** reddish brown, wet | ~309.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, dense to very dense | ~309.3 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 2, 71, 67, 55, 33, 46, 71, 98, 50 for 130mm

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.51 | 4.27 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 29

Project No. BRM-00038305-B0 Drawing No. 28

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.67 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | | 10 | | | | |
| | | | | 11 | 50 for 100mm | | | |
| | | | | 12 | 50 for 100mm | | | |
| | | | ~297.7 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.51 | 4.27 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 30

Project No. BRM-00038305-B0 | Drawing No. 29

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

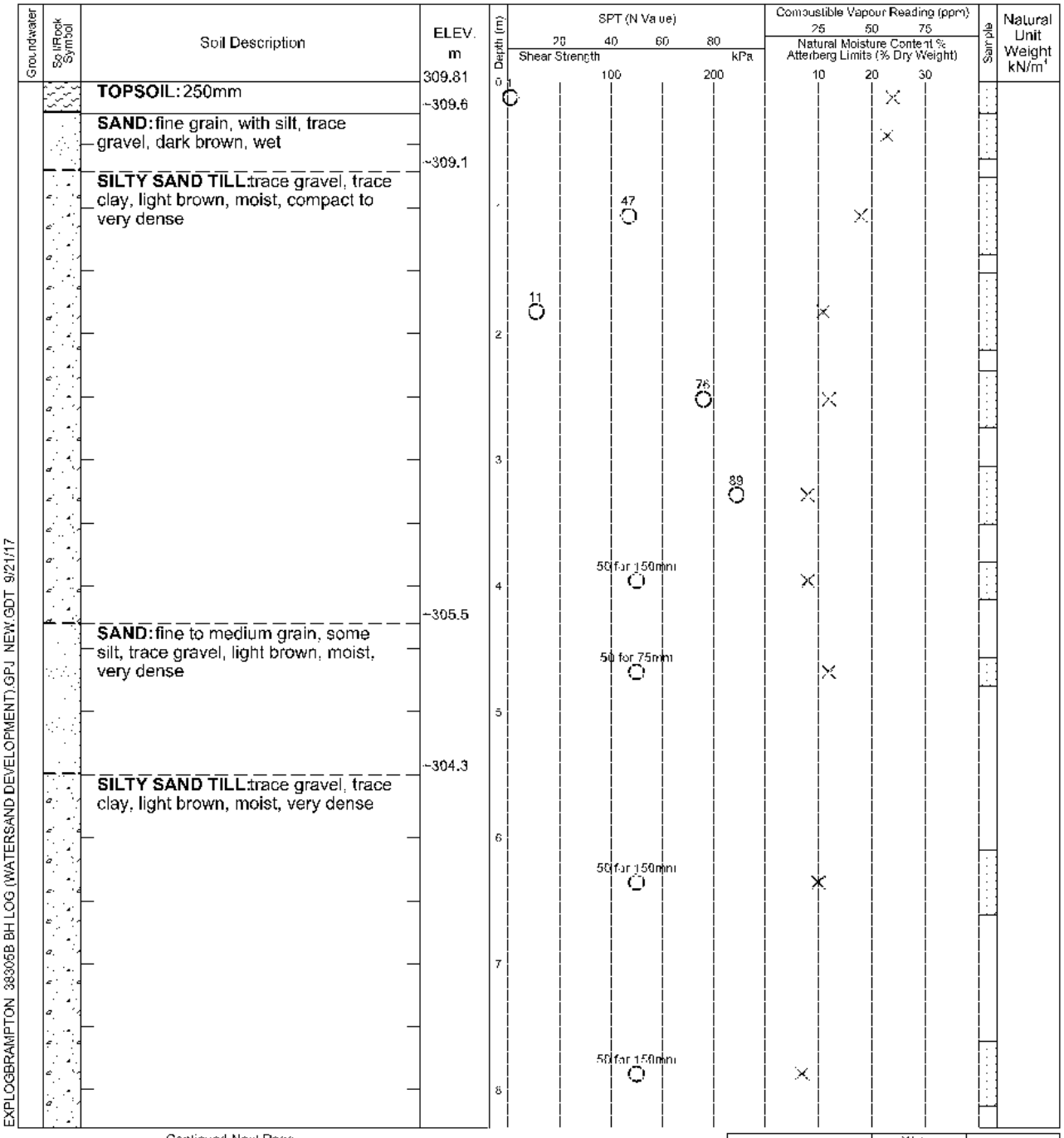
Date Drilled: June 26, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 3.66 |

# Log of Borehole 30

Project No. BRM-00038305-B0 Drawing No. 29

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.51 | | | | | |
| | | | | 9 | 50 for 75mm | | | |
| | | | ~300.6 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 3.66 |

exp.

# Log of Borehole 31

Project No. BRM-00038305-B0 | Drawing No. 30

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 26, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 310.69 | 0 |
| | | | ~310.4 | |
| | | **SAND:** fine grain, with silt, trace gravel, dark brown to mottled dark brown/light brown, wet, compact | | |
| | | | ~309.0 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, dense to very dense | | 2 |
| | | | ~303.7 | 7 |
| | | **SAND:** fine to medium grain, some silt, trace gravel, occasional silty clay inclusions, grey, moist, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

SPT values: 3, 12, 45, 50 for 150mm, 50 for 130mm, 50 for 150mm, 50 for 150mm, 50 for 150mm, 50 for 150mm

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.47 | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 31

Project No. BRM-00038305-B0 Drawing No. 30

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.39 | | | | | |
| | | | | 9 | 50 for 100mm | | | |
| | | | ~301.5 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.47 | 7.62 |

exp.

# Log of Borehole 33

Project No. BRM-00038305-B0 | Drawing No. 31

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 10, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 308.87 | 0 |
| | | | ~308.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, mottled light brown / orange, moist, compact to very dense | | |
| | | light grey | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~302.5 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80, 100, 200

SPT values: 3, 12, 39, 43, 89, 54, 50 for 150mm, 50 for 150mm

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 34

Project No. BRM-00038305-B0 | Drawing No. 32

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

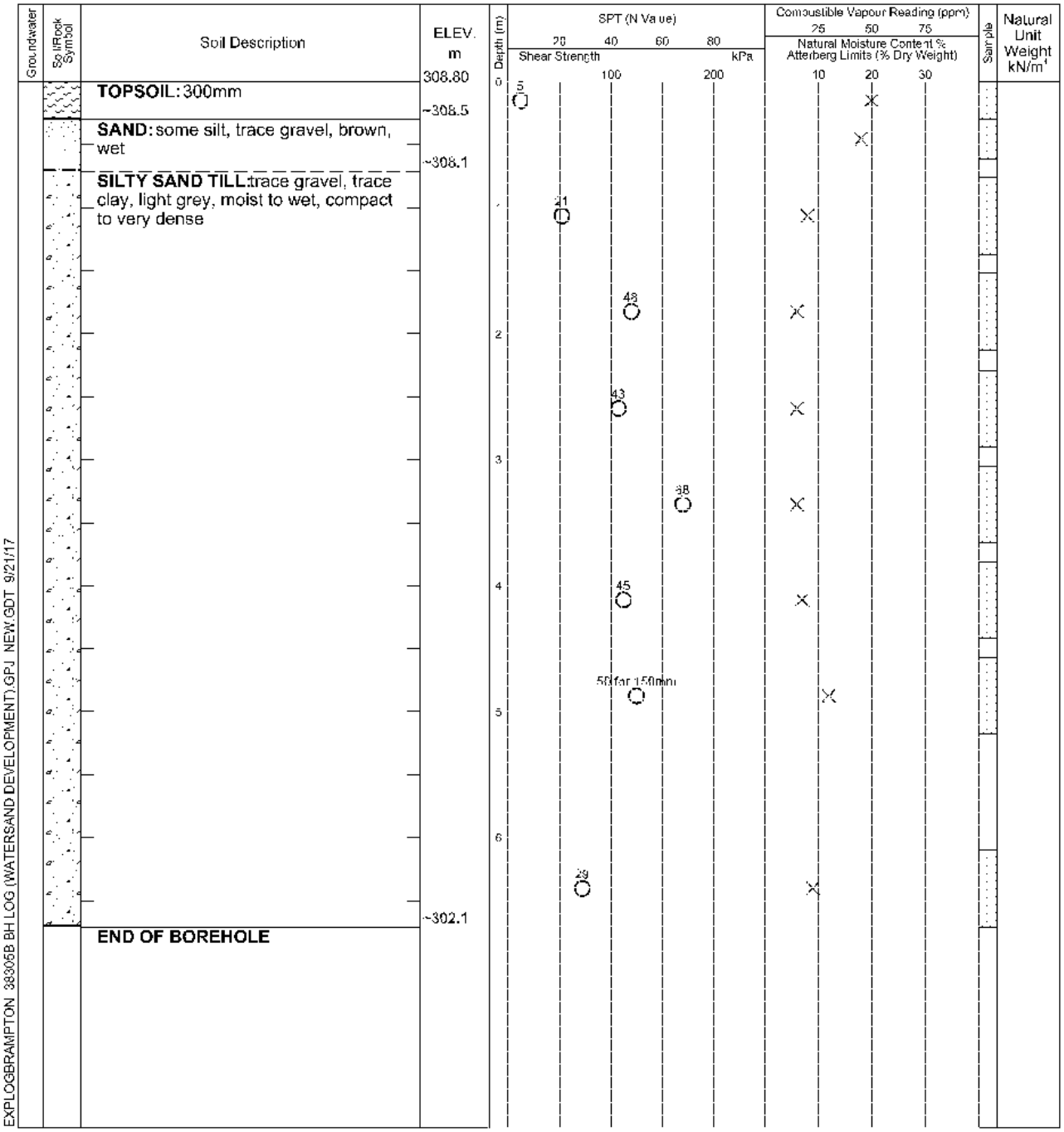
Date Drilled: June 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.18 | 5.49 |

# Log of Borehole 35

Project No. BRM-00038305-B0 | Drawing No. 33

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

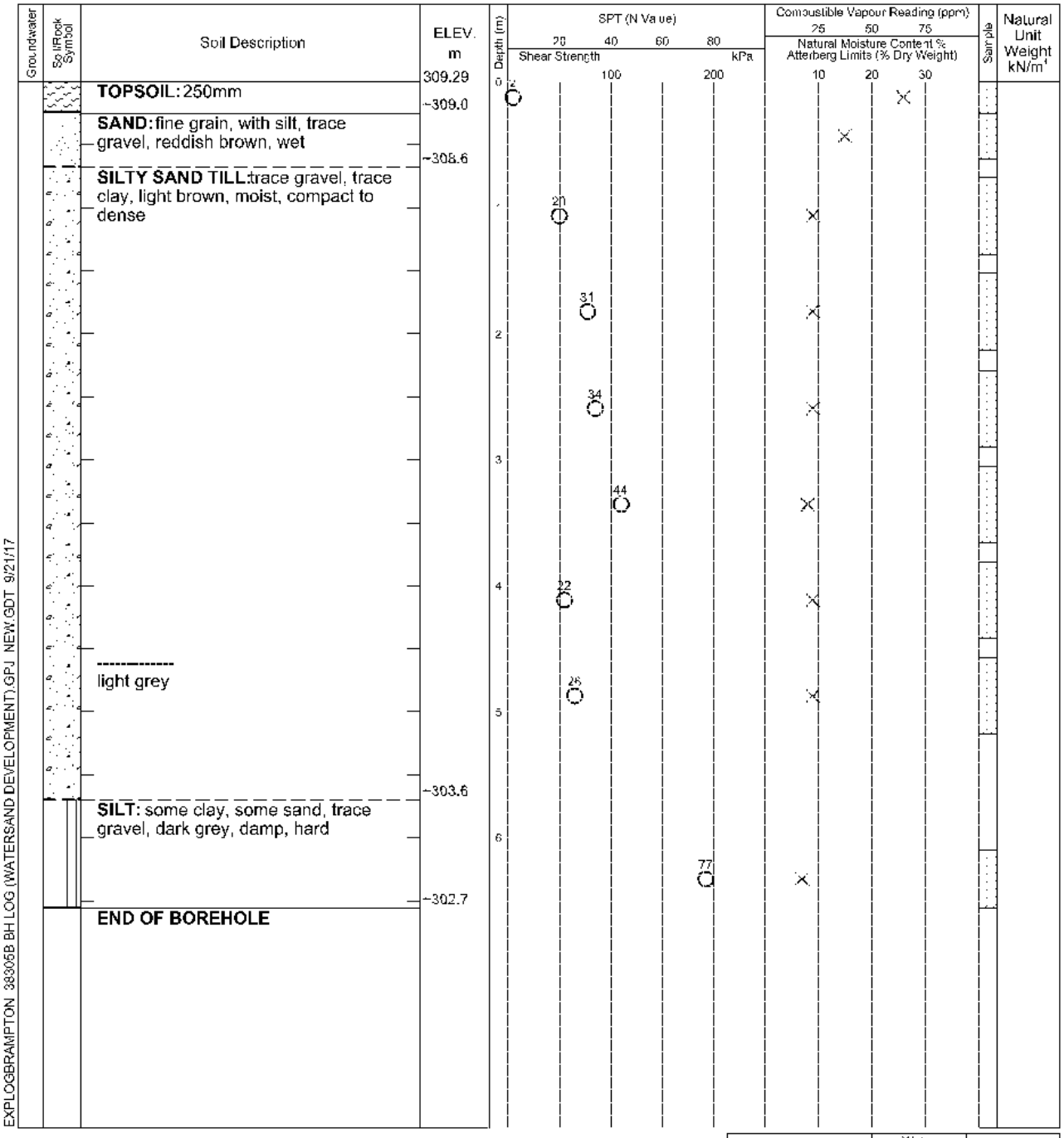
Date Drilled: June 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.66 | 4.88 |

# Log of Borehole 36

Project No. BRM-00038305-B0 | Drawing No. 34

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

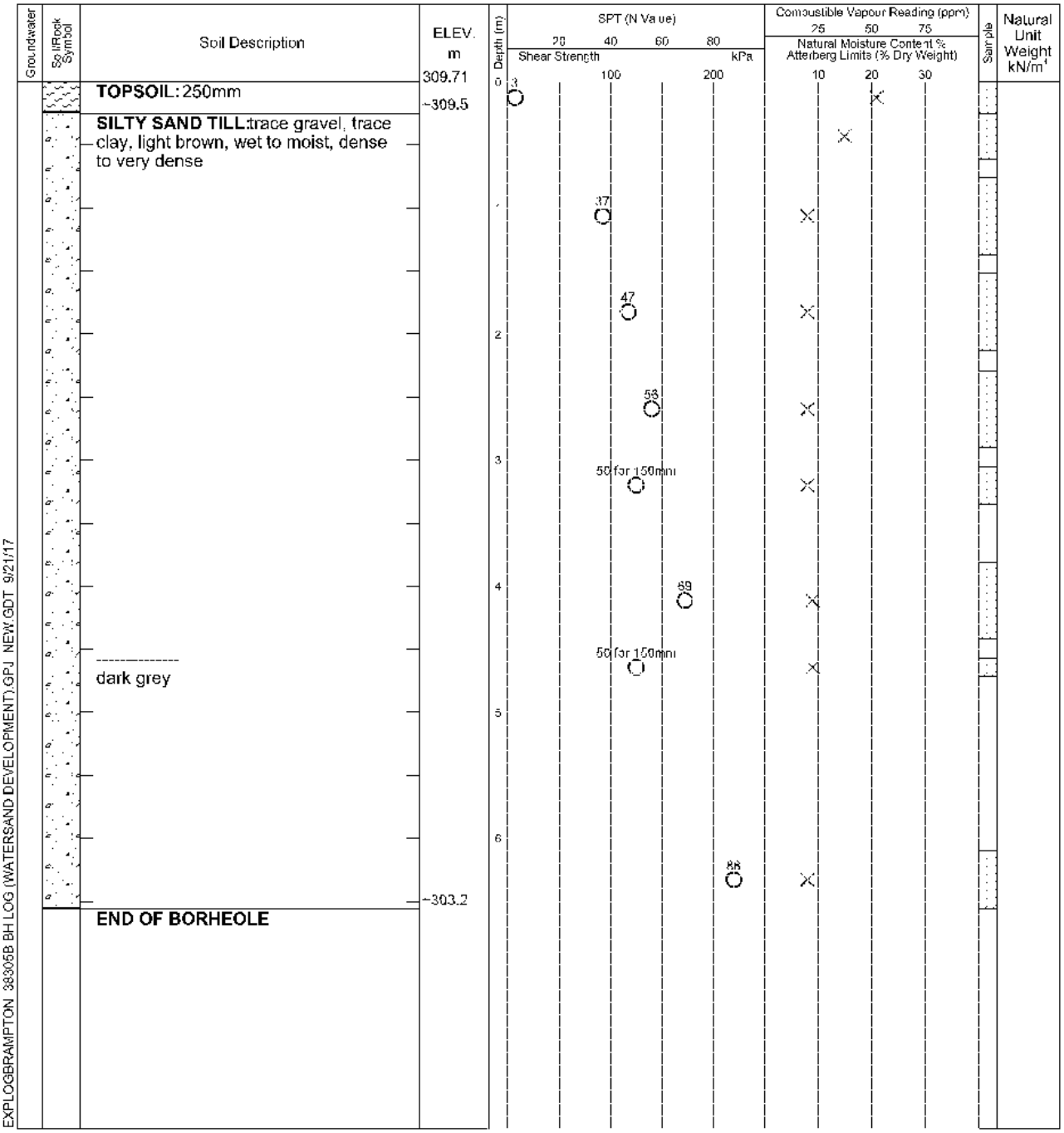
Date Drilled: June 15, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.94 | 6.55 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 37

Project No. BRM-00038305-B0 | Drawing No. 35

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

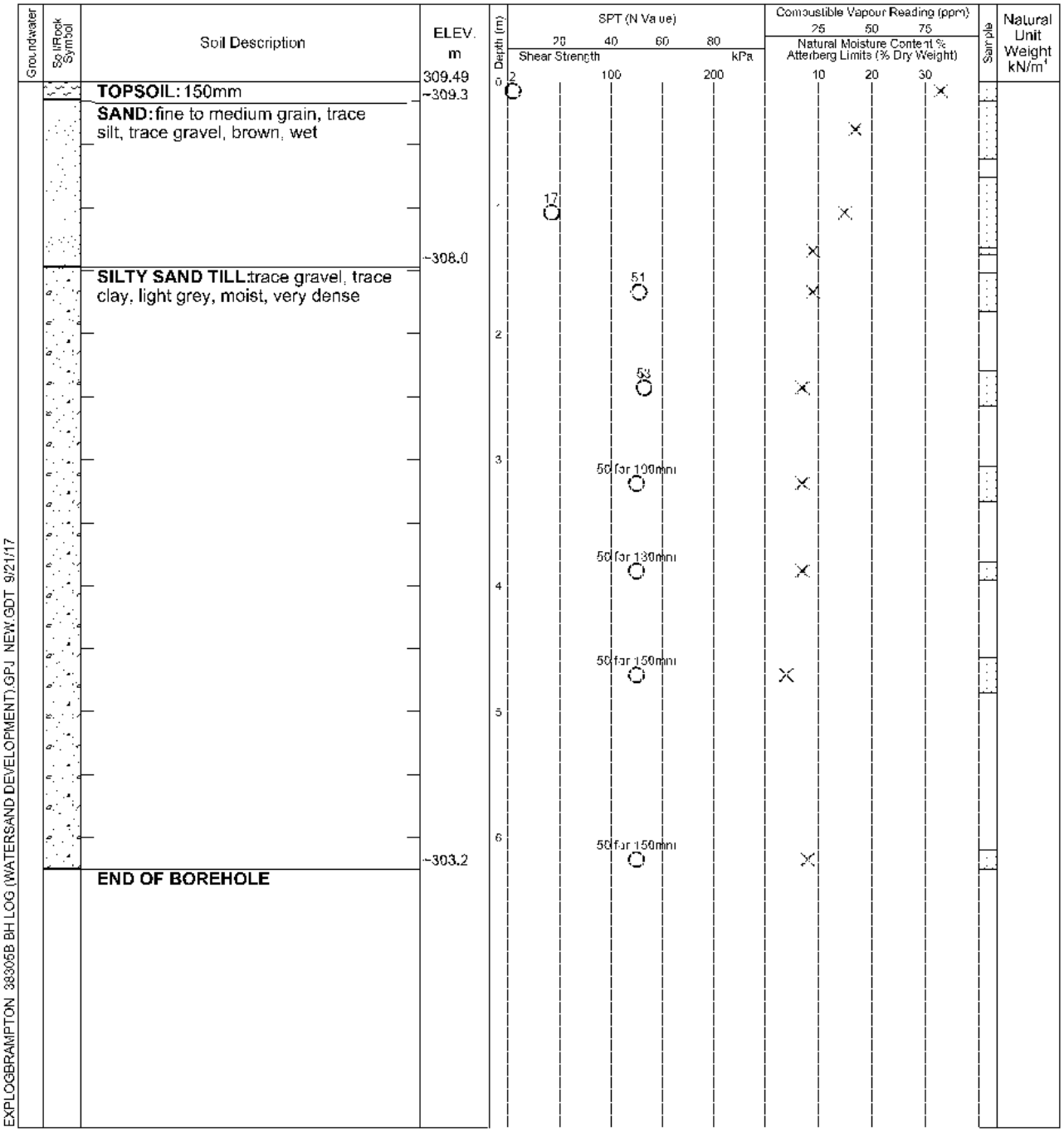
Date Drilled: July 13, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.22 | 1.22 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 38

Project No. BRM-00038305-B0 | Drawing No. 36

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 14, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | | 309.25 | 0 |
| | | **TOPSOIL:** 180mm | ~309.1 | |
| | | **SAND:** fine grain, with silt, trace rootlets, mottled dark brown / orange, wet | ~308.6 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, wet, compact | ~307.8 | 1 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | | 2 |
| | | dark grey | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | | 8 |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80; 100, 200

SPT values: 18; 19; 50 for 150mm; 50 for 75mm; 50 for 100mm; 87; 98; 50 for 130mm

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.61 | 0.61 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 38

Project No. BRM-00038305-B0 Drawing No. 36

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 300.95 | | | | | |
| | | | | 9 | 50 for 130mm | | | |
| | | | | 10 | | | | |
| | | | | 11 | 50 for 130mm | | | |
| | | | | 12 | 50 for 75mm | | | |
| | | | ~296.8 | | | | | |
| | | END OF BOREHOLE | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.61 | 0.61 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 39

Project No. BRM-00038305-B0 | Drawing No. 37

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 13, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 200mm | 309.71 |
| | | **SAND:** fine grain, trace to some silt, trace gravel, light brown, moist, compact | ~309.5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | ~307.5 |

Depth (m)

SPT (N Value)
20 40 60 80
Shear Strength kPa
100 200

Combustible Vapour Reading (ppm)
25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
10 20 30

Sample

Natural Unit Weight kN/m³

11
24
55
57
77
90 for 250mm
50 for 150mm
50 for 150mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 39

Project No. BRM-00038305-B0 Drawing No. 37

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.41 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | -300.4 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

exp.

# Log of Borehole 40

Project No. BRM-00038305-B0 | Drawing No. 38

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

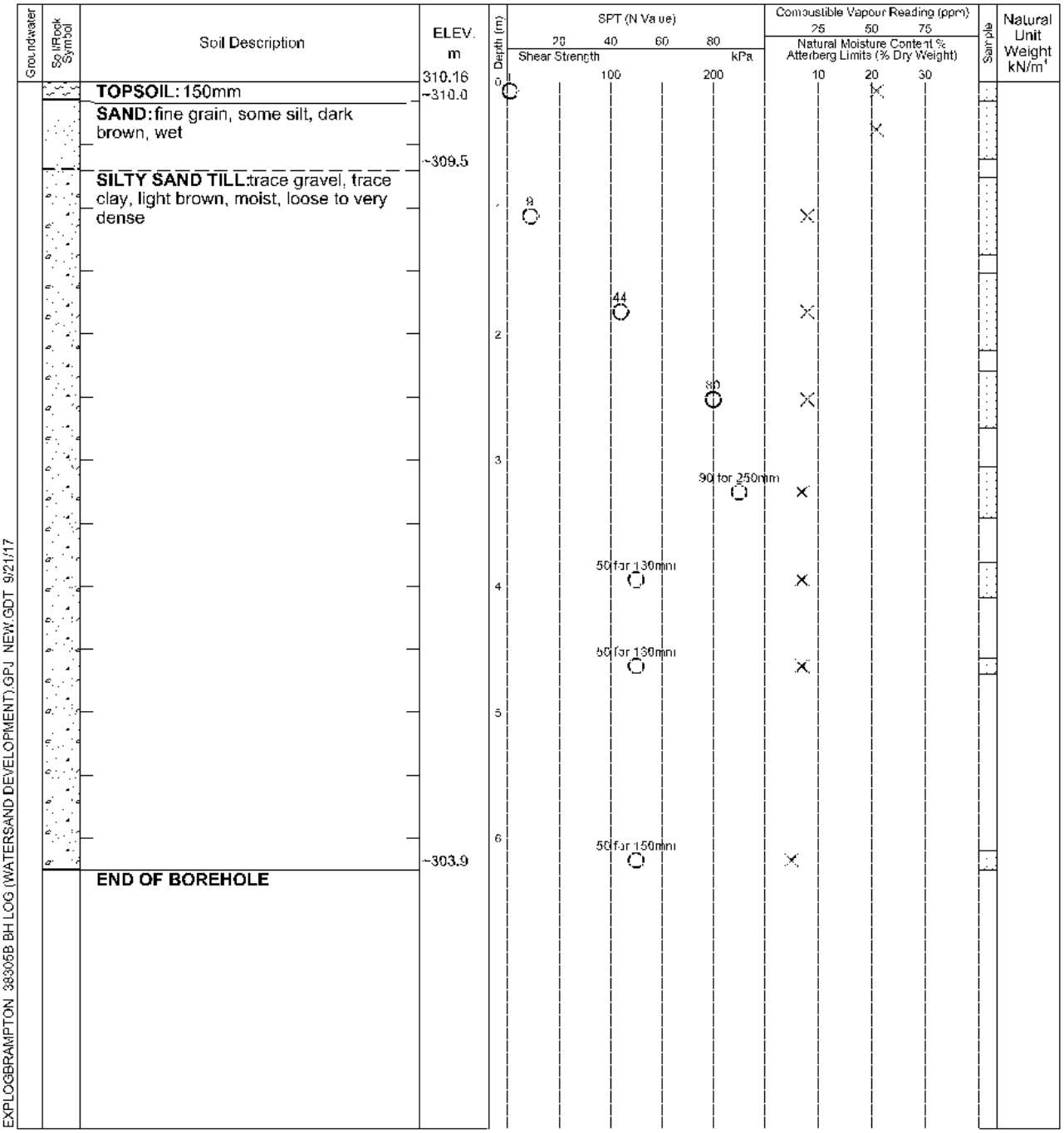
Date Drilled: July 13, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 41

Project No. BRM-00038305-B0 | Drawing No. 39

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 14, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 230mm | 309.38 |
| | | **SAND:** fine grain, with silt, mottled dark / light brown, wet | ~309.2 |
| | | **SAND:** coarse grain, trace silt, trace to some gravel, brown, moist, dense to very dense | ~308.7 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | ~306.5 |
| | | dark grey | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m): 0 1 2 3 4 5 6 7 8

44
57
85
89
90 for 280mm
50 for 150mm
50 for 75mm
50 for 150mm

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 41

Project No. BRM-00038305-B0 Drawing No. 39

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.08 | | | | | |
| | | | | 9 | 50 for 130mm | | | |
| | | | | 10 | | | | |
| | | | | | 50 for 130mm | | | |
| | | | ~298.6 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 43

Project No. BRM-00038305-B0 | Drawing No. 40

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 13, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 310.27 | 0 |
| | | **SAND:** fine grain, with silt, trace gravel, dark brown, moist | ~310.0 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | ~309.6 | |
| | | | ~306.0 | 4 |
| | | **SILT:** with sand, some clay, occasional silty clay inclusions, light brown, moist, hard | | |
| | | | ~304.8 | 5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, damp to moist, very dense | | |
| | | | ~304.0 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa

54
50 for 150mm
50 for 130mm
50 for 130mm
50 for 150mm
50 for 130mm
50 for 150mm

Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight): 10 20 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 44

Project No. BRM-00038305-B0 | Drawing No. 41

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Soil Description | ELEV. m | Depth (m) |
|---|---|---|
| **TOPSOIL:** 250mm | 309.22 / ~309.0 | 0 |
| **SAND:** fine to medium grain, some silt, trace gravel, light brown, moist to wet, dense to compact | | 1 |
| | | 2 |
| | ~306.4 | |
| **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, compact | | 3 |
| | ~305.5 | |
| **SAND:** fine grain, some silt, some gravel, grey, moist, dense | | 4 |
| | ~304.7 | |
| **SILTY SAND TILL:** trace gravel, trace clay, light grey, damp to moist, very dense | | 5 |
| | | 6 |
| | ~302.5 | |
| **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 4, 46, 41, 17, 14, 32, 75 for 280mm, 81

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.61 | 0.61 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 45

Project No. BRM-00038305-B0 | Drawing No. 42

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

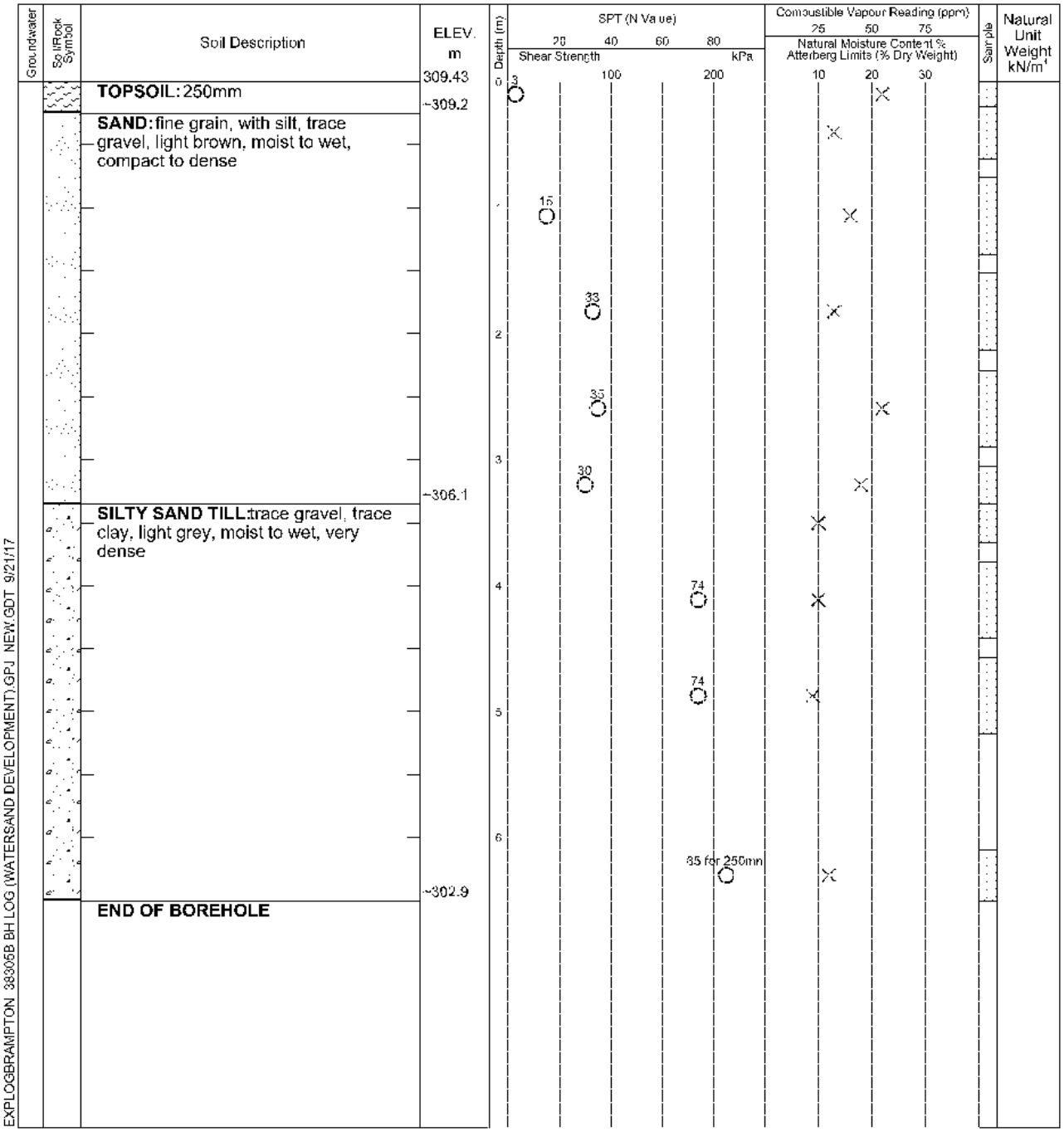
Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 0.61 | 0.61 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 46

Project No. BRM-00038305-B0 | Drawing No. 43

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

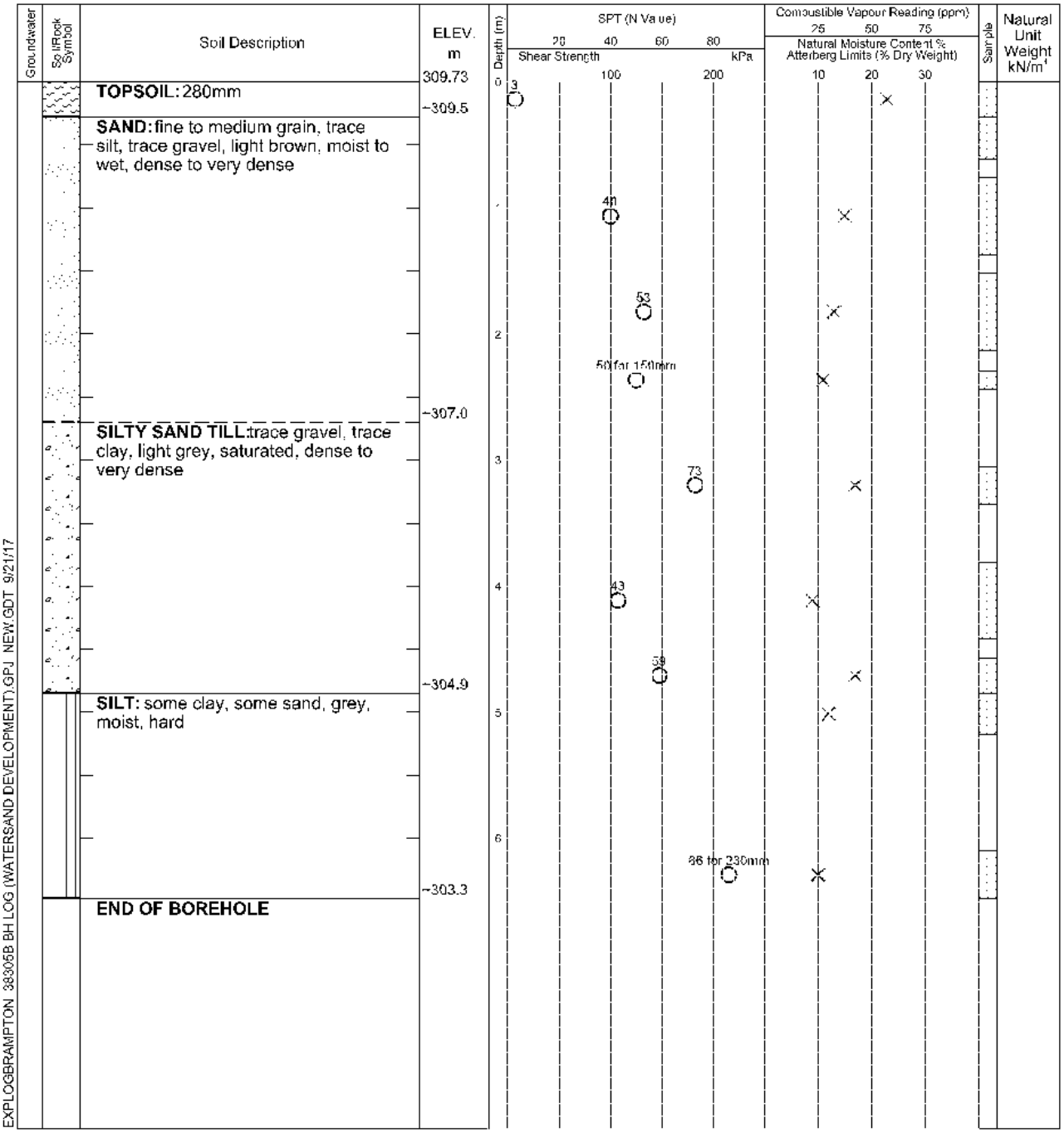
Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.22 | 1.22 |

exp.

# Log of Borehole 48

Project No. BRM-00038305-B0 | Drawing No. 44

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 14, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 309.58 | 0 |
| | | | ~309.3 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, moist, compact to dense | | 1 |
| | | | | 2 |
| | | | ~306.6 | 3 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | 4 |
| | | | | 5 |
| | | | ~303.3 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength kPa 4 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

18
35
23
53
58
50 for 100mm
50 for 150mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.52 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 49

Project No. BRM-00038305-B0 | Drawing No. 45

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 13, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 180mm | 309.76 |
| | | | ~309.6 |
| | | **SAND:** fine to medium grain, trace to some silt, trace gravel, light brown, damp, very dense | |
| | | | ~307.6 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | |
| | | light grey | |

SPT (N Value) 20 40 60 80 | Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 | Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m): 0 1 2 3 4 5 6 7 8

SPT values: 74, 90, 52, 31, 94, 50 for 150mm, 50 for 50mm, 50 for 150mm

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.79 | 5.79 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 49

Project No. BRM-00038305-B0 Drawing No. 45

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.46 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | | 10 | | | | |
| | | | ~299.0 | | 50 for 75mm | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.79 | 5.79 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 50

Project No. BRM-00038305-B0

Drawing No. 46

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 14, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 309.89 | 0 |
| | | | ~309.6 | |
| | | **SAND:** fine to medium grain, trace to some silt, trace to some gravel, brown, damp, compact to very dense | | |
| | | | ~306.3 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | |
| | | | ~303.7 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

3
11
41
34
50 for 130mm
50 for 100mm
50 for 150mm
50 for 130mm

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.23 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 51

Project No. BRM-00038305-B0 | Drawing No. 57

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

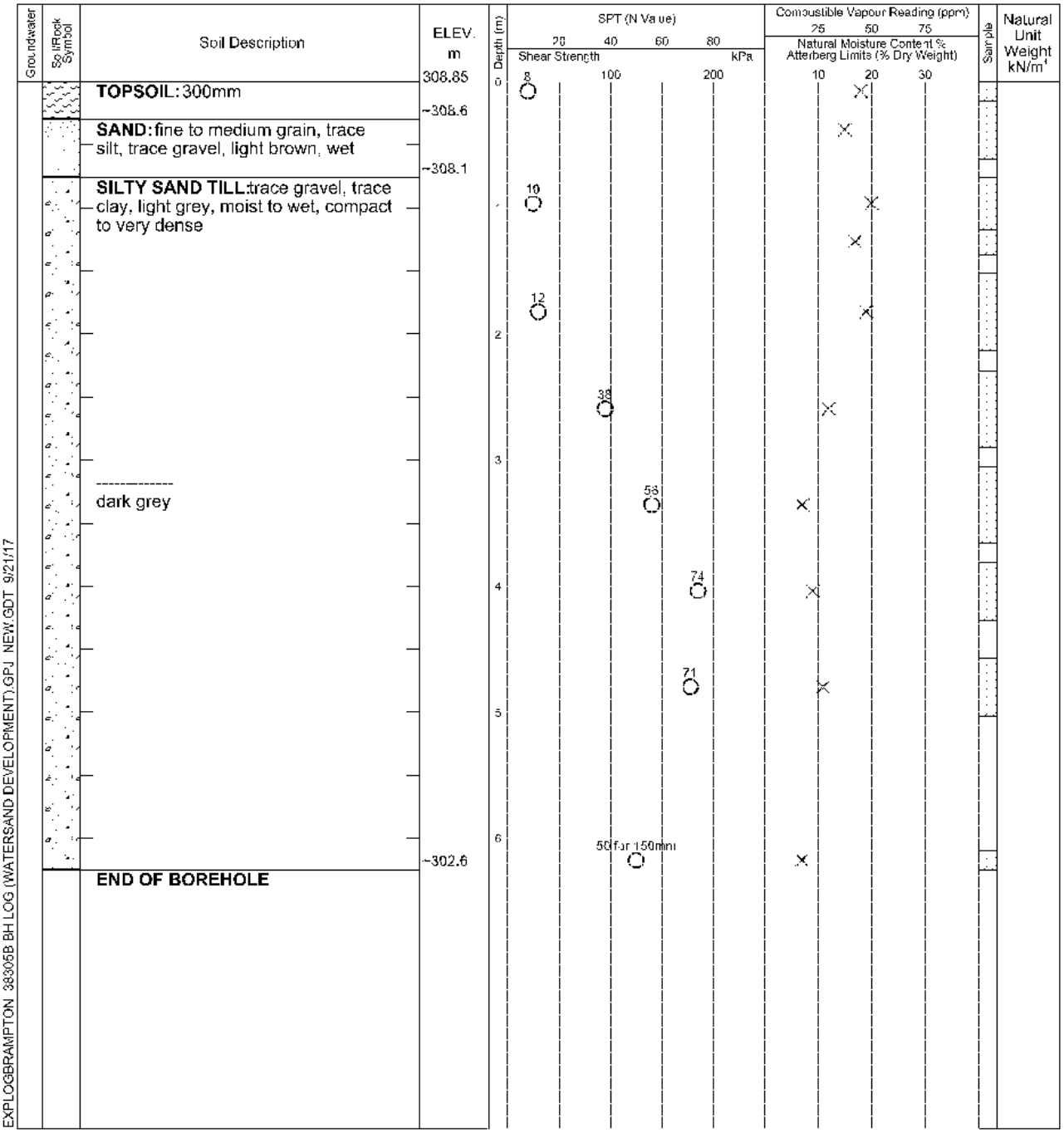
Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.22 | 1.22 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 53

Project No. BRM-00038305-B0 | Drawing No. 58

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

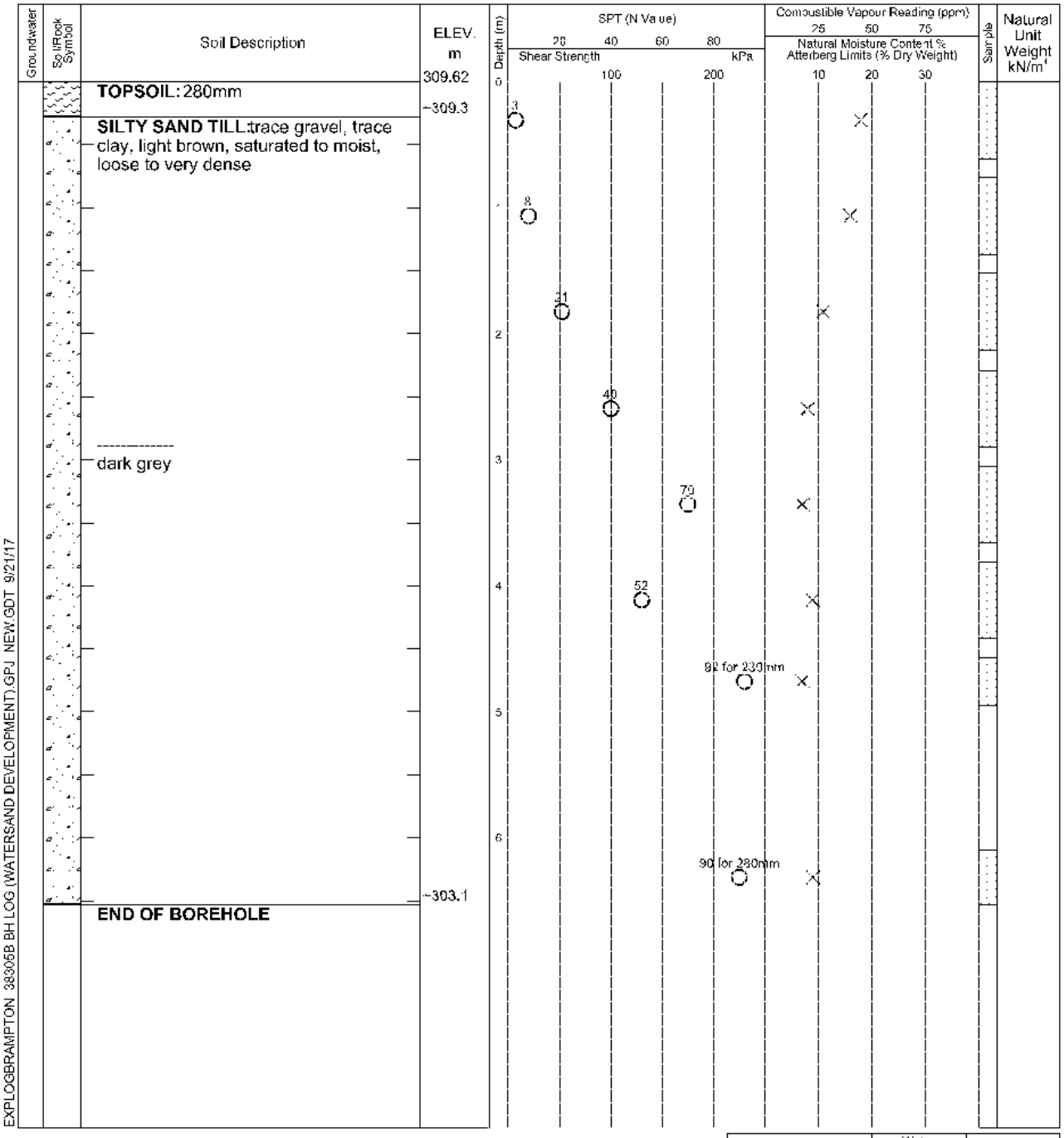
Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.66 | 3.66 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 54

Project No. BRM-00038305-B0 | Drawing No. 59

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

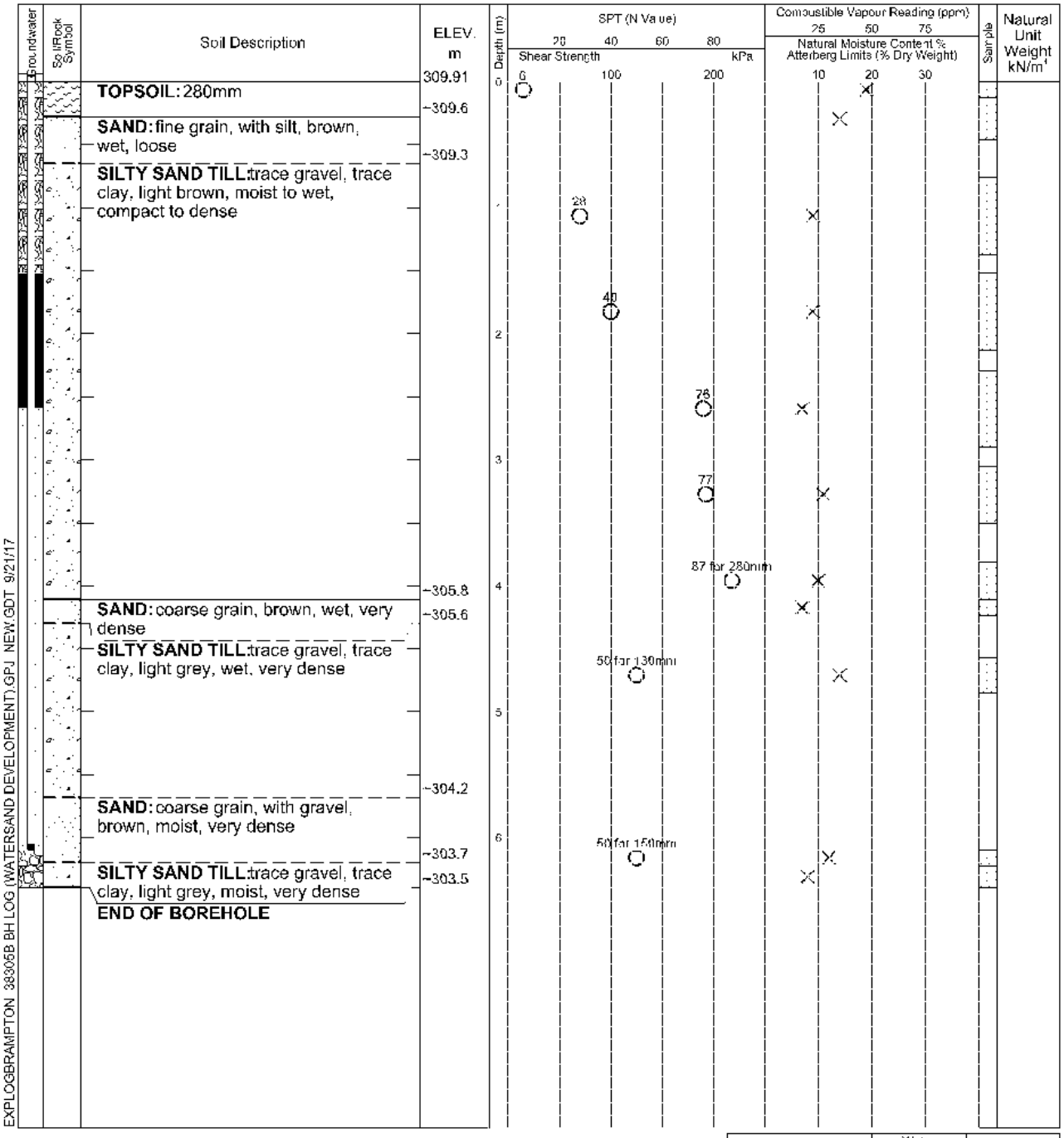
Date Drilled: June 21, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.27 | - |
| June 22, 2017 | 0.67 | - |
| August 9, 2017 | 1.88 | - |

# Log of Borehole 56

Project No. BRM-00038305-B0 | Drawing No. 60

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 309.76 | 0 |
| | | | ~309.5 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, damp to wet, compact to very dense | | |
| | | | ~306.0 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, very dense | | |
| | | | ~303.5 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80, 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample | Natural Unit Weight kN/m³

SPT values: 3, 18, 44, 71, 87, 50 for 150mm, 74, 50 for 150mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.90 | 3.05 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 57

Project No. BRM-00038305-B0 | Drawing No. 61

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 309.70 | 0 |
| | | | ~309.5 | |
| | | **SILTY SAND:** reddish brown, moist | | |
| | | | ~308.9 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, wet to moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | ~304.1 | |
| | | **SAND:** fine grain, trace silt, light brown, damp to moist, very dense | | 5 |
| | | | | 6 |
| | | grey | | 7 |
| | | | | 8 |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80, 100, 200

13
42
83
79 for 130mm
89 for 100mm
50 for 150mm
50 for 130mm
50 for 75mm

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.97 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 57

Project No. BRM-00038305-B0 Drawing No. 61

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | **SILTY SAND TILL:** trace gravel, trace clay, occasional silty clay inclusions, light grey, wet, very dense | 301.40<br>~301.4 | | | | | |
| | | **SAND:** fine grain, trace silt, light grey, damp, very dense | ~300.0 | 9 | 50 for 150mm | | | |
| | | **END OF BOREHOLE** | ~298.8 | 10 | 50 for 130mm | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.97 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 58

Project No. BRM-00038305-B0 | Drawing No. 62

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

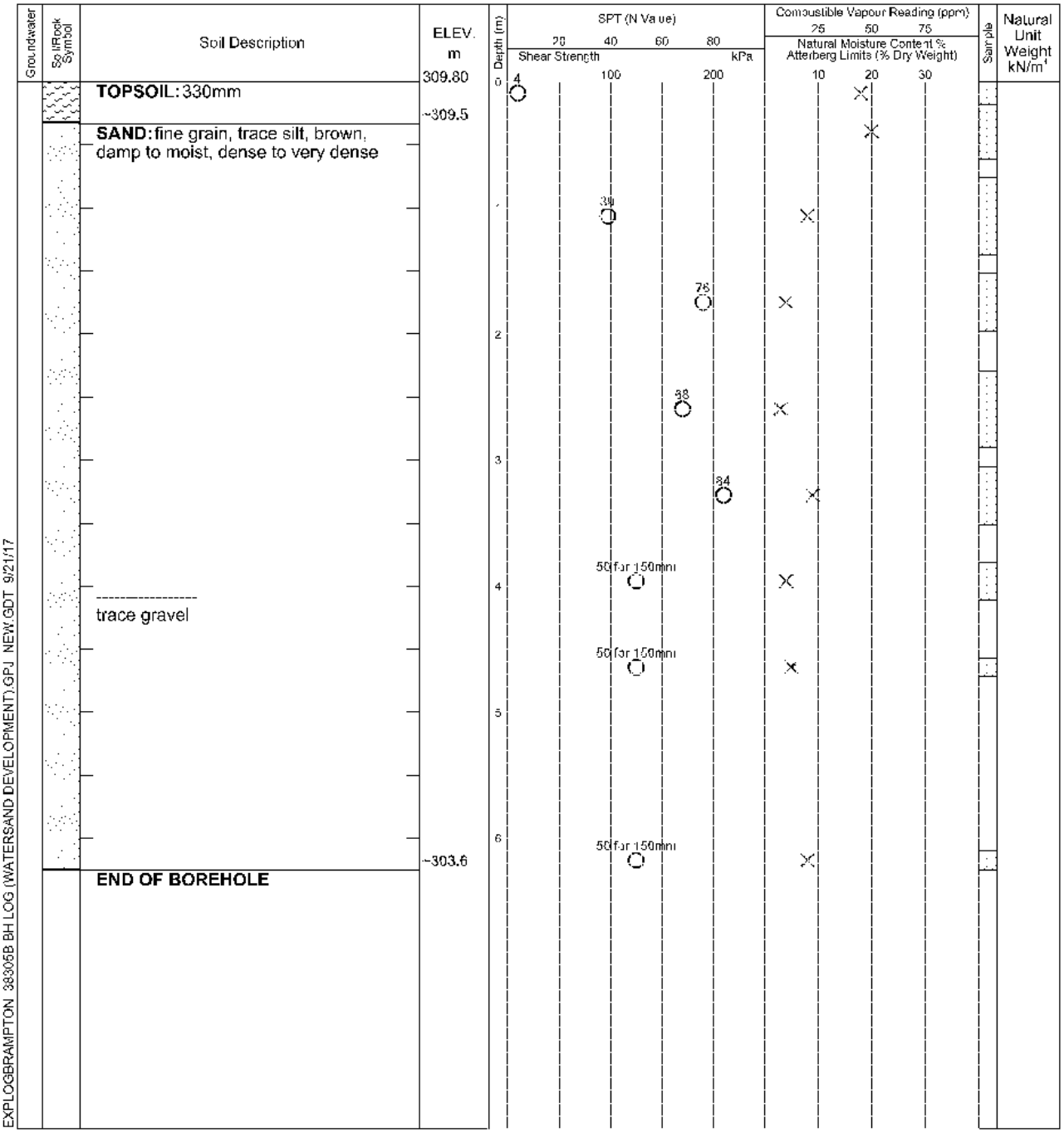
Date Drilled: June 15, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 59

Project No. BRM-00038305-B0 | Drawing No. 63

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 20, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 308.83 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist to wet, loose to very dense | ~308.6 | |
| | | ------ grey | | 3 |
| | | | ~301.1 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % — Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

5 | 9 | 23 | 55 | 90 for 250mm | 50 for 130mm | 50 for 150mm | 50 for 150mm | 50 for 100mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 2.74 | 4.88 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 60

Project No. BRM-00038305-B0 | Drawing No. 64

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 21, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 150mm | 309.41 | 0 |
| | | **SAND:** fine grain, some silt, topsoil inclusions, dark brown to light brown, moist, loose | ~309.3 | |
| | | | | 2 |
| | | | ~307.2 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist to wet, compact to very dense | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | ~301.7 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 5 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

1
2
35
25
45
50 for 150mm
50 for 150mm
50 for 100mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 1.52 | 1.83 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 61

Project No. BRM-00038305-B0 | Drawing No. 65

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 21, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.62 | 0 |
| | | | ~309.3 | |
| | | **SAND:** fine grain, with silt, brown, moist | | |
| | | | ~308.9 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~303.2 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

5
24
43
75
73
50 for 150mm
50 for 150mm
50 for 150mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.33 | 6.40 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 62

Project No. BRM-00038305-B0

Drawing No. 66

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

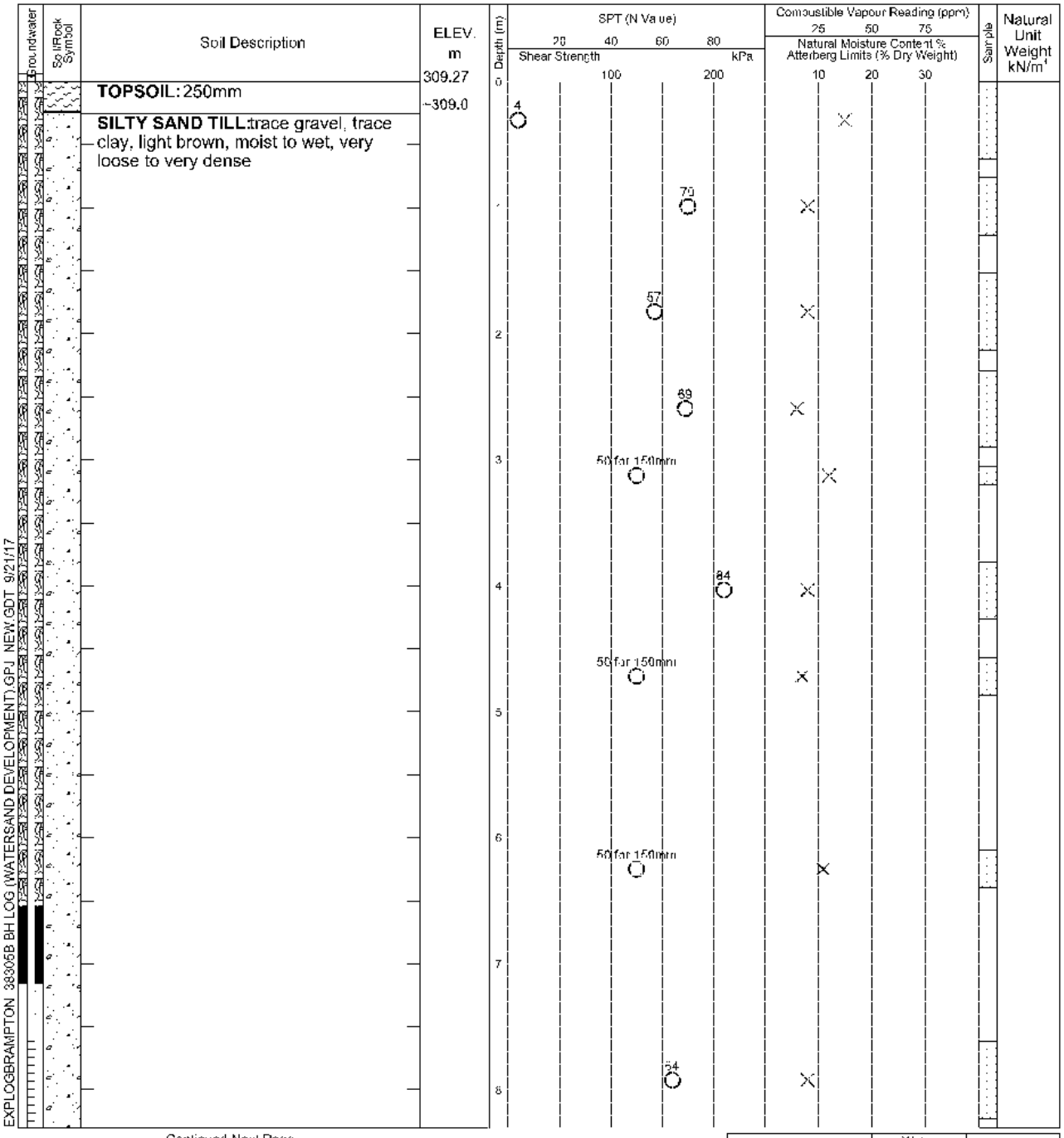
Date Drilled: July 4, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.38 | - |
| July 24, 2017 | 6.59 | - |
| August 9, 2017 | 7.50 | - |
| August 17, 2017 | 7.82 | - |

# Log of Borehole 62

Project No. BRM-00038305-B0 Drawing No. 66

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength 100 200 kPa | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | 300.97 | | | | | | |
| | | | | 9 | | | | |
| | | **SAND:** fine grain, trace silt, trace gravel, brown, wet, very dense | ~299.3 | 10 | | | | |
| | | | ~298.4 | | 90 | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | ~298.2 | 11 | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.38 | - |
| July 24, 2017 | 6.59 | - |
| August 9, 2017 | 7.50 | - |
| August 17, 2017 | 7.82 | - |

exp.

# Log of Borehole 64-D

Project No. BRM-00038305-B0 Drawing No. 67

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

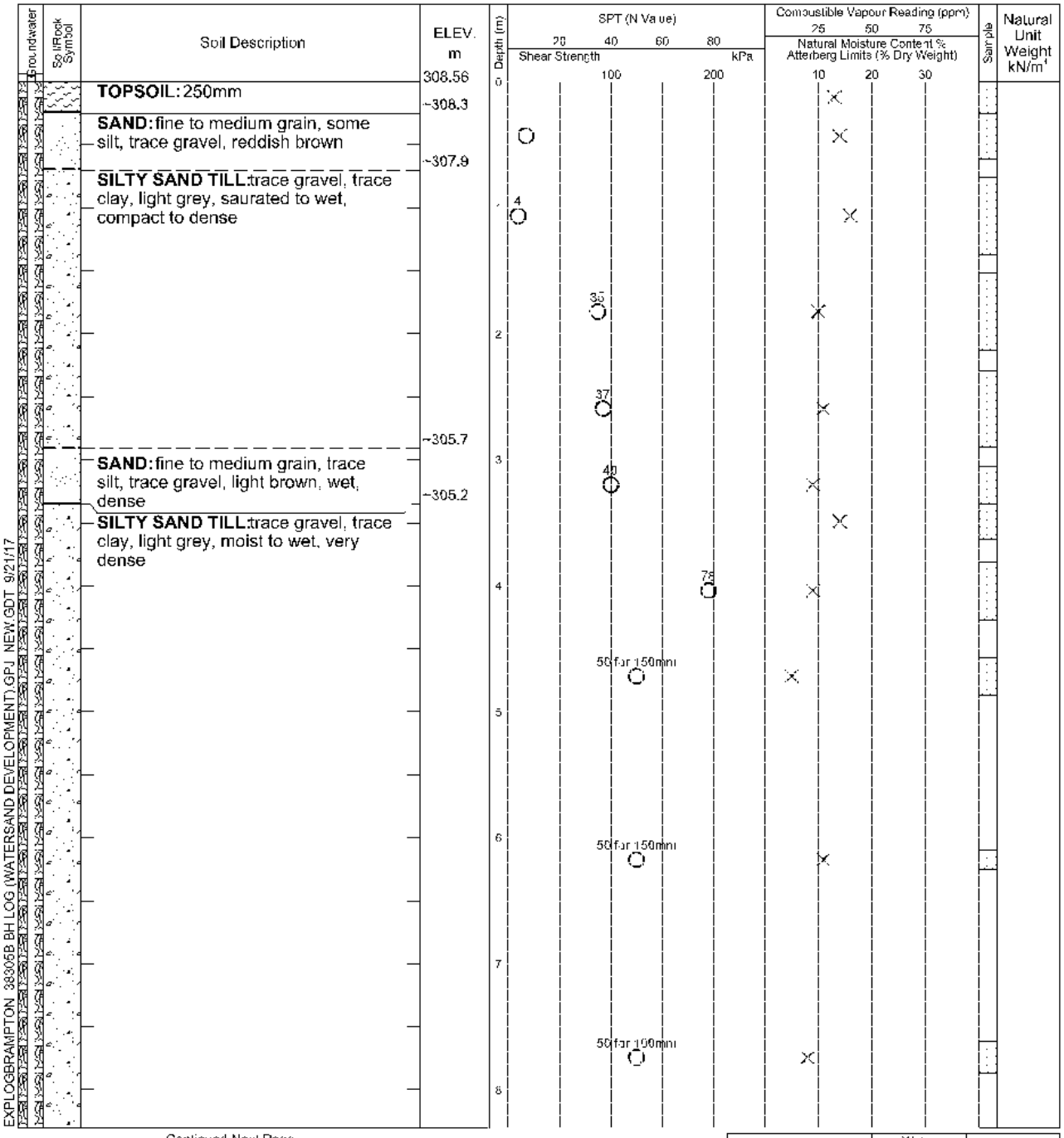
Date Drilled: June 19, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

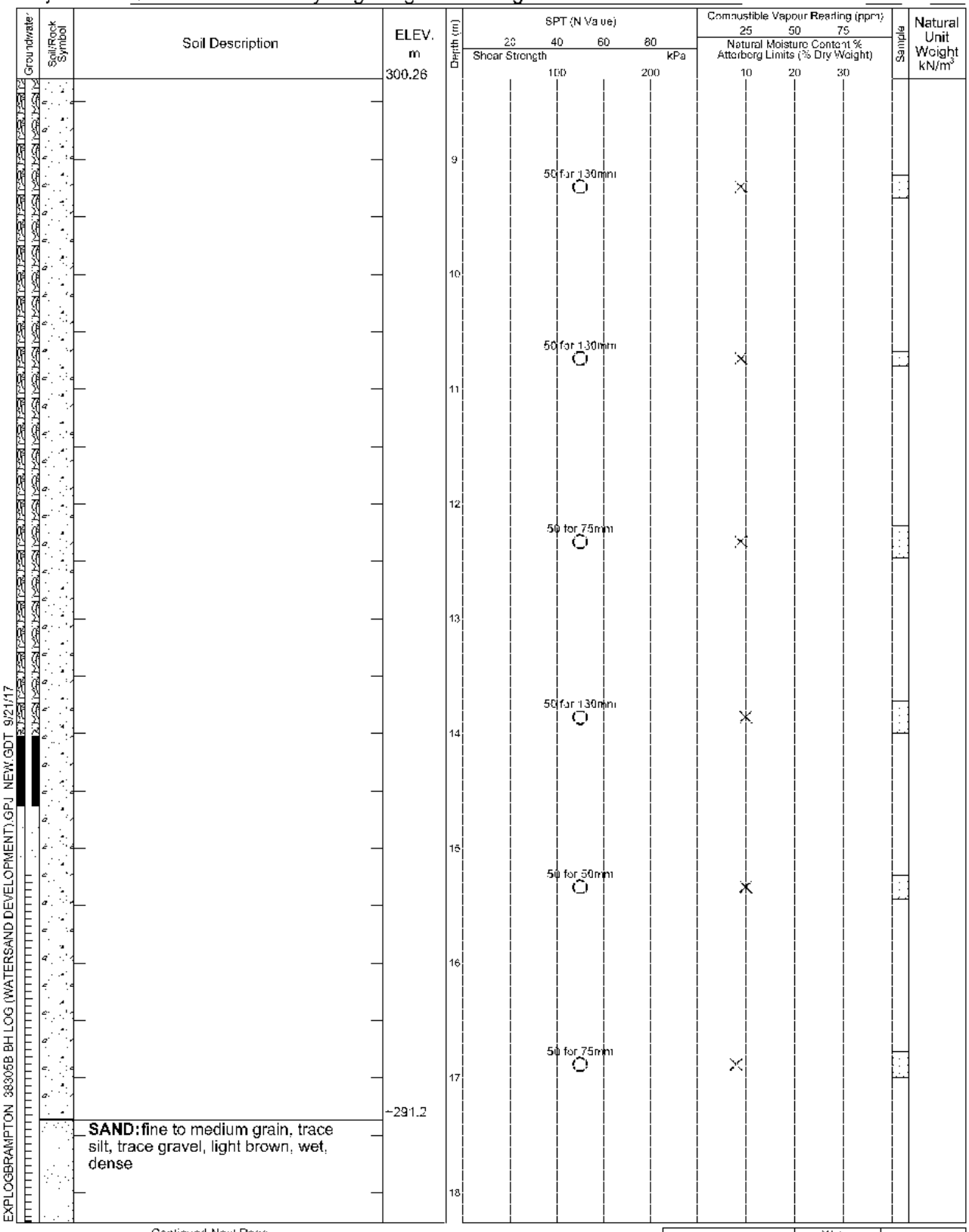
Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| June 22, 2017 | 3.86 | - |
| August 9, 2017 | 4.95 | - |
| August 18, 2017 | 4.98 | - |

# Log of Borehole 64-D

Project No. BRM-00038305-B0 Drawing No. 67

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| June 22, 2017 | 3.86 | - |
| August 9, 2017 | 4.95 | - |
| August 18, 2017 | 4.98 | - |

# Log of Borehole 64-D

Project No. BRM-00038305-B0 Drawing No. 67

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 290.30 | | | | | |
| | | | ~289.7 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| June 22, 2017 | 3.86 | - |
| August 9, 2017 | 4.95 | - |
| August 18, 2017 | 4.98 | - |

# Log of Borehole 64-S

Project No. BRM-00038305-B0 | Drawing No. 68

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 19, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 308.56 | 0 |
| | | **SAND:** some silt, trace gravel, reddish brown | ~308.3 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, saurated to wet, compact to dense | ~307.9 | 2 |
| | | **SAND:** trace silt, trace gravel, light brown, wet, dense | ~305.7 | 3 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, very dense | ~305.2 | 4 |
| | | **END OF BOREHOLE** | ~302.5 | 6 |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| June 22, 2017 | 1.37 | - |
| August 9, 2017 | 2.42 | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 65

Project No. BRM-00038305-B0 | Drawing No. 69

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 308.92 | 0 |
| | | | ~308.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, compact to very dense | | |
| | | | ~302.5 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30
Sample
Natural Unit Weight kN/m³

3
18
23
54
45
50 for 150mm
50 for 130mm
50 for 130mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.49 | 6.40 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 66

Project No. BRM-00038305-B0 | Drawing No. 70

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL**: 250mm | 309.80 | 0 |
| | | | ~309.6 | |
| | | **SILTY SAND TILL**: trace gravel, trace clay, light grey, moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | | 8 |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa

3
29
71
50 for 150mm
50 for 150mm
50 for 150mm
78
50 for 100mm
50 for 150mm

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.84 | 9.30 |

exp.

# Log of Borehole 66

Project No. BRM-00038305-B0 Drawing No. 70

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 301.50 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | -300.5 | | | | | |
| | | END OF BOREHOLE | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.84 | 9.30 |

exp.

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 70

Project No. BRM-00038305-B0 | Drawing No. 71

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 308.32 | 0 |
| | | | ~308.1 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | ~302.5 | 6 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, moist, very dense | ~302.0 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value)
20 40 60 80
Shear Strength kPa
100 200

3
36
27
82
85
50 for 130mm
50 for 150mm
50 for 75mm

Combustible Vapour Reading (ppm)
25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
10 20 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.50 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole B1-D

Project No. BRM-00038305-B0 | Drawing No. 72

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 4, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | Combustible Vapour Reading
SPT (N) Value | Natural Moisture
Dynamic Cone Test | Plastic and Liquid Limit
Shelby Tube | Undrained Triaxial at % Strain at Failure
Field Vane Test | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.52 | 0 | 3 | | | |
| | | | ~309.2 | | | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark brown to light brown, moist, dense to very dense | | 1 | 44 | | | |
| | | | | 2 | 44 | | | |
| | | | | | 96 | | | |
| | | | | 3 | 50 for 130mm | | | |
| | | | | 4 | 50 for 130mm | | | |
| | | | | | 50 for 150mm | | | |
| | | | | 5 | | | | |
| | | | | 6 | 50 for 75mm | | | |
| | | | | 7 | | | | |
| | | | | | 50 for 150mm | | | |
| | | ---------- light grey | | 8 | | | | |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

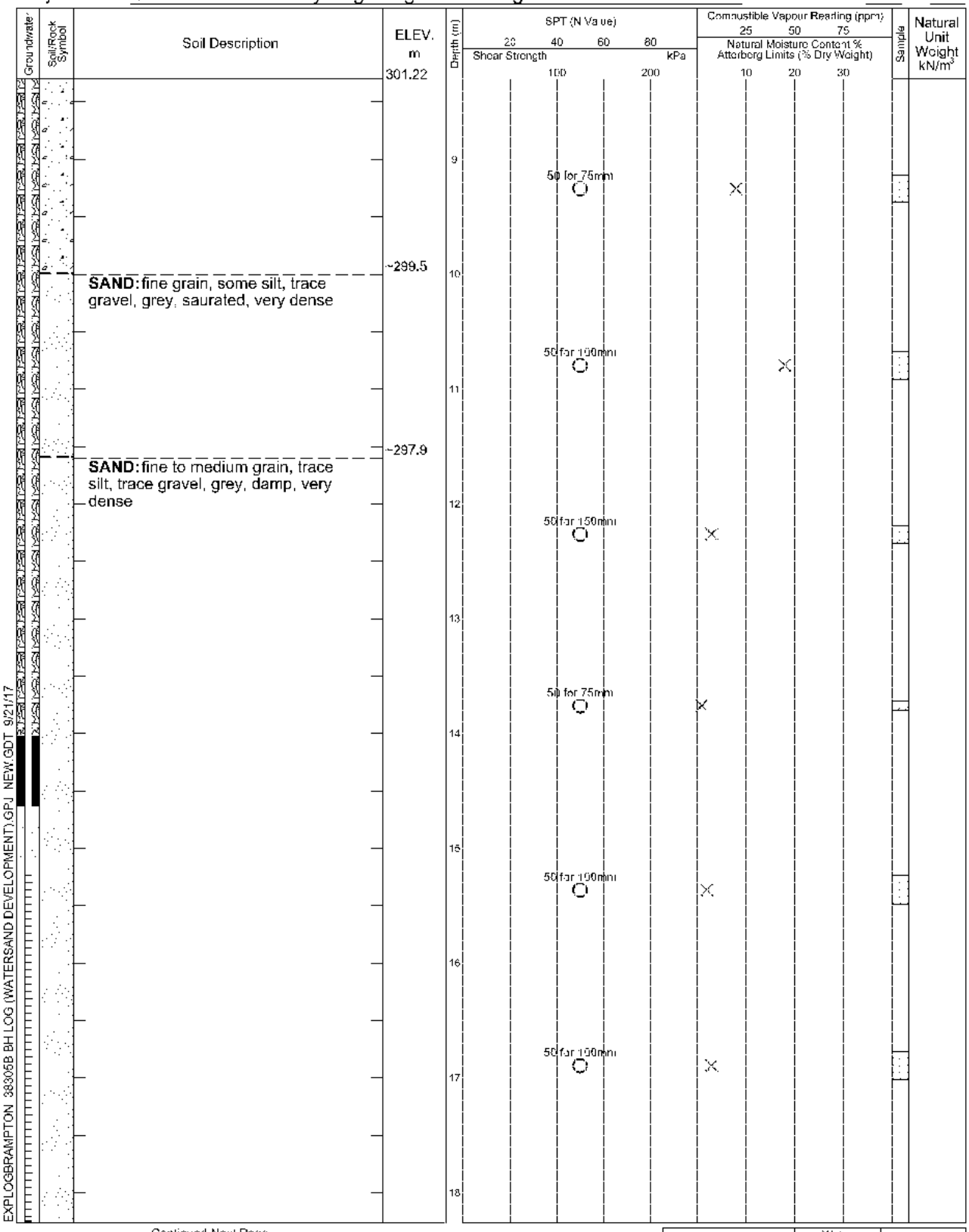
Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

# Log of Borehole B1-D

Project No. BRM-00038305-B0 Drawing No. 72

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

# Log of Borehole B1-D

Project No. BRM-00038305-B0 Drawing No. 72

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 / HP Cu for 150mm | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 291.26 | | | | | |
| | | | ~291.1 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole B1-S

Project No. BRM-00038305-B0 | Drawing No. 73

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.52 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark brown to light brown, moist, dense to very dense | ~309.2 | |
| | | **END OF BOREHOLE** | ~301.9 | 7 |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10, 20, 30
Sample
Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole B2-D

Project No. BRM-00038305-B0 Drawing No. 74

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 309.60 | 0 |
| | | | ~309.4 | |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, moist to saturated, very loose | | |
| | | | ~308.2 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

83
74
50 for 130mm
50 for 150mm
50 for 150mm
50 for 25mm
50 for 150mm

Continued Next Page

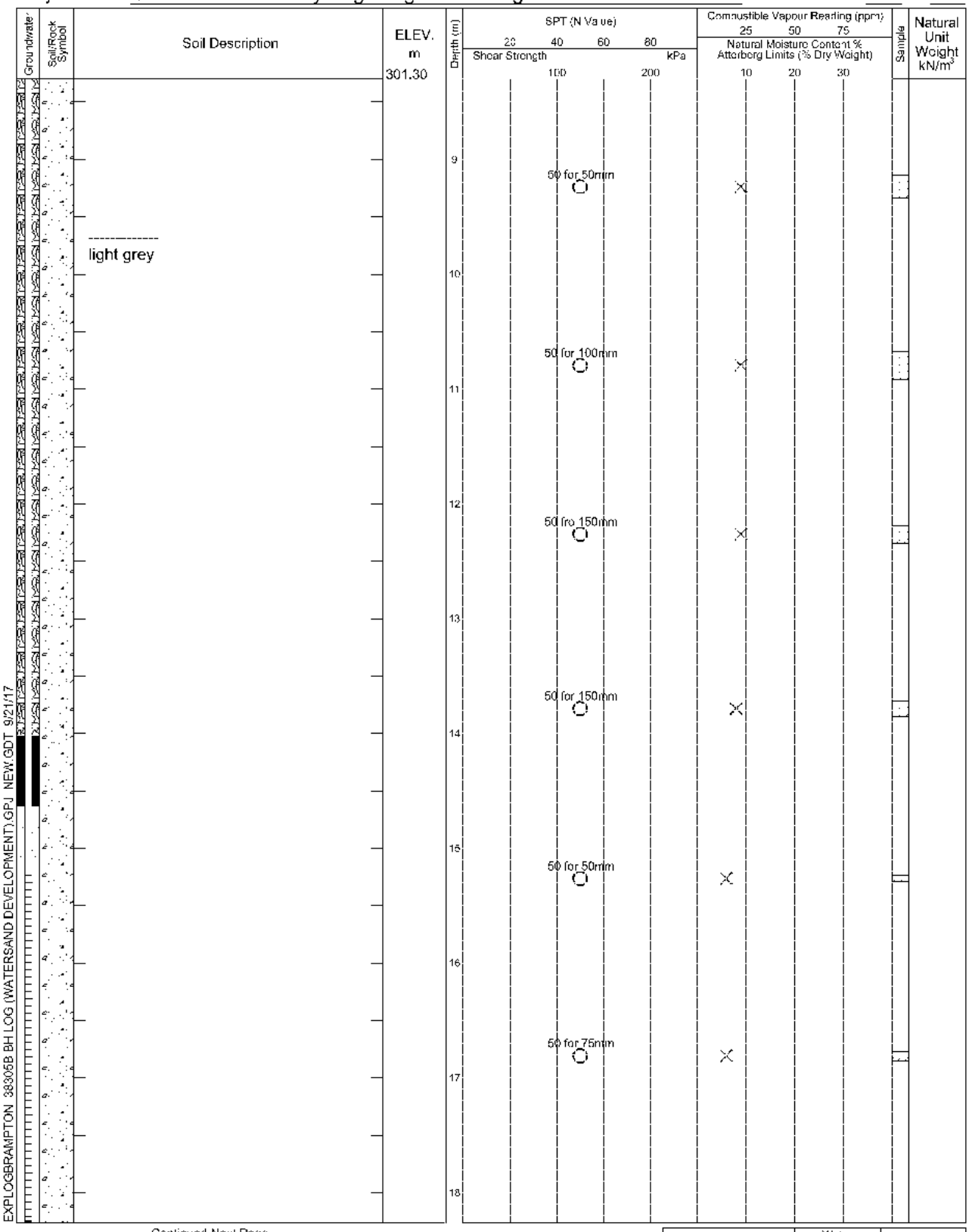
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole B2-D

Project No. BRM-00038305-B0 Drawing No. 74

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3

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| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

# Log of Borehole B2-D

Project No. BRM-00038305-B0 Drawing No. 74

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 (● for 75mm) | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 (× for Natural Moisture Content %) | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 291.34 | | | | | |
| | | **END OF BOREHOLE** | ~291.2 | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole B2-S

Project No. BRM-00038305-B0 | Drawing No. 75

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 309.60 | 0 |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, moist to saturated, very loose | ~309.4 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | ~308.2 | 2 |
| | | **END OF BOREHOLE** | ~302.0 | 7 |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30
Sample
Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | Dry | - |
| August 17, 2017 | Dry | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole C1

Project No. BRM-00038305-B0 | Drawing No. 76

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 26, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 308.37 | 0 |
| | | | ~308.1 | |
| | | **SAND:** fine grain, with silt, trace gravel, reddish brown, moist | ~307.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, dense to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | ~300.7 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

5
42
58
38
87
50 for 75mm
50 for 150mm
50 for 150mm
50 for 100mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.47 | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole C2-D

Project No. BRM-00038305-B0 | Drawing No. 77

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 7 & 10, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 306.71 | 0 |
| | | **SAND:** fine to medium grain, trace silt, light brown, moist to wet, compact to very dense | ~306.5 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, very dense | ~299.5 | 7 |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 7, 32, 34, 70, 50 for 150mm, 50 for 100mm, 50 for 100mm, 50 for 150mm

Sample | Natural Unit Weight kN/m³

Continued Next Page

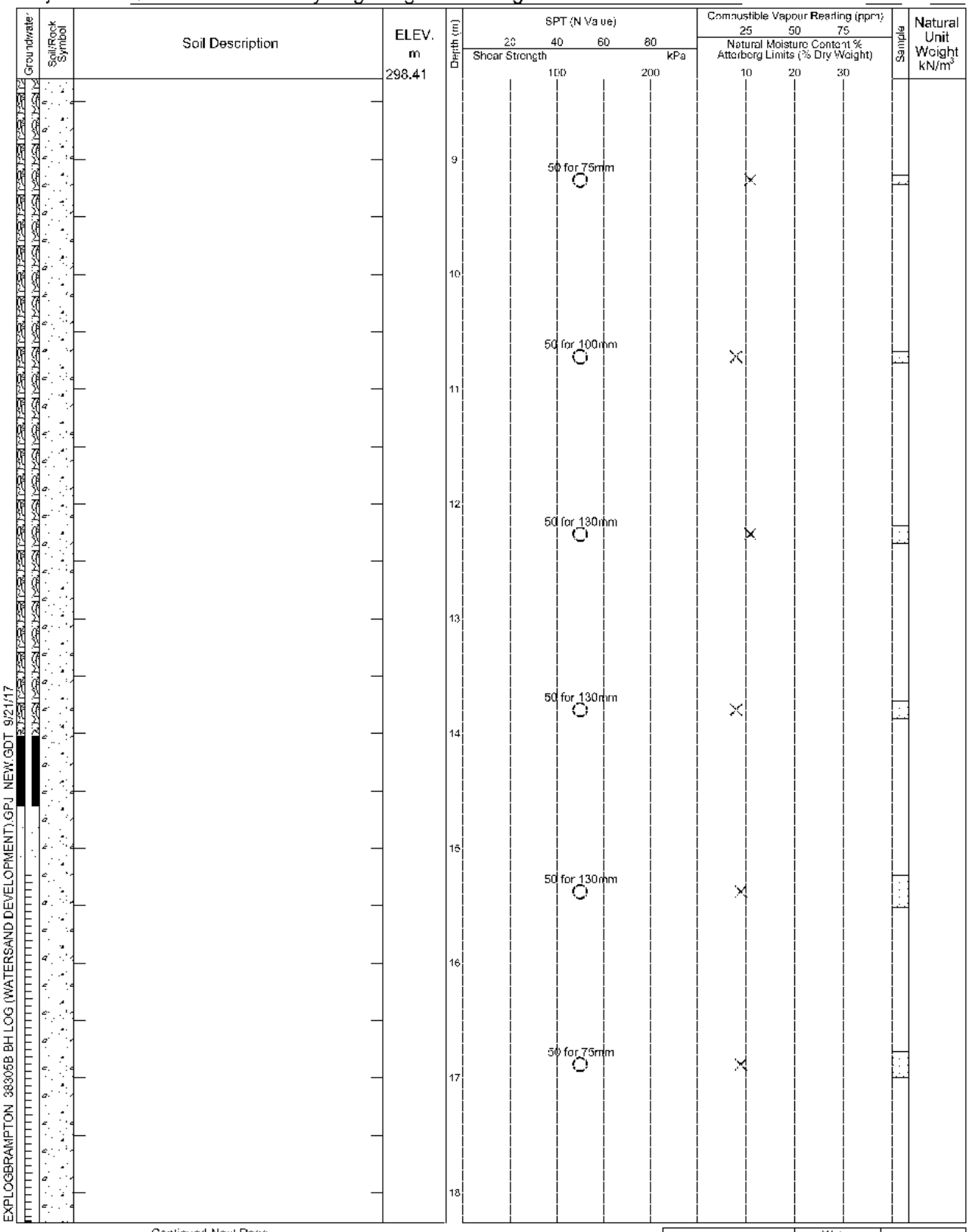
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| August 2, 2017 | 4.34 | - |
| August 9, 2017 | 4.45 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole C2-D

Project No. BRM-00038305-B0 Drawing No. 77

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| August 2, 2017 | 4.34 | - |
| August 9, 2017 | 4.45 | - |

# Log of Borehole C2-D

Project No. BRM-00038305-B0 Drawing No. 77

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 / HP Set for 150mm | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 288.45 | | | | | |
| | | | ~288.2 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| August 2, 2017 | 4.34 | - |
| August 9, 2017 | 4.45 | - |

exp.

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole C2-S

Project No. BRM-00038305-B0 | Drawing No. 78

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 7, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 306.71 | 0 |
| | | **SAND:** fine to medium grain, trace silt, light brown, moist to wet, compact to very dense | ~306.5 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | ~299.5 | 7 |
| | | **END OF BOREHOLE** | ~299.1 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| August 2, 2017 | 4.31 | - |
| August 9, 2017 | 4.39 | - |
| August 17, 2017 | 4.47 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole C3-D

Project No. BRM-00038305-B0 | Drawing No. 79

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 6, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 50mm | 309.77 | 0 |
| | | | ~309.7 | |
| | | **SAND** fine to medium grain, trace silt, trace to some gravel, brown, damp, very dense | | |
| | | | ~307.7 | 2 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, possible cobbles and/or boulders, light grey, moist to wet, very dense | | |

SPT (N Value) 20 40 60 80 — Shear Strength kPa 100 200

45

71

50 for 130mm

50 for 75mm

50 for 100mm

50 for 150mm

50 for 130mm

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

Continued Next Page

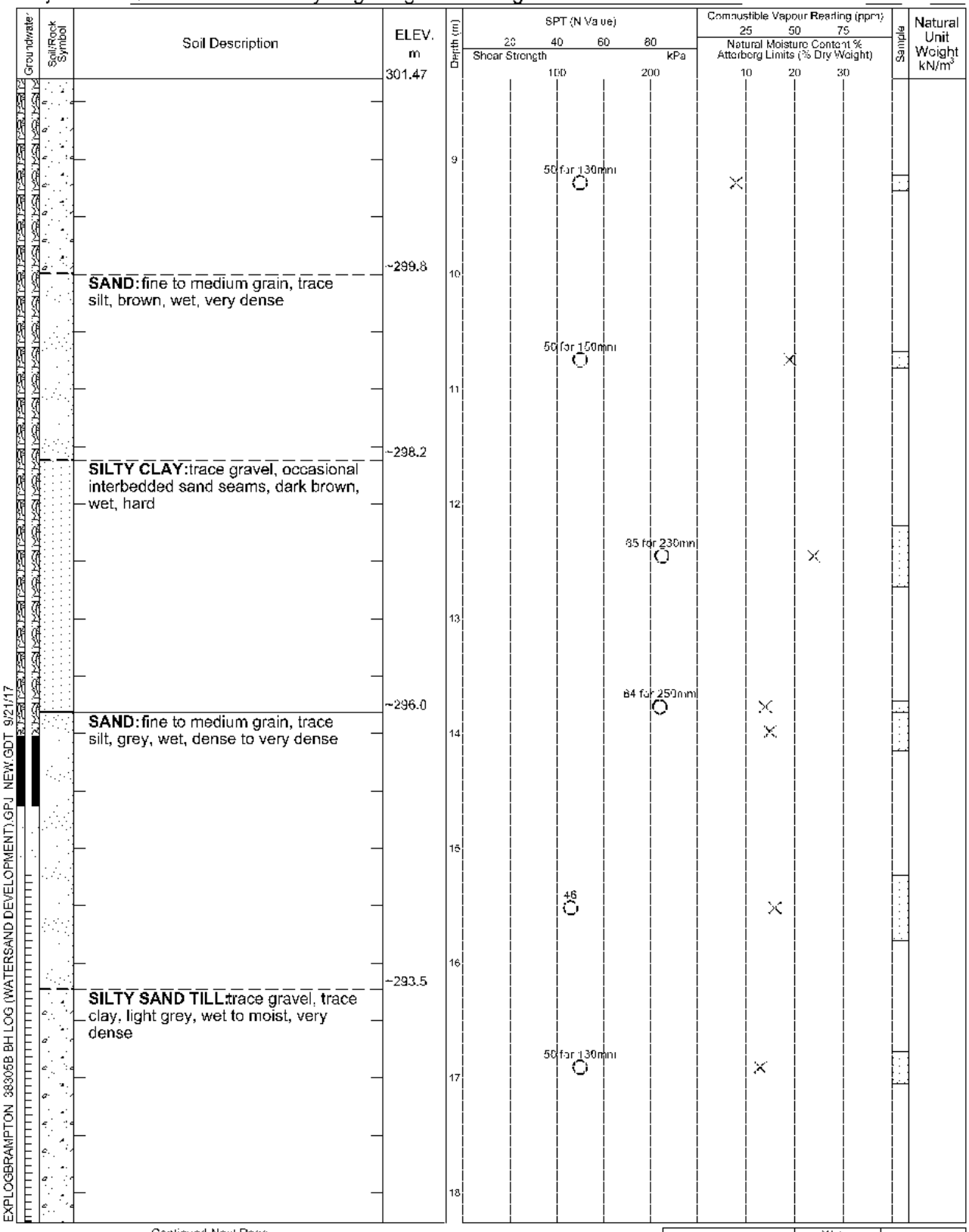
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.88 | - |
| August 2, 2017 | 4.93 | - |
| August 9, 2017 | 5.07 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole C3-D

Project No. BRM-00038305-B0 Drawing No. 79

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.88 | - |
| August 2, 2017 | 4.93 | - |
| August 9, 2017 | 5.07 | - |

# Log of Borehole C3-D

Project No. BRM-00038305-B0 Drawing No. 79

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 50 for 100mm | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 291.51 | | | | | |
| | | | ~291.2 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.88 | - |
| August 2, 2017 | 4.93 | - |
| August 9, 2017 | 5.07 | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole C3-S

Project No. BRM-00038305-B0 | Drawing No. 80

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

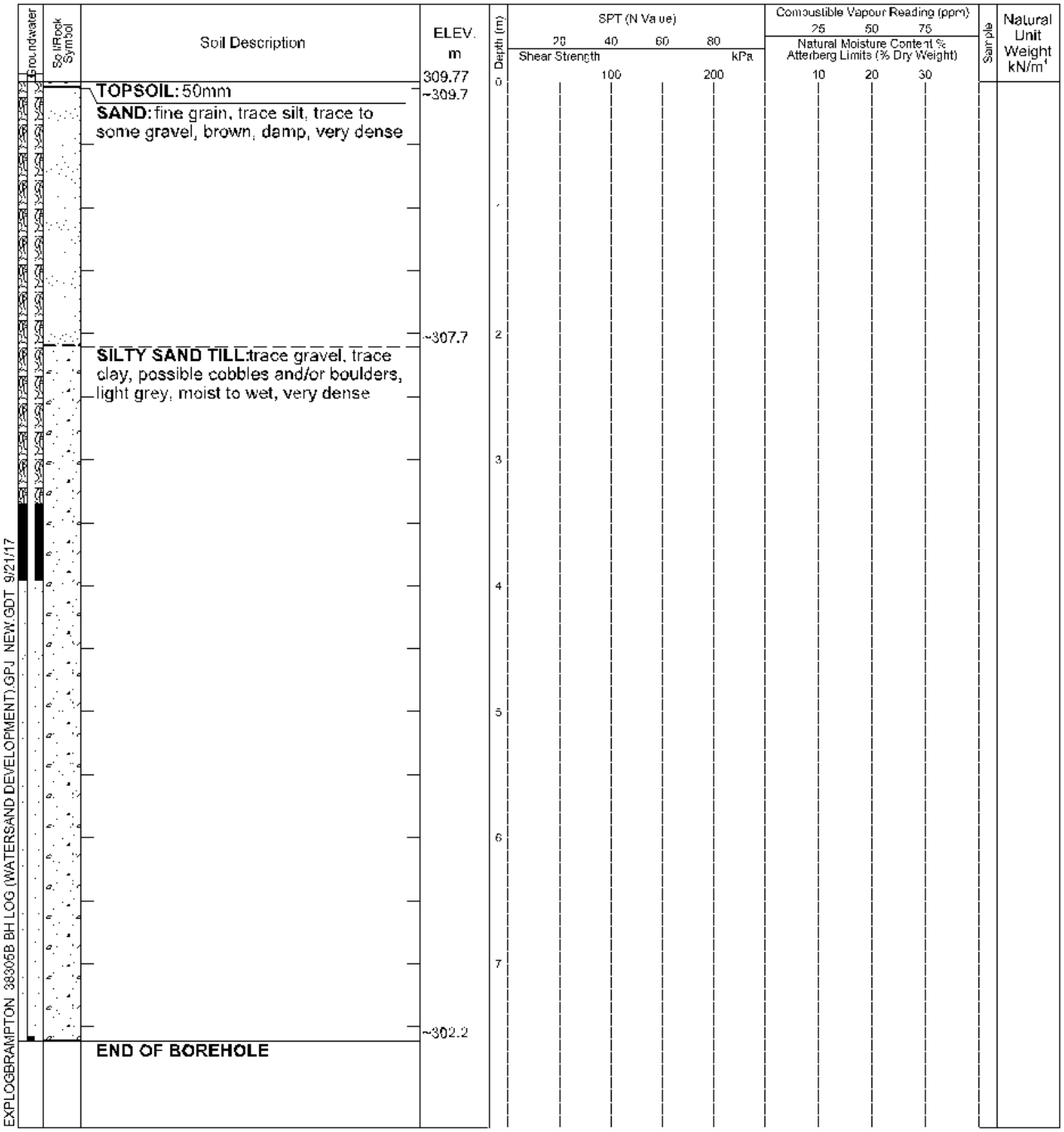
Date Drilled: July 6, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| August 2, 2017 | 4.49 | - |
| August 9, 2017 | 4.63 | - |

ROAD ALLOWANCE BETWEEN CONCESSIONS 9 AND 10

MCKAY ROAD

VETERANS DRIVE

312.07 BH #77
312.00 BH #94
311.52 BH #102
311.19 BH #87
312.12 BH #95
311.89 BH #109
310.79 BH #79
312.23 BH #124
312.06 BH #118
310.69 BH #80
311.39 BH #131
310.91 BH #88
311.17 BH #96
311.90 BH #103
310.03 BH #81
310.82 BH #89
310.95 BH #97
311.68 BH #104
311.43 BH #111
311.65 BH #119
311.95 BH #125
311.10 BH #132
308.40 BH #71
310.20 BH #82
311.89 BH #112
311.64 BH #120
311.67 BH #126
310.61 BH #133
310.94 BH #98
310.73 BH #105
309.40 BH #72
310.73 BH #91
311.42 BH #114
311.18 BH #127
310.81 BH #134
309.40 BH #73
311.54 BH #121
309.76 BH #84
310.18 BH #99
311.39 BH #115
310.93 BH #128
310.24 BH #135
309.07 BH #67
309.50 BH #74
9
309.31 BH #85
309.72 BH #100
310.05 BH #106
310.34 BH #107
311.44 BH #122
310.17 BH #129
307.69 BH #68
LOT 5
308.45 BH #75
308.88 BH #86
309.30 BH #93
309.74 BH #101
310.53 BH #108
311.04 BH #123
310.44 BH #130

VD SOUTH HALF OF LOT 4, CONCESSION 9

4 AND 5, CONCESSION 9

LINE BETWEEN LOTS

ROAD ALLOWANCE BETWEEN LOTS 5 AND

LINE BETW

307.25 BH #A2D BH #A2S
307.89 BH #A1

CONCESSION

307.98 BH #A3D BH #A3S

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

CLIENT: WATERSAND DEVELOPMENT

PROJECT: PROPOSED WATERSAND RESIDENTIAL DEVELOPMENT

TITLE: SECTION 2 – BOREHOLE LOCATION PLAN

| | |
|---|---|
| scale | 1:3500 |
| date | 9/12/2017 |
| drawn by | M.B. |
| project no. | BRM-00038305-B0 |

DRAWING 81

# SECTION 2

| | | |
|---|---|---|
| BH 67 | 82 | 307.69 |
| BH 68 | 83 | 306.43 |
| BH 71 | 84 | 308.40 |
| BH 72 | 85 | 309.40 |
| BH 73 | 86 | 309.40 |
| BH 74 | 87 | 309.50 |
| BH 75 | 88 | 308.45 |
| BH 77 | 89 | 310.67 |
| BH 79 | 90 | 310.79 |
| BH 80 | 91 | 310.69 |
| BH 81 | 92 | 310.03 |
| BH 82 | 93 | 310.20 |
| BH 84 | 94 | 309.76 |
| BH 85 | 95 | 309.31 |
| BH 86 | 96 | 308.88 |
| BH 87 | 97 | 311.19 |
| BH 88 | 98 | 310.91 |
| BH 89 | 99 | 310.82 |
| BH 91 | 100 | 310.73 |
| BH 93 | 101 | 309.30 |
| BH 94 | 102 | 312.00 |
| BH 95 | 103 | 312.12 |
| BH 96 | 104 | 311.17 |
| BH 97 | 105 | 310.95 |
| BH 98 | 106 | 310.94 |
| BH 99 | 107 | 310.18 |
| BH 100 | 108 | 309.72 |
| BH 101 | 109 | 309.74 |
| BH 102 | 110 | 311.52 |
| BH 103 | 111 | 311.90 |
| BH 104 | 112 | 311.68 |
| BH 105 | 113 | 310.73 |
| BH 106 | 114 | 310.05 |

| | | |
|---|---|---|
| BH 107 | 115 | 310.34 |
| BH 108 | 116 | 310.53 |
| BH 109 | 117 | 311.89 |
| BH 111 | 118 | 311.43 |
| BH 112 | 119 | 311.89 |
| BH 114 | 120 | 311.42 |
| BH 115 | 121 | 311.39 |
| BH 118 | 122 | 312.06 |
| BH 119 | 123 | 311.65 |
| BH 120 | 124 | 311.64 |
| BH 121 | 125 | 311.54 |
| BH 122 | 126 | 311.44 |
| BH 123 | 127 | 311.04 |
| BH 124 | 128 | 312.23 |
| BH 125 | 129 | 311.95 |
| BH 126 | 130 | 311.67 |
| BH 127 | 131 | 311.18 |
| BH 128 | 132 | 310.98 |
| BH 129 | 133 | 310.17 |
| BH 130 | 134 | 310.44 |
| BH 131 | 135 | 311.39 |
| BH 132 | 136 | 311.10 |
| BH 133 | 137 | 310.61 |
| BH 134 | 138 | 310.81 |
| BH 135 | 139 | 310.24 |
| | | |
| **SWM A** | | |
| BH A1 | 140 | 307.89 |
| BH A2-D | 141 | 307.25 |
| BH A2-S | 142 | 307.25 |
| BH A3-D | 143 | 307.98 |
| BH A3-S | 144 | 307.98 |

# Log of Borehole 67

Project No. BRM-00038305-B0 | Drawing No. 82

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

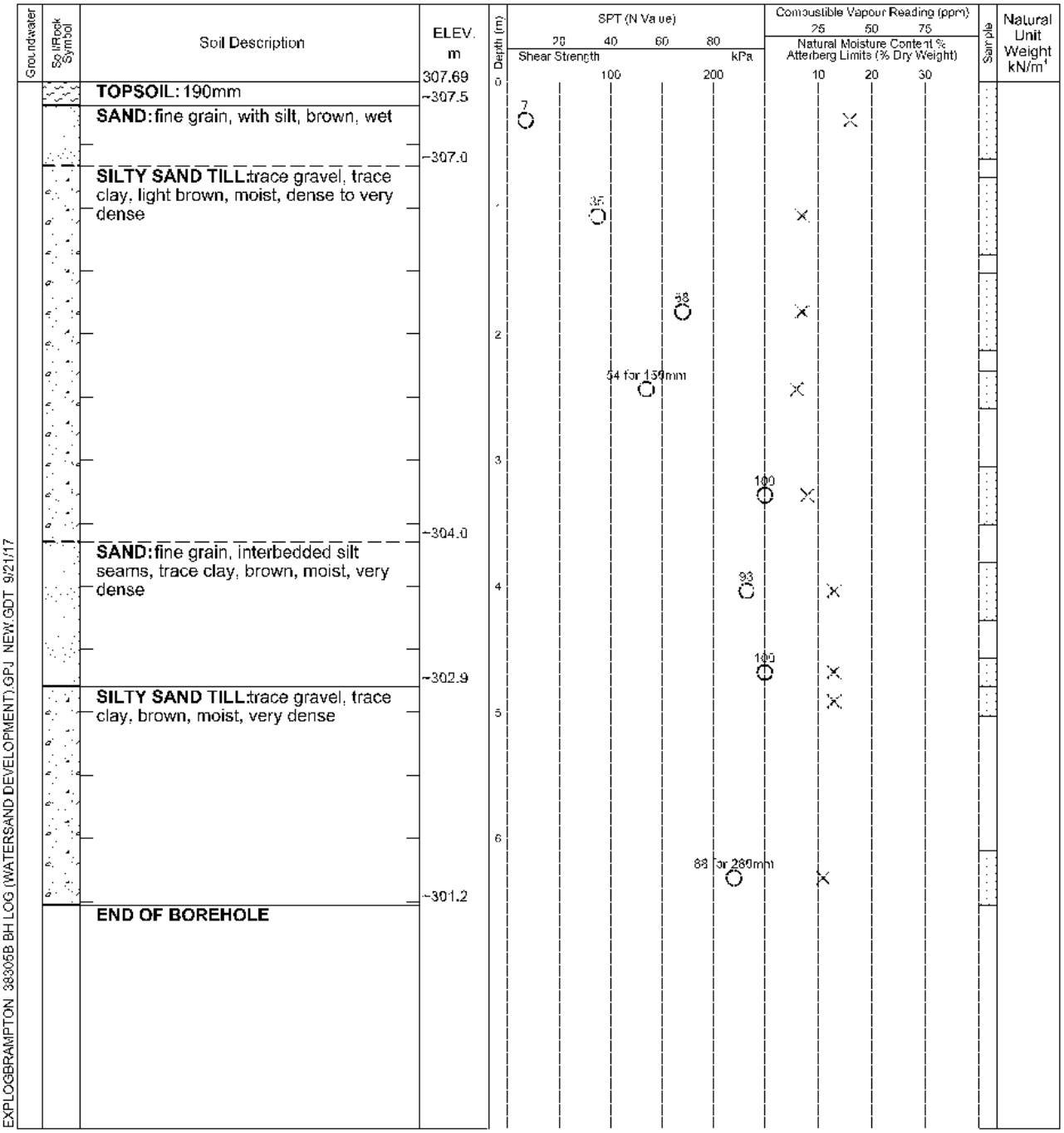
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.79 |

# Log of Borehole 68

Project No. BRM-00038305-B0 | Drawing No. 83

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

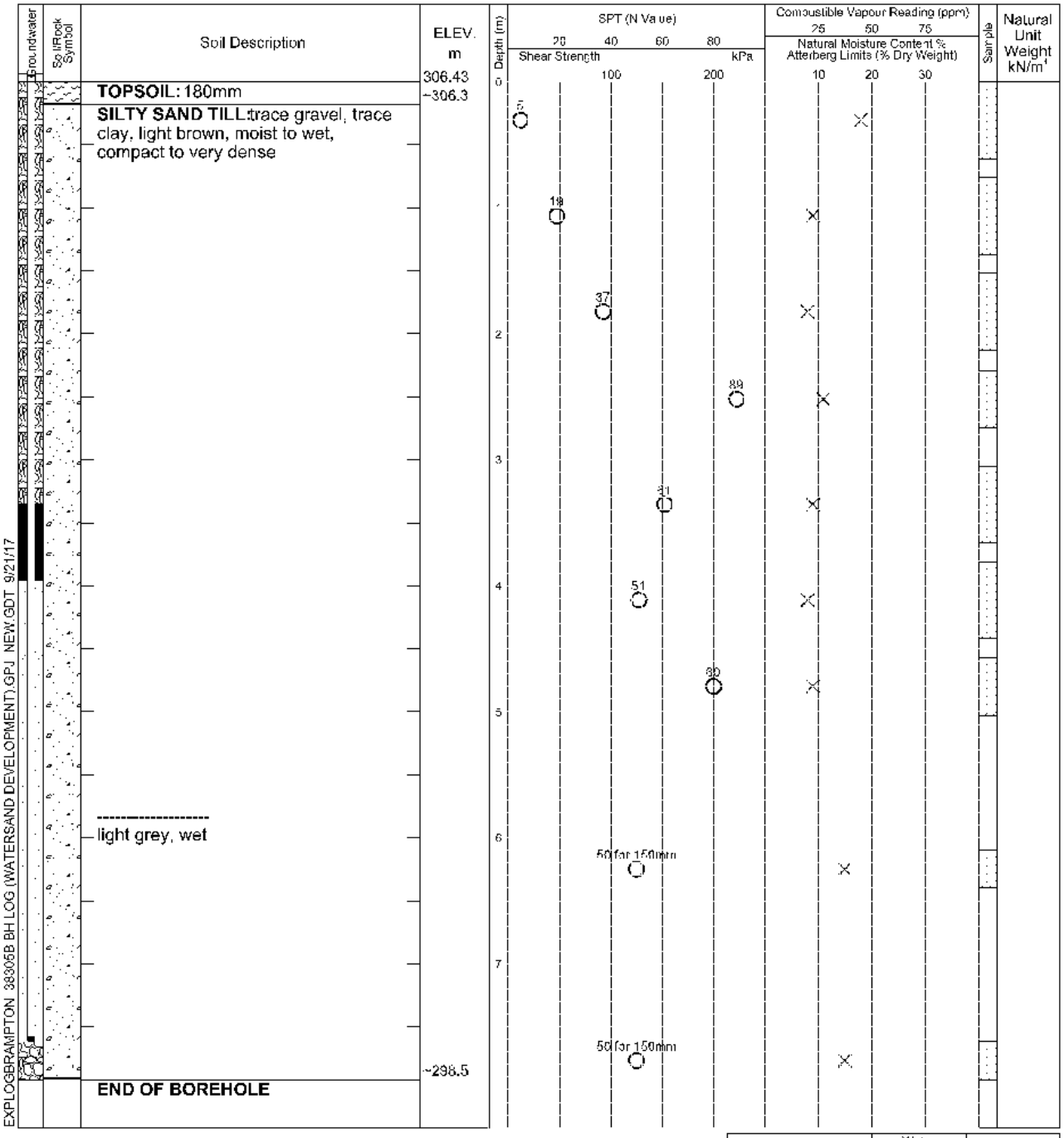
Date Drilled: July 11, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 4.04 | - |
| August 9, 2017 | 5.59 | - |
| August 17, 2017 | 6.08 | - |

# Log of Borehole 71

Project No. BRM-00038305-B0 | Drawing No. 84

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

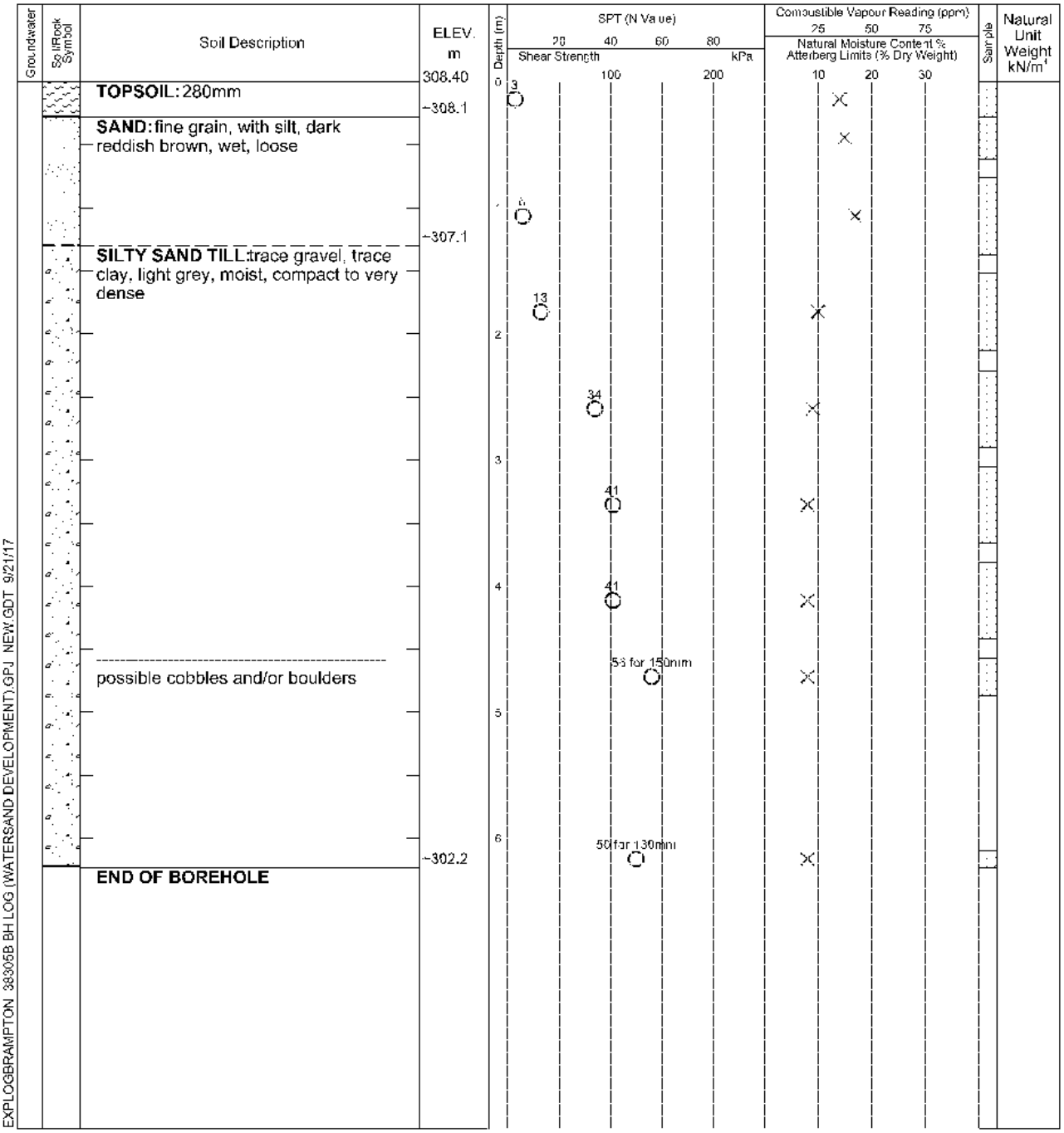
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

# Log of Borehole 72

Project No. BRM-00038305-B0 | Drawing No. 85

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

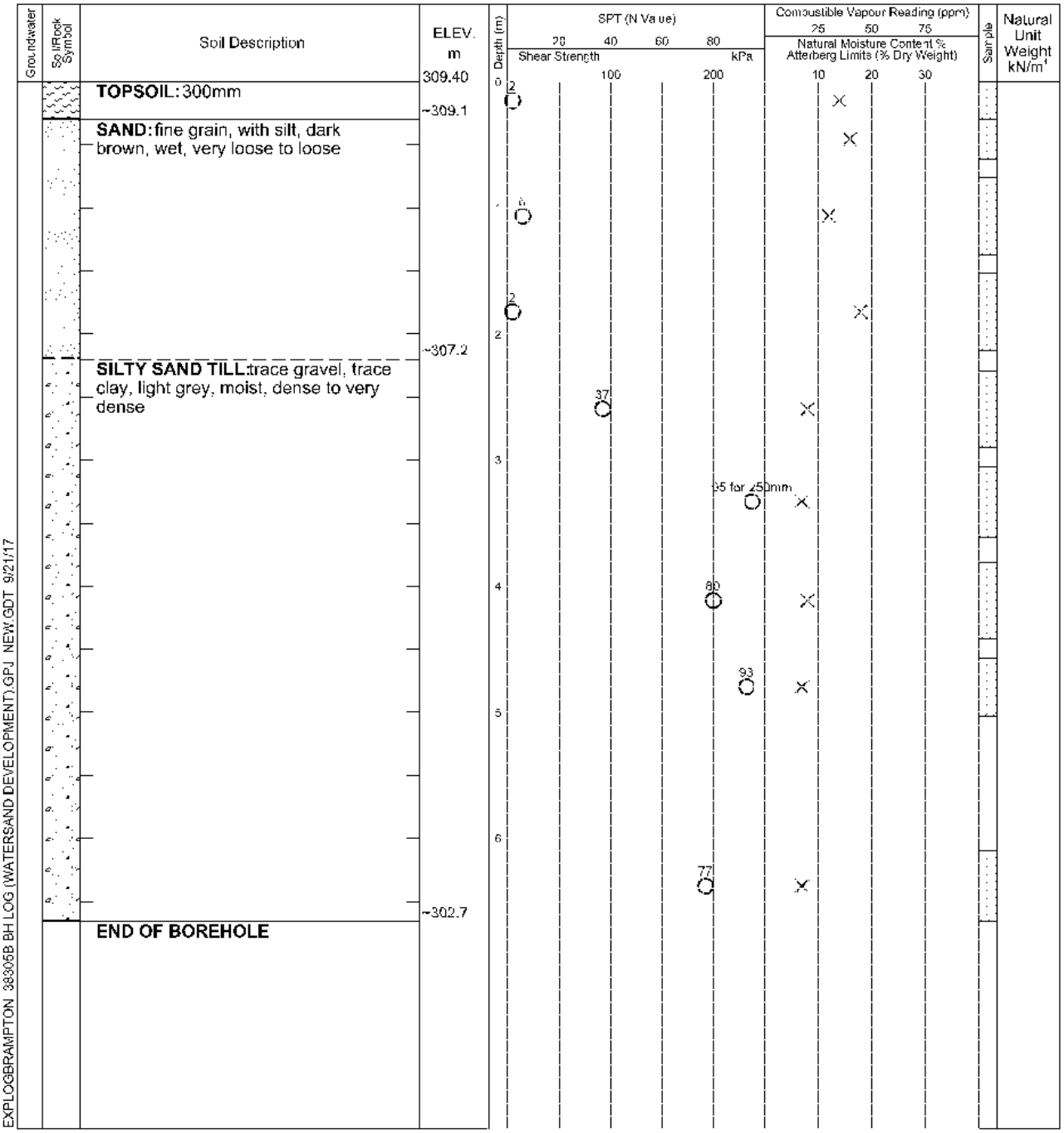
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 73

Project No. BRM-00038305-B0 | Drawing No. 86

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

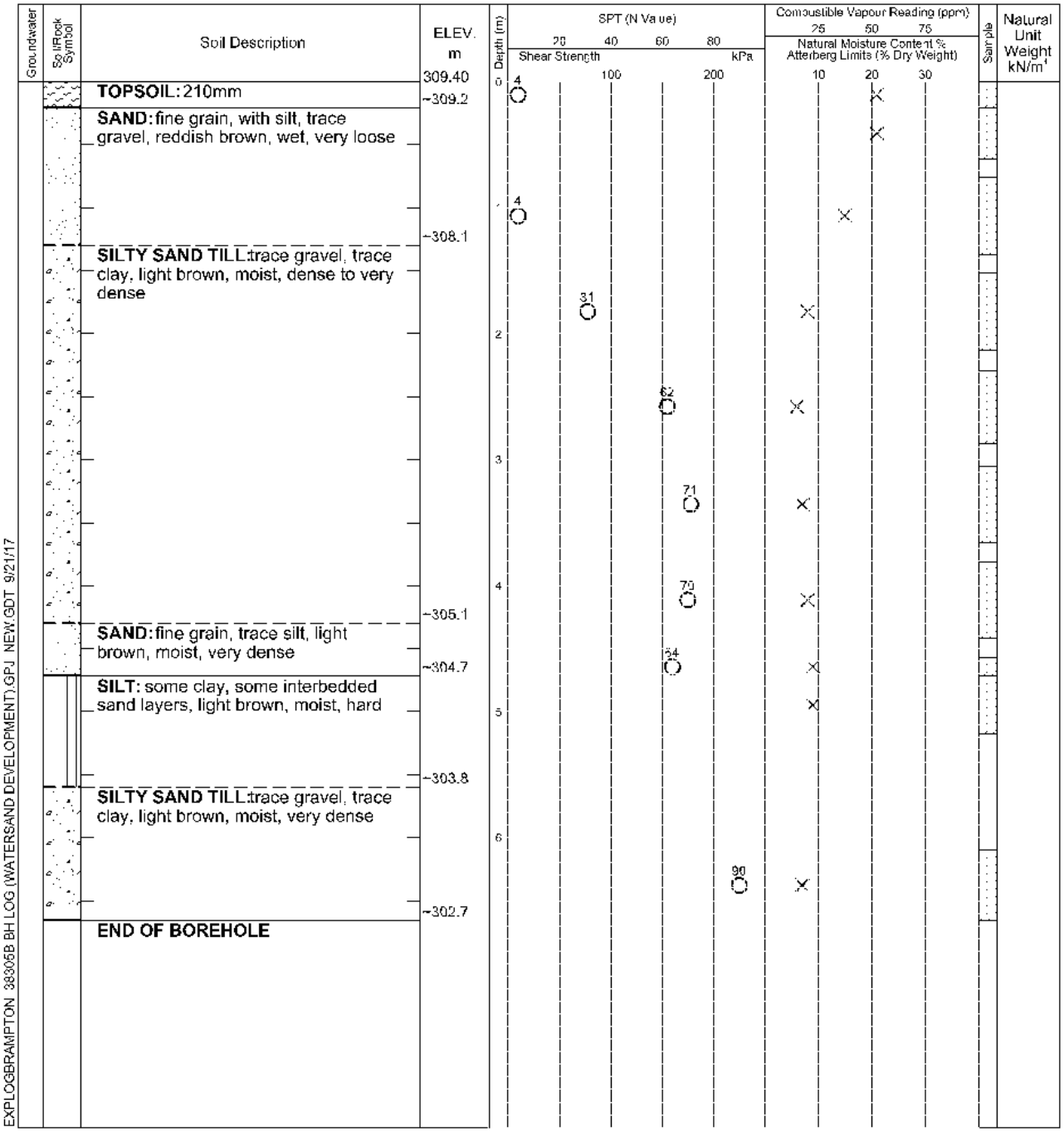
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.79 | 6.10 |

# Log of Borehole 74

Project No. BRM-00038305-B0 | Drawing No. 87

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

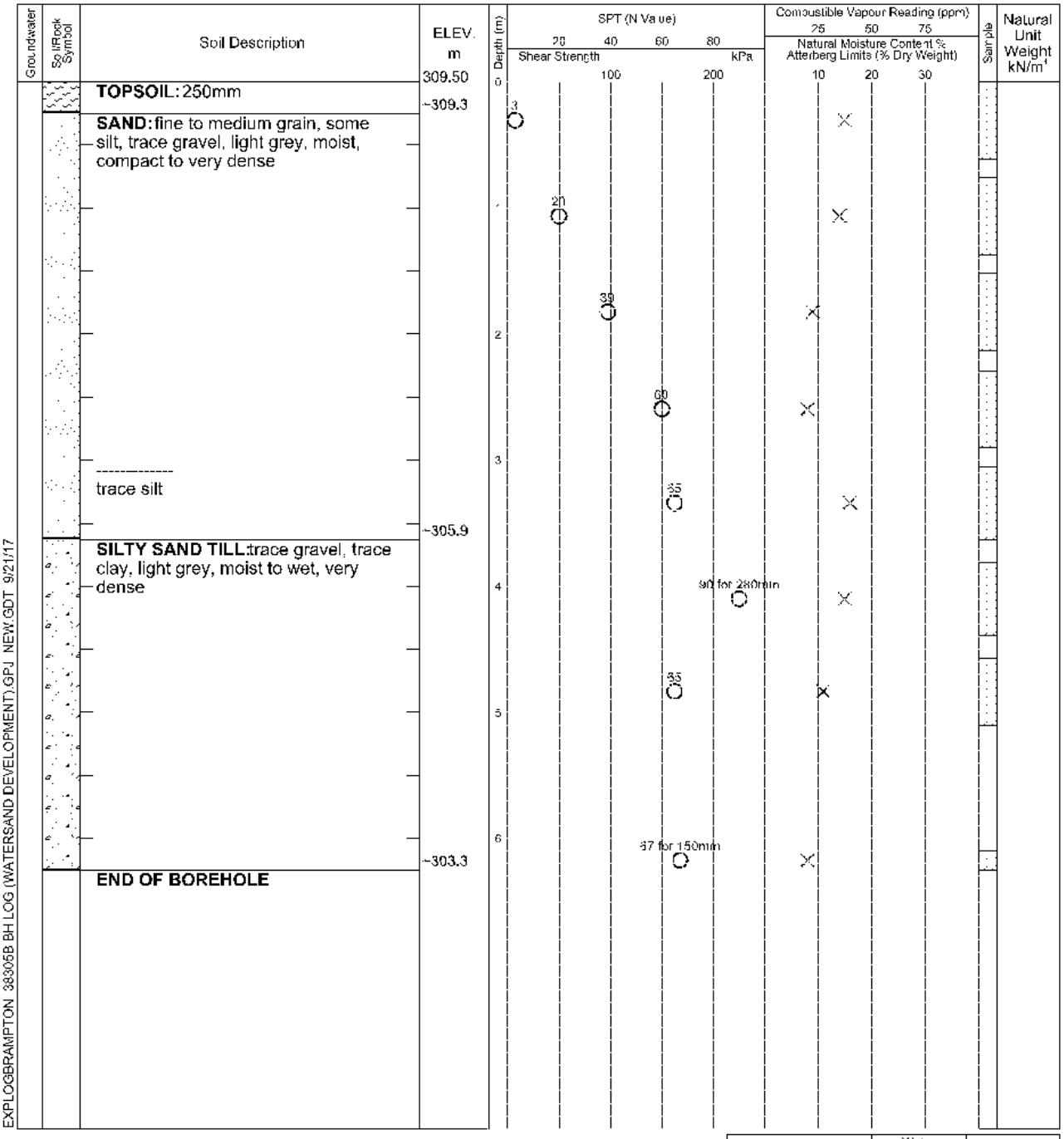
Date Drilled: June 20, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.94 | 6.10 |

# Log of Borehole 75

Project No. BRM-00038305-B0 | Drawing No. 88

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 20, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 180mm | 308.45 | 0 |
| | | | ~308.3 | |
| | | **SAND:** fine to medium grain, some silt, trace gravel, grey, moist, compact | | |
| | | | ~307.0 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, compact to very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.27 | 4.57 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 75

Project No. BRM-00038305-B0 Drawing No. 88

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 300.15 | | | | | |
| | | | | 9 | | | | |
| | | | ~298.8 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.27 | 4.57 |

# Log of Borehole 77

Project No. BRM-00038305-B0 | Drawing No. 89

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 11, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 200mm | 310.67 |
| | | | ~310.5 |
| | | **SAND:** fine grain, trace silt, reddish brown, moist to wet, very loose to dense | |
| | | light brown | |
| | | | ~306.6 |
| | | **SILT:** some clay, some sand, trace gravel, dark grey, wet, very soft to soft | |
| | | | ~304.9 |
| | | **SAND:** fine grain, trace silt, trace gravel, brown, wet, very dense | |
| | | | ~304.3 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | |

Depth (m): 0 1 2 3 4 5 6 7 8

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa

9 13 33 38 25 4 75 for 280mm 50 for 100mm

Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample

Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.62 | 7.62 |

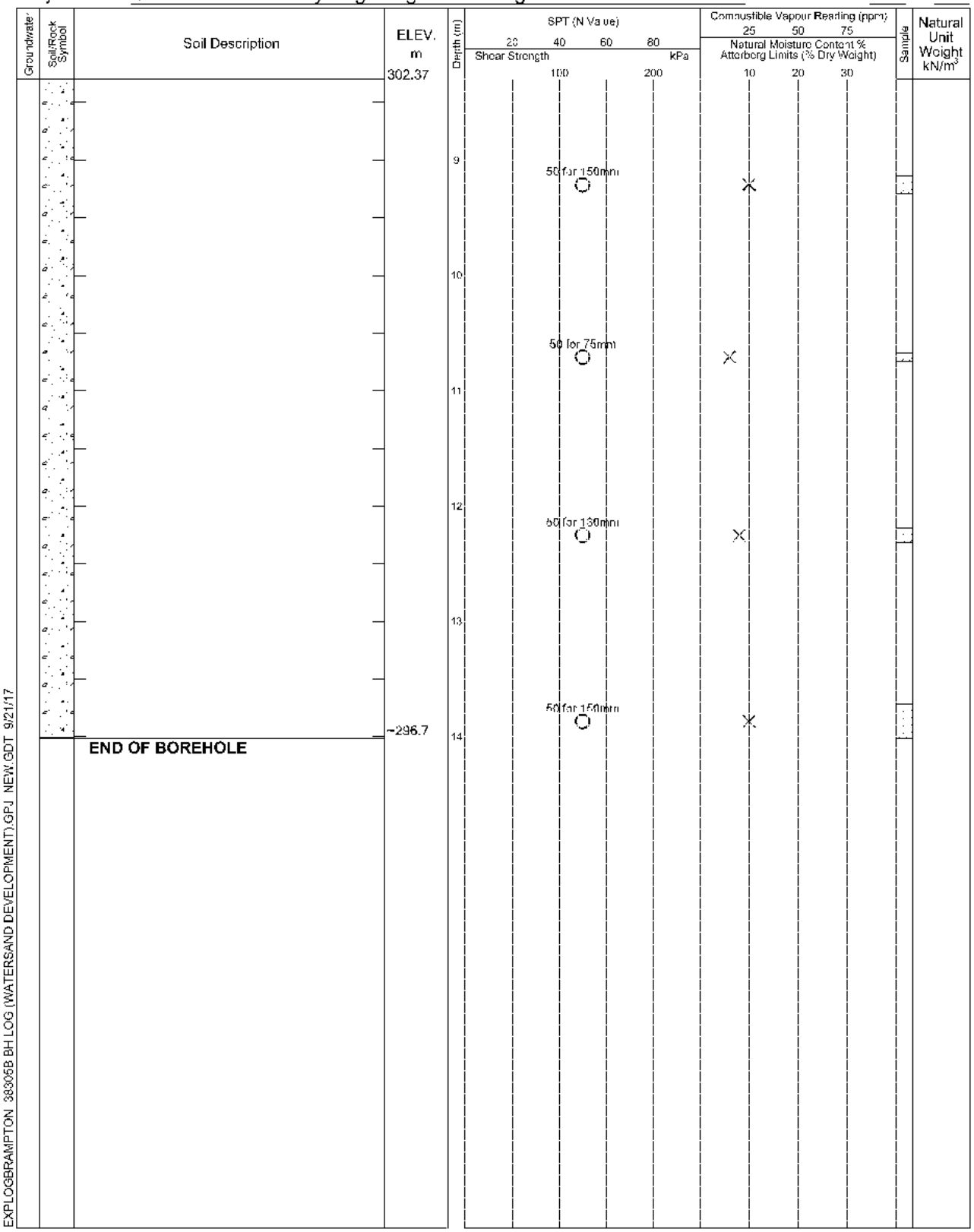
EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 77

Project No. BRM-00038305-B0 Drawing No. 89

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.62 | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 79

Project No. BRM-00038305-B0 | Drawing No. 90

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

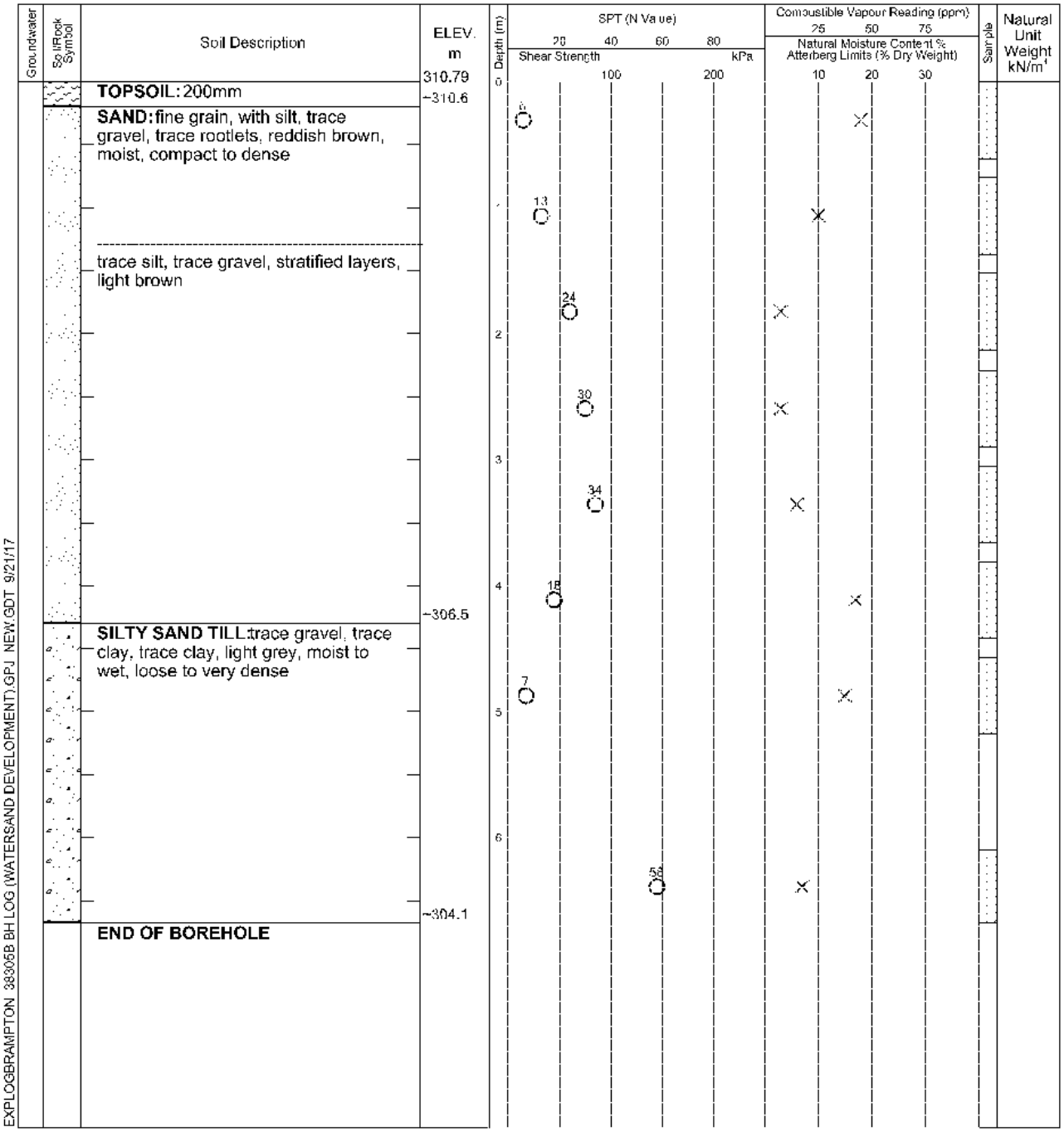
Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.81 | 3.81 |

exp.

# Log of Borehole 80

Project No. BRM-00038305-B0 | Drawing No. 91

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

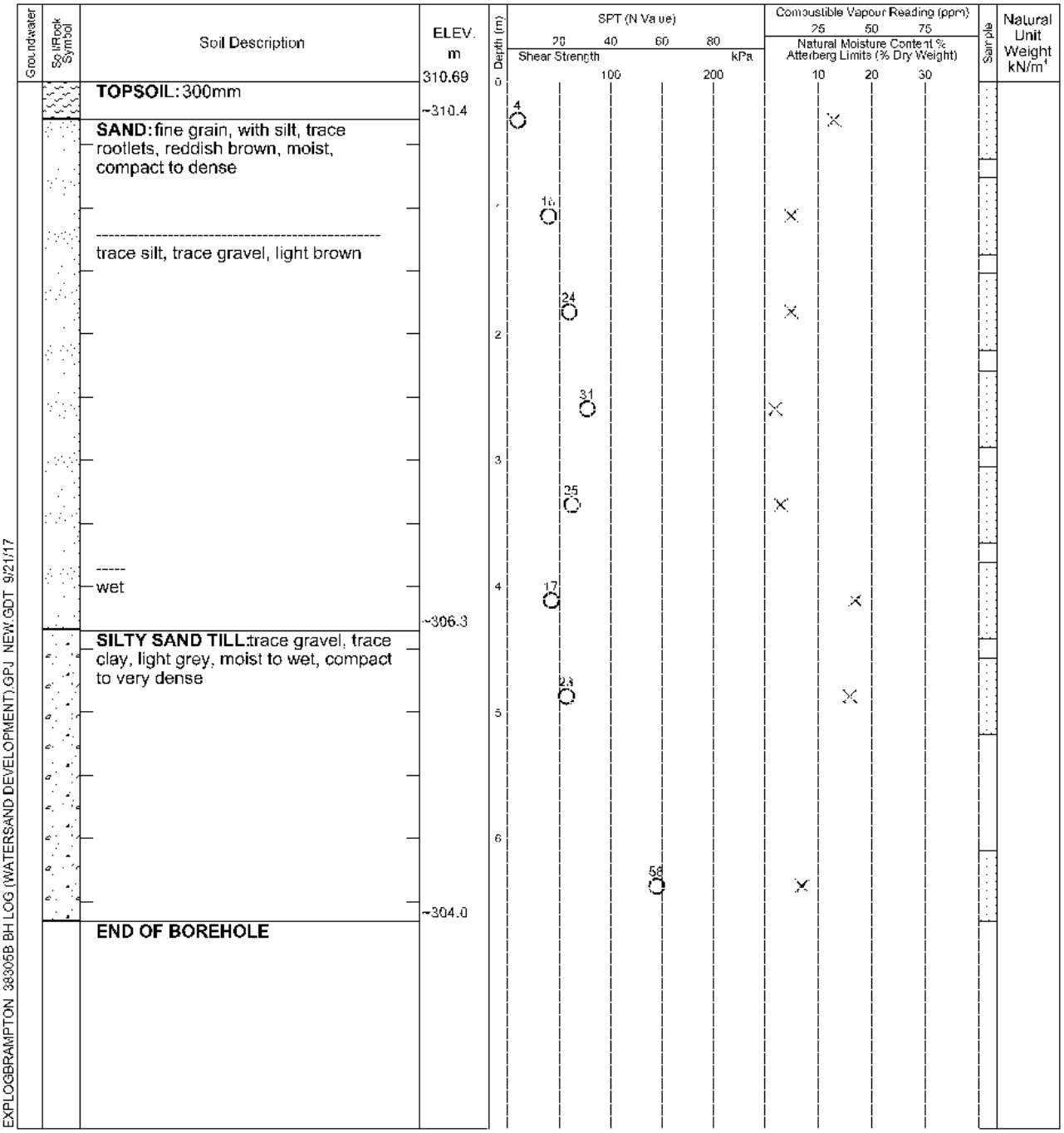
Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.66 | 3.66 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 81

Project No. BRM-00038305-B0 | Drawing No. 92

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

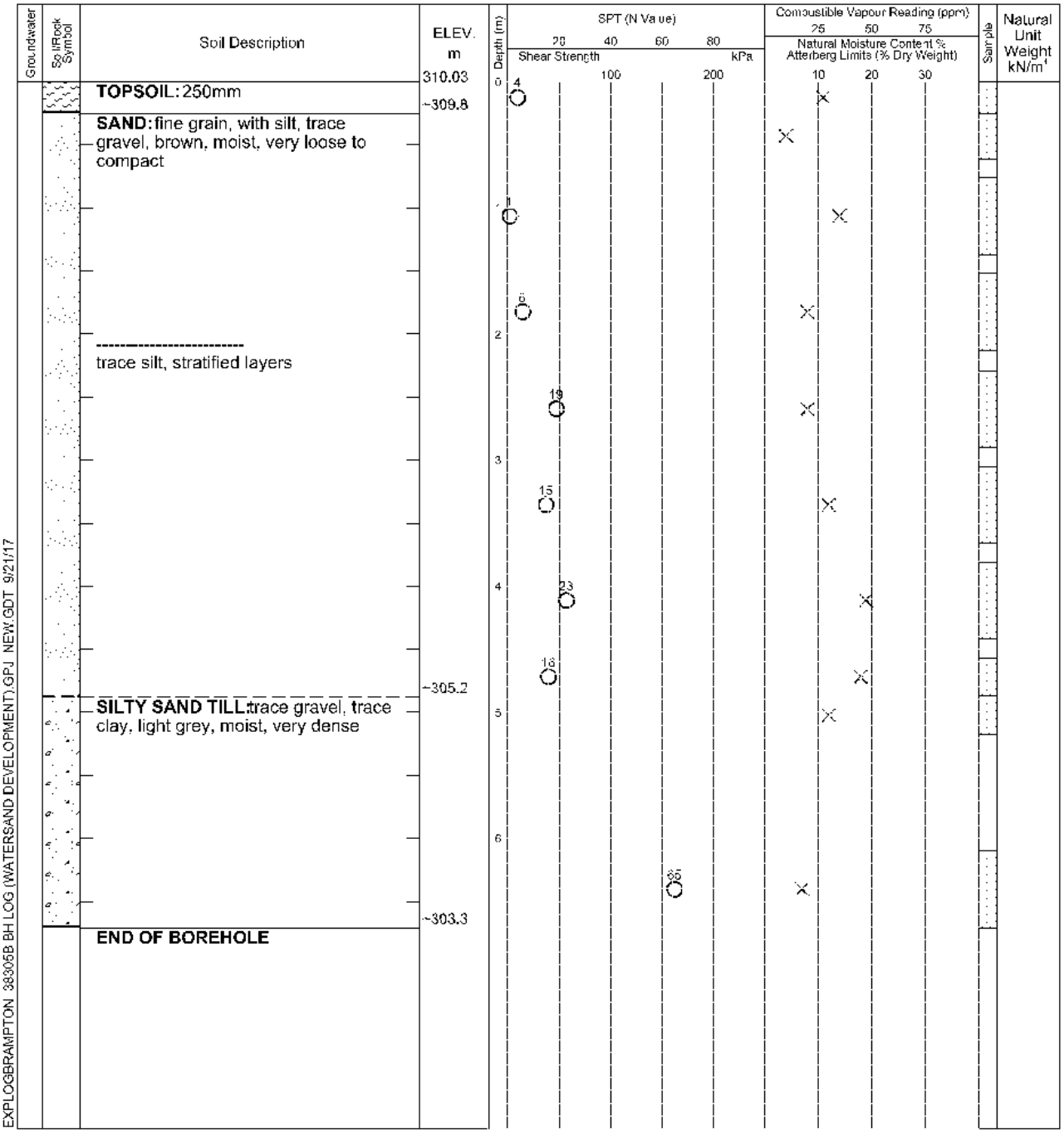
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.05 | 3.05 |

exp.

# Log of Borehole 82

Project No. BRM-00038305-B0 | Drawing No. 93

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

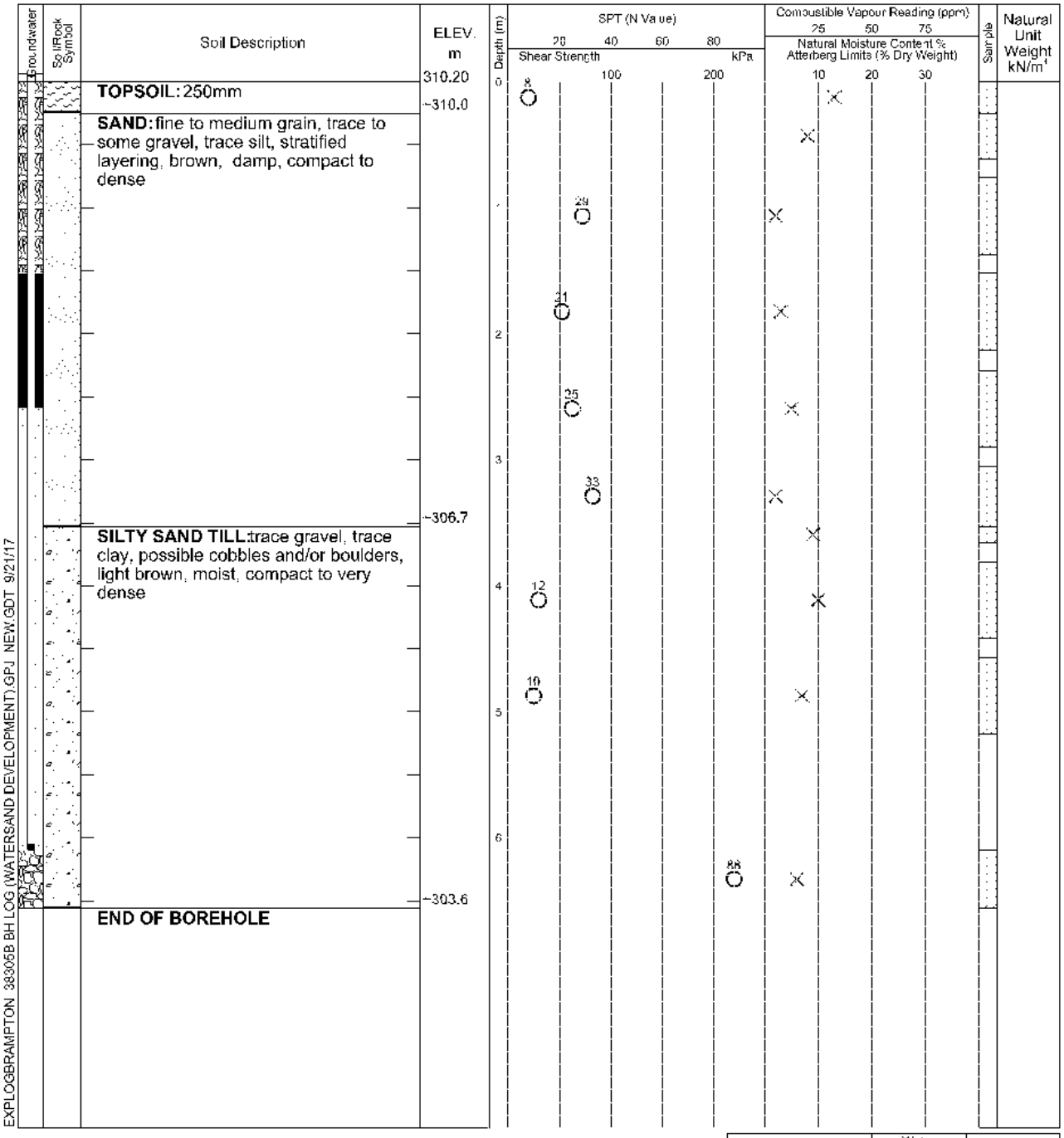
Date Drilled: June 28, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| August 10, 2017 | 5.91 | - |

# Log of Borehole 84

Project No. BRM-00038305-B0 | Drawing No. 94

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

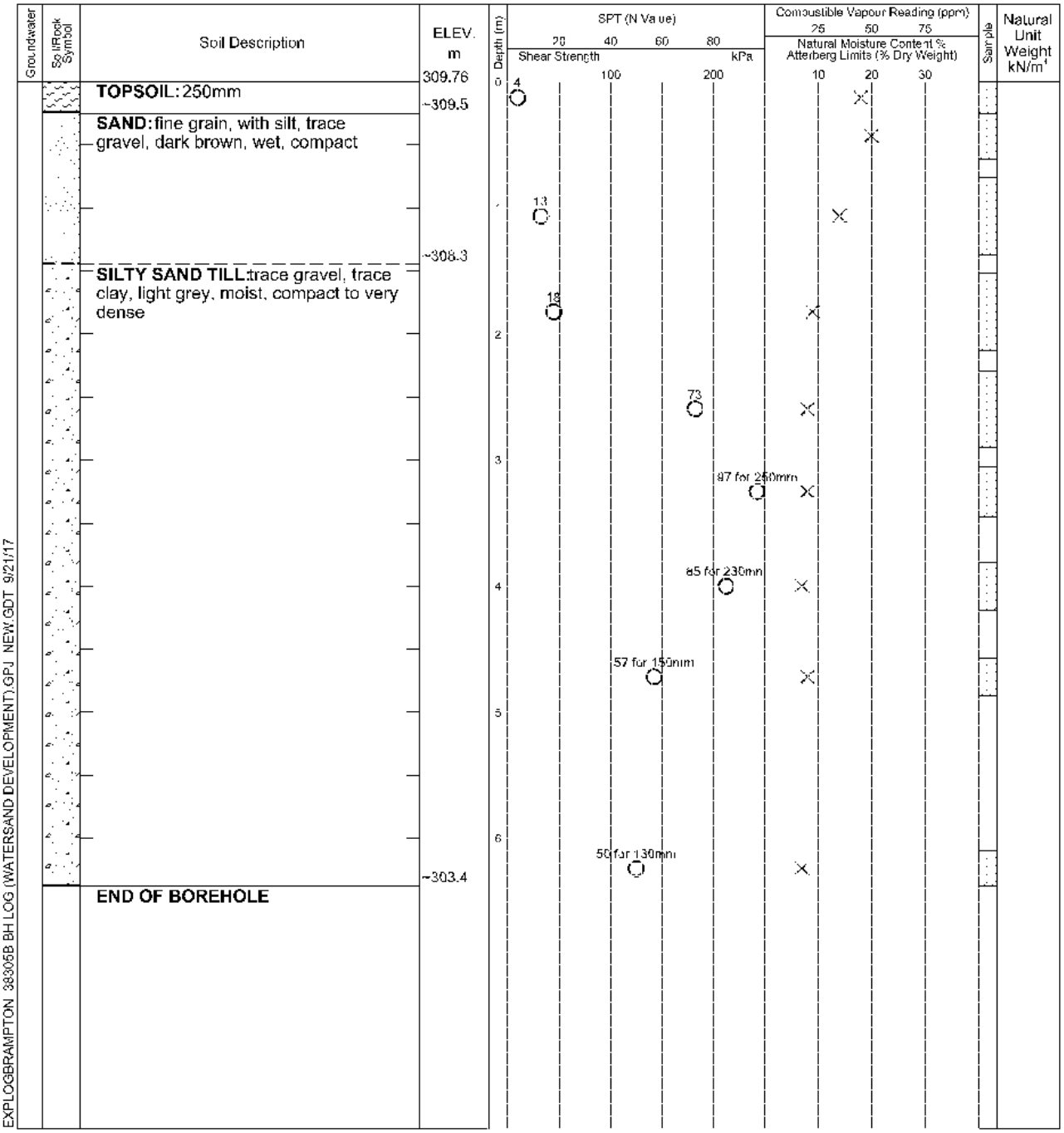
Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 85

Project No. BRM-00038305-B0 | Drawing No. 95

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 21, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 309.31 | 0 |
| | | | ~309.1 | |
| | | **SAND:** fine grain, some silt, brown, moist | | |
| | | | ~308.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | occasional silt inclusions | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~302.9 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

7
28
35
75 for 280mm
85
89 for 280mm
88
61 for 150mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.49 | 5.64 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 86

Project No. BRM-00038305-B0 | Drawing No. 96

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 20, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 308.88 | 0 |
| | | | ~308.7 | |
| | | **SAND:** fine grain, with silt, reddish brown, light grey, wet, compact | | |
| | | | ~307.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | |
| | | | ~301.8 | 7 |
| | | **SAND:** fine grain, with silt, light grey, moist, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

Sample | Natural Unit Weight kN/m³

3, 11, 50, 56, 80, 54, 72, 50 for 100mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.99 | 9.14 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 86

Project No. BRM-00038305-B0 Drawing No. 96

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 300.58 | | | | | |
| | | | | 9 | 34 blr/50mm | | | |
| | | | -299.6 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.99 | 9.14 |

exp.

# Log of Borehole 87

Project No. BRM-00038305-B0 | Drawing No. 97

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

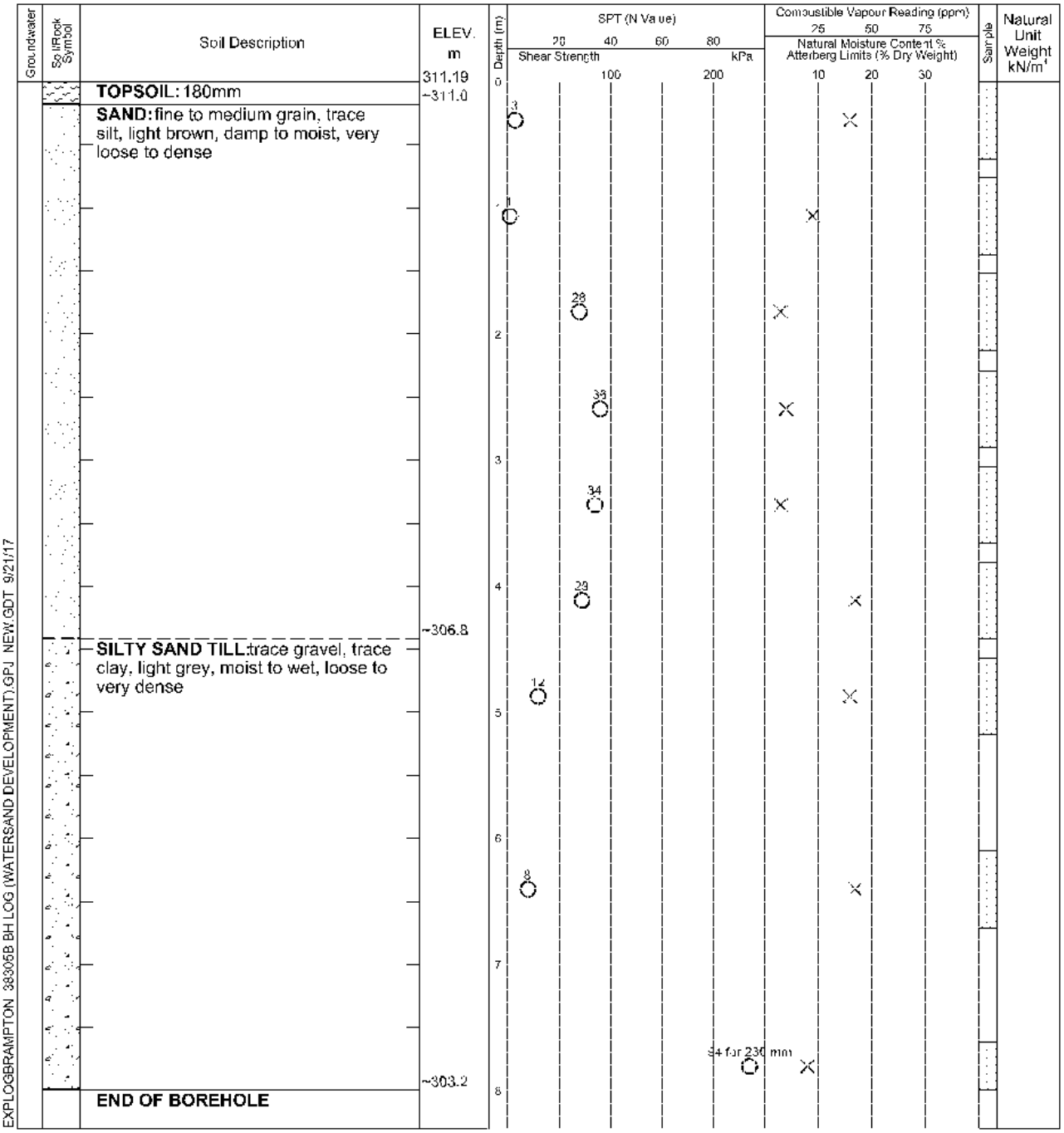
Date Drilled: June 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 4.27 |

# Log of Borehole 88

Project No. BRM-00038305-B0 | Drawing No. 98

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

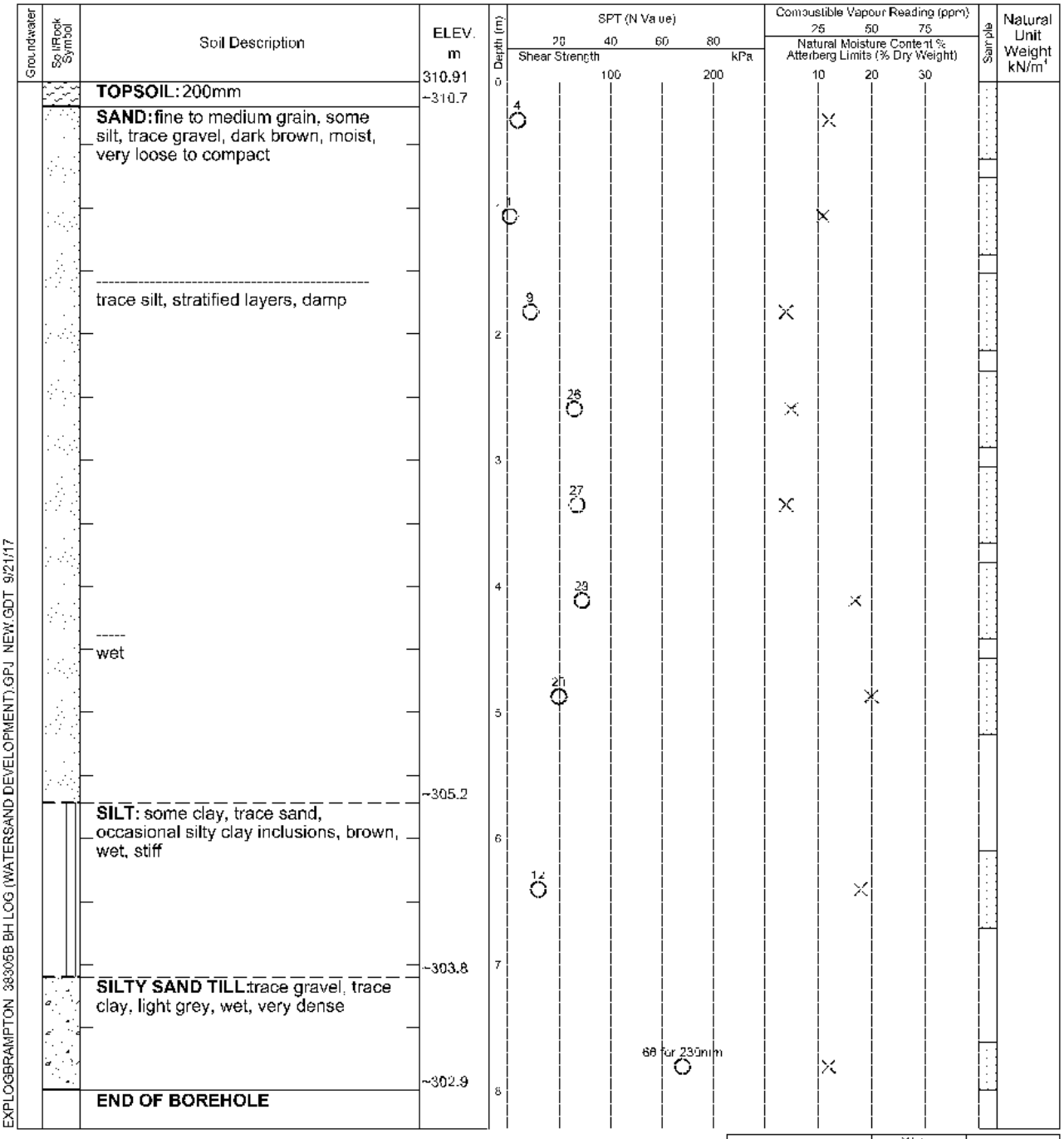
Proposed Watersand Development

Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.27 | 4.27 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 89

Project No. BRM-00038305-B0 | Drawing No. 99

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

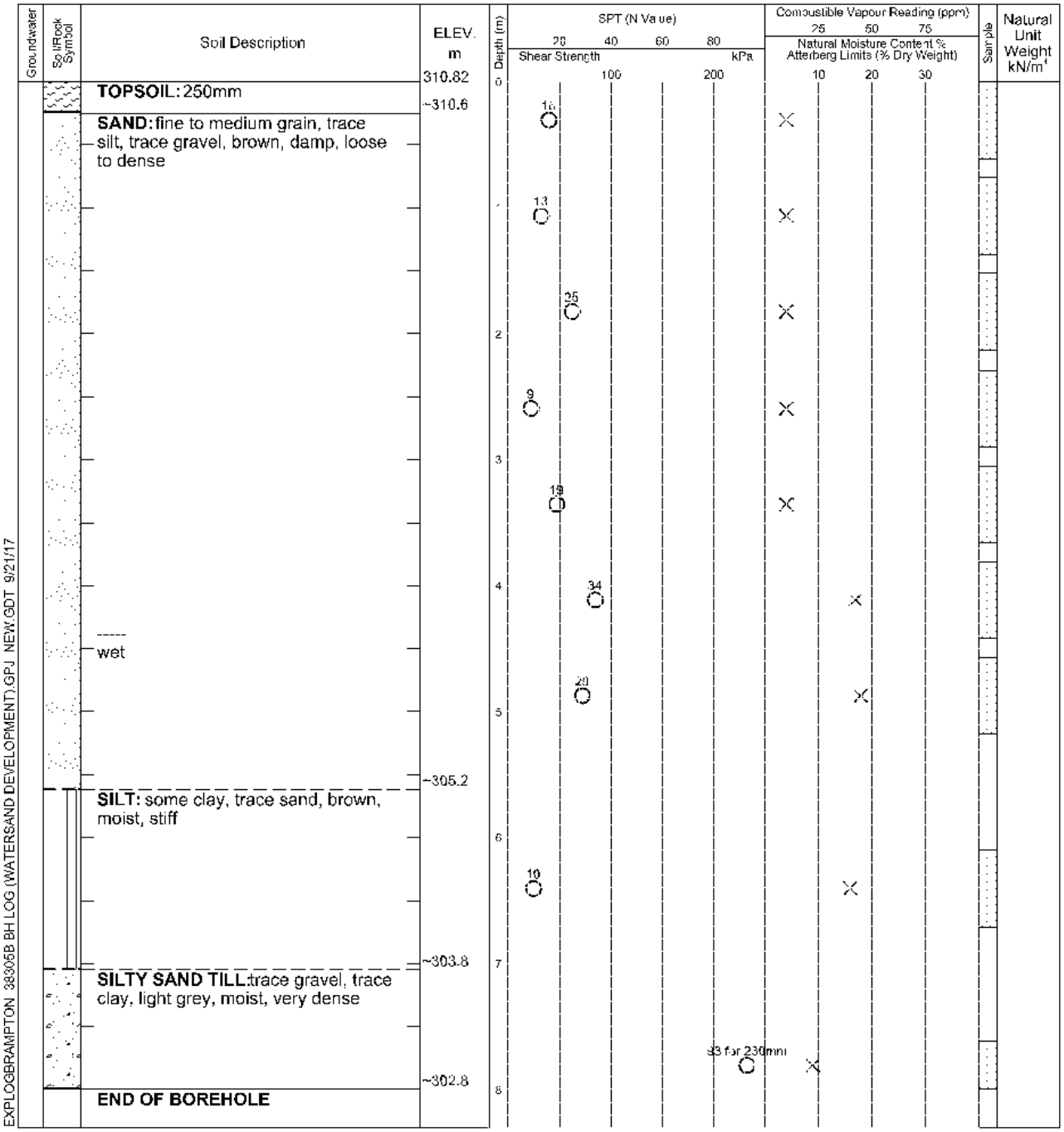
Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 4.11 | 4.42 |

# Log of Borehole 91

Project No. BRM-00038305-B0 | Drawing No. 100

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 23, 2017

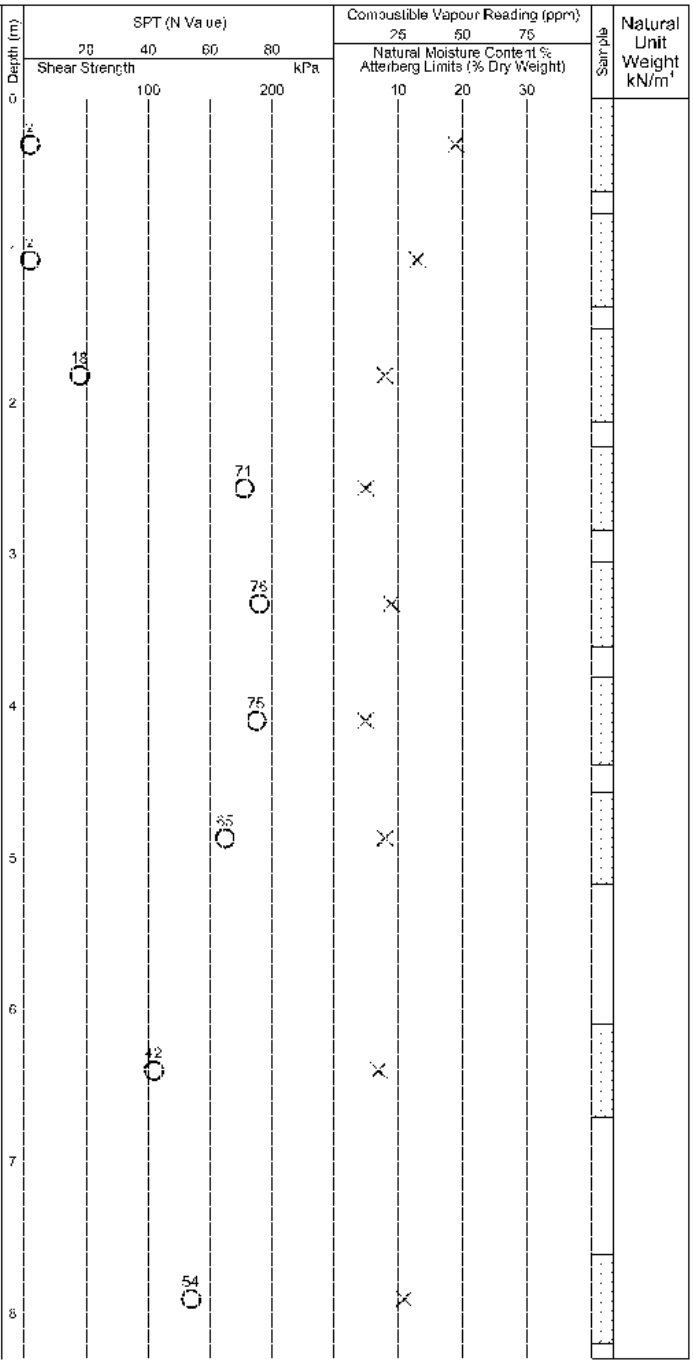
Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 300mm | 310.73 |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, moist, very loose | ~310.4 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, damp to moist, compact to very dense | ~309.2 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, damp, very dense | ~307.2 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, dense to very dense | ~306.2 |
| | | **SILTY CLAY:** trace sand, trace gravel, dark grey, damp, hard | ~303.0 |




Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.38 | 8.84 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 91

Project No. BRM-00038305-B0 Drawing No. 100

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.43 | | | | | |
| | | | ~302.0 | | | | | |
| | | **SILTY SAND TILL**:trace gravel, trace clay, possible cobbles and/or boulders, light grey, moist, very dense | | 9 | 50 for 25mm | | | |
| | | | ~301.4 | | | | | |
| | | **END OF BROEHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.38 | 8.84 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 93

Project No. BRM-00038305-B0 | Drawing No. 101

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 19, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.30 | 0 |
| | | **SAND:** fine grain, some silt, reddish brown, wet | ~309.0 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, compact to dense | ~308.6 | |
| | | **SAND:** fine grain, trace silt, light brown, moist, very dense | ~303.8 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | ~302.3 | |
| | | **END OF BOREHOLE** | ~301.5 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 4, 26, 38, 50, 44, 49, 35, 73, 50 for 50mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 7.01 | 7.32 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 94

Project No. BRM-00038305-B0 | Drawing No. 102

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 312.00 | 0 |
| | | | ~311.8 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, damp, compact to dense | | |
| | | | ~307.2 | 5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, grey, moist, compact to dense | | |
| | | | ~305.7 | 6 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light grey, wet, dense | | |
| | | | ~304.9 | 7 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, grey, moist to wet, very dense | | |

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Sample | Natural Unit Weight kN/m³

SPT values: 5, 37, 44, 38, 37, 36, 28, 37, 51

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.08 | 8.08 |

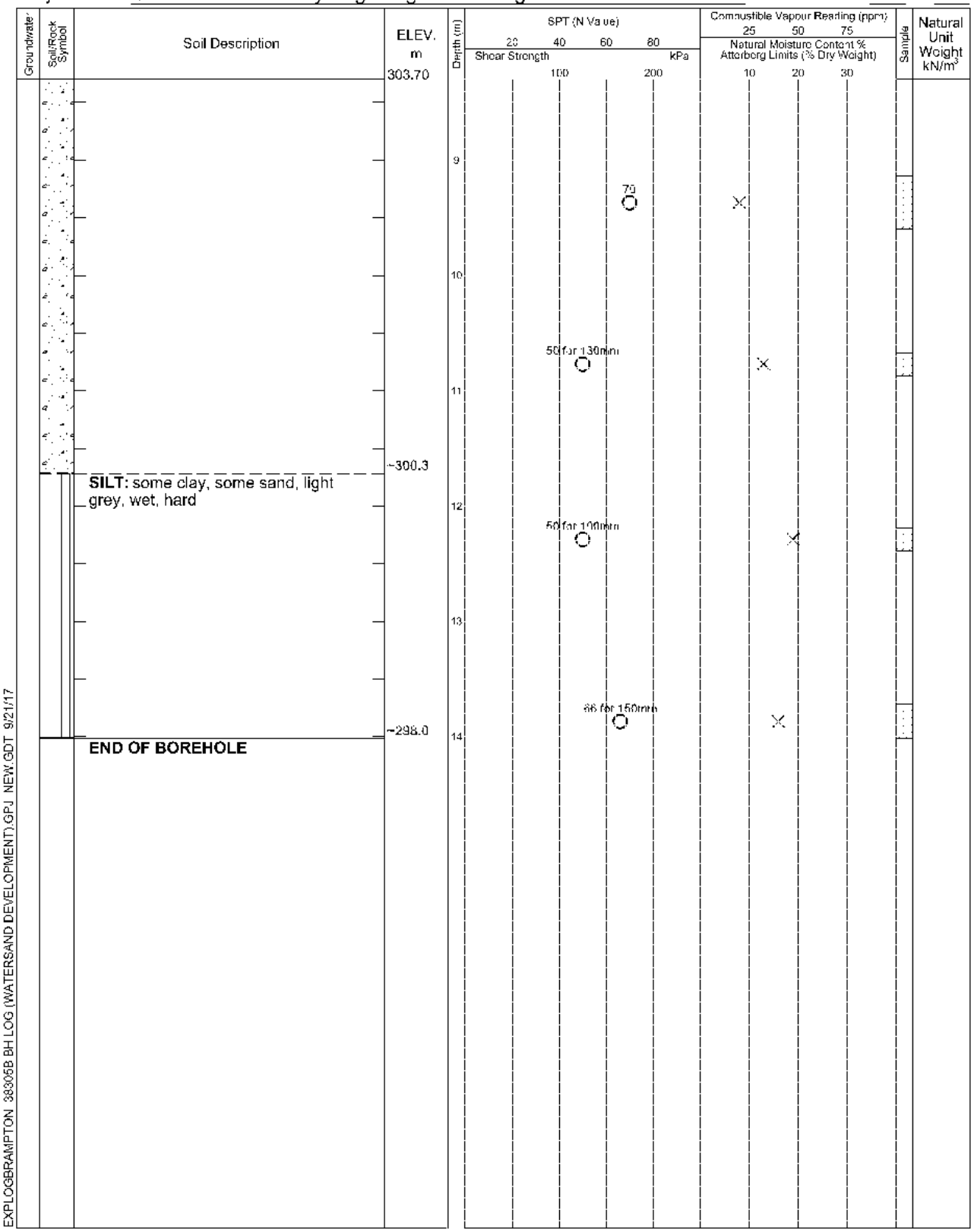
EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 94

Project No. BRM-00038305-B0 Drawing No. 102

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 8.08 | 8.08 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 95

Project No. BRM-00038305-B0 | Drawing No. 103

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 312.12 | 0 |
| | | | ~311.9 | |
| | | **SAND:** fine to medium grain, trace to some gravel, trace silt, stratified layering, brown, damp, dense to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | ~304.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, very dense | | 8 |

SPT (N Value) — Shear Strength kPa: 20, 40, 60, 80; 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 10.97 | 11.43 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 95

Project No. BRM-00038305-B0 Drawing No. 103

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 303.82 | | | | | |
| | | | | 9 | 50 for 100 mm | | | |
| | | | | 10 | | | | |
| | | | | | 50 for 100 mm | | | |
| | | | ~300.7 | 11 | | | | |
| | | **SAND:** fine to medium grain, trace silt, light grey, moist, very dense | | | | | | |
| | | | | 12 | 50 for 100 mm | | | |
| | | | ~299.7 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 10.97 | 11.43 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 96

Project No. BRM-00038305-B0 | Drawing No. 104

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

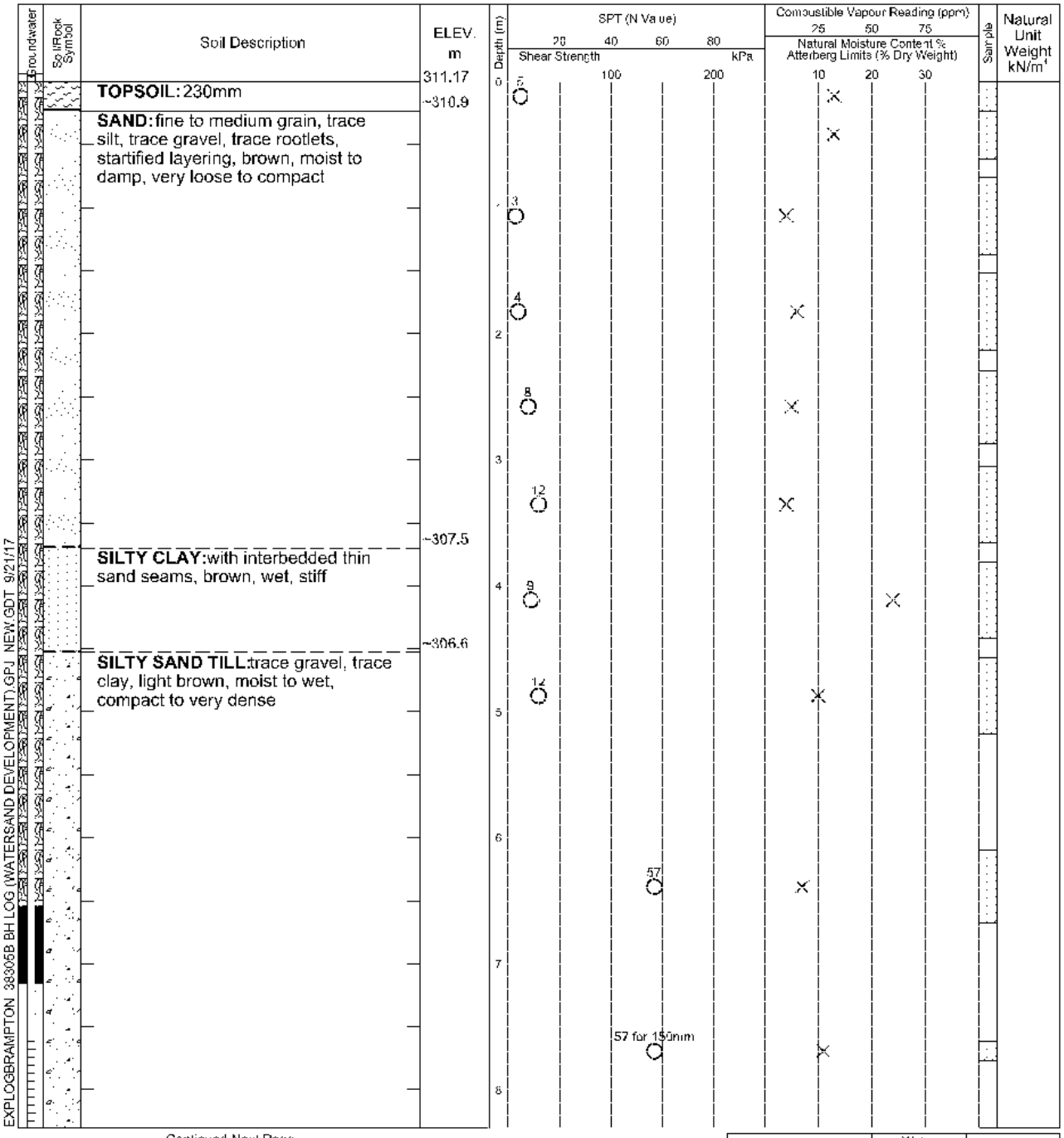
Date Drilled: June 28, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer



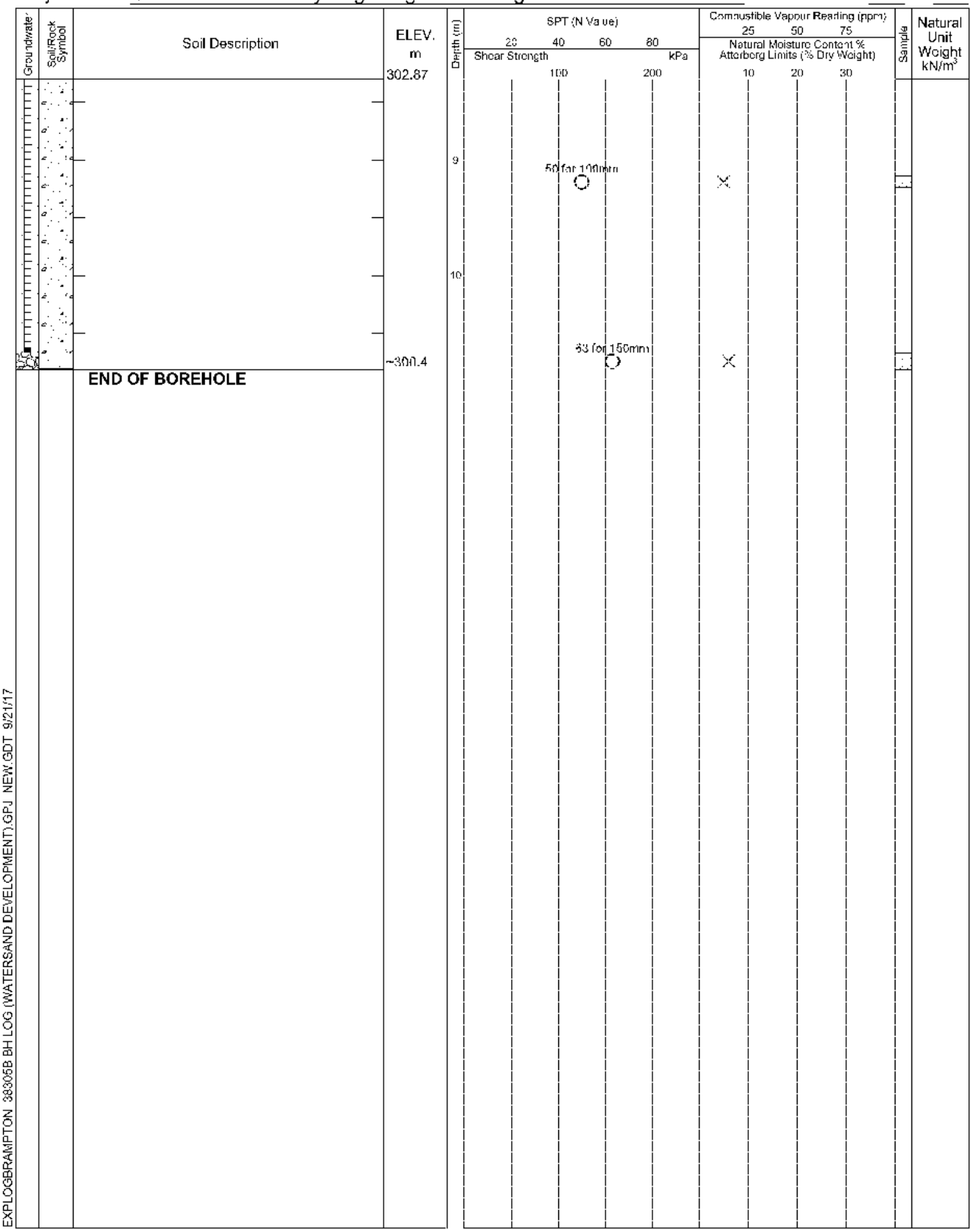

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| August 2, 2017 | Dry | - |
| August 10, 2017 | Dry | - |

# Log of Borehole 96

Project No. BRM-00038305-B0 Drawing No. 104

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| August 2, 2017 | Dry | - |
| August 10, 2017 | Dry | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 97

Project No. BRM-00038305-B0 | Drawing No. 105

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 19, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 310.95 | 0 |
| | | | ~310.7 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, dark brown, moist, loose | | |
| | | | ~309.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, compact to very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

3 7 11 42 58 55 83 85 50 for 100mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 8.99 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 97

Project No. BRM-00038305-B0 Drawing No. 105

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.65 | | | | | |
| | | | | 9 | 44 for 150mm | | | |
| | | | ~301.5 | | | | | |
| | | END OF BOREHOLE | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 8.99 |

exp.

# Log of Borehole 98

Project No. BRM-00038305-B0 | Drawing No. 106

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 19, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 310.94 | 0 |
| | | | ~310.7 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, moist, compact to very dense | | |
| | | | ~306.4 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30
Sample
Natural Unit Weight kN/m³

Continued Next Page

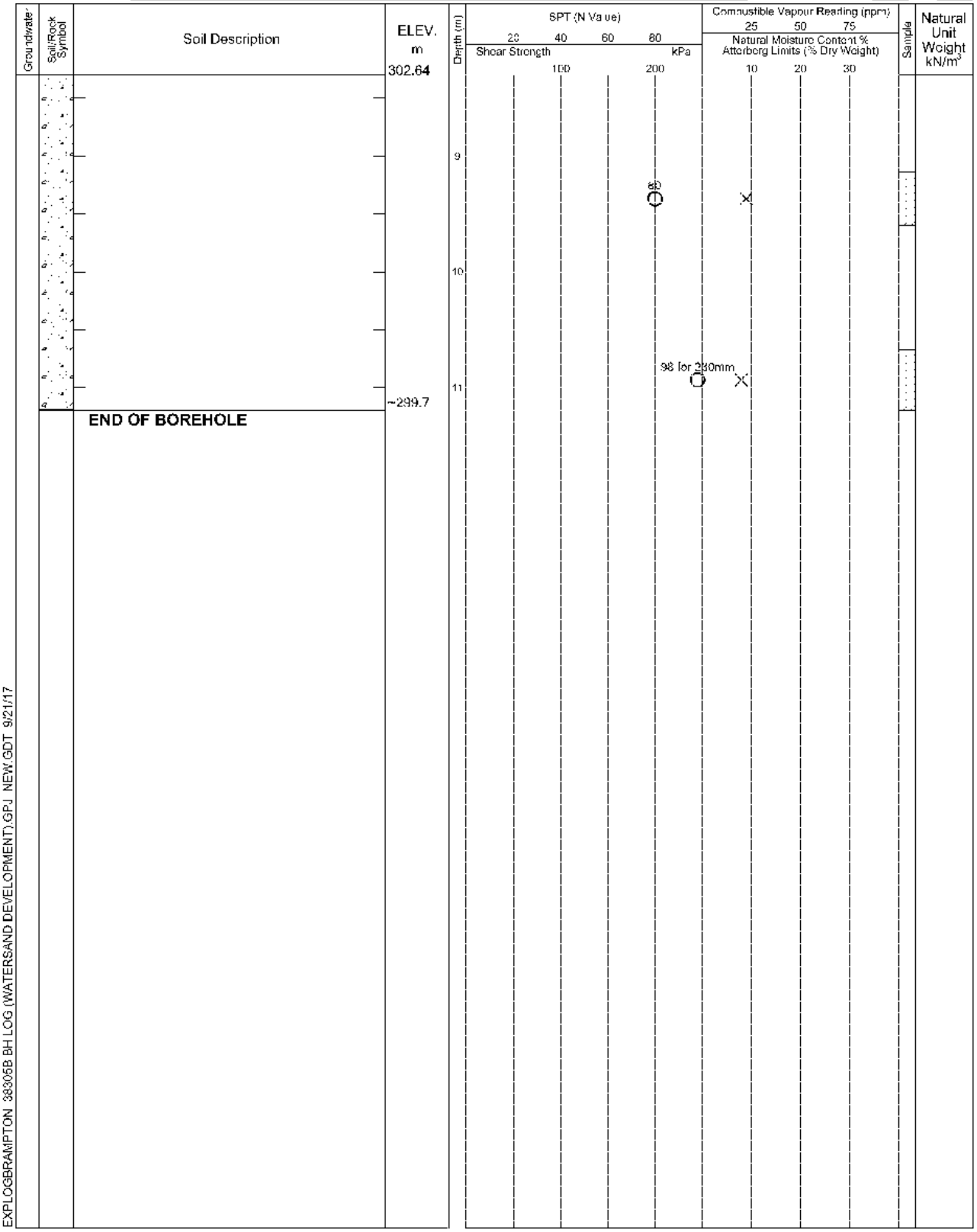
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.86 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 98

Project No. BRM-00038305-B0 Drawing No. 106

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.86 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 99

Project No. BRM-00038305-B0 | Drawing No. 107

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

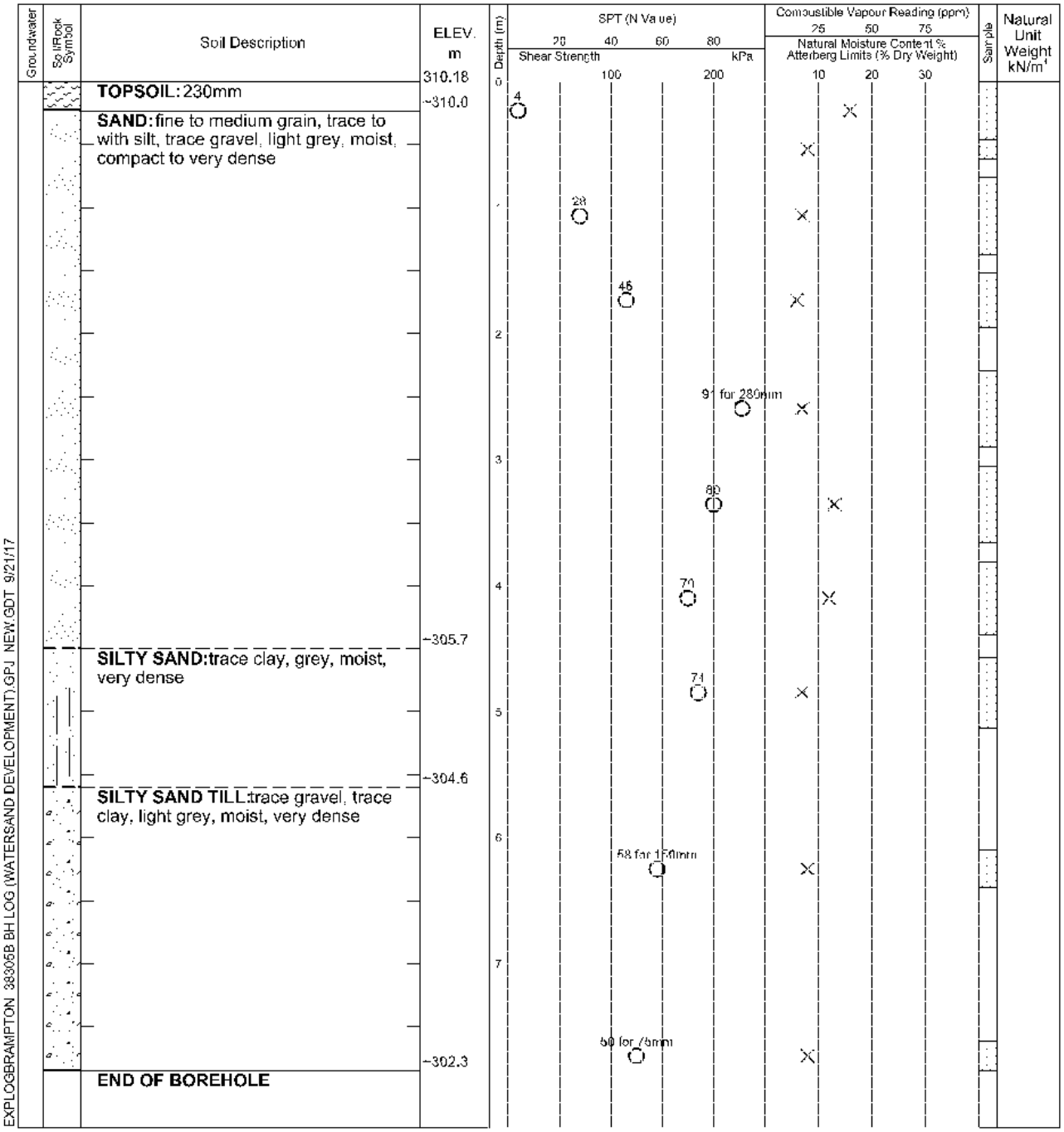
Date Drilled: June 19, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.87 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 100

Project No. BRM-00038305-B0 Drawing No. 108

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 19, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 309.72 | 0 |
| | | | ~309.5 | |
| | | **SAND:** fine grain, some silt, trace gravel, light grey, moist, dense | | |
| | | | ~307.5 | 2 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | |
| | | | ~301.9 | 7 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

3
30
32
78
75
73
72
89
50 for 100mm

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 6.86 | 7.32 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 101

Project No. BRM-00038305-B0 | Drawing No. 109

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

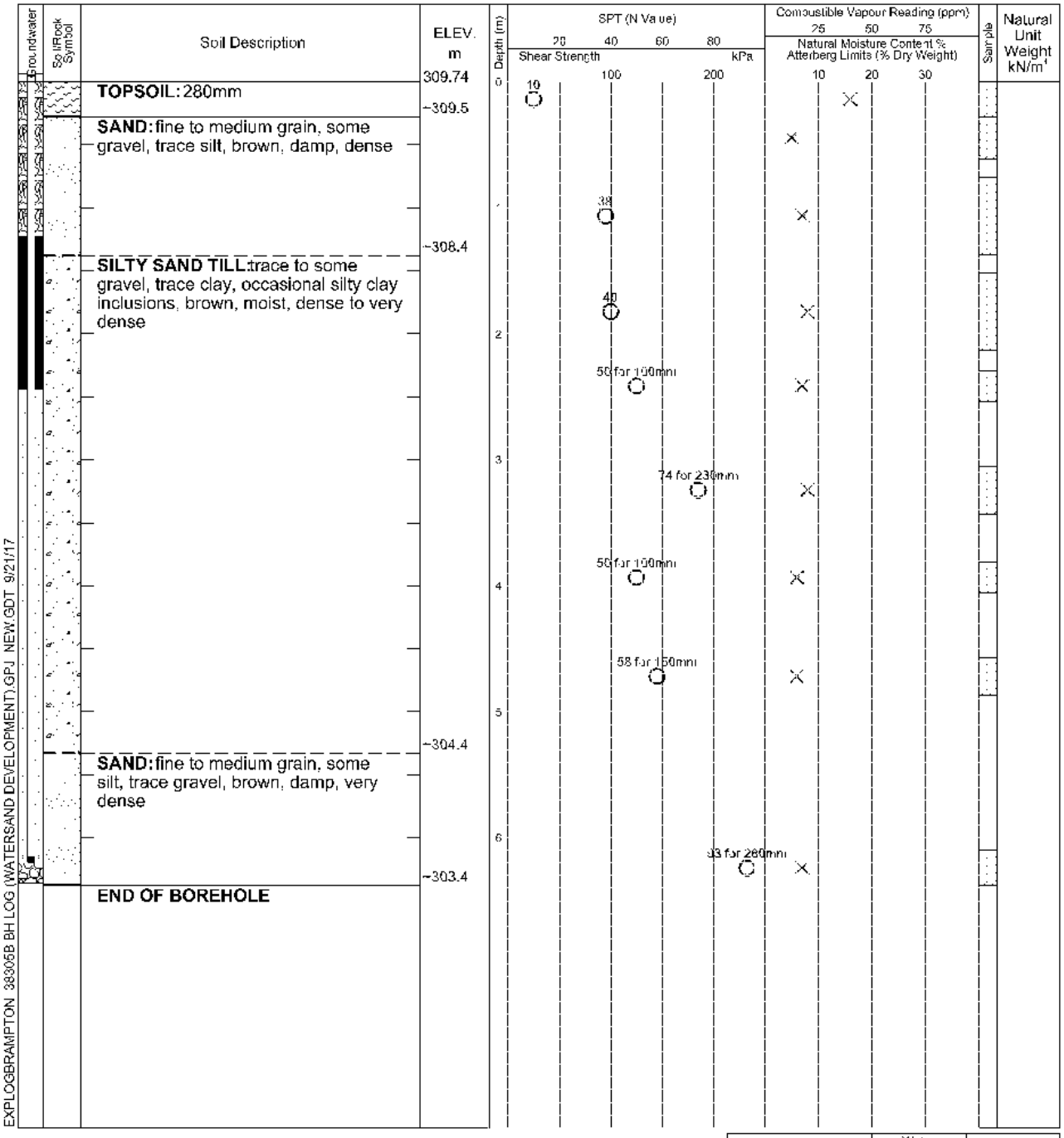
Date Drilled: June 29, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.02 |
| August 2, 2017 | Dry | - |
| August 10, 2017 | Dry | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 102

Project No. BRM-00038305-B0 | Drawing No. 110

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 311.52 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, compact to dense | ~311.3 | |
| | | | ~308.6 | 3 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light grey, moist, very dense | | |
| | | | ~305.9 | 5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, grey, moist, very dense | | 6 |
| | | | ~305.0 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 6, 17, 33, 49, 55, 50 for 125 mm, 50 for 150 mm, 94 for 250 mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 103

Project No. BRM-00038305-B0 | Drawing No. 111

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

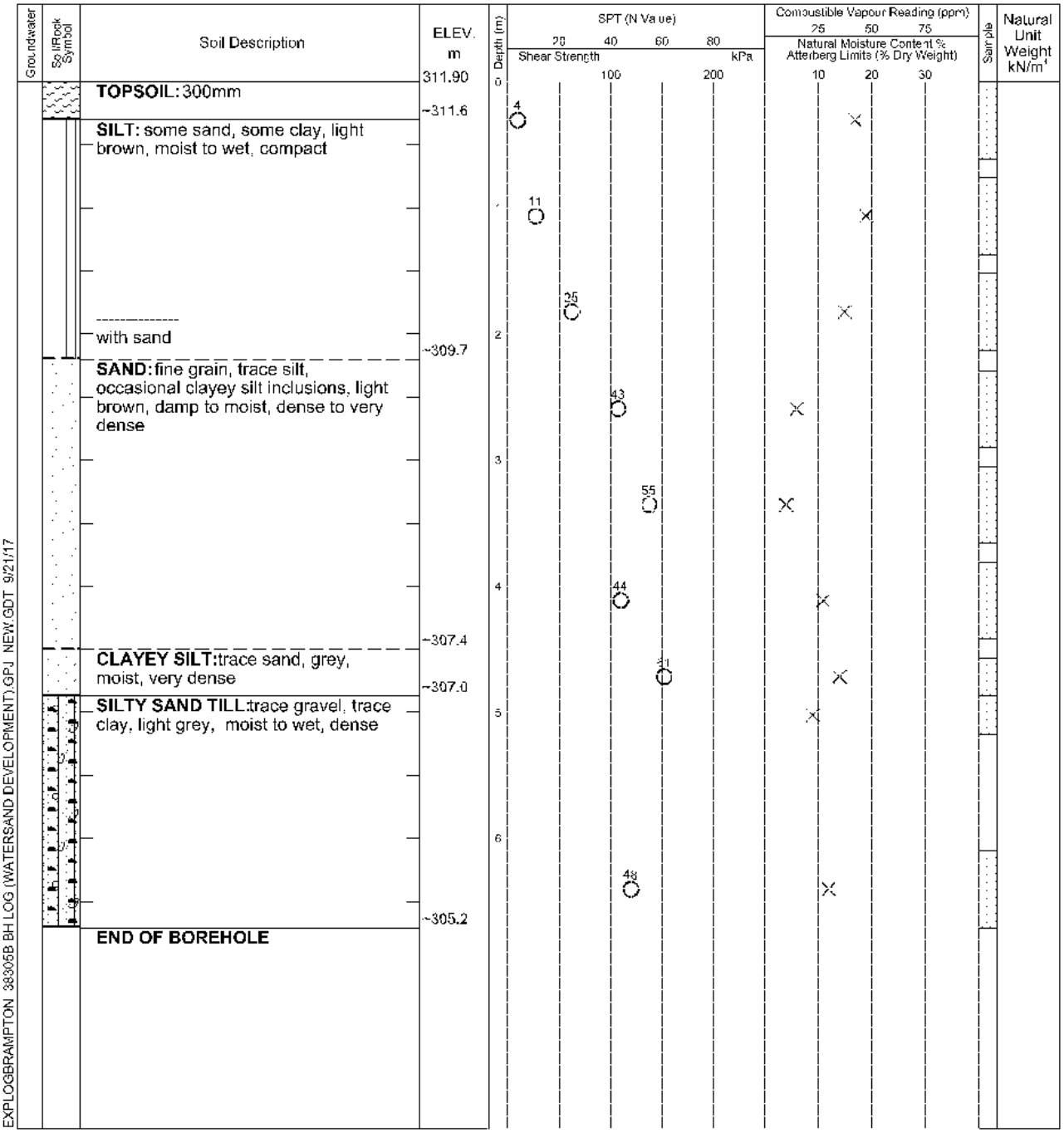
Date Drilled: June 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.79 |

exp.

# Log of Borehole 104

Project No. BRM-00038305-B0 | Drawing No. 112

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Soil Description | ELEV. m | Depth (m) |
|---|---|---|
| **TOPSOIL:** 230mm | 311.68 | 0 |
| | ~311.5 | |
| **SILTY SAND:** light grey, moist, compact to very dense | | |
| occasional interbedded silt seams | | 2 |
| | ~308.0 | 3 |
| **SILTY SAND TILL:** trace gravel, trace clay, grey, moist, dense to very dense | | 4 |
| | | 5 |
| | ~305.5 | 6 |
| **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 4, 14, 17, 37, 51, 48, 67, 50/for 130mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 105

Project No. BRM-00038305-B0 | Drawing No. 113

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 310.73 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, grey, moist to wet, compact to very dense | ~310.5 | |
| | | | ~308.5 | 2 |
| | | **SAND:** fine to medium grain, some silt, trace gravel, grey, damp, very dense | | 3 |
| | | | ~305.2 | 4 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, grey, wet, very dense | | 5 |
| | | | ~304.1 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

Sample | Natural Unit Weight kN/m³

5
10
54
82
98 for 250mm
83 for 280mm
84 for 150mm
93 for 280mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.94 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 106

Project No. BRM-00038305-B0 Drawing No. 114

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 16, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 310.05 | 0 |
| | | **SAND:** fine to medium grain, some silt, light brown, damp to moist, compact to dense | ~309.8 | |
| | | | | 1 |
| | | | | 2 |
| | | | ~307.5 | |
| | | **SILT:** some clay, some sand, light brown, moist, hard | ~307.1 | |
| | | **SAND:** fine to medium grain, some silt, trace gravel, brown, moist to wet, compact to dense | | 3 |
| | | | | 4 |
| | | occasional interbedded silt seams | | 5 |
| | | | | 6 |
| | | | ~303.4 | |
| | | **END OF BOREOLE** | | |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10, 20, 30
Sample
Natural Unit Weight kN/m³

SPT values: 2, 24, 21, 41, 57, 34, 24, 42

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.64 | 5.64 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 107

Project No. BRM-00038305-B0 | Drawing No. 115

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

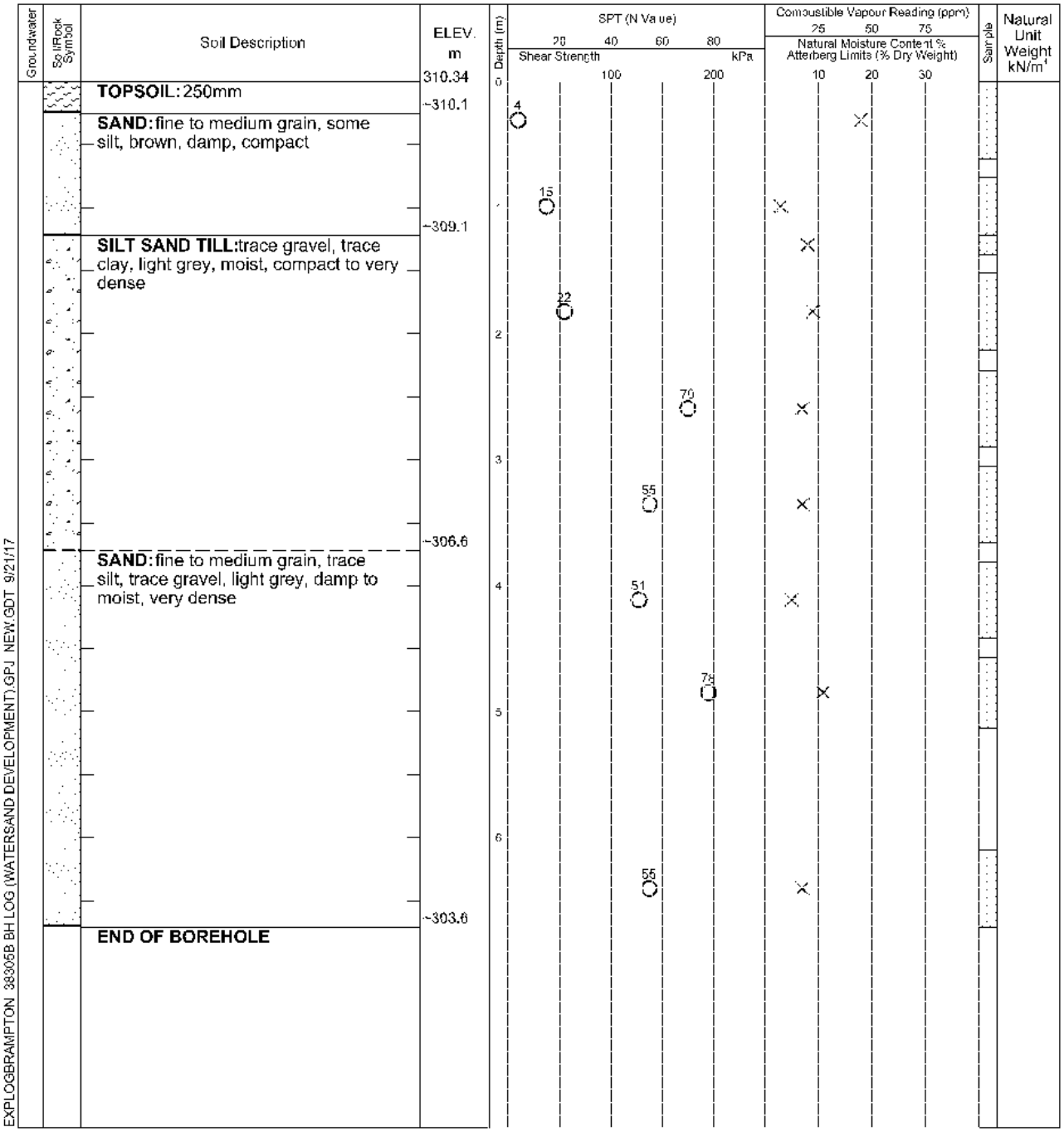
Date Drilled: June 16, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

# Log of Borehole 108

Project No. BRM-00038305-B0 Drawing No. 116

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 23, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 320mm | 310.53 | 0 |
| | | | ~310.2 | |
| | | **SAND:** fine grain, trace silt, trace gravel, trace rootlets, brown, wet, compact to dense | | |
| | | some gravel, damp | | 1 |
| | | | ~308.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, loose to compact | | 2 |
| | | some clay | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~303.9 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

11, 45, 37, 32, 84 for 230mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.64 | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 109

Project No. BRM-00038305-B0 | Drawing No. 117

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

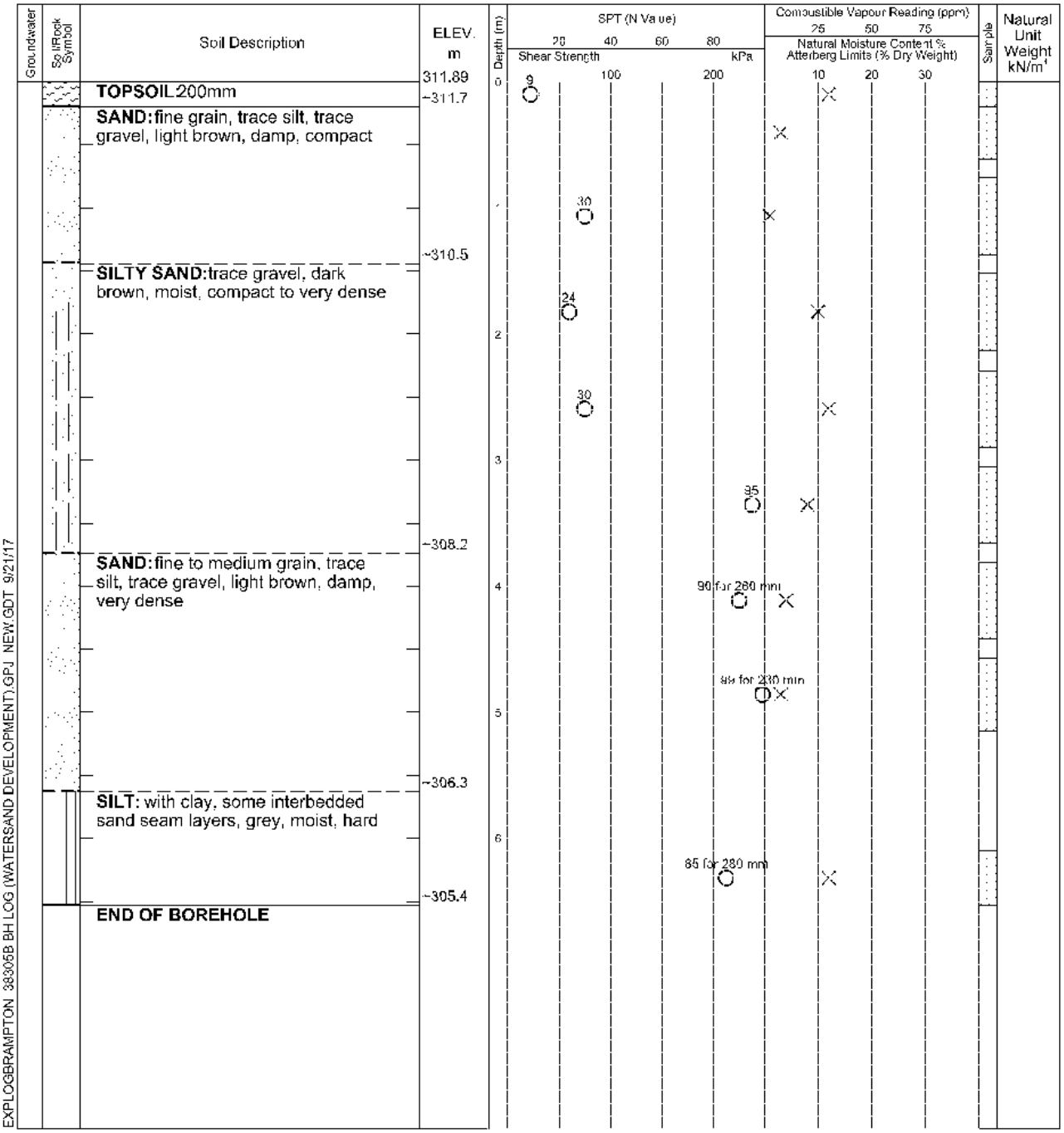
Date Drilled: June 13 & 14, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.94 |

# Log of Borehole 111

Project No. BRM-00038305-B0 | Drawing No. 118

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

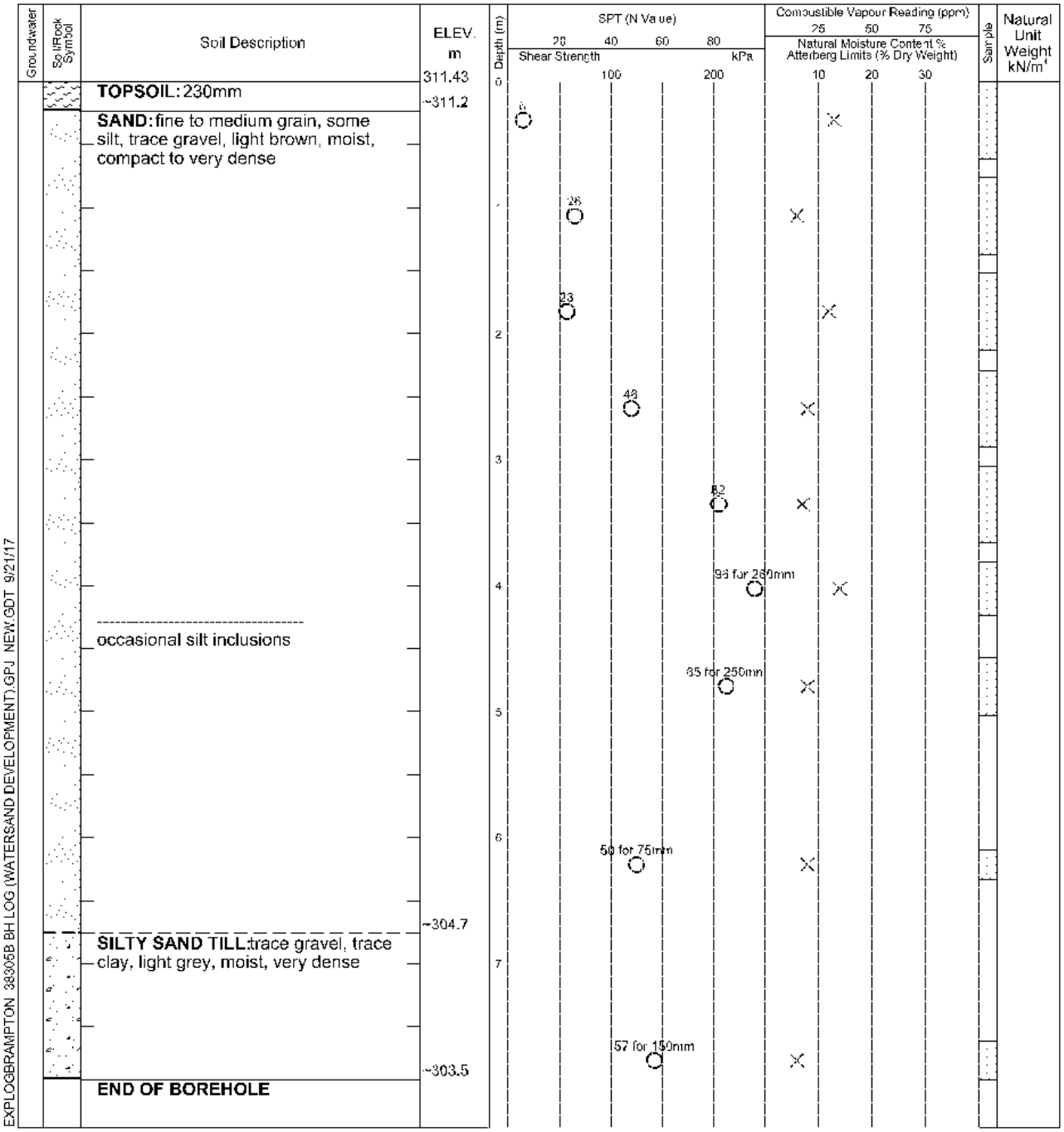
Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.62 |

# Log of Borehole 112

Project No. BRM-00038305-B0 | Drawing No. 119

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 22, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 311.89 | 0 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, moist, compact | ~311.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, dense | ~310.5 | 2 |
| | | **SAND:** fine to medium grain, some silt, trace gravel, light grey, damp to moist, dense to very dense | ~308.9 | 3 |
| | | **END OF BOREHOLE** | ~305.3 | 6 |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

3 18 38 32 44 91 for 280mm 38 88

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 114

Project No. BRM-00038305-B0 | Drawing No. 120

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

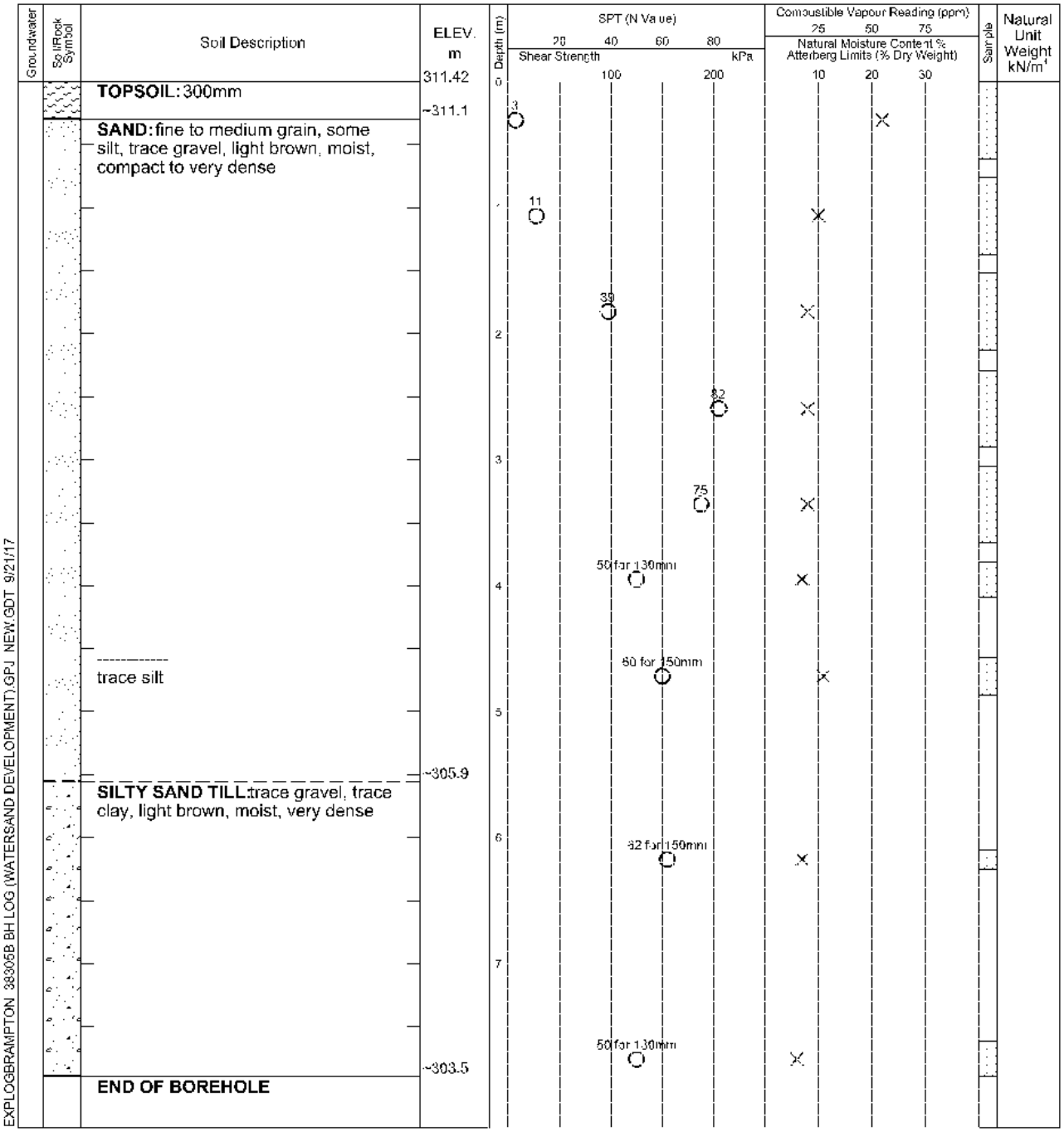
Date Drilled: June 23, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.32 |

# Log of Borehole 115

Project No. BRM-00038305-B0 Drawing No. 121

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

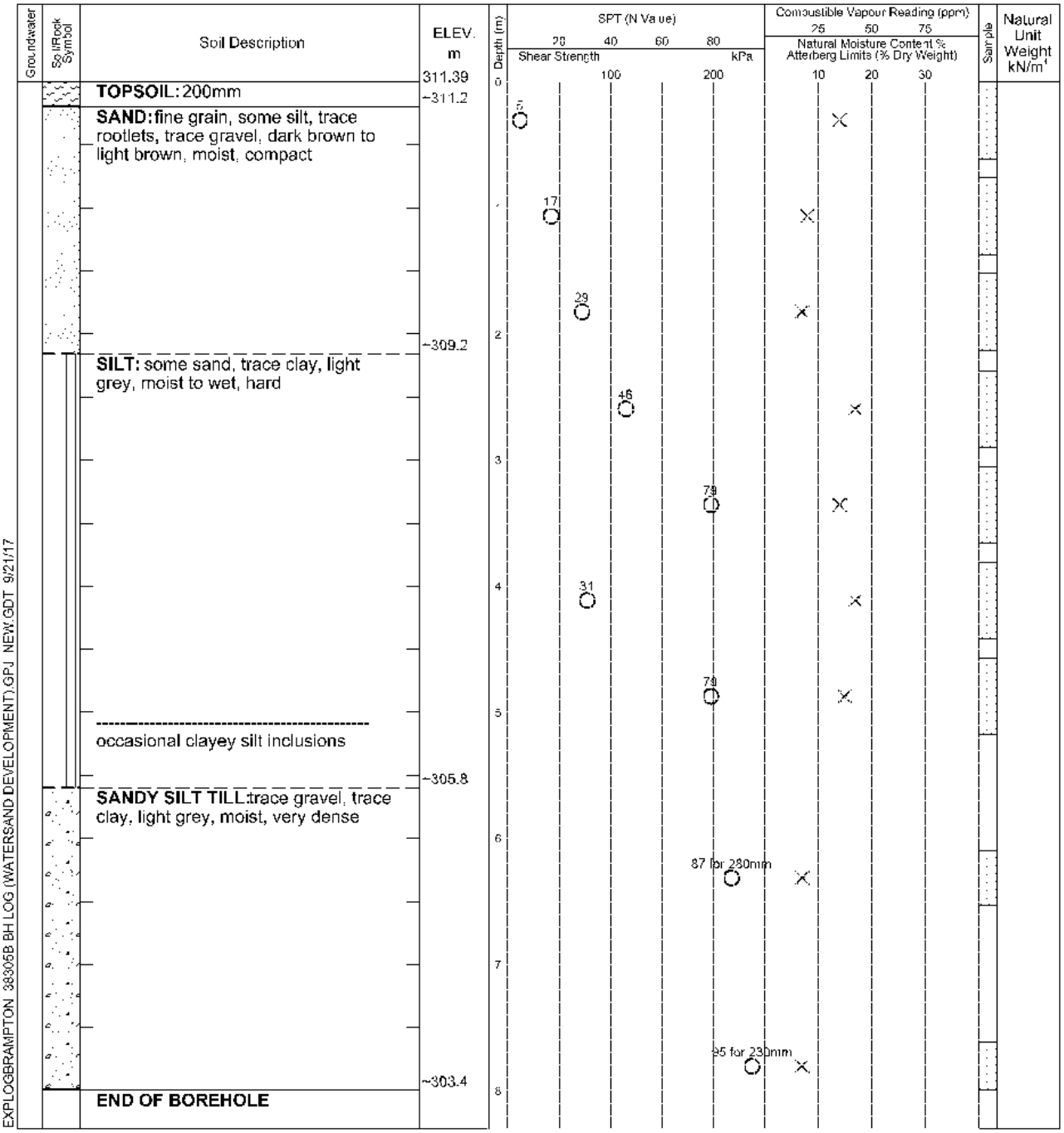
Date Drilled: June 23, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.62 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 118

Project No. BRM-00038305-B0 Drawing No. 122

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 12, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 350mm | 312.06 | 0 |
| | | | ~311.7 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist to wet, loose to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | ~304.0 | 8 |
| | | **SILTY CLAY:** trace sand, trace | | |

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

4
6
15
19
33
55
69
72
89 for 280mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 13.72 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 118

Project No. BRM-00038305-B0 Drawing No. 122

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) / Shear Strength kPa | Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | gravel, grey, damp to moist, very dense | 303.76 | | | | | |
| | | **SILTY SAND:** grey, moist, very dense | ~302.7 | 9 | 97 for 250mm | | | |
| | | **SILTY CLAY :** trace sand, trace gravel, grey, moist, hard | ~301.3 | 10 | 50 for 100mm | | | |
| | | | | 11 | | | | |
| | | | | 12 | 90 for 230mm | | | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, grey, moist, very dense | ~299.0 | 13 | 50 for 100mm | | | |
| | | **END OF BOREHOLE** | ~298.3 | | | | | |

SPT (N Value): 20, 40, 60, 80
Shear Strength kPa: 100, 200
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 13.72 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 119

Project No. BRM-00038305-B0 Drawing No. 123

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

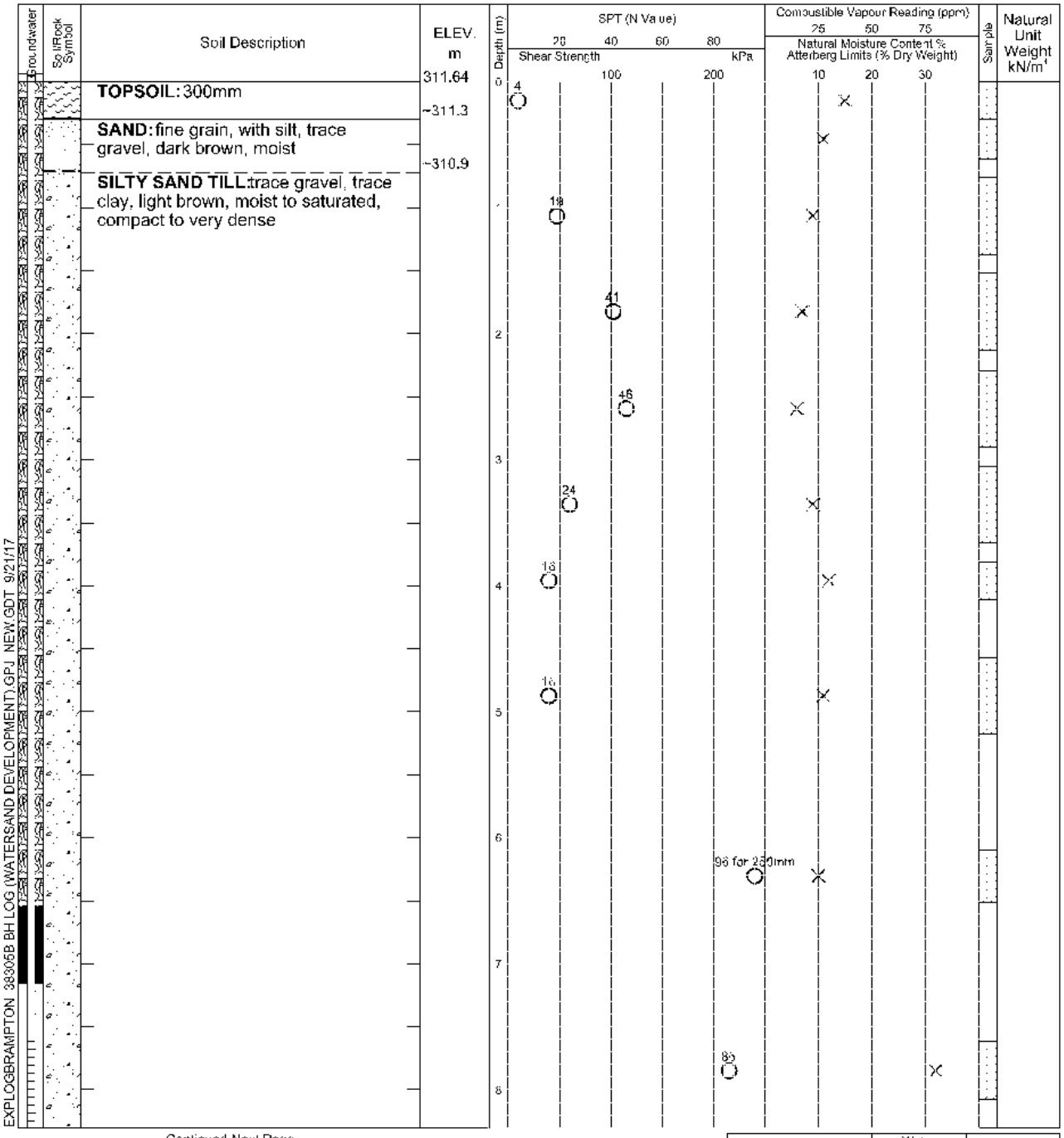
Date Drilled: July 7, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



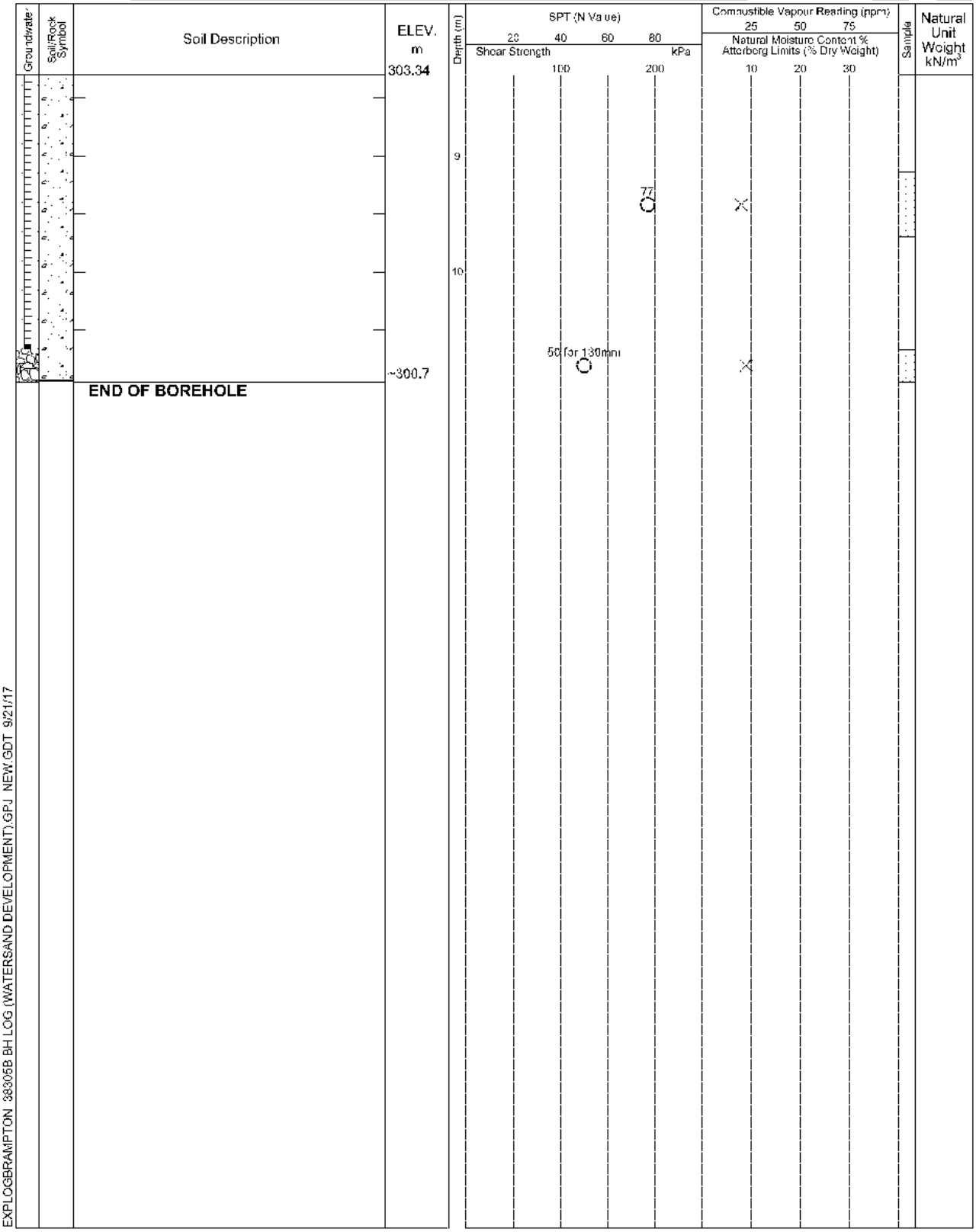

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 10.21 | - |
| July 24, 2017 | 8.36 | - |
| August 10, 2017 | 8.88 | - |

# Log of Borehole 119

Project No. BRM-00038305-B0 Drawing No. 123

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 10.21 | - |
| July 24, 2017 | 8.36 | - |
| August 10, 2017 | 8.88 | - |

# Log of Borehole 120

Project No. BRM-00038305-B0 Drawing No. 124

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 15, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 311.64 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, compact | ~311.4 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, damp, dense to very dense | ~307.1 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | ~304.4 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

SPT values: 5, 10, 19, 16, 15, 28, 70, 42, 67

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.36 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 120

Project No. BRM-00038305-B0 Drawing No. 124

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) / Shear Strength kPa | Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight) | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 303.34 | | 20 40 60 80 / 100 200 | 25 50 75 / 10 20 30 | | |
| | | | ~303.1 | | | | | |
| | | **SAND:** fine grain, trace silt, trace gravel, grey, moist, very dense | | 9 | 50 for 130mm | | | |
| | | | ~301.8 | | | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | 10 | 97 for 230mm | | | |
| | | | ~300.7 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.36 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 121

Project No. BRM-00038305-B0 | Drawing No. 125

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

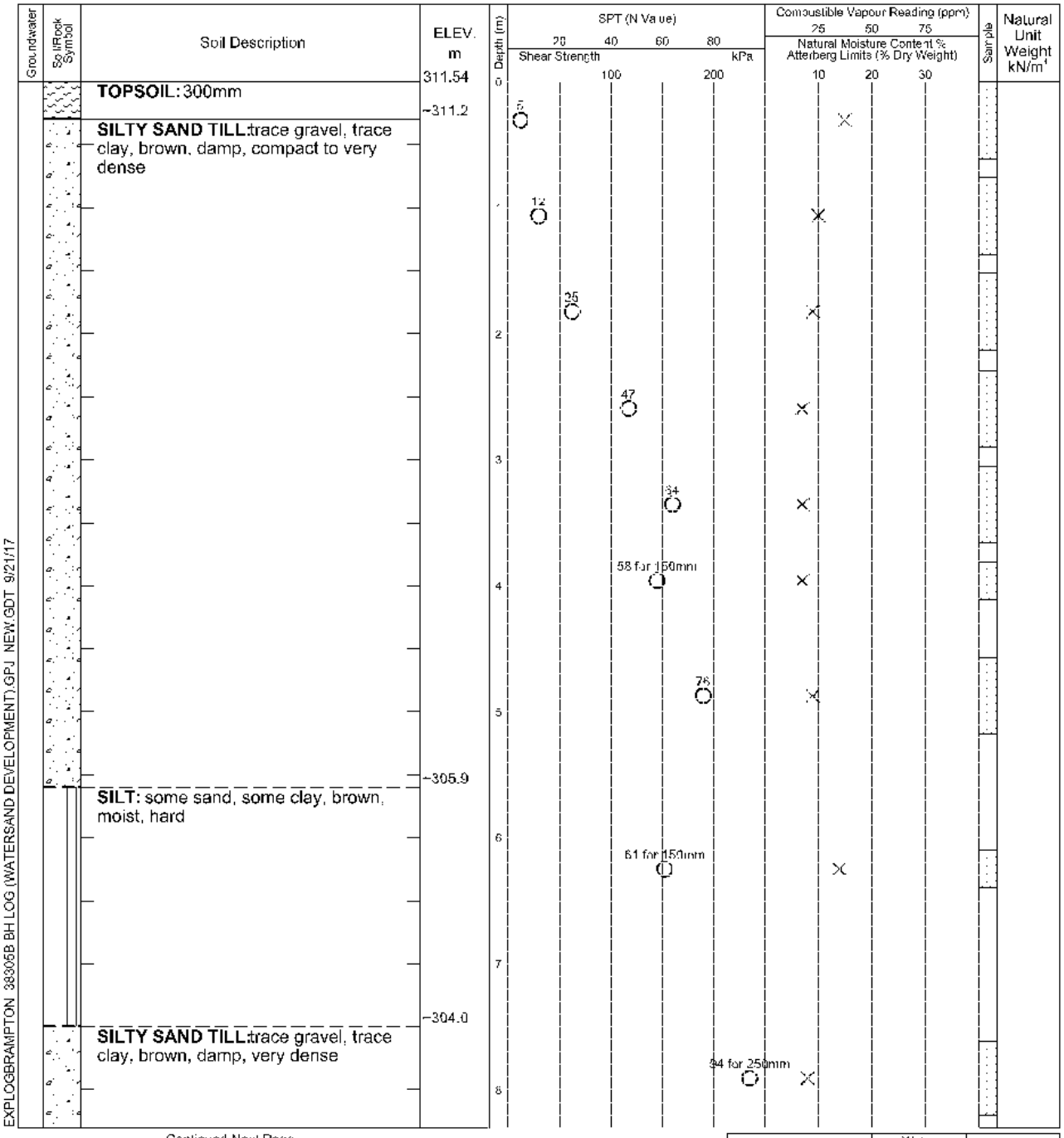
Date Drilled: June 15, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.67 |

# Log of Borehole 121

Project No. BRM-00038305-B0 Drawing No. 125

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Attorberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 303.24 | | | | | |
| | | | | 9 | 50 for 130mm | X | | |
| | | | | 10 | | | | |
| | | | ~301.2 | | | | | |
| | | **SAND:** fine to medium grain, some gravel, trace silt, brown, damp, very dense | | | 55 for 75mm | X | | |
| | | | ~300.8 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.67 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 122

Project No. BRM-00038305-B0 | Drawing No. 126

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

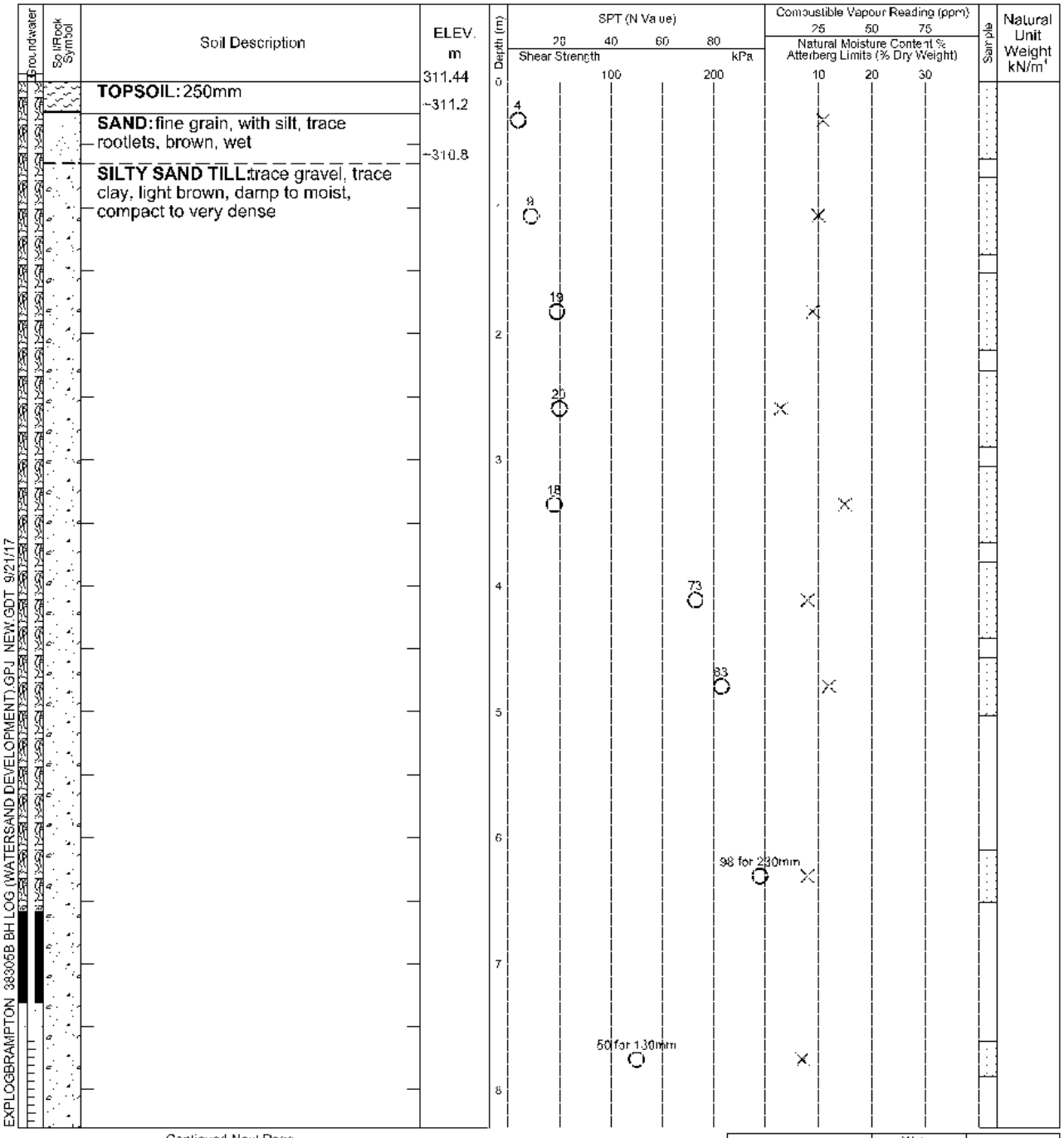
Date Drilled: July 7, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 10, 2017 | Dry | - |

# Log of Borehole 122

Project No. BRM-00038305-B0 Drawing No. 126

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 303.14 | | | | | |
| | | | | 9 | 50 for 100mm | | | |
| | | | ~301.8 | | | | | |
| | | **SAND:** fine to medium grain, trace silt, brown, damp, very dense | | 10 | | | | |
| | | | | | 50 for 150mm | | | |
| | | | ~300.5 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| July 24, 2017 | Dry | - |
| August 10, 2017 | Dry | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 123

Project No. BRM-00038305-B0 | Drawing No. 127

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

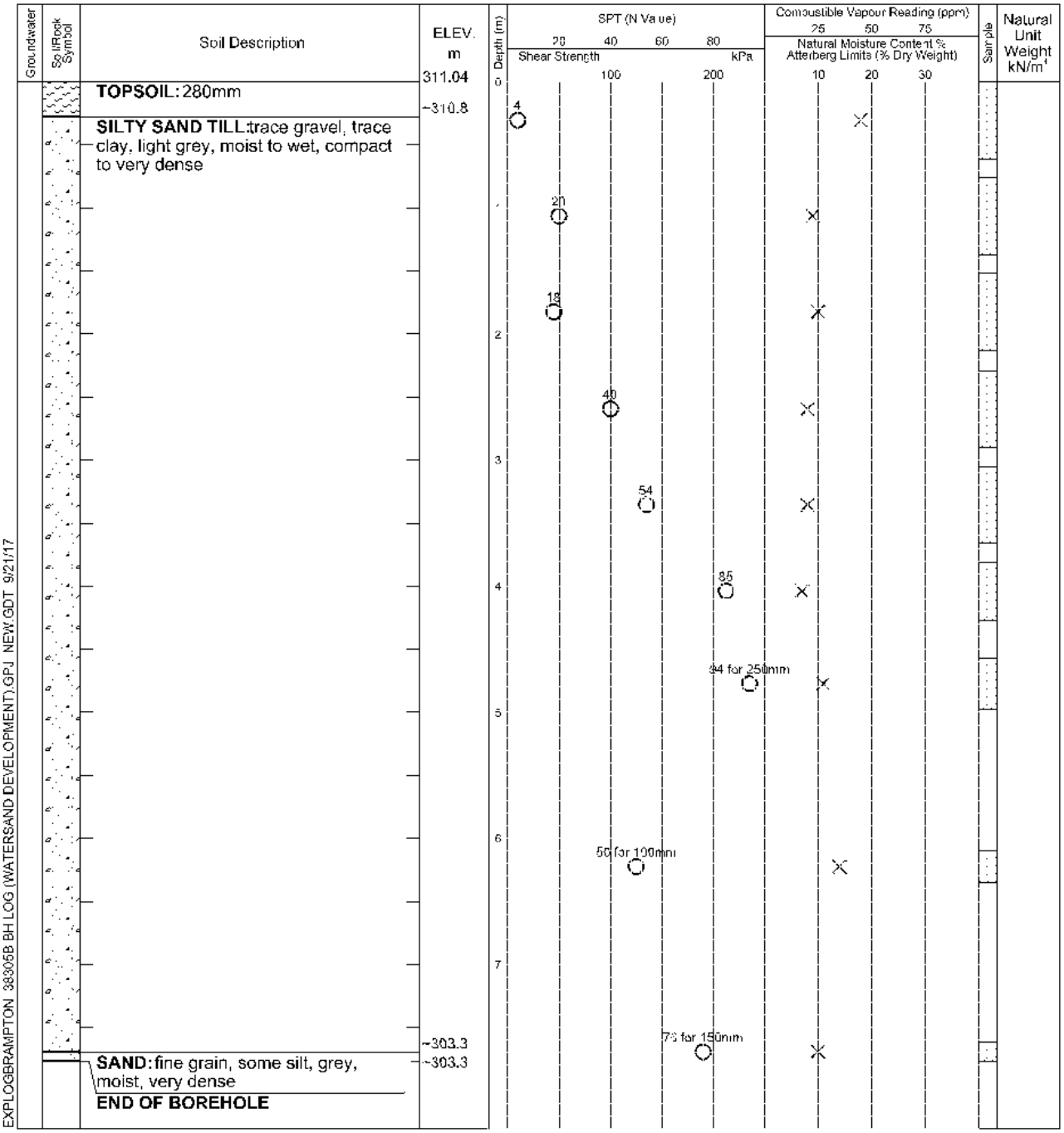
Date Drilled: June 16, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.62 |

# Log of Borehole 124

Project No. BRM-00038305-B0 | Drawing No. 128

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

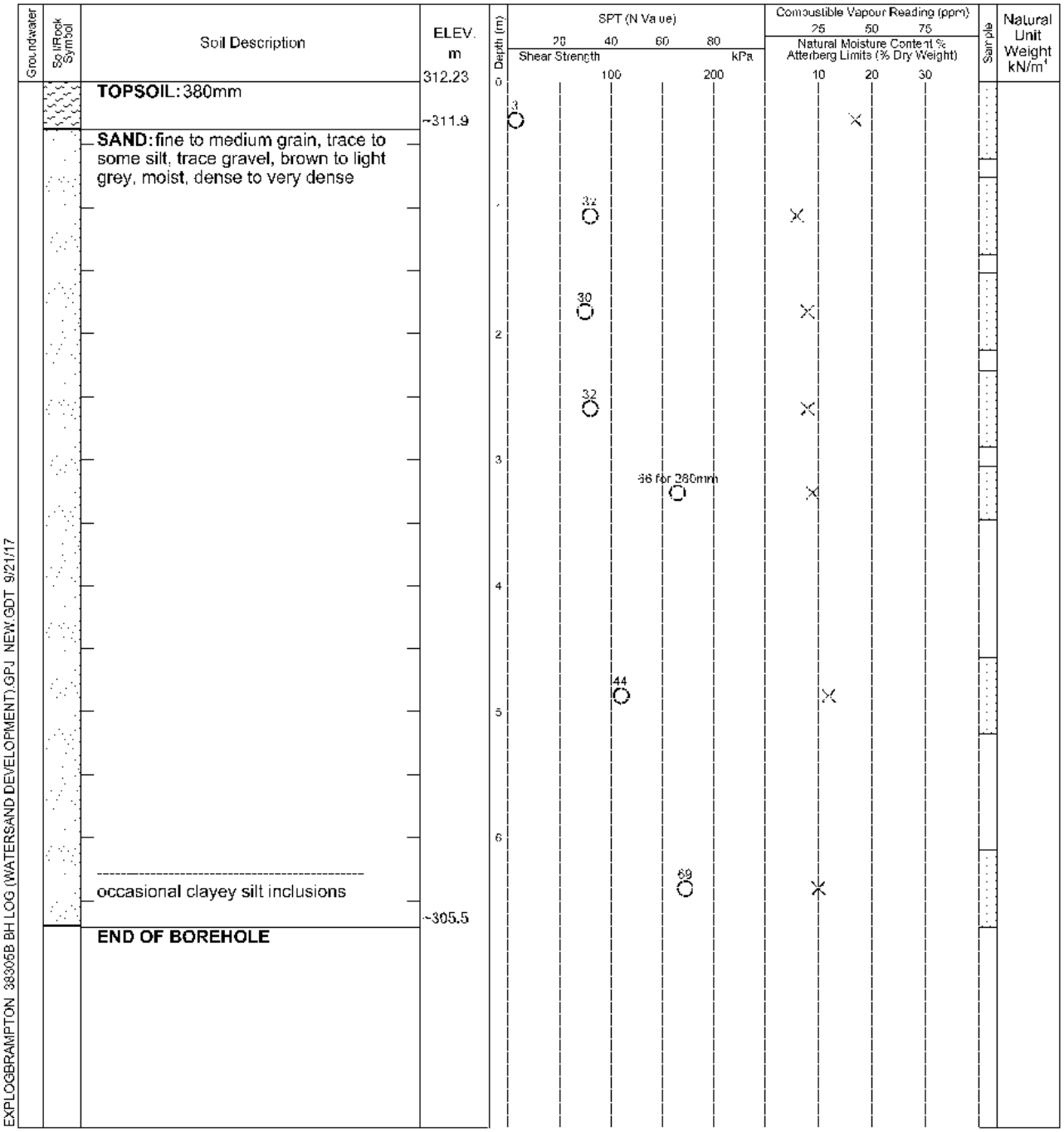
Date Drilled: June 12, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 125

Project No. BRM-00038305-B0 Drawing No. 129

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

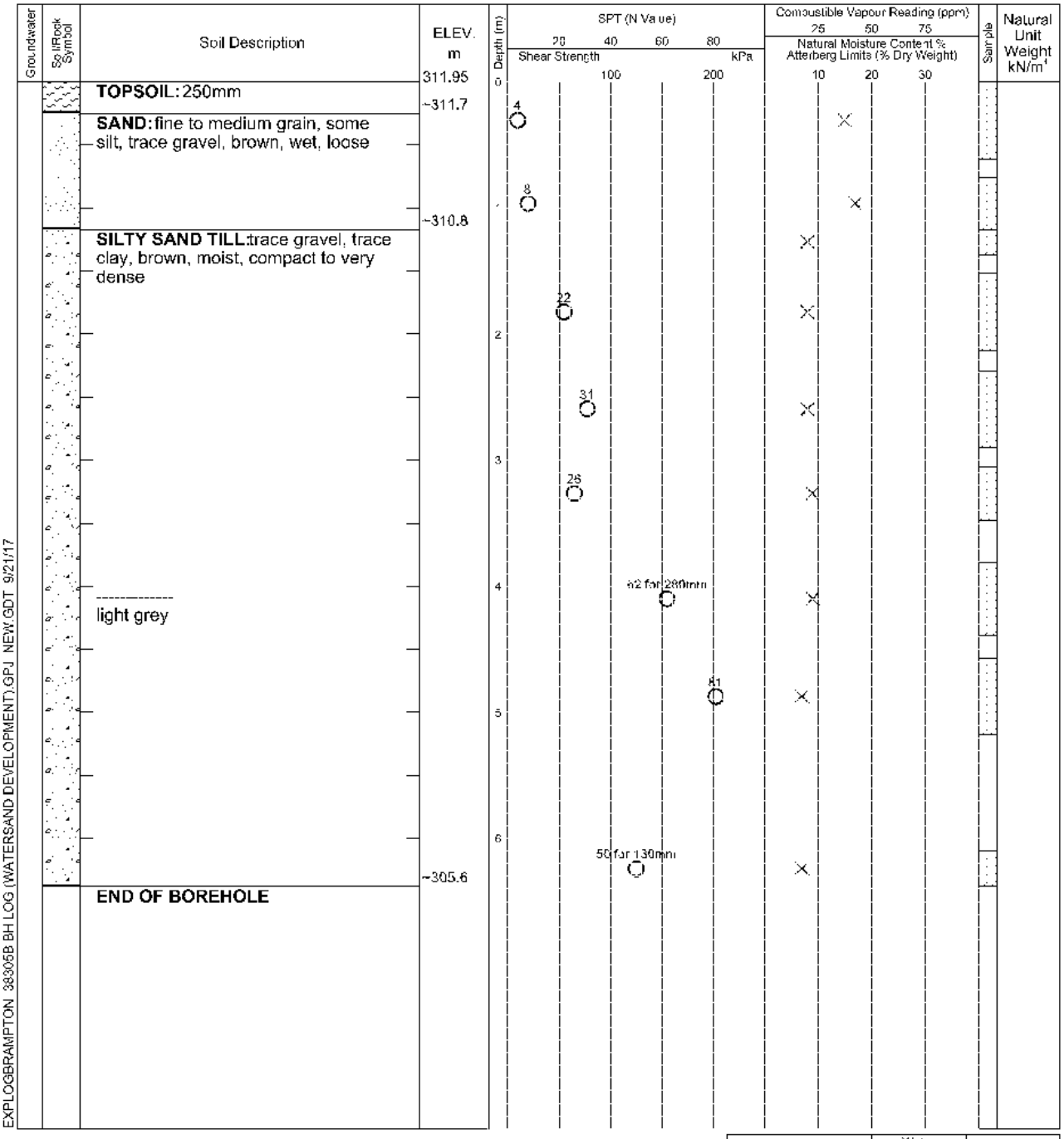
Date Drilled: June 15, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

# Log of Borehole 126

Project No. BRM-00038305-B0 | Drawing No. 130

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

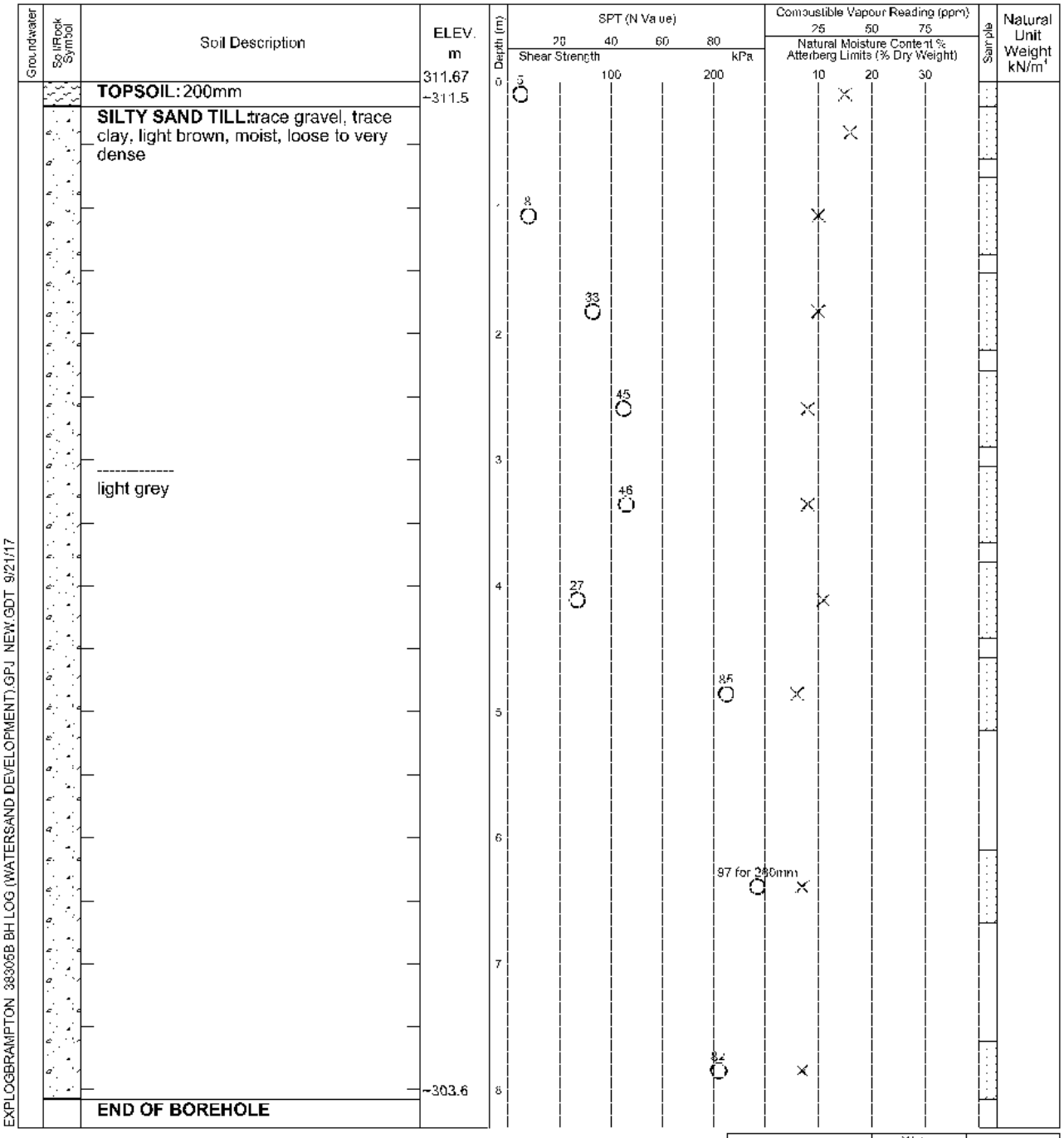
Date Drilled: June 15, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.32 |

exp.

# Log of Borehole 127

Project No. BRM-00038305-B0 | Drawing No. 131

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

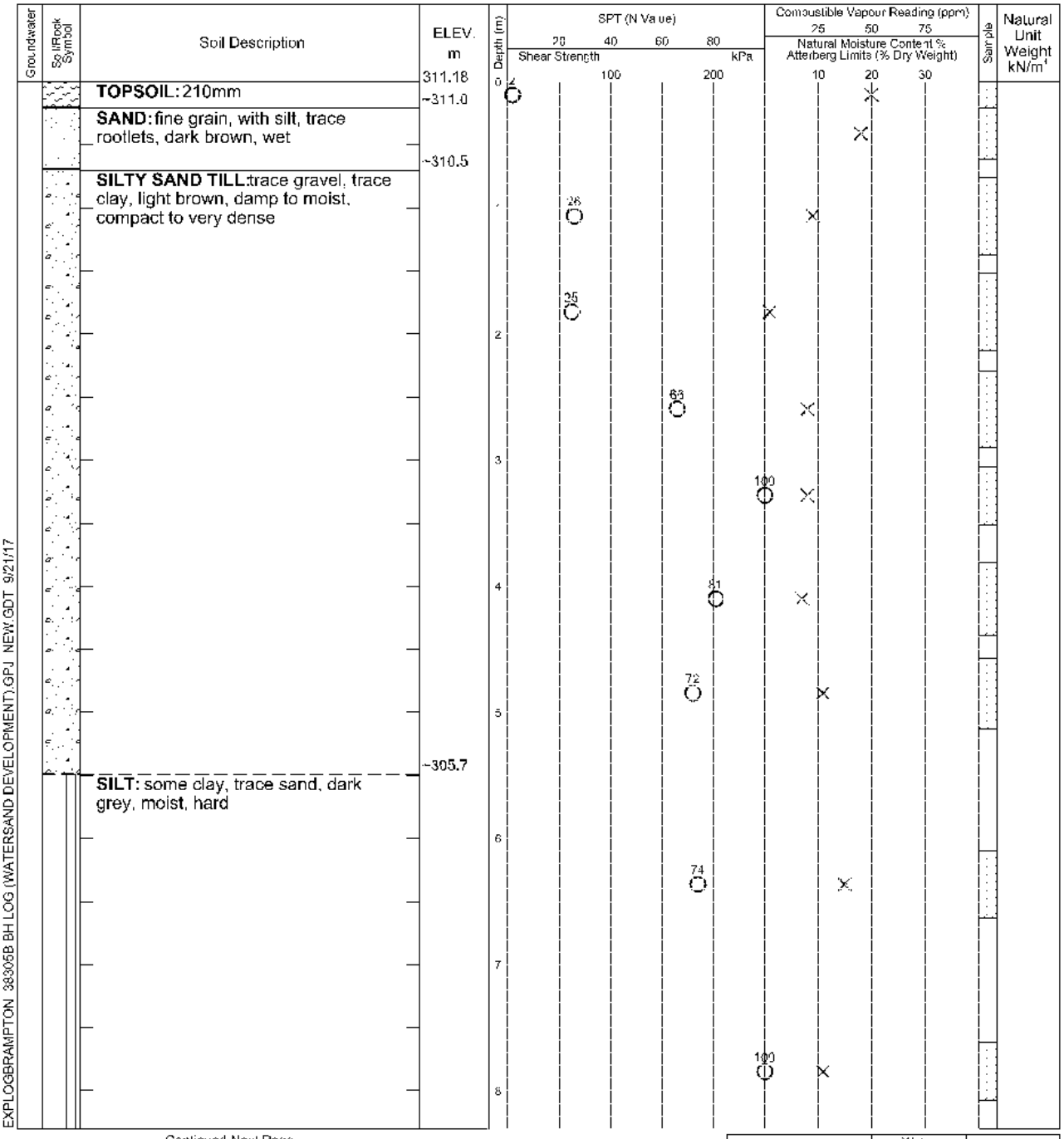
Date Drilled: June 26, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 13.11 | 13.56 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 127

Project No. BRM-00038305-B0 Drawing No. 131

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 302.88 | | | | | |
| | | | | 9 | 96 | | | |
| | | | | 10 | | | | |
| | | | ~301.0 | | | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist to wet, very dense | | | 50 for 130mm | | | |
| | | | | 11 | | | | |
| | | | | 12 | 80 for 75mm | | | |
| | | | | 13 | | | | |
| | | | | | 61 for 150mm | | | |
| | | | ~297.3 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 13.11 | 13.56 |

exp.

# Log of Borehole 128

Project No. BRM-00038305-B0 Drawing No. 132

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

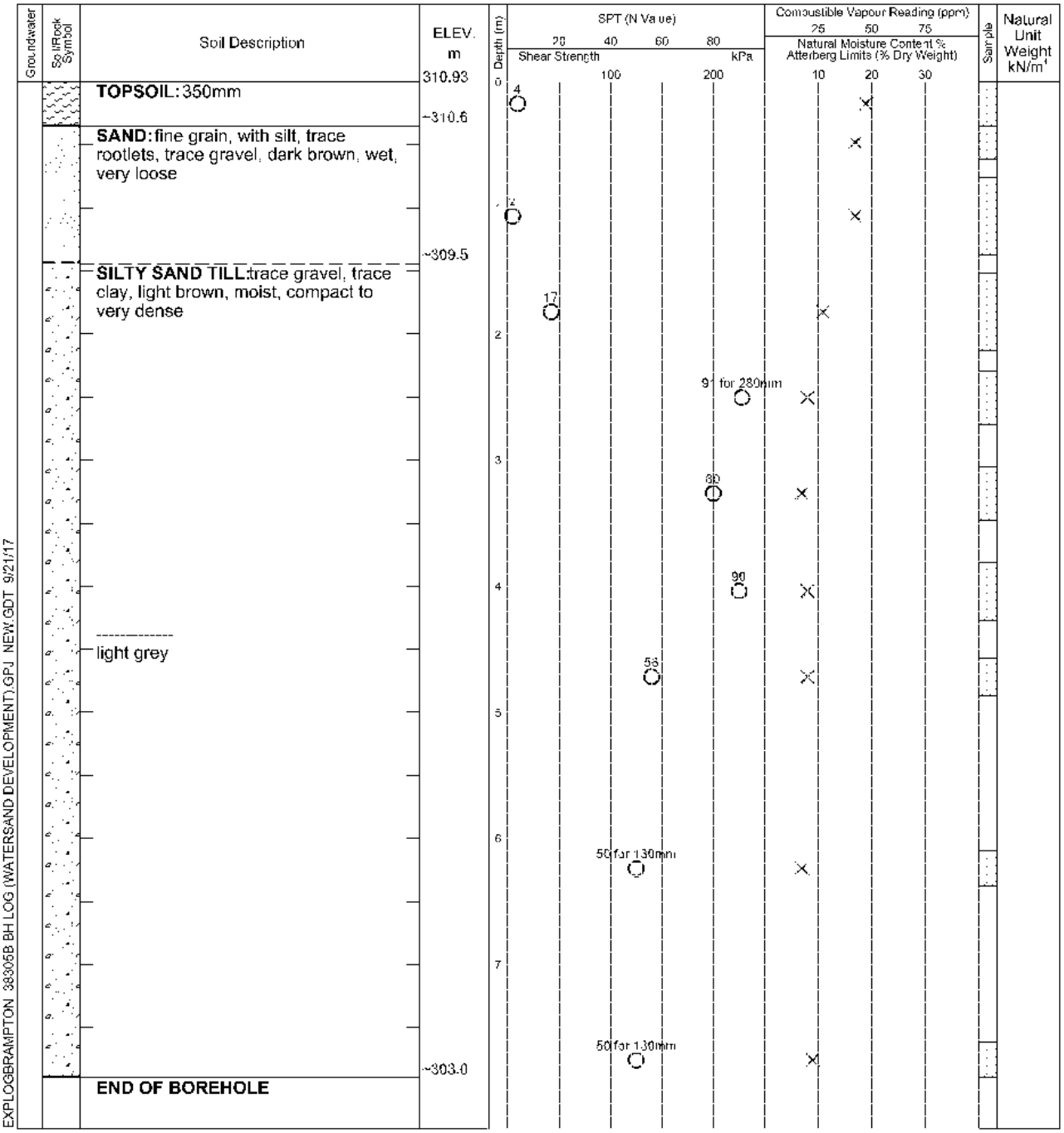
Date Drilled: June 26, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.47 |

# Log of Borehole 129

Project No. BRM-00038305-B0 | Drawing No. 133

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 27, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Soil Description | ELEV. m | Depth (m) |
|---|---|---|
| **TOPSOIL:** 300mm | 310.17 | 0 |
| | ~309.9 | |
| **SAND:** fine grain, with silt, trace gravel, dark brown, moist, very loose | | |
| | ~308.7 | |
| **SAND:** fine to medium grain, some silt, trace gravel, occasional silty clay inclusions, light brown, damp to moist, compact to very dense | | 2 |
| | ~306.5 | 3 |
| **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | | 4 |
| | ~304.7 | 5 |
| **SAND:** fine to medium grain, some gravel, occasional silty clay inclusions, brown, damp, very dense | | 6 |
| | ~303.2 | 7 |
| **SILT:** some sand, some clay, trace gravel, light brown, moist, hard | | |
| | ~302.3 | |
| **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 3, 2, 10, 41, 50, 50 for 130mm, 50 for 130mm, 50 for 100mm, 50 for 75mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.47 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 130

Project No. BRM-00038305-B0 | Drawing No. 134

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

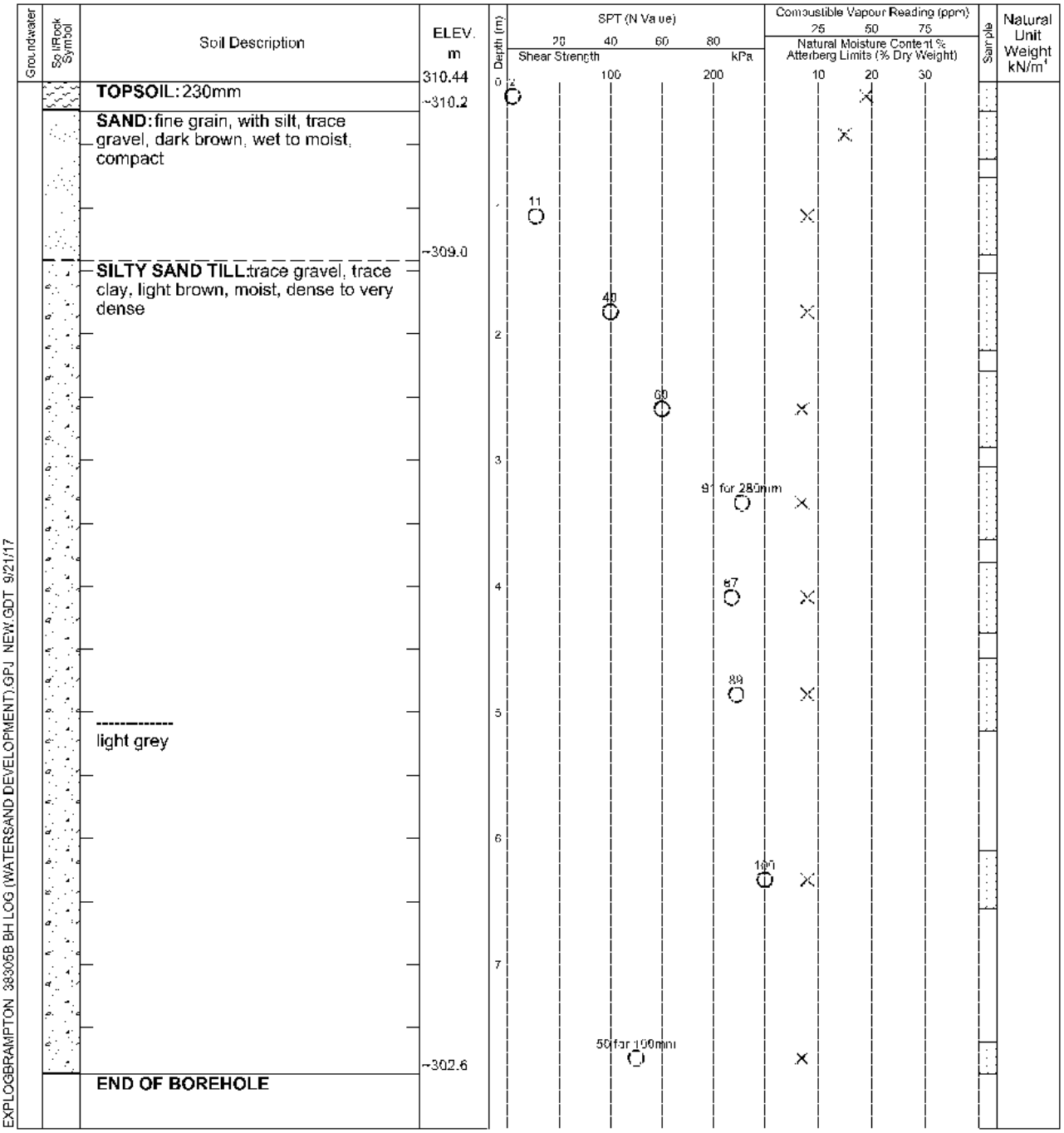
Date Drilled: June 27, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.62 |

# Log of Borehole 131

Project No. BRM-00038305-B0 | Drawing No. 135

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

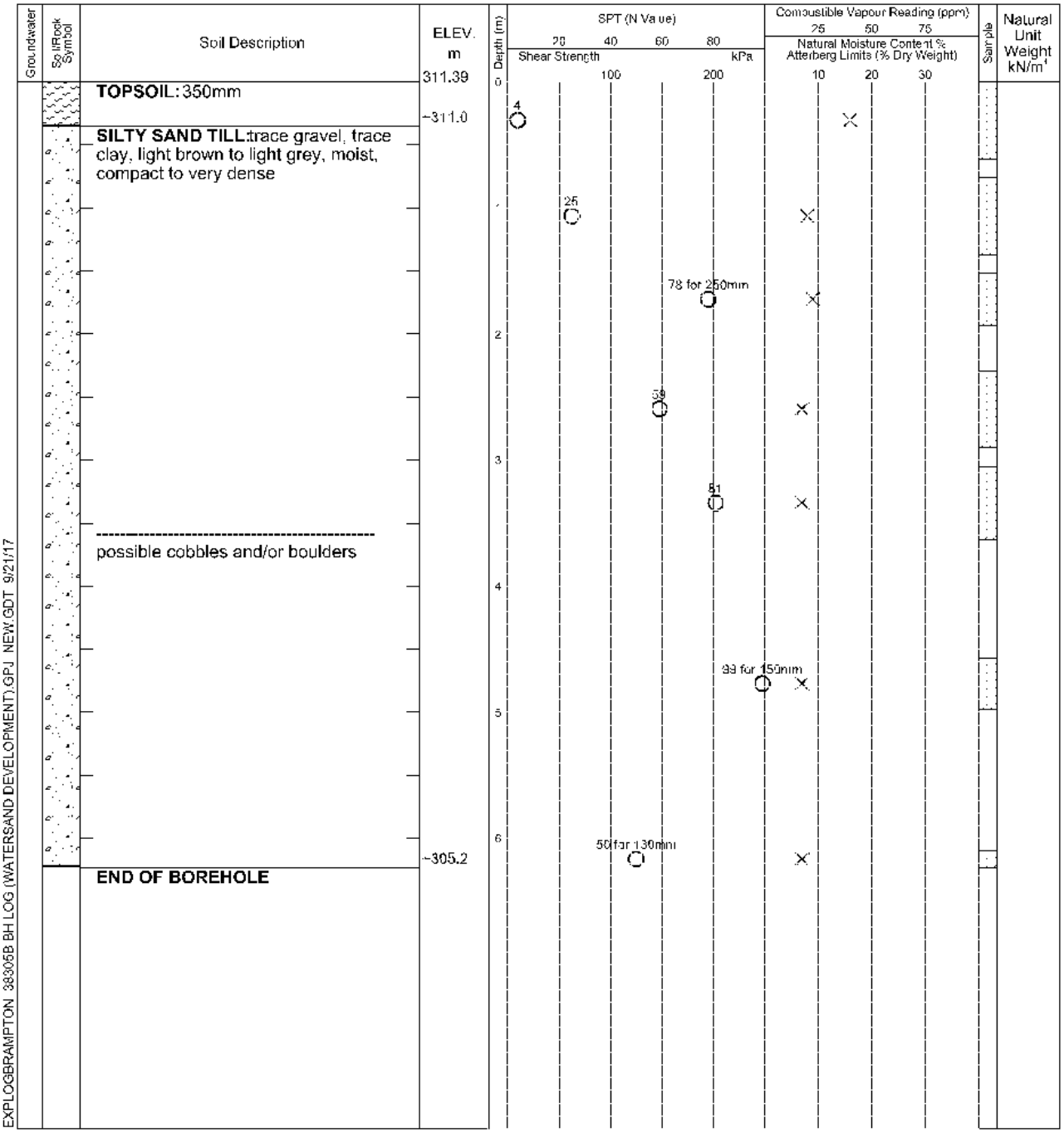
Date Drilled: June 12, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 132

Project No. BRM-00038305-B0 Drawing No. 136

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

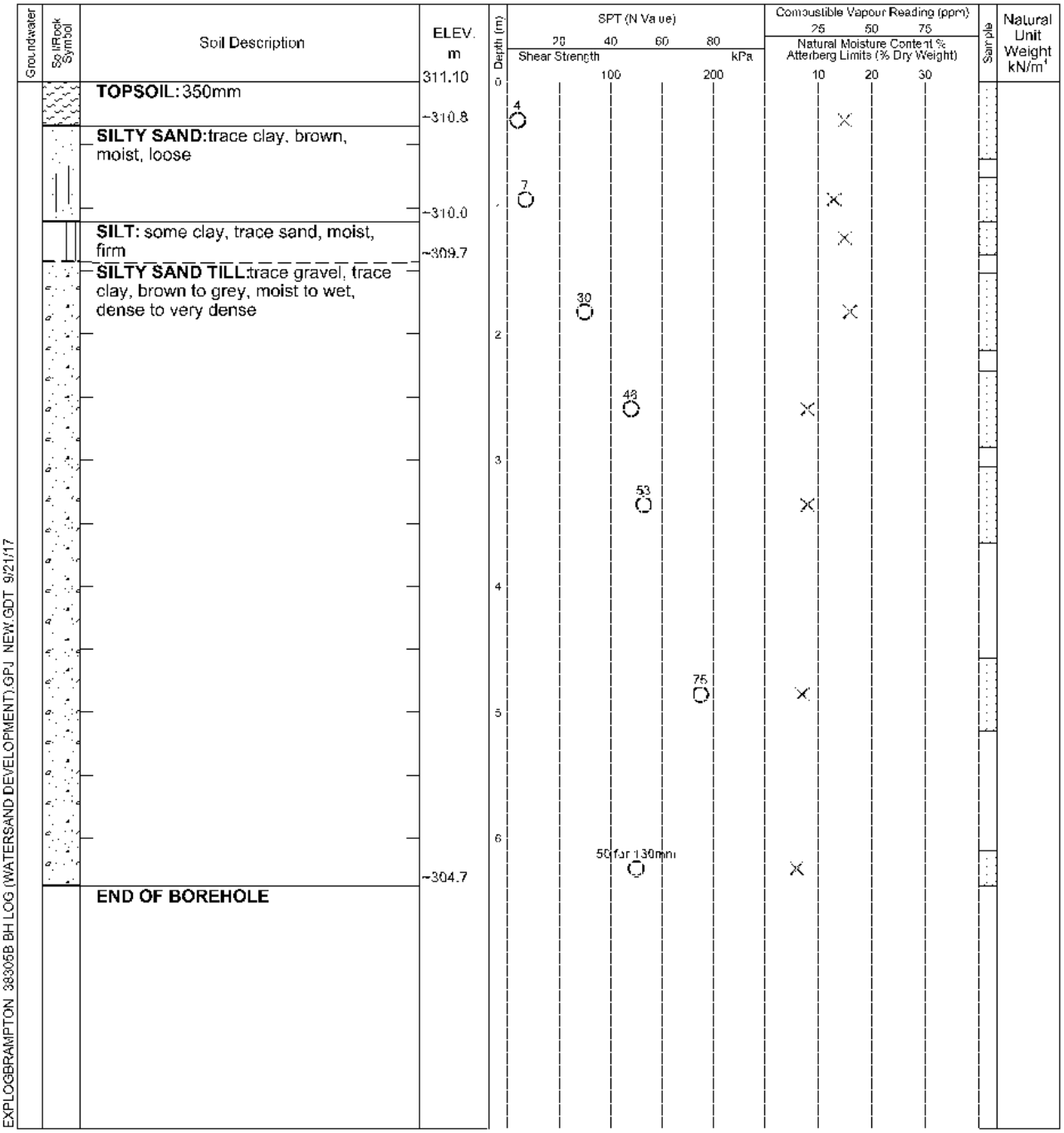
Date Drilled: June 12, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 5.97 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 133

Project No. BRM-00038305-B0 | Drawing No. 137

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 12, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230mm | 310.61 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown to grey, moist, compact to dense | ~310.4 | |
| | | | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | **SAND:** fine grain, trace silt, trace gravel, grey, moist, dense | ~307.1 | |
| | | | ~306.4 | 4 |
| | | **SILTY SAND:** trace gravel, trace clay, occasional silt inclusions, grey, moist, very dense | | 5 |
| | | | | 6 |
| | | | ~304.1 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

5
25
35
50
46
47
94 for 280mm

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

exp.

# Log of Borehole 134

Project No. BRM-00038305-B0 | Drawing No. 138

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 27, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 310.81 | 0 |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, wet | ~310.5 | |
| | | **SILTY SAND TILL:** trace to some gravel, trace clay, brown, moist, loose to dense | ~310.1 | |
| | | **SILT:** some clay, some sand, trace gravel, grey, moist, hard | ~307.8 | 3 |
| | | occasional interbedded sand seams | ~306.3 | 4 |
| | | **SAND:** fine grain, trace silt, brown, damp, very dense | ~305.2 | 5 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light brown, moist, very dense | ~304.6 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

3, 8, 33, 16, 35, 84, 50, 50/0.100mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 135

Project No. BRM-00038305-B0 | Drawing No. 139

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 27, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 310.24 | 0 |
| | | | ~310.0 | |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, moist | ~309.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, moist, very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | ---------- light grey | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~303.8 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

53
78
50
50 for 100mm
30
50 for 150mm
93

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.10 | 5.33 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole A1

Project No. BRM-00038305-B0 | Drawing No. 140

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

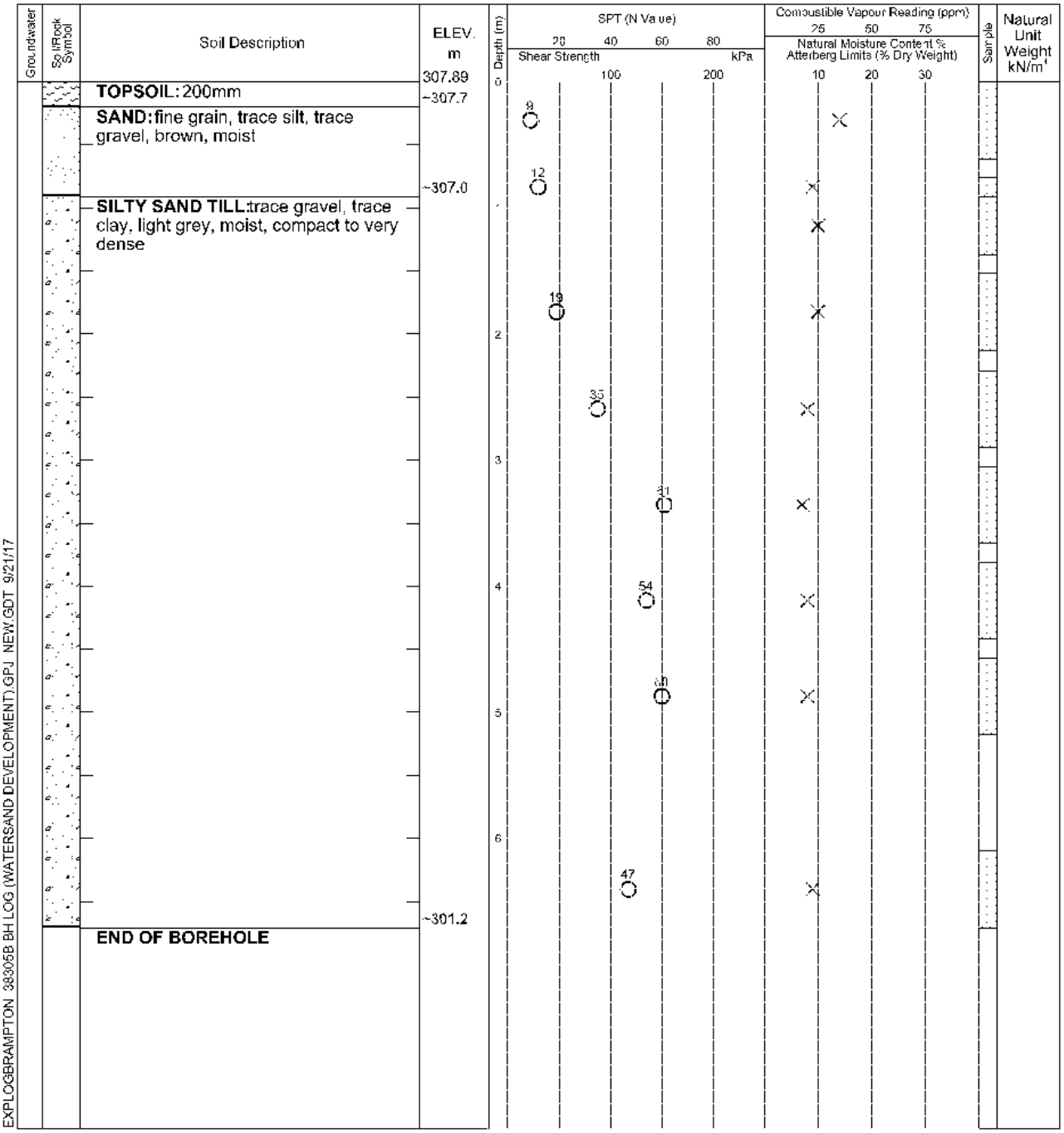
Date Drilled: June 20, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 5.79 | 6.10 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole A2-D

Project No. BRM-00038305-B0 Drawing No. 141

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

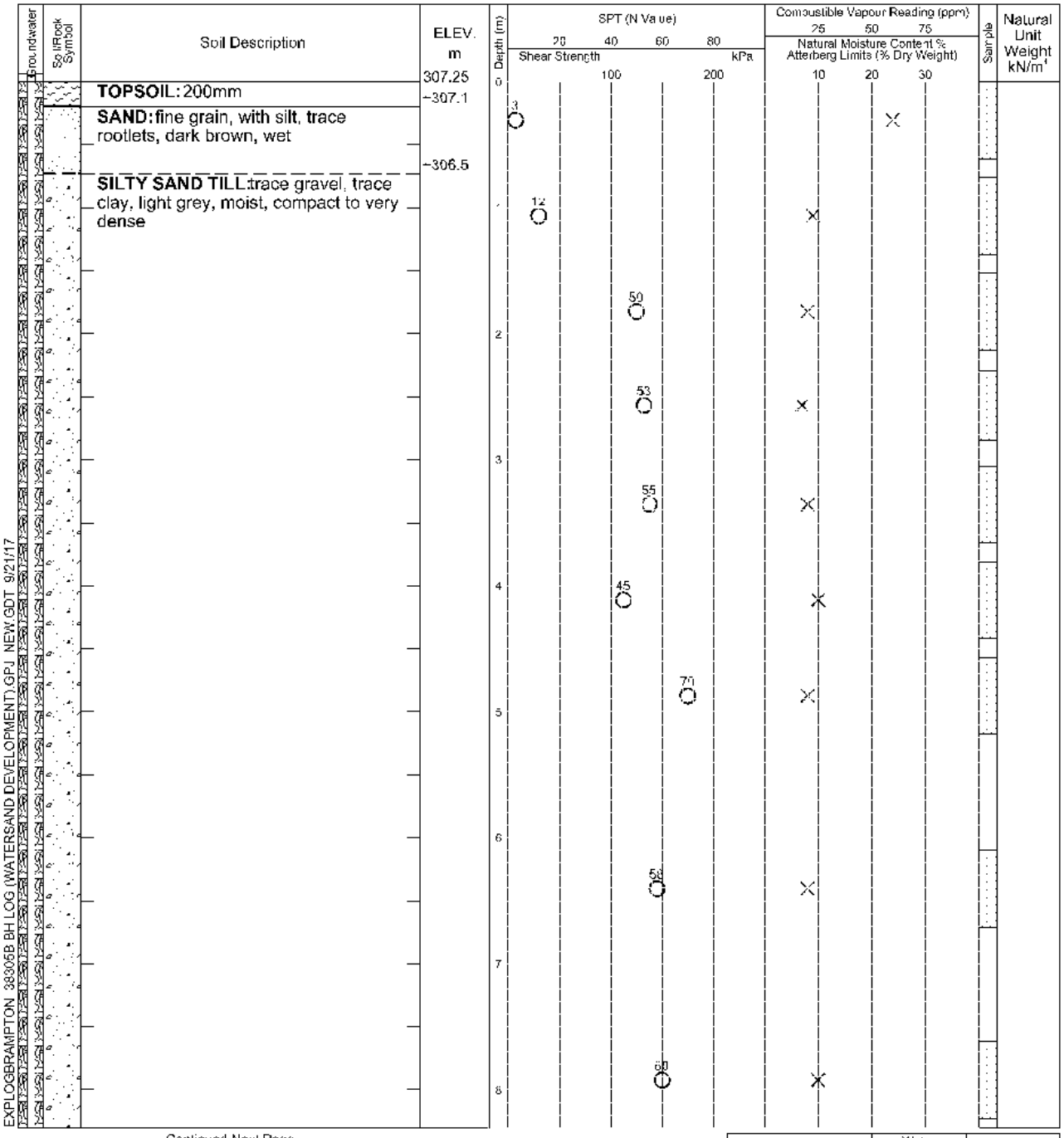
Date Drilled: July 4, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




Continued Next Page

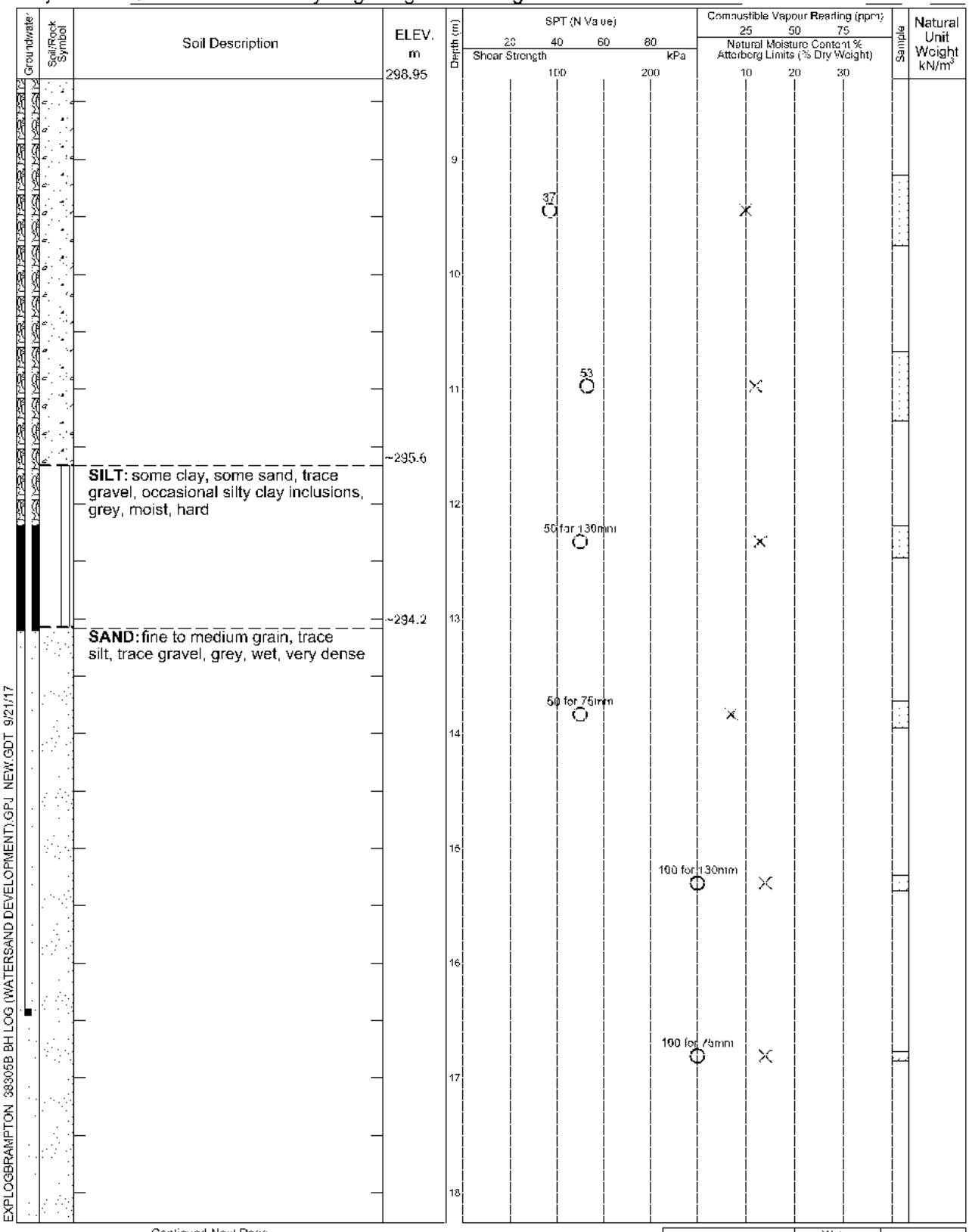
| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.01 | - |
| August 9, 2017 | 14.04 | - |
| August 17, 2017 | 13.97 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole A2-D

Project No. BRM-00038305-B0 Drawing No. 141

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.01 | - |
| August 9, 2017 | 14.04 | - |
| August 17, 2017 | 13.97 | - |

# Log of Borehole A2-D

Project No. BRM-00038305-B0 Drawing No. 141

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 288.99 | | | | | |
| | | | ~288.8 | | 100 for 150mm | | | |
| | | **END OF BOREHOLE** | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.01 | - |
| August 9, 2017 | 14.04 | - |
| August 17, 2017 | 13.97 | - |

exp.

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole A2-S

Project No. BRM-00038305-B0 | Drawing No. 142

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 4, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 307.25 | 0 |
| | | **SAND:** fine grain, with silt, trace rootlets, dark brown, wet | ~307.1 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, compact to very dense | ~306.5 | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | ~301.2 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 1.95 | - |
| August 9, 2017 | 2.38 | - |
| August 17, 2017 | 2.54 | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole A3-D

Project No. BRM-00038305-B0 | Drawing No. 143

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

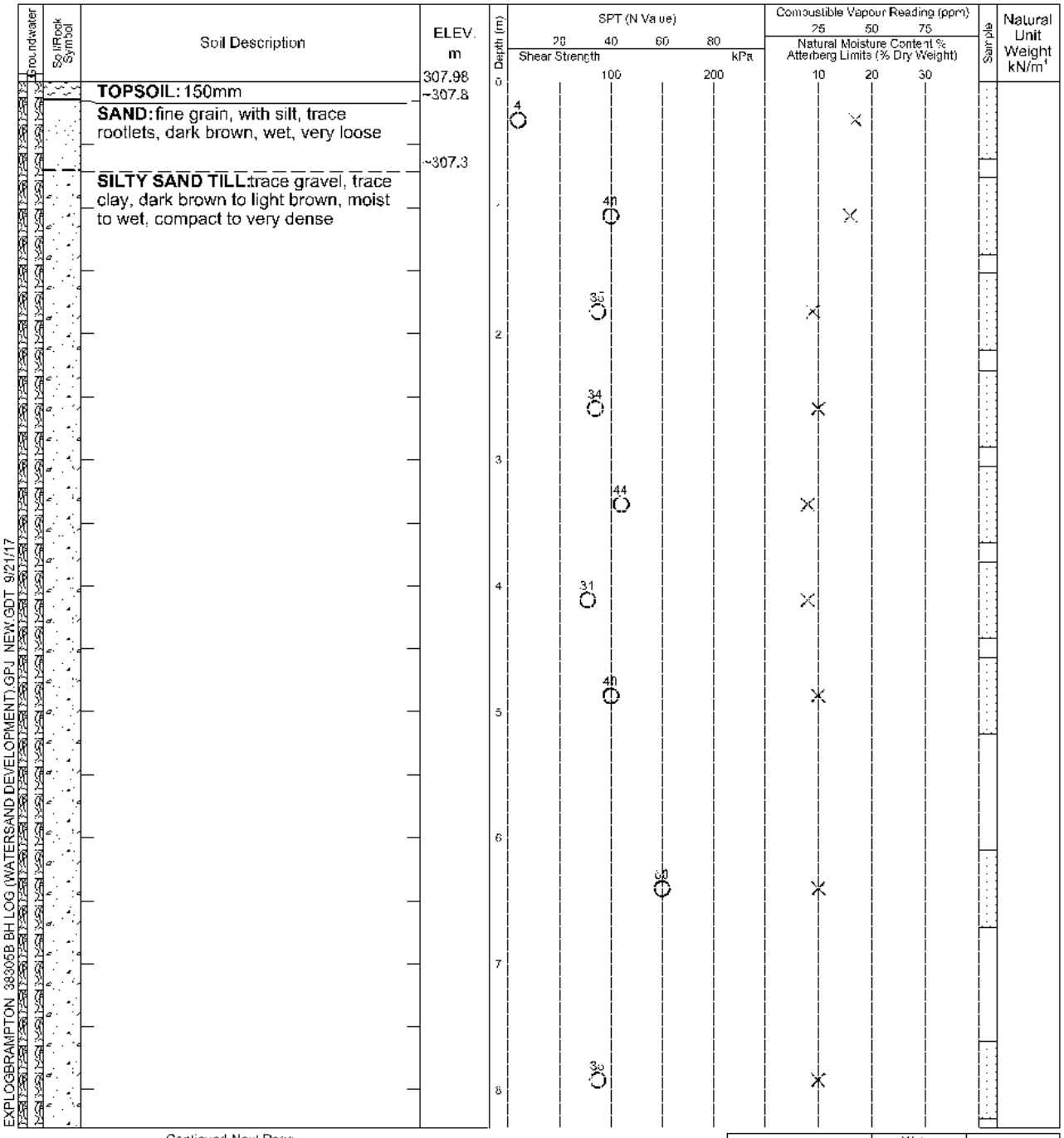
Date Drilled: July 6, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

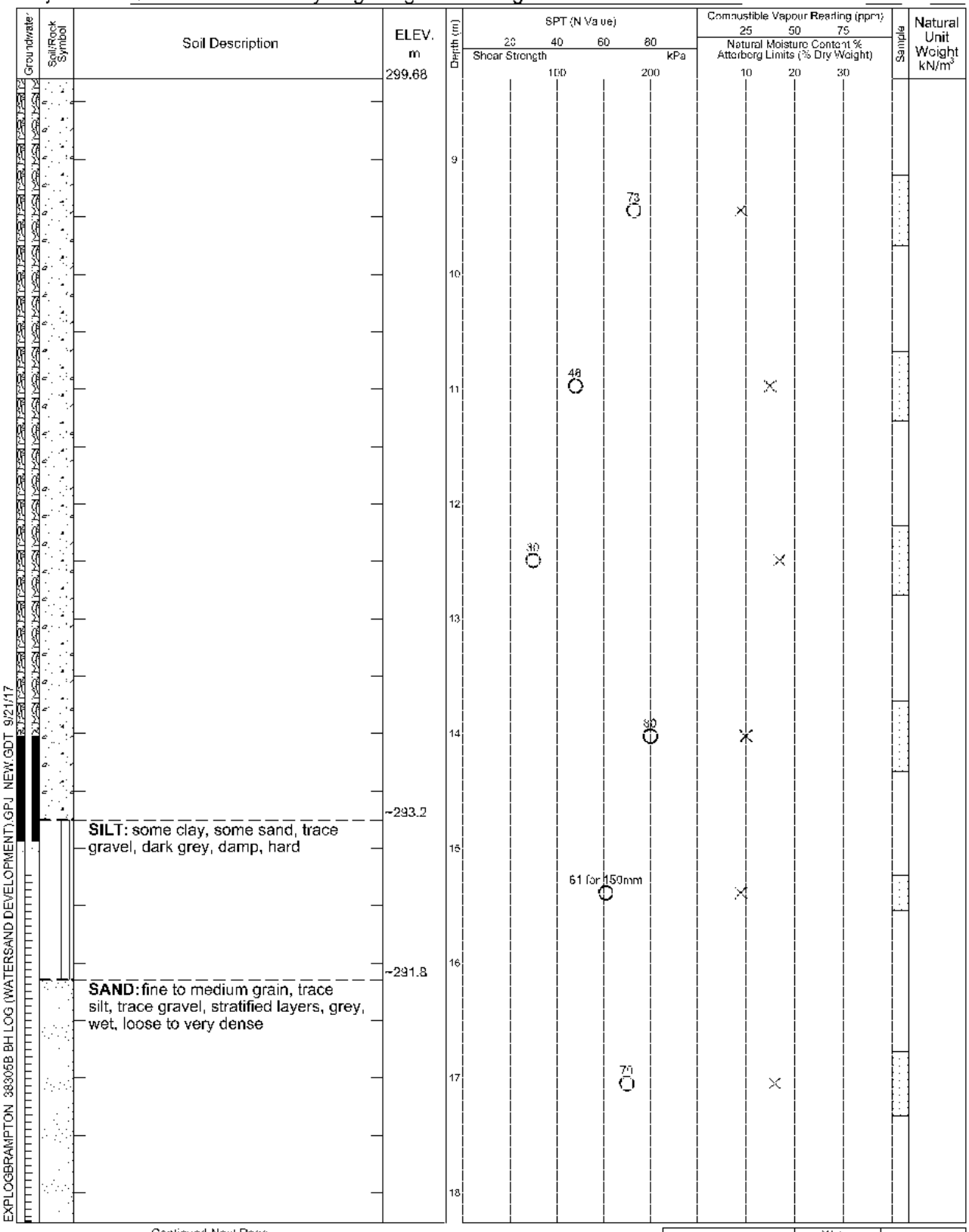
Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.86 | - |
| August 9, 2017 | 13.36 | - |

# Log of Borehole A3-D

Project No. BRM-00038305-B0 Drawing No. 143

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 3




Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.86 | - |
| August 9, 2017 | 13.36 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole A3-D

Project No. BRM-00038305-B0 Drawing No. 143

Project: Geotechnical and Hydrogeological Investigation Sheet No. 3 of 3

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Samples | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 289.72 | | | | | |
| | | | ~289.1 | | | | | |
| | | END OF BOREHOLE | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 12.86 | - |
| August 9, 2017 | 13.36 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole A3-S

Project No. BRM-00038305-B0 | Drawing No. 144

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

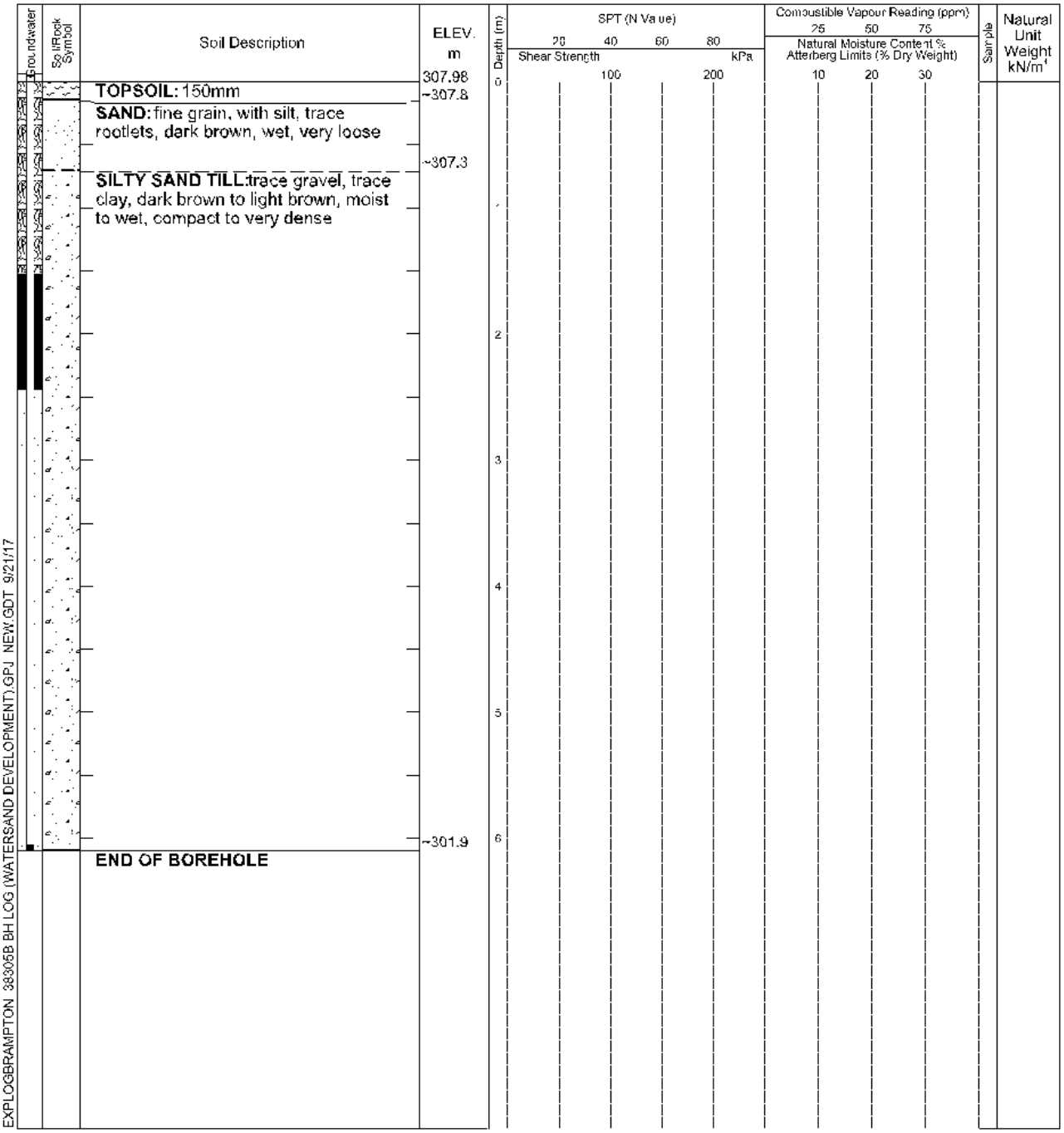
Date Drilled: July 6, 2017

Drill Type: D52 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| July 24, 2017 | 2.54 | - |
| August 9, 2017 | 3.15 | - |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

ND 10

MCKAY ROAD

VETERANS DRIVE

ROAD ALLOWANCE BETWEEN LOTS 5 AND

LINE BETWEEN THE CITY OF BARRIE

LOT 6

9

CONCESSIC

LOT

BLOCK 31
(STREET WIDENING)

BLOCK 30

LOT 7

LOT 8

LOT 6

308.06
BH #138D

306.86
BH #147

307.08
BH #146

308.96
BH #147C

306.13
BH #148C

305.07
BH #149C

307.52
BH #145

309.06
BH #139A

304.96
BH #140A

305.00
BH #141A

305.71
BH #142A

306.53
BH #143A

309.96
BH #148A

305.40
BH #147A

303.97
BH #146A

303.78
BH #145A

304.82
BH #144A

308.97
BH #138B

304.88
BH #139B

303.21
BH #140B

302.62
BH #141B

303.20
BH #142B

309.12
BH #147B

305.42
BH #146B

304.71
BH #145B

302.80
BH #144B

302.62
BH #143B

303.00
BH #141C

308.61
BH #148B

308.48
BH #149B

306.73
BH #138C

305.30
BH #139C

303.79
BH #140C

306.13
BH #142C

308.40
BH #145C

306.34
BH #143C

307.71
BH #144C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• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

CLIENT: WATERSAND DEVELOPMENT

PROJECT: PROPOSED WATERSAND RESIDENTIAL DEVELOPMENT

TITLE: SECTION 3 – BOREHOLE LOCATION PLAN

| | |
|---|---|
| scale | 1:3500 |
| date | 9/12/2017 |
| drawn by | M.B. |
| project no | BRM-00038305-B0 |

DRAWING 145

# SECTION 3

| BH# | Figure # | Elevation |
|---|---|---|
| BH 138B | 146 | 308.97 |
| BH 138C | 147 | 306.73 |
| BH 138D | 148 | 308.06 |
| BH 139A | 149 | 309.06 |
| BH 139B | 150 | 304.88 |
| BH 139C | 151 | 305.30 |
| BH 140A | 152 | 304.96 |
| BH 140B | 153 | 303.21 |
| BH 140C | 154 | 303.79 |
| BH 141A | 155 | 305.00 |
| BH 141B | 156 | 302.62 |
| BH 141C | 157 | 303.00 |
| BH 142A | 158 | 305.71 |
| BH 142B | 159 | 303.20 |
| BH 142C | 160 | 306.13 |
| BH 143A | 161 | 306.53 |
| BH 143B | 162 | 302.62 |
| BH 143C | 163 | 306.34 |
| BH 144A | 164 | 304.82 |

| BH# | Figure # | Elevation |
|---|---|---|
| BH 144B | 165 | 302.80 |
| BH 144C | 166 | 307.71 |
| BH 145 | 167 | 307.52 |
| BH 145A | 168 | 303.78 |
| BH 145B | 169 | 304.71 |
| BH 145C | 170 | 308.40 |
| BH 146 | 171 | 307.08 |
| BH 146A | 172 | 303.97 |
| BH146B | 173 | 305.42 |
| BH 147 | 174 | 306.86 |
| BH 147A | 175 | 305.40 |
| BH 147B | 176 | 309.12 |
| BH 147C | 177 | 308.96 |
| BH 148A | 178 | 309.96 |
| BH 148B | 179 | 308.61 |
| BH 148C | 180 | 306.13 |
| BH 149B | 181 | 308.48 |
| BH 149C | 182 | 305.07 |

# Log of Borehole 138B

Project No. BRM-00038305-B0 Drawing No. 146

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

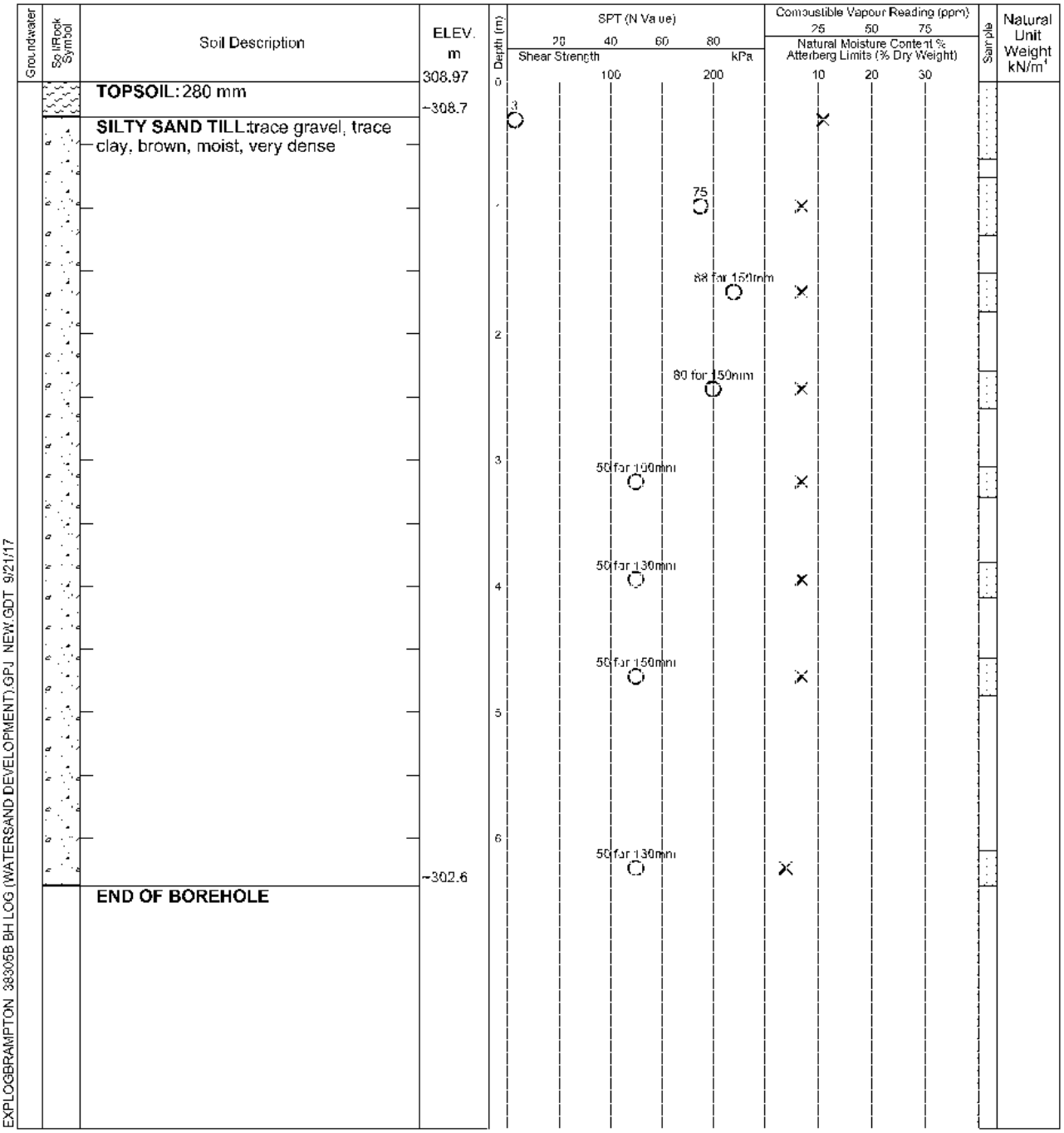
Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.38 |

exp.

# Log of Borehole 138C

Project No. BRM-00038305-B0 | Drawing No. 147

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250 mm | 306.73 | 0 |
| | | | ~306.5 | |
| | | **SAND:** fine grain, with silt, dark brown, moist | | |
| | | | ~305.9 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, dense to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | ~300.5 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20, 40, 60, 80
Shear Strength: 100, 200 kPa
Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

5
40
84
50 for 100mm
50 for 100mm
50 for 100mm
50 for 75mm
50 for 100mm

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.35 |

exp.

# Log of Borehole 138D

Project No. BRM-00038305-B0 Drawing No. 148

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 300mm | 308.06 | 0 |
| | | | ~307.8 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark brown, moist to wet, loose to very dense | | |
| | | ------ grey | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | | | 7 |
| | | | | 8 |

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

9
40
77
93
83
50 for 75mm
85
50 for 130mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 9.29 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 138D

Project No. BRM-00038305-B0 Drawing No. 148

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 299.76 | | | | | |
| | | | | 9 | 50 for 150mm | | | |
| | | | -298.8 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 9.29 |

exp.

# Log of Borehole 139A

Project No. BRM-00038305-B0 | Drawing No. 149

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280 mm | 309.06 | 0 |
| | | | ~308.8 | |
| | | **SAND:** fine to medium grain, trace to some silt, trace gravel, brown, damp, compact to very dense | | |
| | | | ~306.9 | 2 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, very dense | | |
| | | | ~304.6 | 4 |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, brown, moist, very dense | | |
| | | | ~303.4 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, very dense | | 6 |
| | | | ~302.8 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 27; 55; 50 for 150mm; 50 for 100mm; 50 for 130mm; 50 for 150mm; 50 for 150mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 139B

Project No. BRM-00038305-B0 Drawing No. 150

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 230 mm | 304.88 | 0 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, damp to moist, very dense | ~304.7 | |
| | | | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | | 5 |
| | | | | 6 |
| | | **END OF BOREHOLE** | ~298.7 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa

50 for 150mm
50 for 130mm
50 for 75mm
50 for 130mm
50 for 130mm
50 for 130mm
50 for 130mm

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.23 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 139C

Project No. BRM-00038305-B0 Drawing No. 151

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

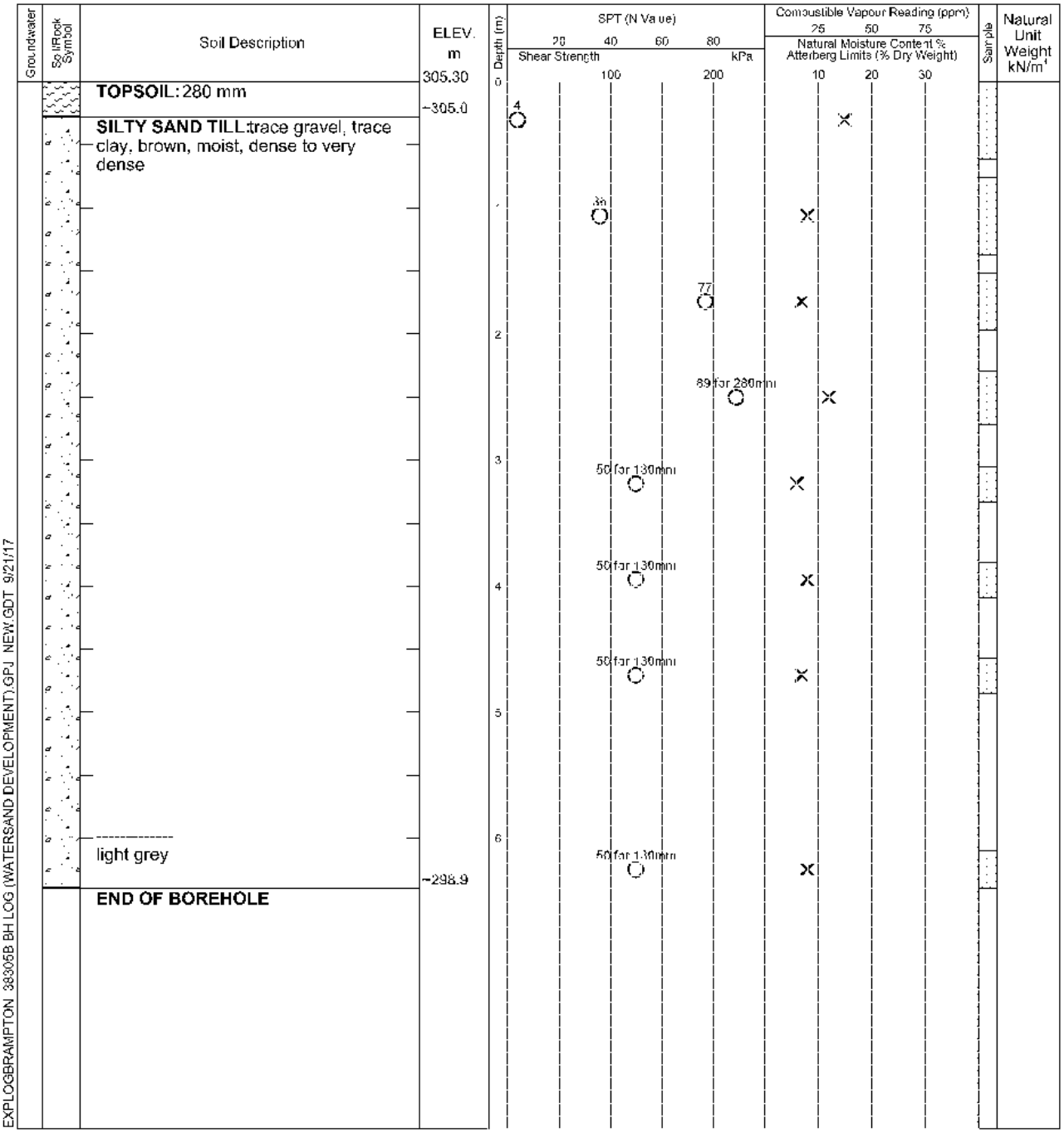
Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.40 |

# Log of Borehole 140A

Project No. BRM-00038305-B0 Drawing No. 152

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

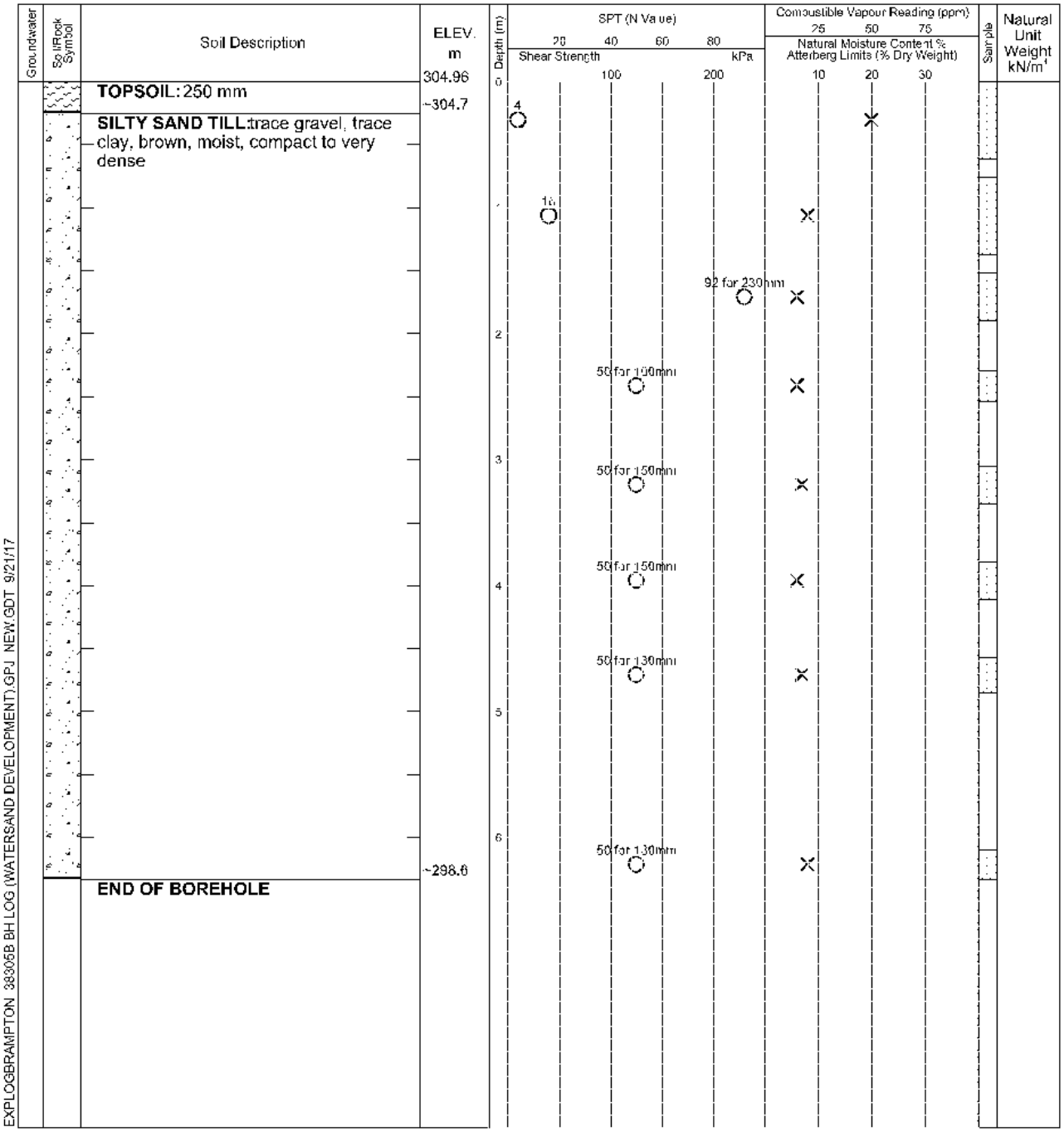
Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.33 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 140B

Project No. BRM-00038305-B0 Drawing No. 153

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

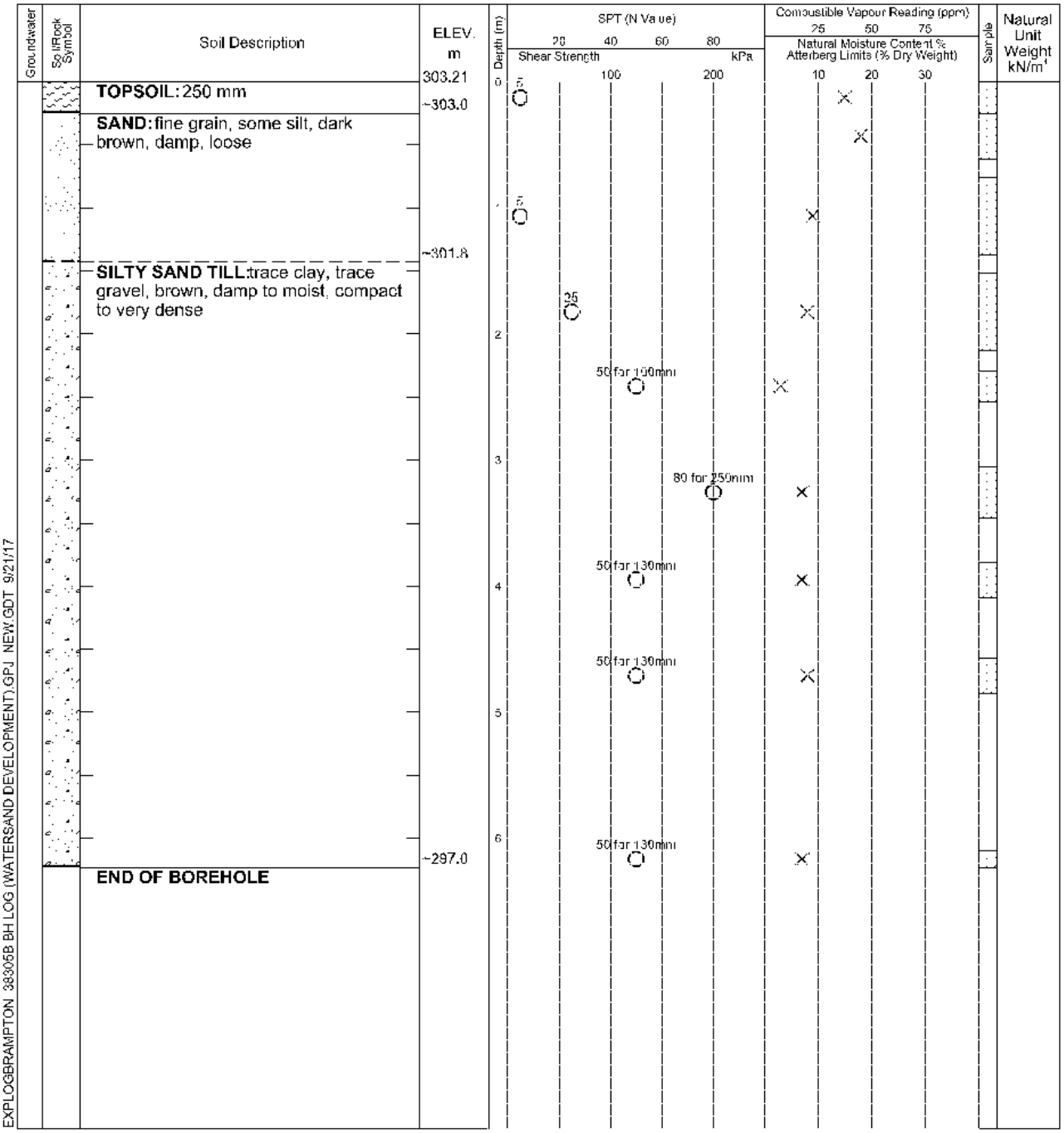
Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.23 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 140C

Project No. BRM-00038305-B0 Drawing No. 154

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

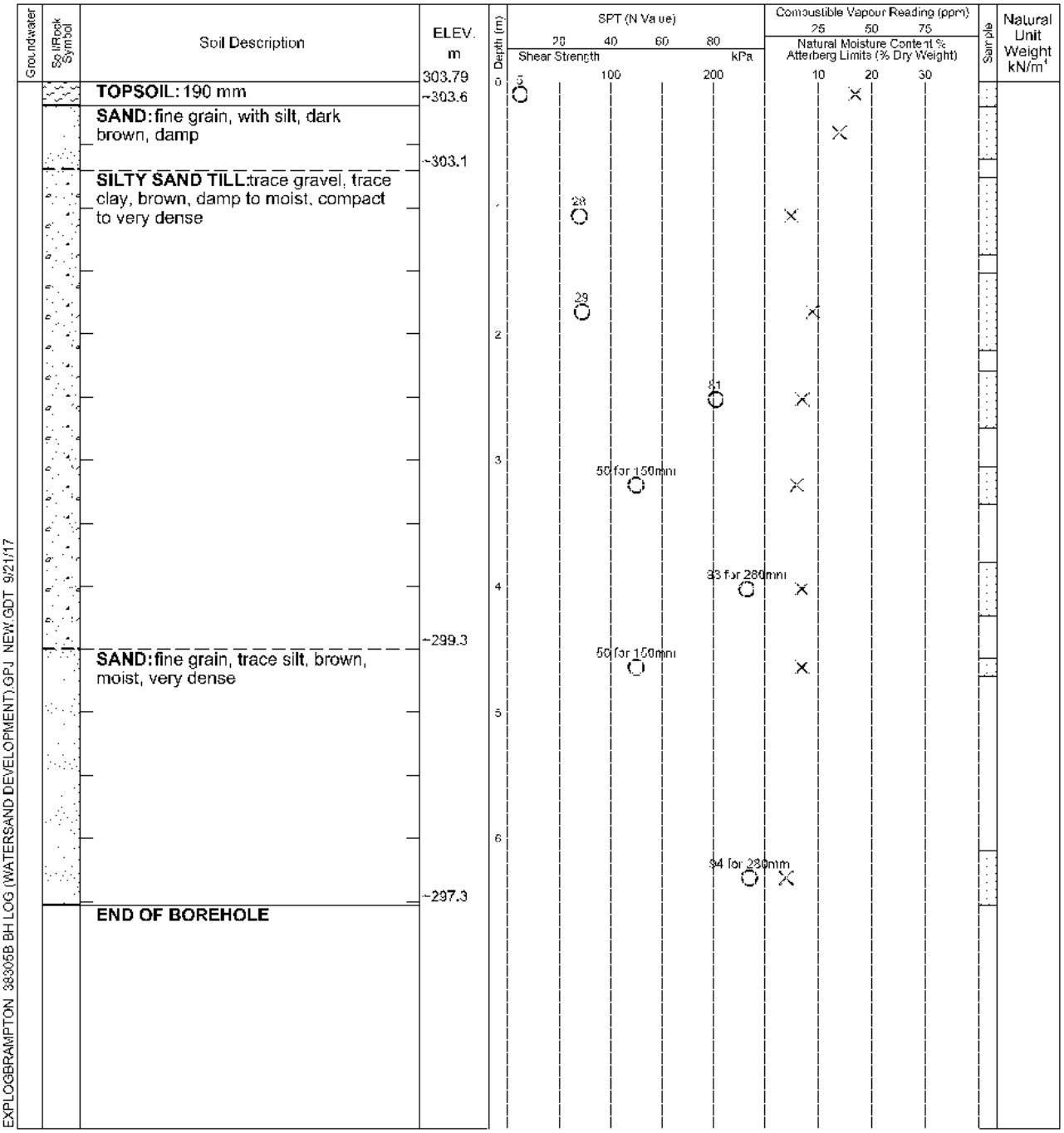
Date Drilled: May 29 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.53 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 141A

Project No. BRM-00038305-B0 | Drawing No. 155

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Soil Description | ELEV. m | Depth (m) |
|---|---|---|
| **TOPSOIL:** 180 mm | 305.00 | 0 |
| | ~304.8 | |
| **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, dense to very dense | | |
| | ~299.4 | |
| **SAND:** fine to medium grain, some silt, brown, moist, very dense | | |
| | ~298.5 | |
| **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

4
43
54
55
47
78
50 for 100mm
92 for 280mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.53 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 141B

Project No. BRM-00038305-B0 | Drawing No. 156

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

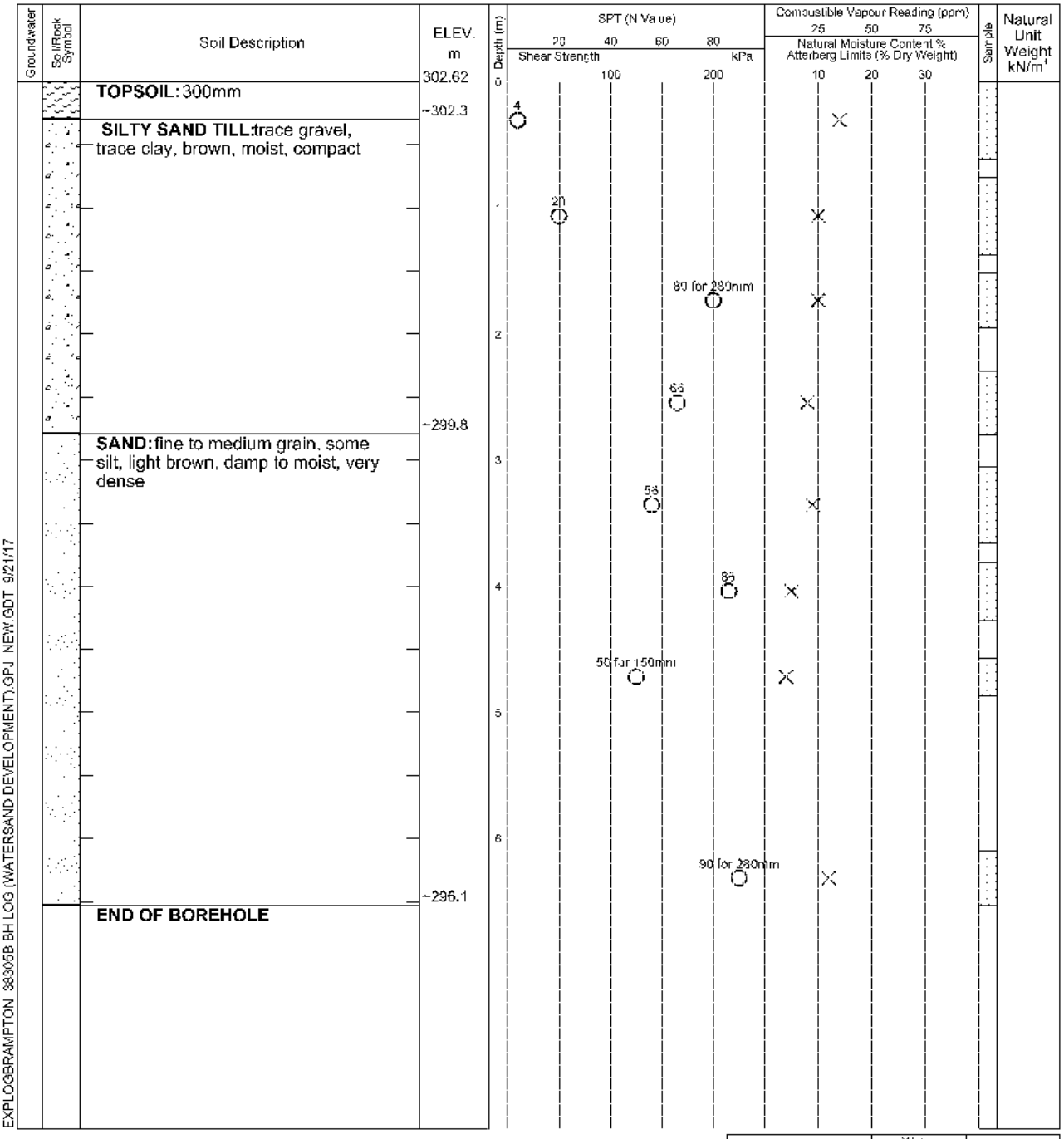
Proposed Watersand Development

Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.53 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 141C

Project No. BRM-00038305-B0 Drawing No. 157

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 330mm | 303.00 | 0 |
| | | | ~302.7 | |
| | | **SILTY CLAY:** trace sand, light brown, moist | ~302.3 | |
| | | **SAND:** fine grain, some silt, light brown, damp to moist, compact | ~301.0 | 2 |
| | | **SILTY CLAY:** trace sand, light brown, moist, very stiff | ~300.8 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, compact | ~300.3 | |
| | | **SAND:** fine grain, trace silt, light brown, damp | ~300.1 | 3 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, very dense | ~299.1 | |
| | | **SAND:** fine to medium grain, trace silt, trace gravel, light brown, damp, very dense | ~296.6 | 4 |
| | | **END OF BOREHOLE** | | 6 |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample | Natural Unit Weight kN/m³

5
26
26
26
74
50 for 150mm
50 for 150mm
86

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.40 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 142A

Project No. BRM-00038305-B0 | Drawing No. 158

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

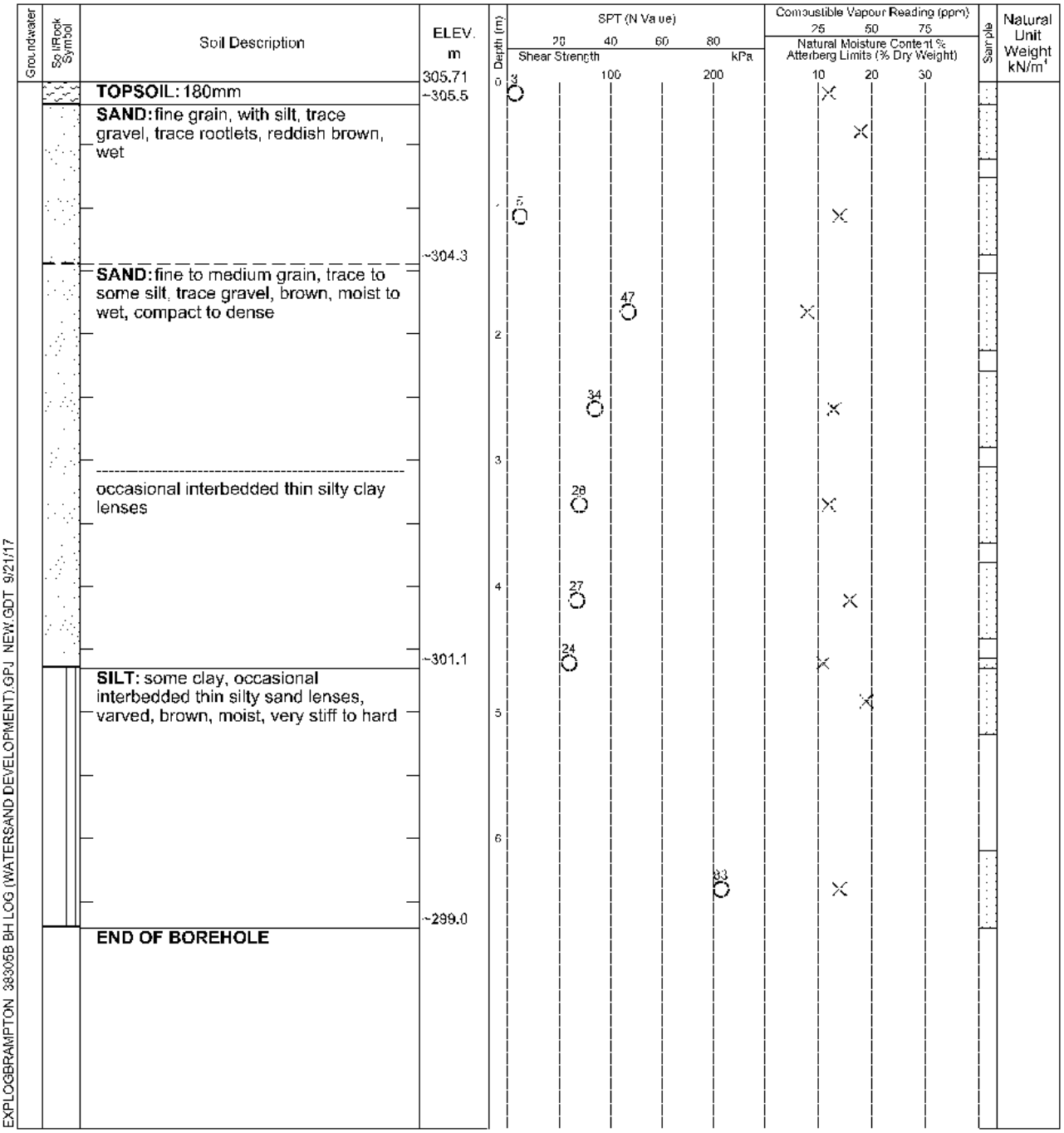
Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | 3.35 | 3.35 |

# Log of Borehole 142B

Project No. BRM-00038305-B0 | Drawing No. 159

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 200mm | 303.20 | 0 |
| | | | ~303.0 | |
| | | **SAND:** fine grain, with silt, dark brown, moist | | |
| | | | ~302.5 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, dense to very dense | | |
| | | occasional silt layering | | |
| | | | ~298.7 | |
| | | **SAND:** fine to medium grain, some silt, trace gravel, light brown, damp, very dense | | |
| | | | ~296.7 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80
Shear Strength: 4 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

33
87 for 280mm
55
55
50 for 150mm
72
90 for 230mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.48 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 142C

Project No. BRM-00038305-B0 | Drawing No. 160

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 306.13 | 0 |
| | | | ~305.9 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, dark brown to brown, moist to wet, compact to very dense | | |
| | | | ~299.8 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value)
20 40 60 80
Shear Strength kPa
100 200

Combustible Vapour Reading (ppm)
25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
10 20 30

SPT values: 2, 23, 33, 50 for 150mm, 50 for 150mm, 50 for 150mm, 50 for 75mm, 50 for 75mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.33 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 143A

Project No. BRM-00038305-B0 | Drawing No. 161

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

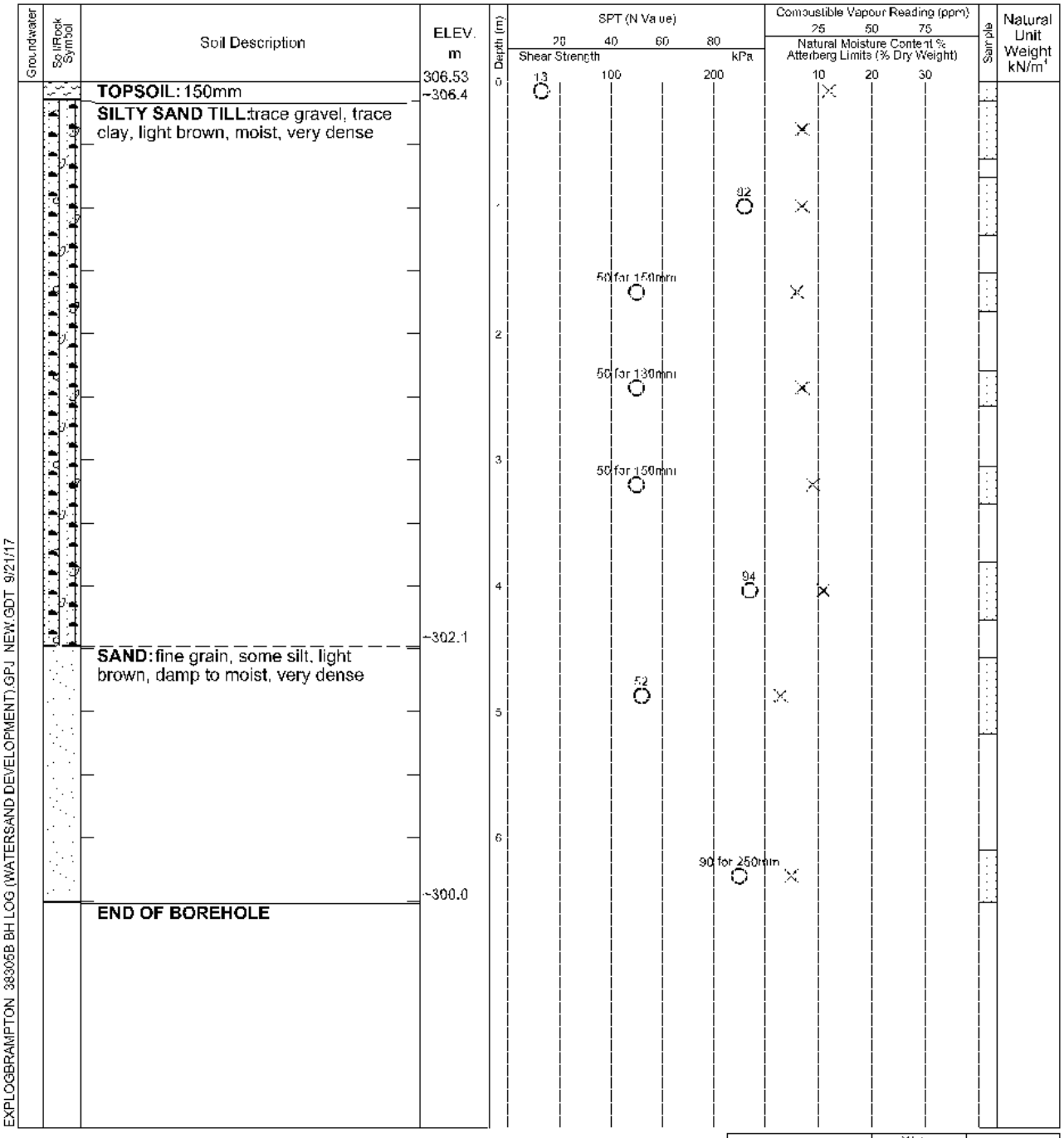
Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.71 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 143B

Project No. BRM-00038305-B0 | Drawing No. 162

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

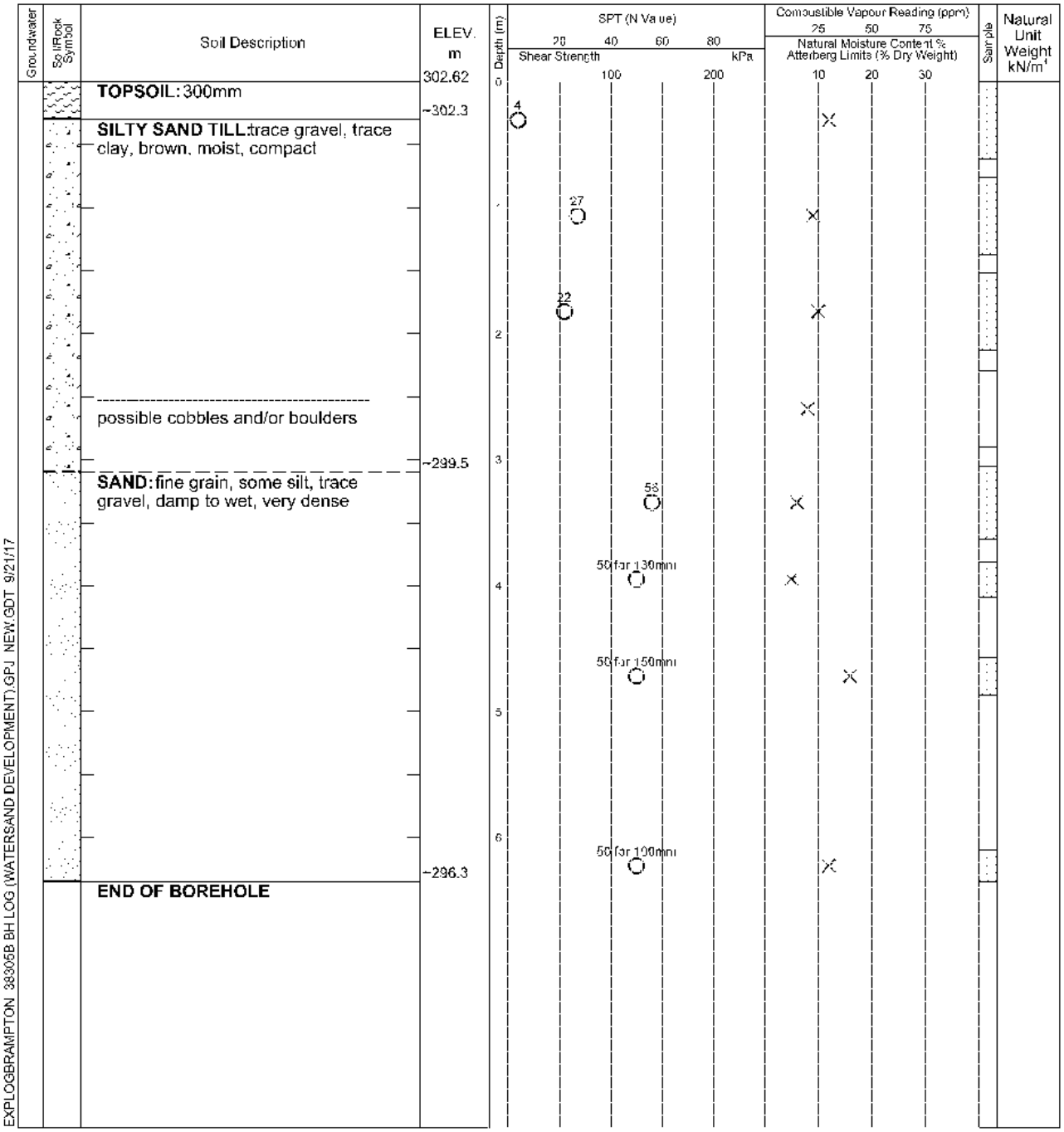
Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.35 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 143C

Project No. BRM-00038305-B0 Drawing No. 163

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 2, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 180mm | 306.34 | 0 |
| | | **SAND:** fine to medium grain, some silt, trace gravel, reddish brown, moist | ~306.2 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, damp to wet, compact to very dense | ~305.6 | |
| | | | ~301.9 | |
| | | **SILTY SAND:** trace gravel, light brown, damp, very dense | | |
| | | **END OF BOREHOLE** | ~298.4 | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

SPT values: 13, 29, 34, 50 for 75mm, 50 for 150mm, 90 for 280mm, 50 for 150mm, 50 for 150mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.92 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 144A

Project No. BRM-00038305-B0 | Drawing No. 164

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 304.82 | 0 |
| | | | ~304.6 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, very dense | | |
| | | | ~302.8 | 2 |
| | | **SAND:** fine grain, with silt, brown, damp, dense to very dense | | |
| | | | ~300.3 | 3 |
| | | **SILT:** with sand, brown, wet, very dense | | |
| | | | ~299.3 | 5 |
| | | **SILT:** trace clay, trace sand, brown, moist to wet, hard | | |
| | | | ~298.5 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight): 10 20 30

3
41
63
78
50 for 150mm
50 for 150mm
50 for 150mm
50 for 75mm

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.33 |

exp.

# Log of Borehole 144B

Project No. BRM-00038305-B0 | Drawing No. 165

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 302.80 | 0 |
| | | | ~302.5 | |
| | | **SAND:** fine grain, with silt, reddish brown, moist | | |
| | | | ~302.1 | |
| | | **SILTY SAND TILL:** trace to some gravel, trace clay, brown, moist, dense to very dense | | 1 |
| | | | | 2 |
| | | | | 3 |
| | | | | 4 |
| | | | ~298.5 | |
| | | **SAND:** trace silt, brown, moist, very dense | | 5 |
| | | | | 6 |
| | | | ~296.3 | |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

6
34
67
50 for 150mm
50 for 150mm
88
89 for 280mm
81

Sample | Natural Unit Weight kN/m³

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.55 |

exp.

# Log of Borehole 144C

Project No. BRM-00038305-B0 Drawing No. 166

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

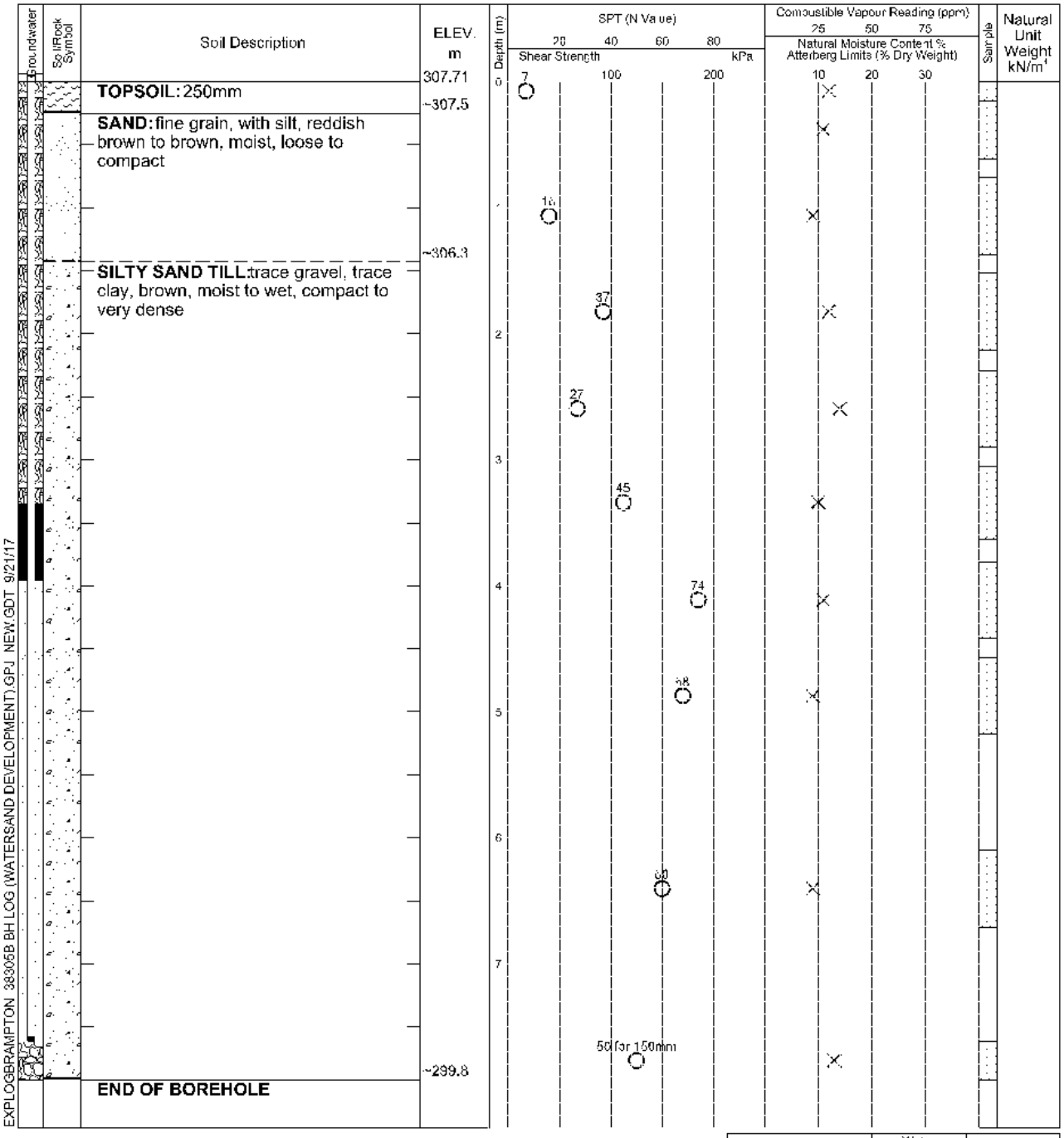
Date Drilled: June 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | - |
| June 22, 2017 | 5.18 | - |
| August 10, 2017 | 5.80 | - |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 145

Project No. BRM-00038305-B0 Drawing No. 167

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 307.52 | 0 |
| | | | ~307.3 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, dense to very dense | | |
| | | | ~304.3 | 3 |
| | | **SAND:** fine grain, trace silt, brown, damp, very dense | | |
| | | | ~303.4 | 4 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, damp to moist, very dense | ~303.0 | |
| | | **SAND:** fine to medium grain, trace to some silt, trace gravel, brown, damp, very dense | | |
| | | | ~301.3 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength kPa 17 100 200
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30
Sample
Natural Unit Weight kN/m³

SPT values: 36, 38, 72, 63, 87 for 250mm, 50 for 25mm, 50 for 150mm

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.25 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 145A

Project No. BRM-00038305-B0 Drawing No. 168

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

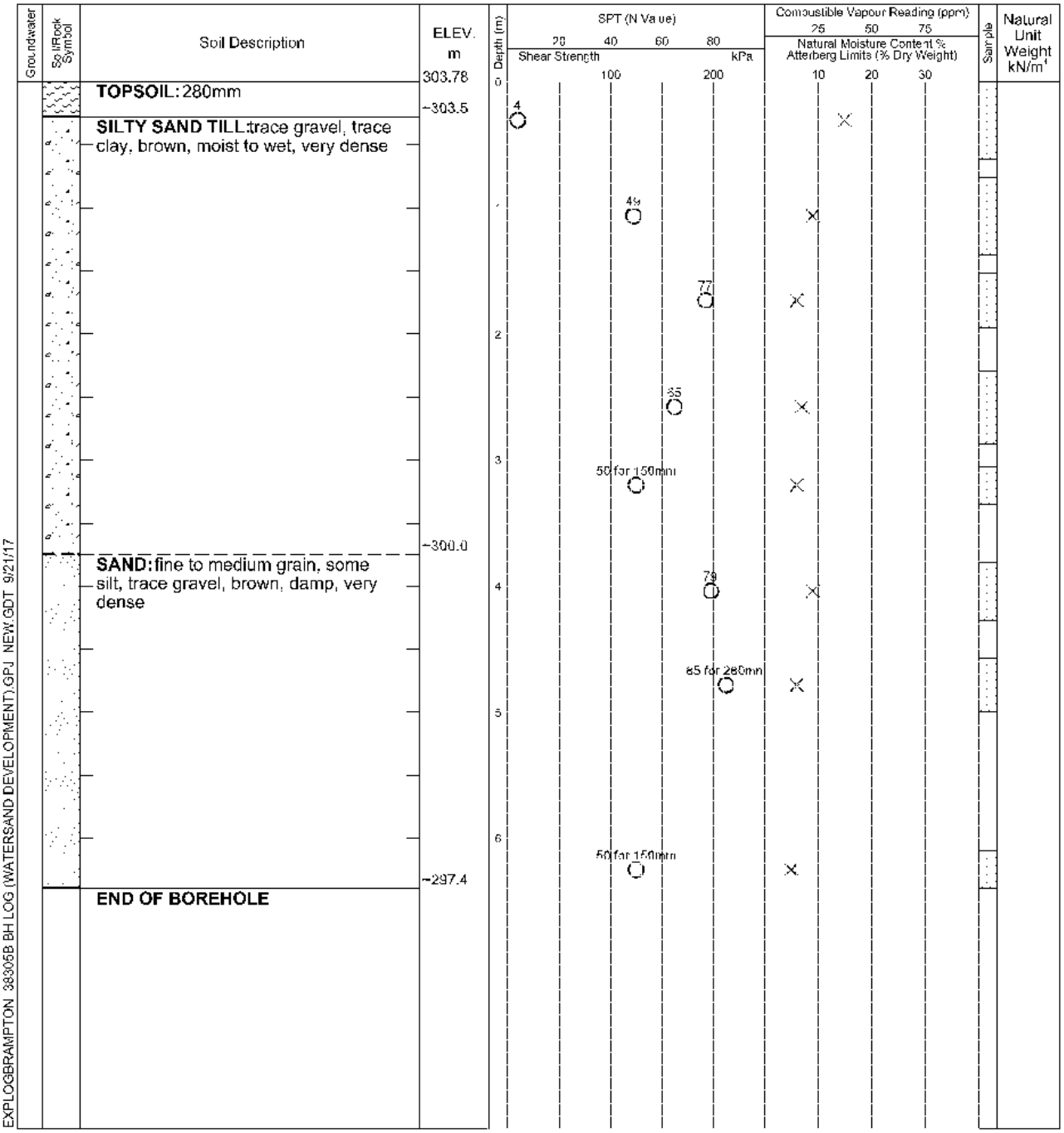
Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.40 |

# Log of Borehole 145B

Project No. BRM-00038305-B0 | Drawing No. 169

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

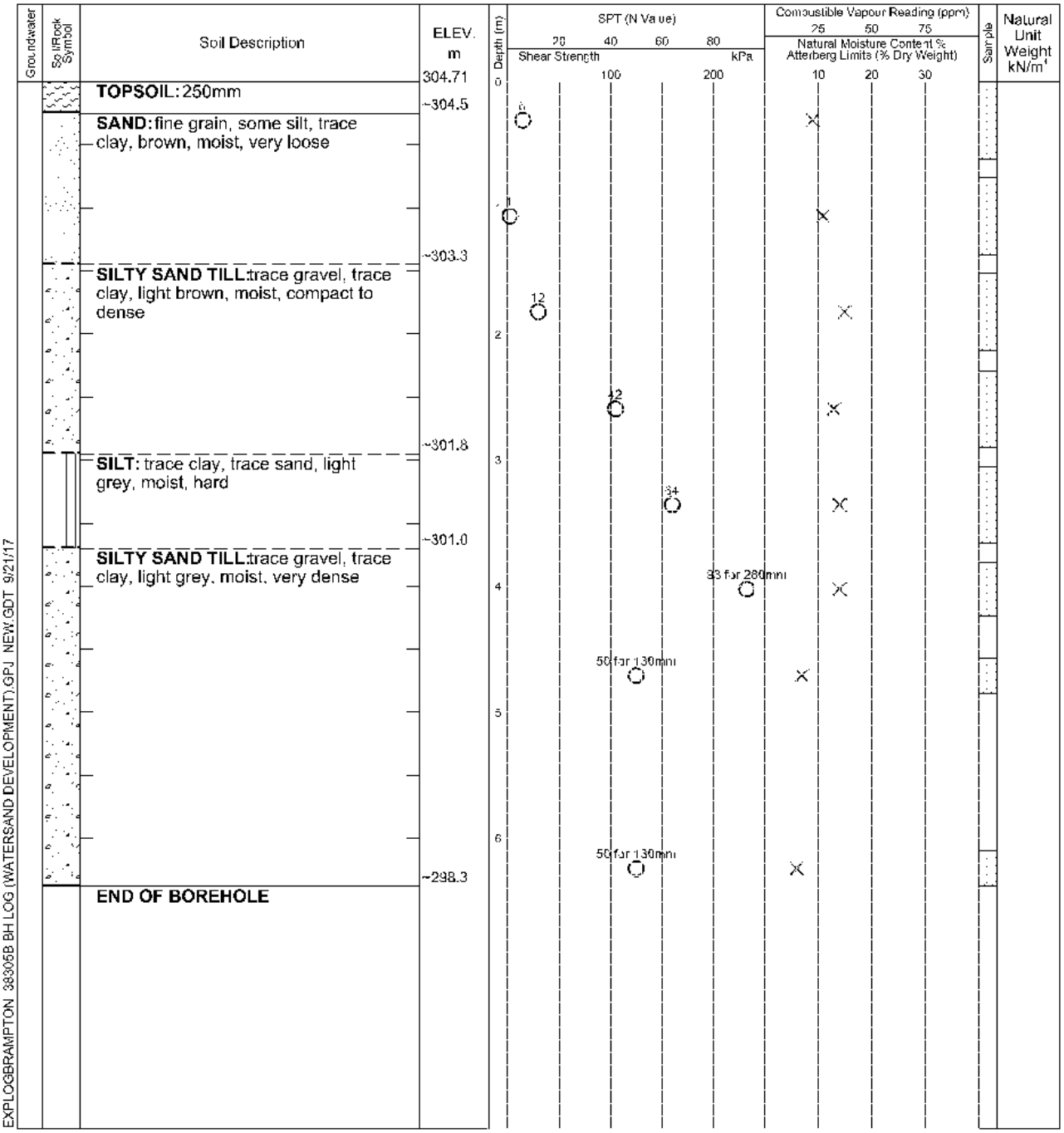
Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.38 |

# Log of Borehole 145C

Project No. BRM-00038305-B0 | Drawing No. 170

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 5, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 308.40 | 0 |
| | | | ~308.2 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown to greyish brown, moist to wet, compact to very dense | | |
| | | | ~305.4 | 3 |
| | | **SILT:** some clay, some sand, trace gravel, mottled light brown and reddish brown, moist, hard | | |
| | | | ~303.9 | 4 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, light grey, moist, very dense | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % 10 20 30
Atterberg Limits (% Dry Weight)

Sample | Natural Unit Weight kN/m³

SPT values: 5, 25, 45, 81, 35, 54, 62, 41, 50 for 75mm

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 9.24 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 145C

Project No. BRM-00038305-B0 Drawing No. 170

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 300.10 | | | | | |
| | | | | 9 | 50 for 100mm | | | |
| | | | ~299.2 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 9.24 |

exp.

# Log of Borehole 146

Project No. BRM-00038305-B0 | Drawing No. 171

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength 100 200 kPa | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | **TOPSOIL:** 250mm | 307.08 | 0 | | | | |
| | | | ~306.8 | | | | | |
| | | **SAND:** fine grain, with silt, trace to some clay, trace rootlets, dark brown, moist, very loose | | | 4 | | | |
| | | | | 1 | 1 | | | |
| | | | ~305.7 | | | | | |
| | | **SAND:** fine grain, trace silt, brown, damp, compact | | | 12 | | | |
| | | | ~304.8 | 2 | | | | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, greyish brown, moist, very dense | | | 50 for 150mm | | | |
| | | | | 3 | 50 for 130mm | | | |
| | | | | | 50 for 75mm | | | |
| | | | | 4 | | | | |
| | | | | | 50 for 130mm | | | |
| | | | | 5 | | | | |
| | | | | 6 | 50 for 130mm | | | |
| | | | | 7 | | | | |
| | | | | | 50 for 130mm | | | |
| | | | ~299.2 | | | | | |
| | | **END OF BOREHOLE** | | | | | | |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.90 |

exp.

# Log of Borehole 146A

Project No. BRM-00038305-B0 Drawing No. 172

Project: Geotechnical and Hydrogeological Investigation Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

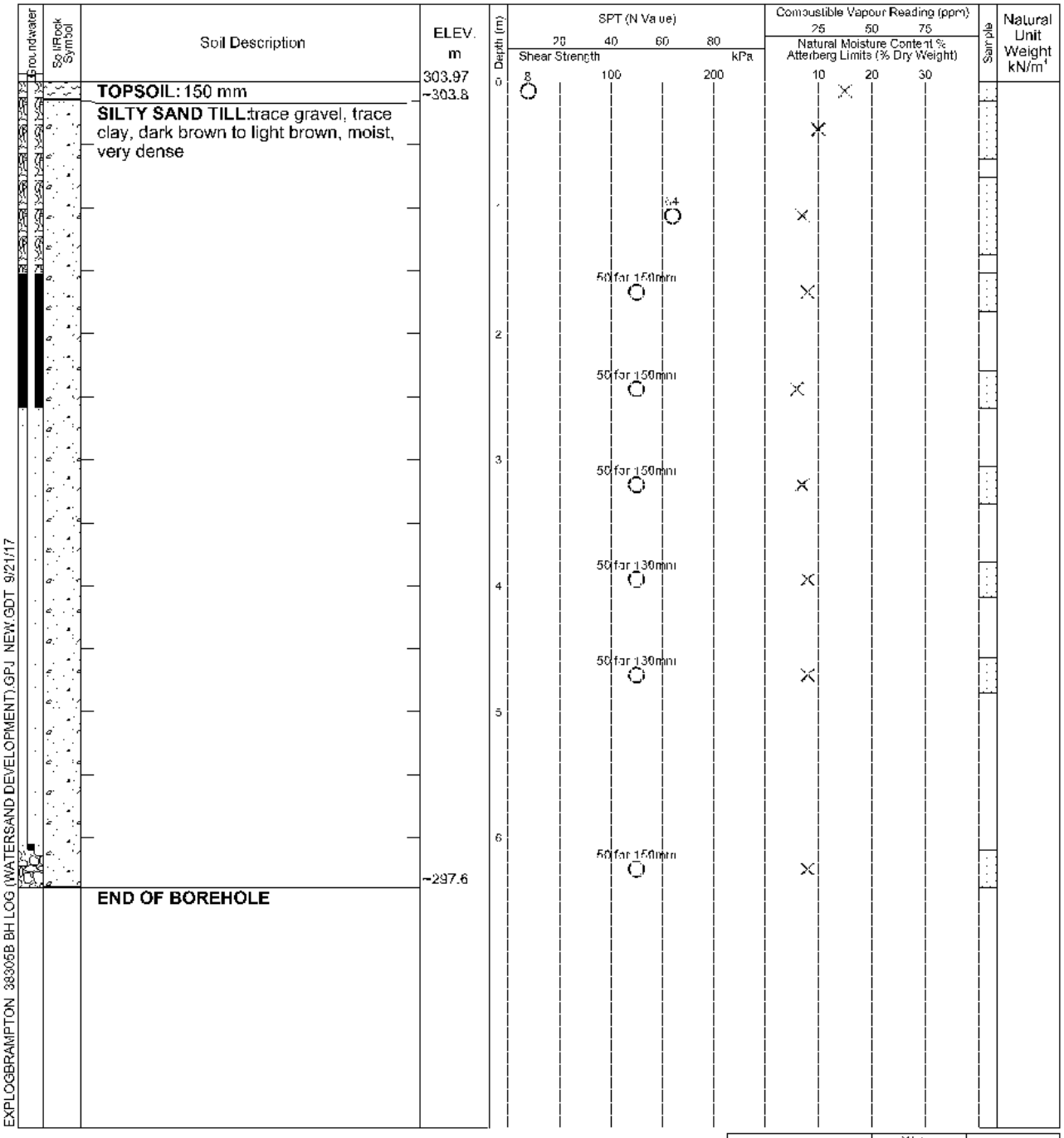
Date Drilled: May 31, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.40 |
| June 22, 2017 | Dry | - |
| August 18, 2017 | Dry | - |

exp.

# Log of Borehole 146B

Project No. BRM-00038305-B0 | Drawing No. 173

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

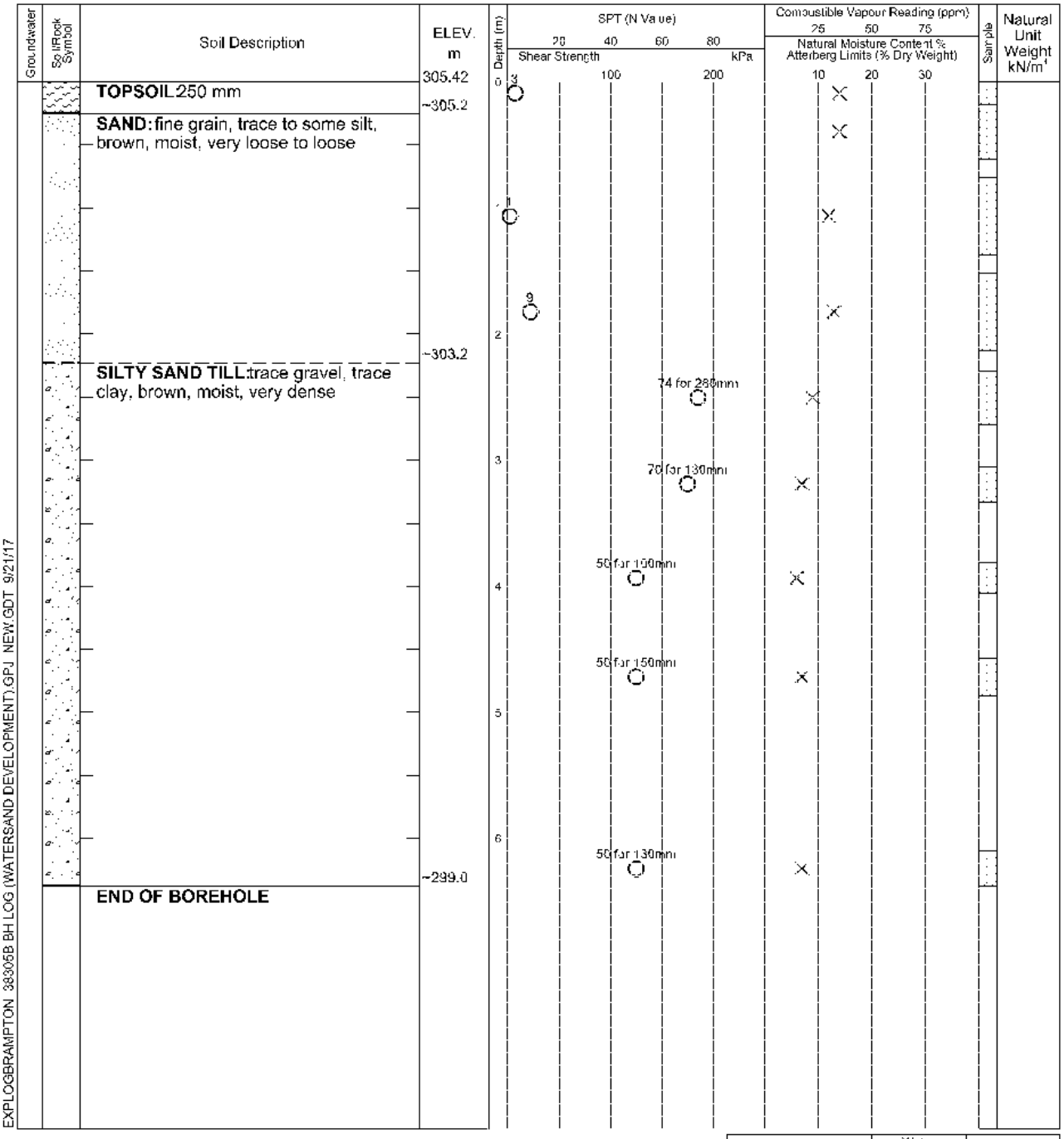
Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.38 |

# Log of Borehole 147

Project No. BRM-00038305-B0 | Drawing No. 174

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

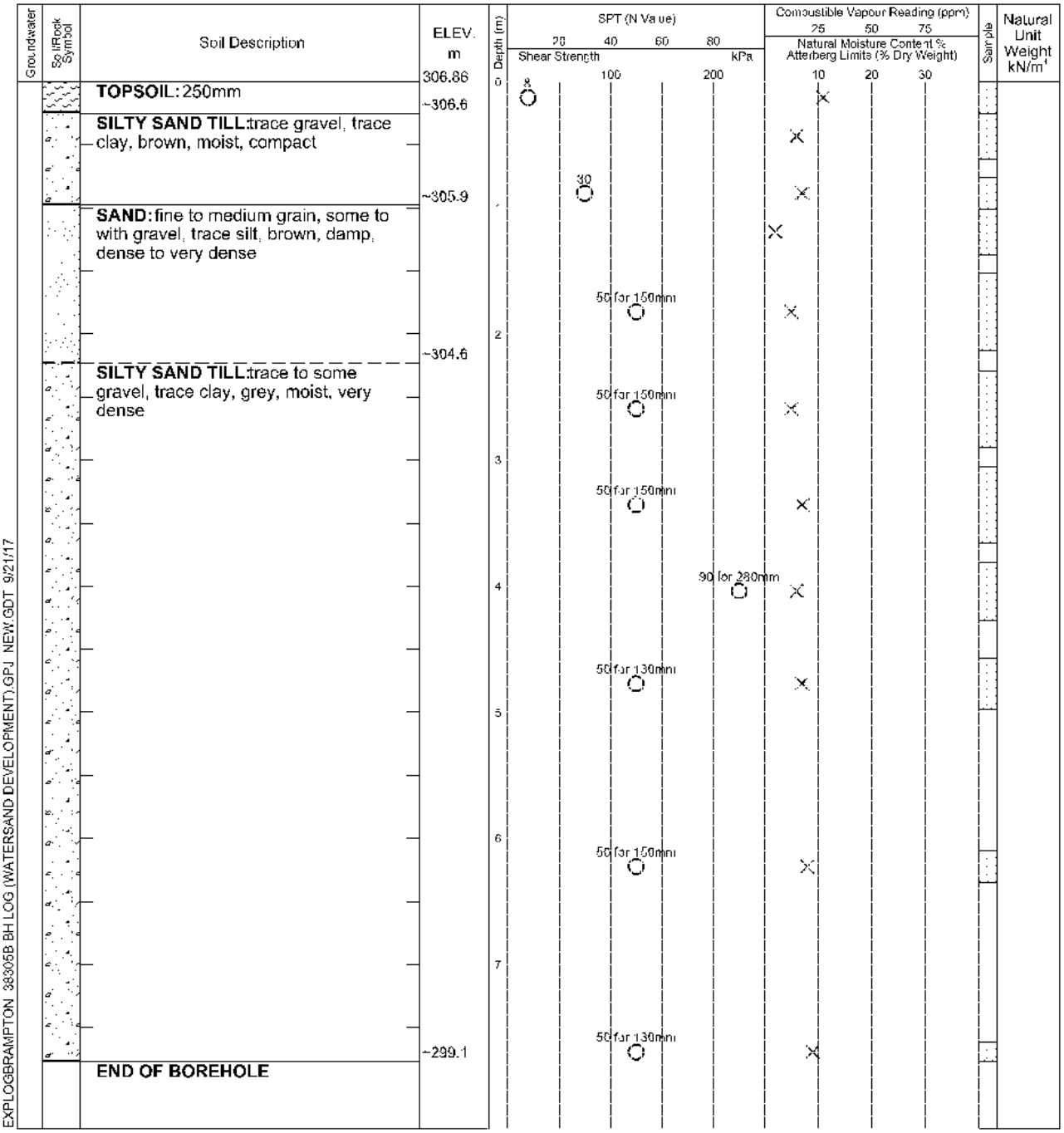
Date Drilled: June 1, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 7.77 |

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 147A

Project No. BRM-00038305-B0 | Drawing No. 175

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

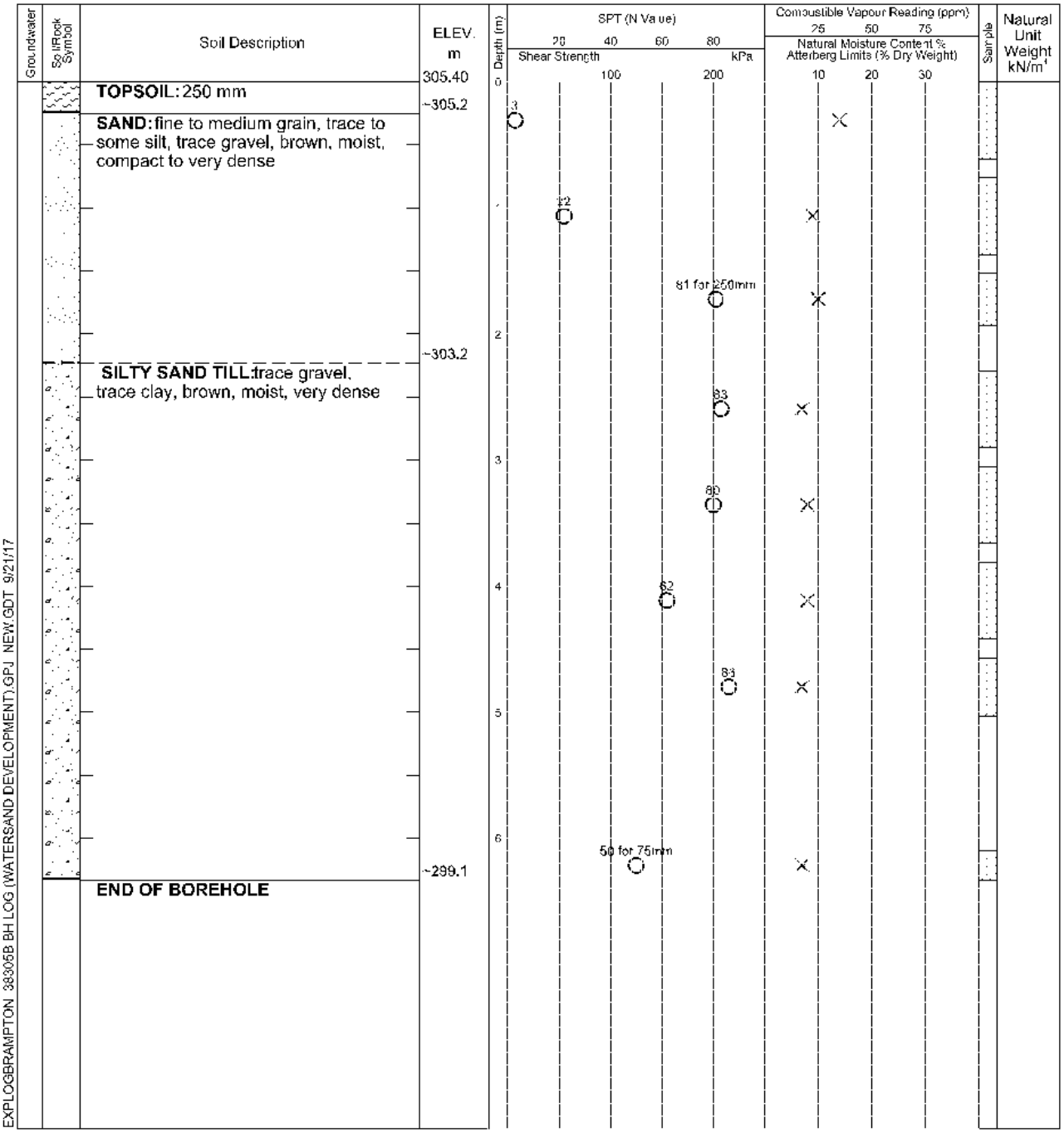
Date Drilled: May 30, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer




EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.33 |

# Log of Borehole 147B

Project No. BRM-00038305-B0 | Drawing No. 176

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 29, 2017

Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) |
|---|---|---|---|---|
| | | **TOPSOIL:** 280mm | 309.12 | 0 |
| | | | ~308.8 | |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, very loose to very dense | | |
| | | | ~302.9 | 6 |
| | | **END OF BOREHOLE** | | |

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

13
3
62
50/for 150mm
50/for 150mm
50/for 130mm
50/for 130mm
50/for 130mm

Sample | Natural Unit Weight kN/m³

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 6.22 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.

# Log of Borehole 147C

Project No. BRM-00038305-B0 | Drawing No. 177

Project: Geotechnical and Hydrogeological Investigation | Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 2, 2017

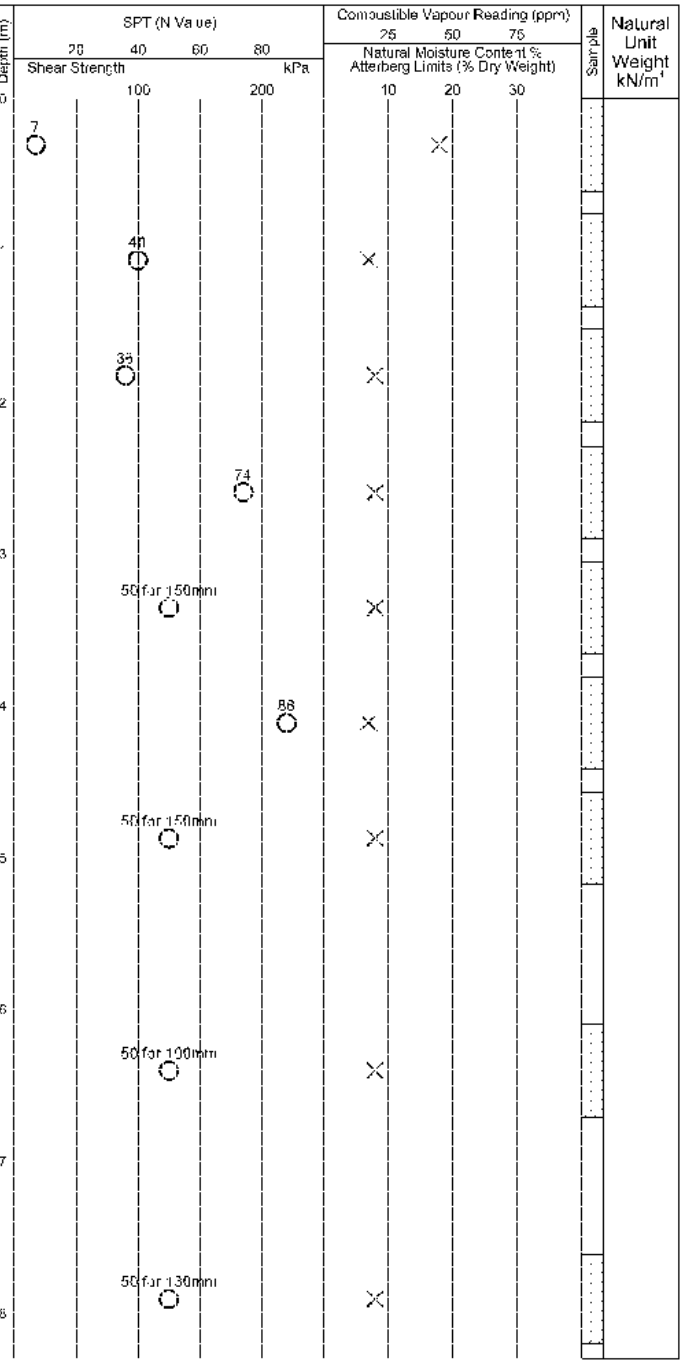
Drill Type: CME55 - Track Mount

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m |
|---|---|---|---|
| | | **TOPSOIL:** 300mm | 308.96 |
| | | | ~308.7 |
| | | **SILTY SAND TILL:** trace gravel, trace clay, brown, moist, dense to very dense | |




Sample | Natural Unit Weight kN/m³

Continued Next Page

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.82 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

# Log of Borehole 147C

Project No. BRM-00038305-B0 Drawing No. 177

Project: Geotechnical and Hydrogeological Investigation Sheet No. 2 of 2

| Groundwater | Soil/Rock Symbol | Soil Description | ELEV. m | Depth (m) | SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200 | Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % / Atterberg Limits (% Dry Weight) 10 20 30 | Sample | Natural Unit Weight kN/m³ |
|---|---|---|---|---|---|---|---|---|
| | | | 300.66 | | | | | |
| | | | | 9 | 50 for 150mm | X | | |
| | | | | 10 | | | | |
| | | | ~298.1 | | 50 for 150mm | X | | |
| | | END OF BOREHOLE | | | | | | |

| Elapsed Time | Water Level (m) | Hole Open to (m) |
|---|---|---|
| Upon Completion | Dry | 10.82 |

EXPLOGBRAMPTON_38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/21/17

exp.