



Watersand Development c/o DG Group

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1 Background

1.1 Project Description

Exp Services Inc. (EXP) was retained by Watersand Development c/o DG Group (DG) to prepare a Hydrogeological Investigation Report for the proposed residential development for the lands known as Watersand Development, Barrie, Ontario, (hereinafter referred to as the 'Site').

It is our understanding that the proposed development consists construction of a residential development with the necessary infrastructure including roads, sewers, three (3) Stormwater Management Ponds (SWMPs) and amenity blocks (parks and school) on the southwest corner of the intersection of McKay Road and Veterans Drive in Barrie, Ontario and on the northwest corner of 5th Sideroad and 9th Line, Innisfil, Ontario. In the southeast of McKay Road West and Veterans Drive and the northeast corner of 5th Sideroad and 9th Line, employment lands will also be developed. The Site location plan is shown on Figure 1.

The lands described from two (2) continuous properties on the east and west sides of Veterans Drive and 5th Sideroad straddling the City of Barrie and Town Innisfil borders.

A geotechnical investigation was undertaken in conjunction with this hydrogeological investigation.

This report is a revised version from the original report (October 20, 2017) to incorporate the dewatering rates for the deep sewer.

1.2 Project Objectives

The objectives of the Hydrogeological Investigation are to refine the understanding of the hydrogeological conditions of the Site, particularly along the pathway of the proposed deep services, and SWM pond areas. The main objectives of the Hydrogeological Investigation can be summarized as follows:

- Establish the local hydrogeological settings within the Site;
- Provide preliminary recommendations for construction dewatering;
- Assess potential impacts on the surrounding environment due to site development activities: and
- Prepare a Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the study objectives, EXP completed the following work program:

- Review of available information and results of previous investigations, search the Ministry of the Environment, Conservation and Parks (MECP) water well record database, geological and hydrogeological mapping in the area, Wellhead Protection Areas existing mapping, and project construction drawing;

- Drill a total of two-hundred and twenty-four (224) geotechnical boreholes where thirty-five (35) of them are instrumented with monitoring wells. This operation includes the installation of twenty (21) single monitoring wells across the Site, as well as seven (7) nested well pairs (two (2) monitoring wells at each nested pair location) in the proposed SWM ponds.
- Install four (4) nested Mini-Piezometer by hand augering at selected locations along existing water course;
- Develop and conduct Single Well Response Tests (SWRT) on all monitoring wells to evaluate hydraulic properties of the saturated soils at the Site;
- Complete two (2) rounds of groundwater level measurements at all monitoring wells;
- Collect two (2) groundwater samples for the City of Barrie Storm and Sanitary by-law criteria;
- Evaluate the information collected during the field investigation program, including borehole geological information, SWRT results, and groundwater level measurements;
- Evaluate the requirement of a MECP Permit to take water for construction dewatering purposes;
- Preparation of site plans, cross sections, geological mapping, and groundwater contour mapping;
- Prepare a Hydrogeological Report.

1.4 Review of Previous Reports

The following reports/drawings were reviewed as part of this Hydrogeological Investigation:

- Exp Services Inc. (September 29, 2017). *Geotechnical Investigation, Proposed Residential Development, McKay Road West & Veterans Drive, Barrie, ON and 5th Sideroad & 9th Sideroad, Innisfil, ON.*, prepared for Watersand c/o DG Group.

2 Methodology

2.1 Monitoring Well Installation

To characterize the hydrogeology of the Site, two-hundred and forty-four (244) geotechnical boreholes were drilled where thirty-five (35) of them were instrumented with monitoring wells between May 29 and July 28, 2017. Monitoring wells included both single shallow and deep wells where a total of fourteen (14) were in a nested configuration at seven (7) locations.

The monitoring wells were installed at depths ranging from approximately 5.4 to 20 mbgs. The locations of the boreholes and monitoring wells are shown on Figures 2 A, B and C. The details of borehole logs and well constructions are presented in Appendix A.

Prior to commencing the drilling operation, the locations of underground services (telephone, natural gas and electrical lines) were marked out by the public and private locators.

Exp continuously monitored the drilling activities to record the physical characteristics of the soils, depth of soil sample collection, groundwater observation, and total depth of boreholes. The boreholes were advanced by a licensed drilling company, using a combination of continuous flight hollow-stem and solid-stem augering equipment. Representative soil samples were collected from the boreholes to obtain geotechnical soil information, using conventional split spoon equipment and standard penetration methods.

Groundwater monitoring wells were constructed using 50 mm diameter and three (3.0) meter long PVC screens (PVC Schedule 40) and an appropriate length of solid PVC riser pipes. The annular space around each well was backfilled with sand (grade 1) from 0.3 to 0.6 m above the top of the screen. A bentonite seal was added from the top of the sand pack to ground surface. Monitoring wells were completed with protective 'stick-up' monument casings, which were grouted into place.

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 and were installed by a licensed well contractor. The wells should be decommissioned by the well owner in accordance with the procedure outlined in the same regulation.

2.2 Monitoring Well Network

The monitoring well network installed as part of the current investigations consists of the following:

- Seven (7) nested pairs were installed at seven (7) locations near the SWMP locations (BH-A2(a)D/BHA2-(b)S, BHA3(a)D/BH-A3(b)S, BH-B1(a)D/BH-B1(b)S, BH-B2(a)D/BH-B2(b)S, BH-C2(a)D/BH-C2(b)S, BH-C3(a)D/BH-C3(b)S, and BH64D/BH64S). The intention of installation of the nested wells were to delineate the vertical gradient of groundwater between the shallow and deep water-bearing zones at the noted locations. The approximate depth of completion of the shallow wells ranges from 6 to 7.5 mbgs; whereas for the deep wells, it is approximately 18 mbgs.

- Twenty-one (21) single monitoring wells, including shallow and deep wells were installed across the Site. These wells included as follows:
 - Fifteen (15) shallow monitoring wells, including BH-17, BH-54, BH-68, BH-82, BH-101, BH-136, BH-144 C, BH-146 A, BH-146 B, BH-157, BH-E4, BH-E8, BH-E10, BH-E33, BH-E40, and BH-E44. The approximate depth of completion of the noted wells ranges from 6 to 7 mbgs; and
 - Six (6) deep monitoring wells, including BH-62, BH-96, BH-119, BH-122, BH-137 and BH-151. The approximate depth of completion of the noted wells is 10 mbgs, except for BH-137 where it is completed at approximately 20 mbgs.

The locations of the boreholes and monitoring wells are shown on Figures 2 A through C. The details of borehole logs and well constructions are presented in Appendix A.

BHs 150 to 159 were drilled north of the development along Veterans Drive to service the proposed development with underground services.

2.3 Nested Mini-Piezometers

The mini-piezometer (MP) network utilized as part of the current Site investigative activities consists of the following:

- Four (4) nested MPs were installed at the Site on September, 2017. These include as follows:
 - One (1) pair of nested MPs (MP1D/S) located on the northern boundary of the northern block, in the tributary that intersects the northern block;
 - One (1) pair of nested MPs (MP2D/S) located on the southern boundary of the northern block, in the tributary that intersects the northern block near the SWM ponds;
 - One (1) pair of nested MPs (MP4D/S) located on the northern boundary of the southern block, in the tributary that intersects the southern block;
 - One (1) pair of nested MPs (MP3D/S) located on the southern boundary of the southern block, in the tributary that intersects the southern block;

The locations of the nested MPs are shown on Figure 2. The MPs were installed using a 50-mm diameter PVC screen (up to 15 cm in length) and an appropriate length of PVC riser pipe. The annular space around each MP screen was backfilled with sand to an average height of 0.10 m above the top of the screen. A bentonite seal was added from the top of the sand pack to ground surface.

Each MP nest comprises of a deep (up to 1.5 m) and shallow (up to 0.5 m) pipe installation at each location. The vertical distance separating the shallow and deep piezometer screens at each nested location ranged from approximately 0.2 to 0.5 m to allow for the measurement of shallow vertical hydraulic gradients. All MPs were completed with above ground riser pipe sections.

The MP nests are used to monitor groundwater levels in proximity to the surface water features to measure vertical hydraulic gradients, which were subsequently utilized to assess surface water and groundwater interactions.

The locations of the boreholes and monitoring wells are shown on Figures 2 A through C.

2.4 Elevation Survey

The elevation survey was conducted to obtain vertical control of the newly installed monitoring well locations and nested mini-piezometers (MPs). The location and ground surface elevation of the boreholes and monitoring wells were surveyed by a private contractor. The elevation survey of the nested MPs and staff gauges was completed by EXP, relative to the on-site surveyed monitoring wells.

2.5 Hydraulic Conductivity Testing

Hydraulic conductivity tests were conducted to estimate the K value of the saturated soils in proximity to the well screens using Single Well Response Tests (SWRT). Sixteen (16) SWRTs were conducted across the Site.

The static water level within the monitoring well was measured prior to commencing the test. In advance of performing SWRT, the monitoring well underwent development to remove fine grained sediments introduced into the screen following the well construction. The development process involved purging of the monitoring well to induce the flow of fresh formation water through the screen. The monitoring well was later permitted to fully recover prior to performing SWRT.

The SWRT procedure employs the hydrostatic time-lag method for groundwater recovery following the introduction of a slug of known volume into a monitoring well, and makes use of the theory of Hvorslev (1951), as described in Freeze and Cherry (1979). Hvorslev's method is expressed by the following equation:

$$K = \frac{r^2 \ln(L/R)}{2LT_0}$$

Where:

K = hydraulic conductivity of the tested material (m/sec)

r = inner radius of the well riser pipe (m)

R = outer radius of the well riser pipe (m)

L = length of screen and sand pack (m)

To = time lag (sec), where (H-h)/(H- Ho) = 0.37

h = water level at each time of measurement (m)

Ho = initial water level (m, start of test)

H = stabilized water level prior to introducing slug (m)

The time lag (T_0) is defined as the time required for the water level to recover to the stabilized level if the initial flow rate into the well is maintained. This time lag is determined graphically as the time for which $(H - h)$ divided by $(H - H_0)$ is equal to 0.37.

The static water level was measured within each monitoring well immediately prior to the start of the SWRT. The SWRTs were completed by removing a known volume of water from each monitoring well using Waterra tubing and recording well recovery thereafter. Groundwater level measurements began immediately after purging was complete and continued until the water level had recovered by at least 90%, or until 30 minutes had passed. Groundwater levels were recorded electronically by a data-logger configured to obtain readings at a regular interval. Manual groundwater level measurements were also recorded using an electronic water level tape. A complete description of EXP's SWRT procedure is included in Appendix E.

Hydraulic conductivity value was calculated from the SWRT data as per the Hvorslev solution included in the AQTESOLV Pro Version 4.50.002 software package. The semi-log plot for drawdown versus time is included in Appendix E.

2.6 Groundwater Chemistry Testing

To assess the general groundwater chemistry of the Site, two (2) groundwater samples were collected from monitoring wells BH-62 and BH-A2 S on August 17, 2017 using a peristaltic pump. The samples were analyzed for the City of Barrie Storm and Sanitary by-law criteria

Samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Groundwater samples collected for dissolved metals analysis were field filtered. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted to an independent laboratory, Maxxam Analytics Inc., in Mississauga, Ontario, for analysis.

3 Physical Setting

3.1 Site Description

It is our understanding that the proposed development consists construction of a residential development including three (3) Stormwater Management Ponds (SWMP) and amenity blocks (parks and school) on the southwest corner of the intersection of McKay Road and Veterans Drive in Barrie, Ontario and on the northwest corner of 5th Sideroad and 9th Line, Innisfil, Ontario. In the southeast of McKay Road West and Veterans Drive and the northeast corner of 5th Sideroad and 9th Line, employment lands will also be developed. The Site location plan is shown on Figure 1.

The lands described from two (2) continuous properties on the east and west sides of Veterans Drive and 5th Sideroad straddling the City of Barrie and Town Innisfil borders.

Based on the Nottawasaga Valley Conservation Authority Land Use (NVCA) map, the Site falls within the regulated and jurisdiction areas (Appendix B).

3.1.1 Physiography

The Site is located within a physiographic region known as the Peterborough Drumlin Field and within a landform known as the Till Plains.

Morphologically, this region is characterized by flat, low-lying plains composed of silts, clays and fine to medium grained sands deposited within glacial Lake Algonquin. Stratified clay and silt were also observed within this area. (Chapman & Putnam, 2007).

The topography of the till plain slopes gently towards Lake Simcoe. The physiography of the Site and the surrounding areas is presented in Figure 3.

3.1.2 Regional Geology and Hydrogeology

The surficial (Quaternary) geology is described as ice-contact stratified deposits of fine sand to gravel, and stone poor carbonate derived sandy silt to silty sand textured till and a small portion coarse-textured glaciolacustrine deposits to the north. The surficial geology of the Site and surrounding areas is shown on Figure 4.

The bedrock in the study area is interpreted to be the Middle Ordovician - age limestone of Simcoe Group Lindsay Formation primarily composed of limestone, minor dolostone and shale (Ministry of Northern Development and Mines, 2012). Figure 5 presents the geology of bedrock within the Site boundaries, as well as in the surrounding areas.

The regional groundwater flow direction in the region is expected to be directed northeast, towards Lake Simcoe. Local deviation from the regional groundwater flow path may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure

3.2 Site Setting

3.2.1 Topography

The general surface elevation at the Site ranges from approximately 303 to 313 masl. There is a topographical high point in the western portion and a low point that runs through the center of the Site, leading to the tributary. In overall, the Site topography slopes towards southeast.

3.2.2 Surface Water Features

The Site is located within the Lake Simcoe drainage basin.

There is a drainage feature traverses the central portion of the Site and joins a tributary located on the southwestern flanks of the Site. Lovers Creek and its tributaries also are located on the east and west of the Site. Lake Simcoe is located approximately 8 km to the northeast of the Site.

3.2.3 Existing Water Well Survey

Well Records from the MECP Water Well Record (WWR) Database were reviewed to determine the number of water wells present within a 500-m radius of the Site boundary.

According to the MECP WWR database, a total of forty-three (43) well records are located within a 500-m radius of the Site. Six (6) of the records were located on-site where they were listed as water supply wells for either domestic and/or livestock uses.

The thirty-seven (37) of the well records were located off-site. Twenty-nine (29) records were indicated as water supply wells for either domestic or livestock uses. The remainders of the records were listed as abandoned and observation wells, as well as the ones with unknown use. The reported water levels ranged from an approximate depth of 2 to 58 mbgs.

The locations of the MECP WWR within 500 m of the Site boundary are shown on Figure 6. A summary of the WWR is presented in Appendix C.

Based on the Wellhead Protection Area (WHPA) map (Lake Simcoe Conservation Authority & York region) the Site does not fall within the protected areas. The location of the Site with respect to the WHPAs is presented in Appendix D.

4 Hydrogeological Investigation Results

4.1 Soil Stratigraphy

Based on the results of the Geotechnical and Hydrogeological Investigations, a brief description of the general subsurface geology at the Site, in order of depth, is summarized in the following sections. The borehole logs are provided in Appendix A. Inferred geological cross sections traversing the Site are presented in Figures 7A and 7B.

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.

Pavement Structure

All boreholes advanced within the 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 gravel with trace to some silt. The granular fill is in a generally moist condition.

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 mbgs. 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 %.

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. Moisture contents in the native soils were recorded as follows:

- Sand/Silty Sand - approximately 1 to 29 %
- Silty Clay / Clayey Silt – approximately 8 to 22 %
- Silt – approximately 14 to 20 %
- Silty Sand Till – approximately 4% to 32 %

- Peat – approximately 68 and 260 %

Silty Sand Till

The predominant soil deposit at the site was a glacial silty sand till. The till deposit was encountered in borehole locations with the exception of boreholes 58, 106, 124, 14A, E27, E28, 150, 152, and 154. The till contained trace gravel and occasional cobble. The till deposit existed in a compact to very dense state.

Silty Sand

In boreholes 99, 104, 108 133 and E44 discontinuous deposit of silty sand was encountered. The deposit typically contained trace gravel, trace clay and occasional silt seam. The deposit existed in a very loose to very dense state has moisture content ranging from 7 to 19%.

Silt

A discontinuous deposit of silt was encountered across the majority of the Site. The deposit typically contained some clay, some sand, trace gravel, and the occasional sand seam. The silt had a hard consistency and moisture content ranged from 7 to 24%.

Silty Clay

A discontinuous silty clay deposit was encountered along McKay Road West and Veterans Drive roadways. The deposit typically contained trace sand and trace gravel. The deposit existed in a hard consistency and had moisture content ranging from 8 to 26%.

Clayey Silt

Locally in borehole 103, a discontinuous deposit of clayey silt was encountered. The deposit was generally hard, and had moisture content was 14%.

Peat

Peat was encountered locally in Boreholes 31 and 76 in the southeastern portion of the site

Fine to Medium Sand

Deposits of fine to medium sand were overlaying, underlying and within the silty sand till deposit. The sand contains trace to some gravel, and trace to some silt. The deposit is generally in very loose to loose state and has a moisture content ranging from 1 to 11%.

Water Bearing Sand

A 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.

4.2 Groundwater Elevations and Flow Direction

Static groundwater level measurements were recorded for all available monitoring wells as part of the Hydrogeological Investigation. A summary of the static water level data as it relates to the elevation survey is summarized in Table 1-A (enclosed).

The highest groundwater elevation measured in the shallow wells, including the ones installed in a nested configuration was 310.48 masl (0.28 mbgs in BH-17 on June 22, 2017). The lowest groundwater measured in the noted wells was 300.4 masl (6.1 mbgs in BH-68 on August 18, 2017).

The highest groundwater elevation measured in the deep wells, including the ones installed in a nested configuration was 305.16 masl (7.79 mbgs in BH-151 on August 18, 2017). The lowest groundwater measured in the noted wells was 290.1 masl (19.9 mbgs in BH-137 on August 18, 2017).

Horizontal Groundwater Flow

Interpreted overburden groundwater flow maps based on the August 2017 monitoring events for the shallow and deep wells are presented in Figure 8 and Figure 9, respectively. The groundwater contour map delineated for the shallow water-bearing zone is based on the water level measurements recorded for all existing shallow wells, including the ones with a nested configuration installed across the Site; whereas the groundwater contour map delineated for the deep water-bearing zone is based on the water level measurements recorded for the deep wells installed in a nested configuration.

Based on the obtained water level measurements, the general direction of groundwater flows in both shallow and deep water-bearing zones are inferred to be approximately towards southeast of the Site. The general flow directions are consistent with the approximate trend of the creek traversing the centre of the Site (Figures 8 and 9) as well.

Vertical Groundwater Gradients

Based on the water level measurements completed in the nested wells, the inferred general vertical hydraulic gradient is to be approximately downward, towards deeper water-bearing zones.. The downward gradient suggests the Site to be in an area of groundwater recharge.

A summary of the hydraulic gradients observed at each monitoring well location is summarized in Table 1-A (enclosed).

It should be noted that the horizontal and vertical groundwater flow directions are subject to seasonal variations. As a result, further monitoring will provide a better understanding of groundwater flows within the overburden.

4.3 Hydraulic Connection between Surface Water Features and Groundwater

A total of four (4) pairs of nested mini-piezometers (MPs) were installed at the Site (Figure 2):

- One (1) pair of nested MPs (MP1D/S) located on the northern boundary of the northern block, in the tributary that intersects the northern block;

- One (1) pair of nested MPs (MP2D/S) located on the southern boundary of the northern block, in the tributary that intersects the northern block near the SWM ponds;
- One (1) pair of nested MPs (MP4D/S) located on the northern boundary of the southern block, in the tributary that intersects the southern block;
- One (1) pair of nested MPs (MP3D/S) located on the southern boundary of the southern block, in the tributary that intersects the southern block;

A summary of the measured groundwater levels in the MPs is summarized in Table 1-B (enclosed). The locations of the MPs are presented in Figures 2A through 2C.

It should be noted that since groundwater levels in the installed MPs had not been stabilized at the time of this report, and as such, the water level measurements for the noted MPs have not been used for contouring groundwater table.

4.4 Hydraulic Conductivity Testing

Sixteen (16) Single Well Response Tests (SWRT's) were completed on sixteen (16) monitoring wells, including single and the ones with nested configuration. The tests were completed to estimate the saturated hydraulic conductivity (K) of the water-bearing zones at the well screen intervals.

The static water level within the monitoring well was measured prior to the start of testing. In advance of performing SWRT, the monitoring well underwent development to remove fine grained sediments introduced into the screen following the well construction. The development process involved purging of the monitoring well to induce the flow of fresh formation water through the screen. The monitoring well was later permitted to fully recover prior to performing SWRT.

Hydraulic conductivity value was calculated from the SWRT data as per the Hvorslev solution included in the AQTESOLV Pro Version 4.50.002 software package. The semi-log plot for drawdown versus time is included in Appendix E.

A summary of the hydraulic conductivity (K) values estimated from the SWRTs are provided in Table 4-1 below.

Table 4-1: Summary of Hydraulic Conductivity Testing

Monitoring Well	Well Depth (mbgs)	Screen Interval (mbgs)		Soil Formation Screened	Estimated Hydraulic Conductivity (m/s)
		from	to		
BH-A2 (a) D	16.5	13.5	16.5	Sand	9×10^{-6}
BH-A2 (b) S	5.9	2.9	5.9	Silty Sand Till	2.7×10^{-7}
BH-A3 (a) D	18.3	15.3	18.3	Silt / Sand	4.3×10^{-6}
BH-A3 (b) S	6.1	3.1	6.1	Silty Sand Till	1.7×10^{-6}
BH-C2 (a) D	18.3	15.3	18.3	Silty Sand Till	5.1×10^{-7}
BH-C2 (b) S	7.6	4.6	7.6	Sand / Silty Sand Till	4.2×10^{-6}
BH-C3 (a) D	18.3	15.3	18.3	Sand / Silty Sand Till	3.8×10^{-6}
BH-C3 (b) S	7.6	4.6	7.6	Silty Sand Till	1.9×10^{-6}
BH-17	7.6	4.6	7.6	Silty Sand Till	7.8×10^{-7}
BH-54	6.1	3.1	6.1	Silty Sand Till / Sand	7.3×10^{-6}
BH-62	10.7	7.7	10.7	Silty Sand Till / Sand	4.05×10^{-6}
BH-64 (a) D	17.4	14.4	17.4	Sandy Silty Till / Sand	1.3×10^{-7}
BH-64 (b) S	6.1	3.1	6.1	Sand / Sandy Silt Till	4.0×10^{-6}
BH-68	7.6	4.6	7.6	Silty Sand Till	4.2×10^{-6}
BH-119	10.6	7.6	10.6	Silty Sand Till	4.2×10^{-7}
BH-151	9.1	6.1	9.1	Silty Sand Till / Sand	2.3×10^{-5}
Highest K value estimate for the tested water-bearing zones					2.3×10^{-5}
Geometric mean of the K values estimated for the tested water-bearing zones					2.1×10^{-6}

SWRT provides estimates of K values for the lithologic units in the immediate zone surrounding the well screen. As shown in Table 4-1, the highest K value is estimated to be 2.3×10^{-5} m/s. Further, the geometric mean of the K values for the tested water-bearing zones is estimated to be 2.1×10^{-6} m/s.

4.5 Groundwater Quality

To assess the suitability for discharge of pumped groundwater to the City of Barrie Sanitary and Storm sewers during dewatering activities, two (2) unfiltered groundwater samples were collected from monitoring wells BH-62 and BH-A2-S on August 17, 2017, using low flow sampling. Prior to collecting the water samples, approximately three (3) standing well volumes of groundwater were purged from the noted wells.

The samples were collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted to an independent laboratory named Maxxam Analytics Inc., in Mississauga, Ontario, for analysis.

For assessment purposes, the analytical results were compared to the Limits for Sanitary and Storm Sewers Discharge of the City of Barrie. A summary of the analytical results and the laboratory Certificate of Analysis (CofA) are enclosed in Appendix F.

The laboratory CofA showed that all parameters in both collected water samples were detected at the concentrations below the sanitary; whereas the concentrations of Total Suspended Solids (TSS) in the noted water samples exceeded the Storm limits.

Table 4-2: Summary of Analytical Results

Parameter	City of Barrie Sanitary Sewer Discharge Limit	City of Barrie Storm Sewer Discharge Limit	Concentration	
			BH-62	BH-A2 S
Total Suspended Solids (TSS) (mg/L)	350	15	16	25

Notes:

Bold indicates concentration exceeds the Storm Sewer limits.

It should also be noted that, during construction, it is anticipated that TSS levels and associated contaminants (for example Metals), in the pumped groundwater may remain above the by-Law limits. Therefore, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities.

Further, approval to discharge water to municipal sewer system during construction will be required prior to any discharge.

If treatment systems are considered, the specifications of the treatment system(s) will need to be provided/adjusted by the treatment specialist/process engineer during the pre-design and commissioning stage of the system.

5 Dewatering

5.1 Construction Dewatering Considerations

It is our understanding that the project involves design and construction of single family residential dwellings associated with the necessary municipal infrastructures such as roads, sewers, water, and other services, including three (3) stormwater management ponds (SWMPs), amenity blocks (parks and school blocks), and employment lands.

For the purpose of assessing potential construction dewatering requirements, it is assumed that the groundwater level would need to be lowered by approximately 1 m below the lowest excavation level to maintain safe and dry working conditions.

It should be noted that localized seepage of perched groundwater located above groundwater table into the excavations is anticipated. The perched groundwater is likely to be sourced from the sand seams and layers associated with the silty sand till unit. The volume of perched groundwater can vary across the Site, depending on the horizontal and vertical extents of the potential lithologic units. Further, seasonal groundwater fluctuations influenced by the atmospheric precipitations are expected across the Site, and as such, localized groundwater control/dewatering may be required (EXP, 2017).

Under certain conditions, dewatering activities can cause ground settlements. As a result, an assessment of potential settlements is recommended prior to any dewatering activities.

5.2 Construction Dewatering Assumptions

Based on the geotechnical report, the maximum depth of excavations for the building structure, as well as underground services such as sewer and watermain systems, as well as SWMPs had not been specified at the time of the noted investigation (EXP, 2017).

The assumptions used to calculate the dewatering rates are presented in Table 5-1 through 5-4. Further, calculations for the construction dewatering assessments are presented in Appendix G.

Table 5-1 Dewatering Estimate Assumptions - Basements

Input Parameter	Assumption	Notes
Surface elevation	310 masl	Approximate average Site elevation based on the geotechnical borehole logs (EXP, 2017).
Lowest excavation elevation	307.5 masl	Based on the geotechnical report, it is anticipated to be approximately 2.5 mbgs (EXP, 2017).
Dewatering target elevation	306.5 masl	It is assumed to be approximately 1.0 m below the bottom of excavation.
Excavation area	100 m x 100 m	Site is expected to be constructed in sections, but will depend on construction staging
Groundwater elevation	307 masl	Highest groundwater contour shown on the Site plan for shallow water-bearing zone (Figure 9).
Hydraulic Conductivity (K)	2.1×10^{-6} m/s	Geometric K value estimated for the Site

Table 5-2 Dewatering Estimate Assumptions – Shallow Sewer (<6 m) and Watermain Systems

Input Parameter	Assumption	Notes
Surface elevation	312 masl	Approximate average Site ground surface elevation based on the geotechnical borehole logs aligned along the designated area for the sewer system (EXP, 2017)
Lowest excavation elevation	306 masl	Based on the geotechnical report, it is anticipated to be approximately 6 mbgs (EXP, 2017)
Dewatering target elevation	305 masl	Assumed to be approximately 1.0 m below excavation elevation.
Excavation area	50 m x 5 m	Sewers are expected to be constructed in 50 m sections, but will depend on constructing staging
Groundwater elevation	305.16 masl	Highest groundwater elevation measured within the proposed sewer and watermain alignment (Figure 9).

Input Parameter	Assumption	Notes
Hydraulic Conductivity (K)	2.1×10^{-6} m/s	Geometric mean K value estimated for the Site

Table 5-3 Dewatering Estimate Assumptions – SWM Ponds

Input Parameter	Assumption	Notes
Surface elevation	307.5 masl	Approximate average ground elevation in the proposed areas for SWMPs based on the geotechnical borehole logs (EXP, 2017)
Lowest excavation elevation	302.5 masl	It is assumed to be approximately 5 mbgs.
Dewatering target elevation target	301.5 masl	Assumed to be one (1) meter below the lowest excavation elevation.
Excavation area	200 m x 100 m	The area of the largest proposed pond on the Site. Each pond is expected to be constructed one at a time, but will depend on staging
Groundwater elevation	304 masl	Highest shallow groundwater elevation contour shown on the proposed SWMP areas (Figure 9).
Hydraulic Conductivity (K)	2.1×10^{-6} m/s	Geometric K value estimated for the Site

Table 5-4 Dewatering Estimate Assumptions – Deep Sewer (13 m)

Input Parameter	Assumption	Notes
Surface elevation	312 masl	Approximate average Site ground surface elevation based on the geotechnical borehole logs aligned along the designated area for the sewer system (EXP, 2017)
Lowest excavation elevation	299 masl	Based on the geotechnical report, it is anticipated to be approximately 13 mbgs (EXP, 2017)
Dewatering target elevation	298 masl	Assumed to be approximately 1.0 m below excavation elevation.
Excavation area	50 m x 5 m	Sewers are expected to be constructed in 50 m sections, but will depend on constructing staging
Groundwater elevation	305.16 masl	Highest groundwater elevation measured within the proposed sewer and watermain alignment (Figure 9).
Hydraulic Conductivity (K)	2.3×10^{-5} m/s	Highest K value estimated for the Site

5.3 Zone of Influence

The radius of influence (Ro) during pumping (dewatering) was estimated based on the Sichardt equation, which is described as follows:

$$R_o = 3000(H - h)\sqrt{K}$$

Where:

- H = Saturated Head beyond zone of influence in m
 h = Saturated head at excavation in m
 K = Hydraulic Conductivity in m/sec

Based on the Sichardt empirical model and the highest K value, the radius of influence of radial flow and the distance to line source ($L_o = R_o/2$) for linear flow for each of the proposed construction areas are

presented in Table 5-5 below. The calculations for the radius of influence for each proposed locations is presented in Appendix G (Table G-1).

Table 5-5 Radius of Influence

Locations	Radius of Influence	
	Radial Flow (Ro)	Linear Flow (Lo)
Basements	7.2	3.6
Shallow Sewer and Watermain Systems	2.3	1.2
SWMP	36	18
Deep Sewer	103	51.5

5.4 Construction Dewatering Flow Rate Estimate

The Dupuit equation for steady state conditions for linear flow to both sides of an excavation in an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate while dewatering is expressed as follows:

$$Q_w = xK(H^2 - h^2)/Lo$$

Where:

- Q_w = Rate of pumping (m³/sec)
- X = Length of excavation in m
- K = Hydraulic conductivity (m/sec)
- H = Head beyond the influence of pumping (static groundwater elevation) (m)
- h = Head above base of aquifer at the excavation (m)
- Lo = Distance of Influence (m)

It is expected that the initial dewatering rate will be higher in order to remove groundwater from aquifer.

The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, locally from storage resulting in lower seepage rates into the excavation.

5.5 Precipitation

The dewatering rates at the Site should also include removing direct input of rain water into the excavation.

A 15-mm rain event was utilized for the estimate. The estimated volume of direct rainwater to be collected in each of the proposed excavation areas are presented in Table 5-7. The calculations for the rainfall input estimate is included in Appendix G (Table G-2). In the event of significant precipitation, the excavation may need to be dewatered over the course of a day or more before safe work conditions can resumed.

Table 5-5 Summary of Rainwater Collection Volume per Event

Location	Rainwater Collection Volume per Event (m³)
Basements	150
Shallow Sewer and Watermain Systems	4
SWMP (one SWMP built at a time)	300
Deep Sewer	4

5.6 Results of Construction Dewatering Flow Rate Estimates

Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Construction dewatering flow rate estimates are provided in Appendix G (Table G-1). A summary of the dewatering flow rates is presented in Table 5-6 below:

Table 5-6 Summary of Dewatering Flow Rate Estimates

Location	Dewatering Flow Rate Including Rainwater Collection and Safety Factor of Two (m ³ /day)	Notes
Basements	370	Geometric K-value for shallow excavation for the water-bearing zones was utilized for the estimations.
Shallow Sewer and Watermain Systems	60	
SWMP	730	
Deep Sewer	400	Highest K for deep sewer estimated for the water-bearing zones was utilized for the estimations
Total	1,560	

These peak dewatering flow rates include a factor of safety of two (2) to account for seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, and variation in hydrogeological properties beyond those encountered during the course of this study. This peak dewatering flow rate also provides additional capacity for the dewatering contractor.

Please note that it is the responsibility of the contractor to ensure dry conditions are maintained within the excavation at all times and at all costs. A combination of sumps, vacuum system (well points, eductors) and deep wells can be used for the construction dewatering activities, subject to the dewatering contractor design and methodologies.

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events.

It is noted that the maximum flow estimate equation calculated with a high K value, provides a conservative estimate to account for higher than expected flow rates during the construction dewatering. As such, the estimate will be used for the submission of a PTTW with the MECP.

5.7 Permit to Take Water

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering will be more than 50 m³/day but less than 400 m³/day, application for the Environmental Activity and Sector Registry (EASR) with MECP is required. If groundwater dewatering rates on-site exceed 400 m³/day, a Category 3 PTTW is required from the MECP.

Based on the estimated dewatering flow rates, it is recommended that a Category 3 PTTW be obtained from the MECP for 1,600 m³/day for a duration of three (3) years.

6 Potential Impacts of Land Development

6.1 Surface Water Features

The Site is located within the Lake Simcoe drainage basin.

A number of surface water features, including headwater streams, as well as tributaries are indicated on-site. Potential impacts of that dewatering activities on the quality and quantity of the surface water features are anticipated. As such, a monitoring program is recommended to mitigate the potential impacts as a result of the construction activities.

6.2 Groundwater Users

Several domestic water supply wells have been identified within both the Site boundaries and off-site. Based on the Wellhead Protection Area (WHPA) map, it is less likely that any of the noted wells are active; however, a private well survey is recommended to gather information regarding the status of the noted wells prior to commencing the construction activities.

6.3 Geotechnical Issues

Under certain conditions, dewatering activities can cause settlements due to an increase in the effective stress in the dewatered soil.

A letter related to geotechnical issues (i.e. settlement) as it pertains to the Site is recommended to be completed under a separate cover.

6.4 Groundwater Quality

The potential discharge from the dewatering system during the construction can be directed to the municipal sewer system. As such, the quality of groundwater discharge must be in compliance with the City of Barrie Discharge to Sewer Use By-Law. If construction dewatering is discharged to surface water, then it must be in compliance with the Provincial Water Quality Objectives (PWQO).

As discussed previously, it is anticipated that the concentrations of TSS and associated metals in the pumped groundwater may remain elevated and exceed the By-Law or PWQO limits. During construction, a treatment system, such as decantation tanks or any other applicable treatment system, will likely be required to lower sediment contents and metal concentration in the dewatered water.

The specifications of the treatment system will need to be adjusted to the water quality by the treatment specialist/process engineer.

It is recommended that the discharge plan be prepared prior to any construction dewatering and maintained on site accompanied by the hydrogeological report, as well as PTTW for the entire duration of construction dewatering.

6.5 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

7 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation, the following summary of conclusions and recommendations is provided:

- The laboratory CofA showed that all parameters in the collected water samples were detected at the concentrations below the sanitary limits; whereas the concentrations of Total Suspended Solids (TSS) in the noted water samples exceeded the Storm limits.
- Based on the assumptions outlined in this report, the estimated high dewatering flow rates for the construction of a building, as well as underground shallow services, SWMPs and deep sewer are approximately 370, 60, 730 and 400 m³/day, respectively, for a total of 1,560 m³/day. A Category 3 PTTW is required for the construction dewatering activities and 1600 m³/day is recommended.
- The estimated construction dewatering volumes should be considered as potential peak volumes and may decline or vary subject to reaching steady state conditions, accumulation of precipitation, seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, variation in hydrogeological properties beyond those encountered during the course of this study, and construction sequence.
- It should be noted that, during construction and post construction, it is anticipated that TSS levels and associated contaminants (for example, Total Metals) in the pumped groundwater may remain elevated and may continue to exceed the By-Law limits. Therefore, it is recommended that a suitable treatment method be implemented during construction dewatering activities.
- If treatment systems are considered for construction and/or for permanent discharge of the sub-drain system, the specifications of the treatment system(s) will need to be provided/adjusted by the treatment specialist/process engineer during the pre-design and commissioning stage of the system.
- It is noted that an agreement to discharge construction dewatering water from the agencies (City and/or Conservation Authority) will be required prior to discharging dewatering effluent.
- A number of surface water features, including headwater streams, as well as tributaries are indicated on-site. Potential impacts of that dewatering activities on the quality and quantity of the noted water bodies are anticipated. As such, a monitoring program is recommended to mitigate the potential impacts as a result of the construction activities.
- There are several domestic water supply wells located within the Site boundaries and off-site. Based on the Wellhead Protection Area (WHPA) map, it is less likely that any of the noted wells are active; however, a private well survey is recommended to gather information regarding the status of the noted wells prior to commencing the construction activities.
- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

It should be noted that the comments and recommendations in this report are based on the assumption that the present design concept described throughout the report will proceed to construction and that the report should be reviewed in its entirety. Further, it should be noted that the estimated flow volumes are solely intended for the construction dewatering purposes. Any changes to the design concept may result in a modification to the recommendations provided in this report.

8 Limitations

This report is based on a limited investigation designed to provide information to support a Hydrogeological Investigation of the Site. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. EXP must be contacted immediately if any unforeseen Site conditions are experienced. This will allow EXP to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost-effective manner.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

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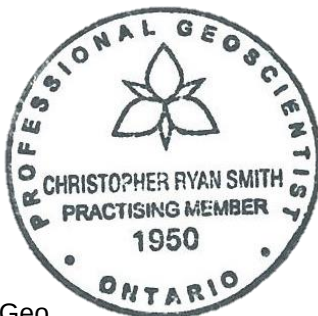
We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

EXP Services Inc.



Ryan Smith, M.Sc., P.Geo.
Senior Hydrogeologist
Environmental Services



Francois Chartier, M.Sc., P.Geo.
Head of Hydrogeology Services
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9 References

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Tables

TABLE 1-A: Groundwater Elevation Summary Monitoring Wells

Watersands

BRM-00038305-C0

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+) / Stick Down (-) (m)	Approximate Full Well Depth (mbgs)	Measurements	22-Jun-17	24-Jul-17	2-Aug-17	9-Aug-17	10-Aug-17	17-Aug-17	18-Aug-17
BH-A2 (a) D	307.25	1.06	16.3	mbtop	-	13.07	-	15.10	-	15.04	-
				mbgs	-	12.01	-	14.04	-	13.97	-
				masl	-	295.24	-	293.21	-	293.28	-
BH-A2 (b) S	307.25	1.01	6.0	mbtop	-	2.96	-	3.39	-	3.55	-
				mbgs	-	1.95	-	2.38	-	2.54	-
				masl	-	305.30	-	304.87	-	304.71	-
				Shallow vs Deep Wells	-	10.06	-	11.66	-	11.44	-
BH-A3 (a) D	307.98	1.16	17.6	mbtop	-	14.02	-	14.52	-	-	-
				mbgs	-	12.86	-	13.36	-	-	-
				masl	-	295.12	-	294.62	-	-	-
BH-A3 (b) S	307.98	1.14	6.1	mbtop	-	3.68	-	4.29	-	-	-
				mbgs	-	2.54	-	3.15	-	-	-
				masl	-	305.44	-	304.83	-	-	-
				Shallow vs Deep Wells	-	10.32	-	10.21	-	-	-
BH-B1 (a) D	309.52	0.91	18.3	mbtop	-	DRY	-	-	-	DRY	-
				mbgs	-	-	-	-	-		-
				masl	-	-	-	-	-		-
BH-B1 (b) S	309.52	0.88	7.5	mbtop	-	DRY	-	-	-	DRY	-
				mbgs	-		-	-	-		-
				masl	-		-	-	-		-
BH-B2 (a) D	309.60	0.92	18.4	mbtop	-	DRY	-	-	-	DRY	-
				mbgs	-		-	-	-		-
				masl	-		-	-	-		-
BH-B2 (b) S	309.60	0.85	7.8	mbtop	-	DRY	-	-	-	DRY	-
				mbgs	-		-	-	-		-
				masl	-		-	-	-		-
BH-C2 (a) D	306.71	0.90	18.4	mbtop	-	-	5.24	5.34	-	-	-
				mbgs	-	-	4.34	4.45	-	-	-
				masl	-	-	302.37	302.27	-	-	-
BH-C2 (b) S	306.71	0.70	6.7	mbtop	-	-	5.01	5.09	-	5.17	-
				mbgs	-	-	4.31	4.39	-	4.47	-
				masl	-	-	302.40	302.33	-	302.78	-
				Shallow vs Deep Wells	-	-	0.04	0.06	-	-	-

BH-C3 (a) D	309.77	0.92	18.1	mbtop	-	-	5.85	5.99	-	-	-
				mbgs	-	-	4.93	5.07	-	-	-
				masl	-	-	304.84	304.70	-	-	-
BH-C3 (b) S	309.77	0.87	7.9	mbtop	-	-	5.36	5.49	-	-	-
				mbgs	-	-	4.49	4.63	-	-	-
				masl	-	-	305.28	305.14	-	-	-
				Shallow vs Deep Wells	-	-	0.44	0.45	-	-	-
BH-17	310.76	0.99	7.6	mbtop	1.27	-	-	2.87	-	-	-
				mbgs	0.28	-	-	1.88	-	-	-
				masl	310.48	-	-	308.88	-	-	-
BH-54	309.91	1.02	6.0	mbtop	1.68	-	-	2.89	-	-	-
				mbgs	0.67	-	-	1.88	-	-	-
				masl	309.25	-	-	308.03	-	-	-
BH-62	309.27	0.86	10.5	mbtop	-	7.46	-	8.37	-	8.68	-
				mbgs	-	6.59	-	7.50	-	7.82	-
				masl	-	302.68	-	301.77	-	301.45	-
BH-64 D	308.56	0.75	17.0	mbtop	4.61	-	-	5.71	-	-	5.73
				mbgs	3.86	-	-	4.95	-	-	4.98
				masl	304.70	-	-	303.61	-	-	303.58
BH-64 S	308.56	0.78	6.1	mbtop	2.09	-	-	3.14	-	-	-
				mbgs	1.31	-	-	2.36	-	-	-
				masl	307.25	-	-	306.20	-	-	-
				Shallow vs Deep Wells	2.55	-	-	2.60	-	-	-
BH-68	306.43	1.16	7.6	mbtop	-	5.19	-	6.74	-	7.23	-
				mbgs	-	4.04	-	5.59	-	6.08	-
				masl	-	302.40	-	300.85	-	300.35	-
BH-82	310.20	0.91	5.9	mbtop	-	-	-	-	6.82	-	-
				mbgs	-	-	-	-	5.91	-	-
				masl	-	-	-	-	304.29	-	-
BH-96	311.17	0.90	10.7	mbtop	-	-	DRY	-	DRY	-	-
				mbgs	-	-		-		-	-
				masl	-	-		-		-	-

BH-101	309.74	1.12	6.2	mbtop	-	-	DRY	-	DRY	-	-
				mbgs	-	-		-		-	-
				masl	-	-		-		-	-
BH-119	311.65	1.24	10.8	mbtop	-	9.59	-	-	10.11	-	-
				mbgs	-	8.36	-	-	8.88	-	-
				masl	-	303.29	-	-	302.77	-	-
BH-122	311.44	1.35	10.8	mbtop	-	DRY	-	-	DRY	-	-
				mbgs	-		-	-		-	-
				masl	-		-	-		-	-
BH-136	309.82	Flushmounts	6.1	mbtop	-	-	DRY	-	-	-	DRY
				mbgs	-	-		-	-	-	
				masl	-	-		-	-	-	
BH-137	309.95	Flushmounts	20.0	mbtop	-	-	-	-	-	-	-
				mbgs	-	-	-	-	-	-	19.87
				masl	-	-	-	-	-	-	290.09
BH-144 C	307.71	0.98	7.8	mbtop	6.15	-	-	-	6.77	-	-
				mbgs	5.18	-	-	-	5.80	-	-
				masl	302.53	-	-	-	301.92	-	-
BH-146 A	303.97	0.89	6.1	mbtop	DRY	-	-	-	-		DRY
				mbgs		-	-	-	-		
				masl		-	-	-	-		
BH-151	312.95	Flushmounts	9.3	mbtop	-	-	-	-	-	-	-
				mbgs	-	-	-	-	-	-	7.79
				masl		-	-	-		-	305.16
BH-157	311.98	Flushmounts	6.1	mbtop	-	-	-	-	-	-	DRY
				mbgs	-	-	-	-	-	-	
				masl	-	-	-	-	-	-	
BH-E4	308.97	1.73	5.4	mbtop	6.31	-	-	-	-	-	DRY
				mbgs	4.58	-	-	-	-	-	
				masl	304.39	-	-	-	-	-	

BH-E8	303.37	1.00	6.0	mbtop	DRY	-	-	-	-	-	DRY
				mbgs		-	-	-	-	-	
				masl		-	-	-	-	-	
BH-E10	310.23	-	6.0	mbtop	DRY	DRY	-	-	-	DRY	DRY
				mbgs			-	-	-		
				masl			-	-	-		
BH-E33	307.89	0.89	6.0	mbtop	DRY	-	-	-	-	-	DRY
				mbgs		-	-	-	-	-	
				masl		-	-	-	-	-	
BH-E40	308.91	1.09	6.1	mbtop	DRY	-	-	-	-	-	DRY
				mbgs		-	-	-	-	-	
				masl		-	-	-	-	-	
BH-E44	307.07	0.10	6.0	mbtop	5.63	-	-	-	-	-	DRY
				mbgs	5.54	-	-	-	-	-	
				masl	301.54	-	-	-	-	-	

Notes:

mbtop: meters below top of casing;
mbgs: meters below ground surface;
masl: meters above sea level.

 upward groundwater gradient at selected location
 downward groundwater gradient at selected location

TABLE 1-B: Groundwater Elevation Summary MPs

Watersands
BRM-00038305-C0

Monitoring Well ID	Ground Elevation (masl)	Stick-up (m)	Total Deoth (mbtop)	Total Depth (mgs)	Measurements	12-Sep-17	14-Sep-17	2-Oct-17
MP1 (S)	308.13	1.12	2.04	0.92	mbtop	1.45	1.51	1.80
					mbgs	0.34	0.39	0.68
					mASL	307.79	307.74	307.45
MP1 (D)	308.04	1.23	2.90	1.68	mbtop	2.14	1.54	1.81
					mbgs	0.91	0.31	0.58
					mASL	307.13	307.73	307.46
					Shallow vs Deep GW elev	0.67	0.01	0.00
MP1 Staff Gauge	-	-	-	-	Depth to water	-	0.10	Dry
					Surface Water Elevation	-	-	
					Deep GW vs Surface Water Elev.	-	-	
MP2 (S)	306.76	1.16	2.12	0.96	mbtop	Dry	Dry	Dry
					mbgs			
					mASL			
MP2 (D)	306.72	0.72	2.10	1.38	mbtop	Dry	Dry	Dry
					mbgs			
					mASL			
					Shallow vs Deep GW elev			
MP2 Staff Gauge	-	-	-	-	Depth to water	Dry	Dry	Dry
					Surface Water Elevation			
					Deep GW vs Surface Water Elev.			
MP3 (S)	-	1.03	1.75	0.73	mbtop	Dry	Dry	Dry
					mbgs			
					mASL			
MP3 (D)	-	0.76	2.07	1.30	mbtop	-	1.58	1.76
					mbgs	-	0.81	1.00
					mASL	-	-	-
					Shallow vs Deep GW elev	-	-	-
MP3 Staff Gauge	-	-	-	-	Depth to water	-	Dry	Dry
					Surface Water Elevation	-		
					Deep GW vs Surface Water Elev.	-		
MP4 (S)	305.36	1.29	2.10	0.82	mbtop	-	1.92	2.08
					mbgs	-	0.64	0.80
					mASL	-	304.72	304.56
MP 4 (D)	305.36	1.08	2.76	1.68	mbtop	-	2.00	2.07
					mbgs	-	0.92	1.00
					mASL	-	304.44	304.36
					Shallow vs Deep GW elev	-	0.28	0.20
MP4 Staff Gauge	-	-	-	-	Depth to water	-	0.14	Dry
					Surface Water Elevation	-	-	
					Deep GW vs Surface Water Elev.	-	-	

Notes:

** - Monitoring well stick up altered on June 20, 2016

1 - mbtop - metres below top of pipe:

2 - mbgs - metres below ground surface

3 - masl - metres above sea level

4 - dates are provided in the following format: month/day/year

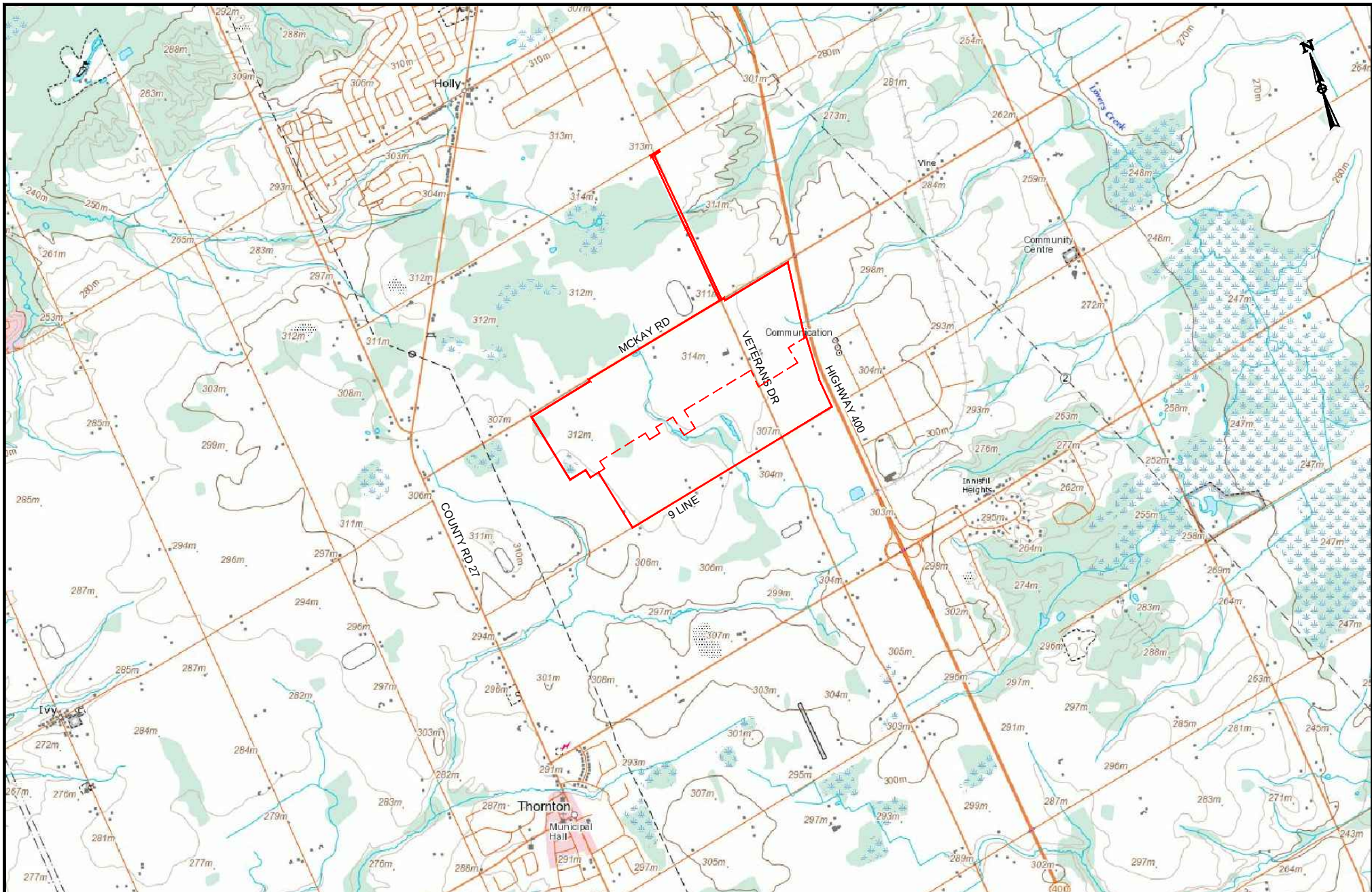
5 water level above ground surface

6 upward groundwater gradient at selected location

7 downward groundwater gradient at selected location

8 nested monitoring well/ mini piezometer in relative equilibrium

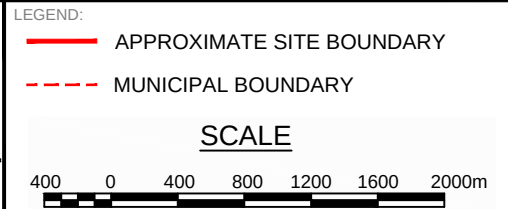
Figures



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TITLE AND LOCATION:

SITE LOCATION PLAN
 HYDROGEOLOGICAL INVESTIGATION
 WATERSAND DEVELOPMENT
 BARRIE / INNISFIL HEIGHTS, ONTARIO

PROJECT NO.:	DWN.:
BRM-00038305-C0	AS
SCALE:	CK:
AS NOTED	RS
DATE:	FIG. NO.:
OCTOBER 2017	1

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- ⊕ MINI-PIEZOMETER LOCATION
- ⊙ BOREHOLE LOCATION
- ⊙ BOREHOLE / MONITORING WELL LOCATION

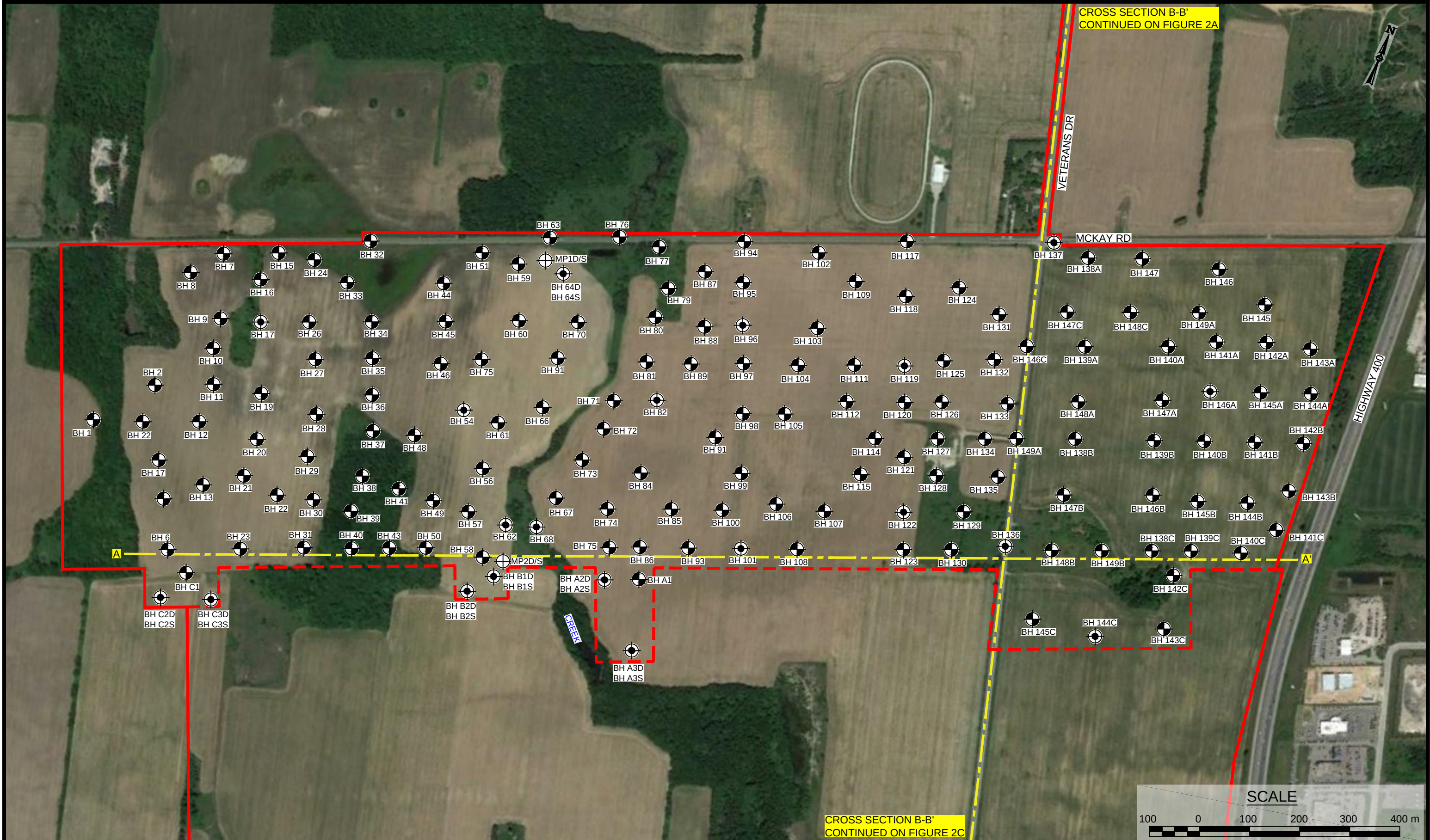
TITLE AND LOCATION:

**BOREHOLE / MONITORING WELL /
MINI-PIEZOMETER LOCATION PLAN**

HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

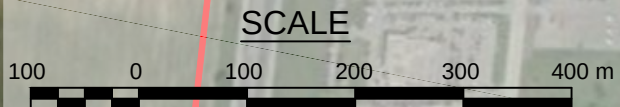
JOB NO.: BRM-00038305-C0	DRAWN BY: AS
SCALE: AS NOTED	CHECKED BY: RS
DATE: OCTOBER 2017	FIG NO.: 2A

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CROSS SECTION B-B'
CONTINUED ON FIGURE 2A

CROSS SECTION B-B'
CONTINUED ON FIGURE 2C



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LEGEND:

- APPROXIMATE SITE BOUNDARY
- - - MUNICIPAL BOUNDARY
- ⊕ MINI-PIEZOMETER LOCATION
- BOREHOLE LOCATION
- ⊕ BOREHOLE / MONITORING WELL LOCATION

TITLE AND LOCATION: BOREHOLE / MONITORING WELL / MINI-PIEZOMETER LOCATION PLAN HYDROGEOLOGICAL INVESTIGATION WATERSAND DEVELOPMENT BARRIE / INNISFIL HEIGHTS, ONTARIO		JOB NO.: BRM-00038305-C0	DRAWN BY: AS
		SCALE: AS NOTED	CHECKED BY: RS
		DATE: OCTOBER 2017	FIG NO.: 2B

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CROSS SECTION B-B'
CONTINUED ON FIGURE 2A, 2B

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LEGEND:

APPROXIMATE SITE BOUNDARY

MUNICIPAL BOUNDARY

MINI-PIEZOMETER LOCATION

BOREHOLE LOCATION

BOREHOLE / MONITORING WELL LOCATION

TITLE AND LOCATION:

BOREHOLE / MONITORING WELL /
MINI-PIEZOMETER LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION

WATERSAND DEVELOPMENT

BARRIE / INNISFIL HEIGHTS, ONTARIO

JOB NO.:

BRM-00038305-C0

SCALE:

AS NOTED

DATE:

OCTOBER 2017

DRAWN BY:

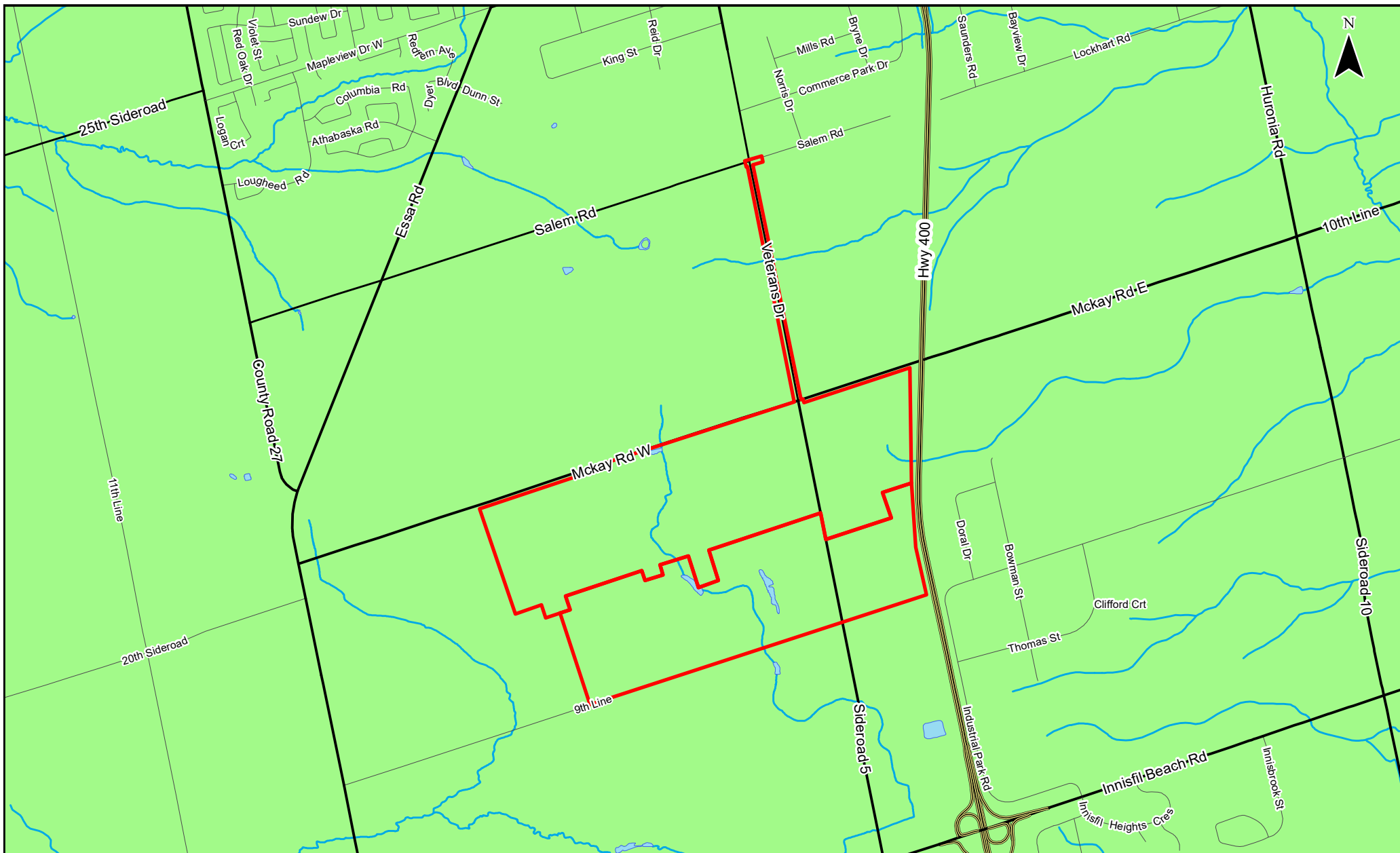
AS

CHECKED BY:

RS

FIG NO.:

2C



Data Source: Physiography of Southern Ontario - Miscellaneous Release - Data 228. Ontario Geological Survey, 2007.

Legend

Approximate Site Boundary Till Plains (Drumlinized)

0 200 400 800 1,200 1,600 2,000
m



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BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

REGIONAL PHYSIOGRAPHY

PROJECT No.:
BRM-00038305-C0

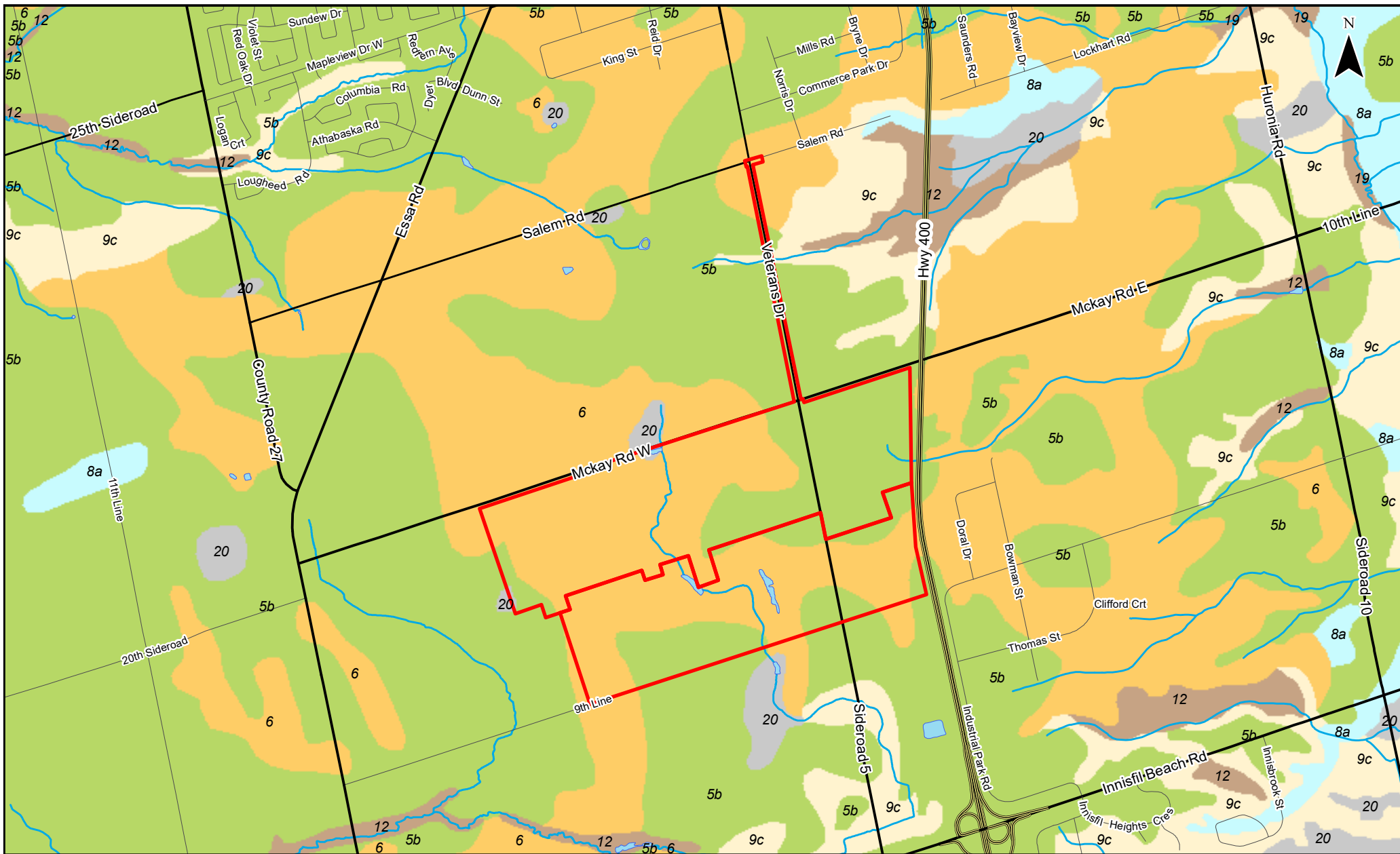
DWN:
AC

SCALE:
AS NOTED

CHKD:
RS

DATE:
SEPTEMBER 2017

DWG. No.:
3



Legend

- Approximate Site Boundary
- 12: Older alluvial deposits
- 6: Ice-contact stratified deposits (fine sand to gravel)
- 20: Organic deposits
- 9c: Coarse-textured (Foreshore-basinal) glaciolacustrine deposits
- 5b: Stone-poor, carbonate-derived silty to sandy till
- 19: Modern alluvial deposits
- 8a: Fine-textured glaciolacustrine deposits

0 200 400 800 1,200 1,600 2,000
m



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PROJECT TITLE:

HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

SURFICIAL GEOLOGY

PROJECT No.:
BRM-00038305-C0

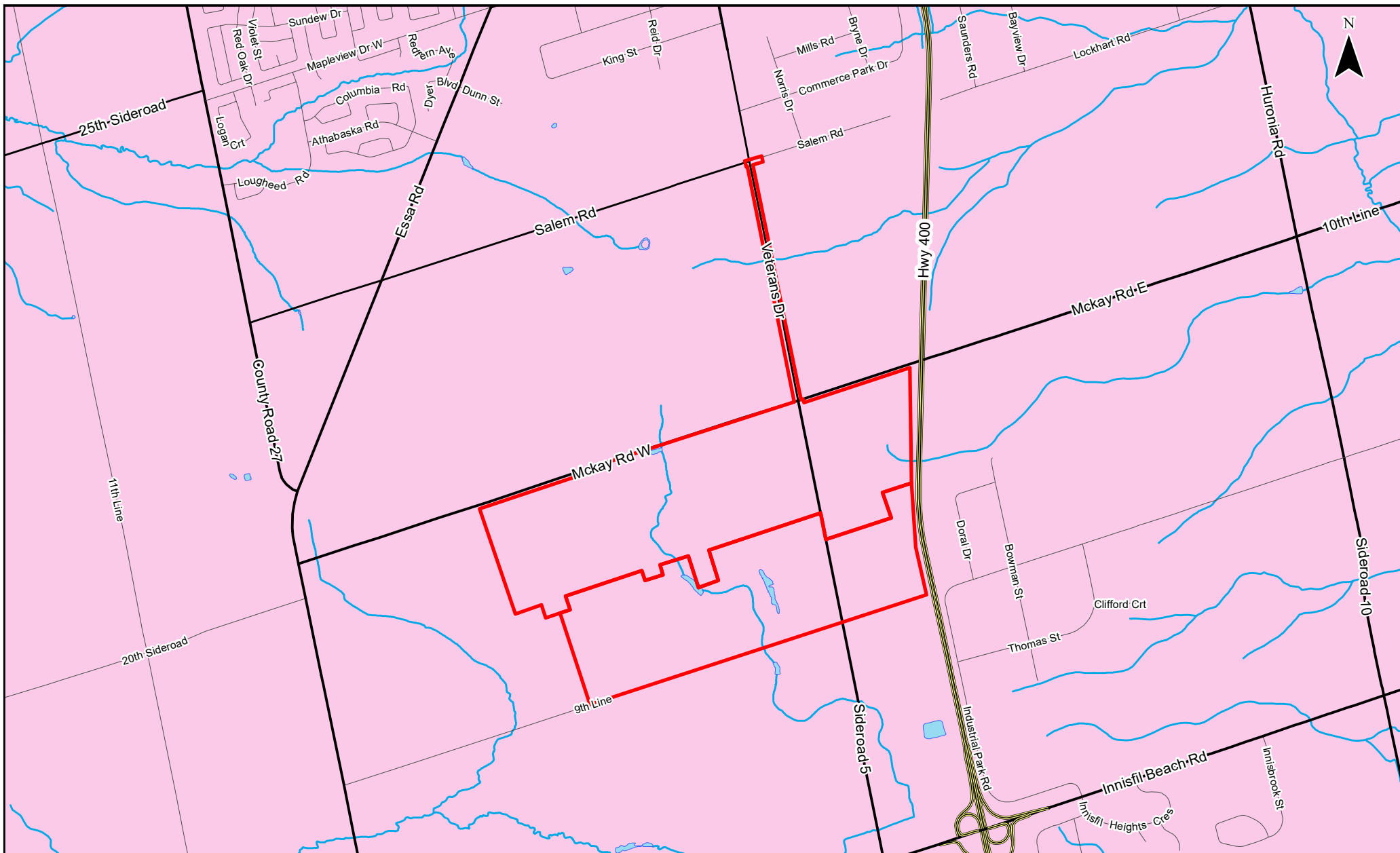
DWN:
AC

SCALE:
AS NOTED

CHKD:
RS

DATE:
SEPTEMBER 2017

DWG. No.:
4



Data Source: 1:250,000 scale bedrock geology of Ontario - Miscellaneous Release - Data 126 - Revision 1. Ontario Geological Survey, 2011.

Legend

Approximate Site Boundary Limestone, Dolostone, Shale, Arkose, Sandstone

0 200 400 800 1,200 1,600 2,000
m



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PROJECT TITLE:

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BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

BEDROCK GEOLOGY

PROJECT No.:
BRM-00038305-C0

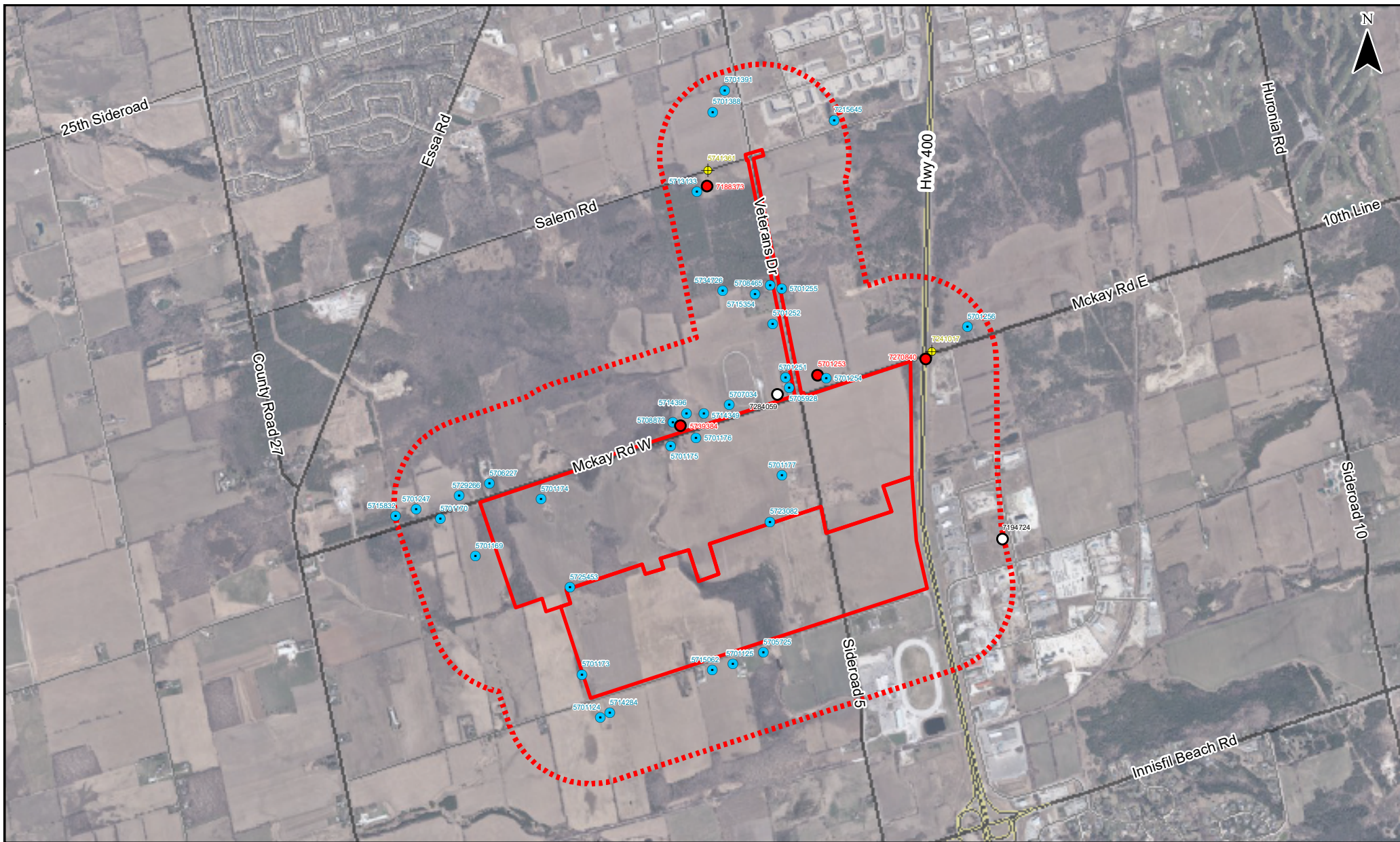
DWN:
AC

SCALE:
AS NOTED

CHKD:
RS

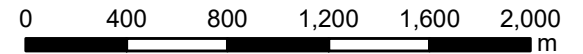
DATE:
SEPTEMBER 2017

DWG. No.:
5



Legend

- Approximate Site Boundary
- Abandoned Well
- Water Supply Well
- 500 m Zone
- ⊕ Monitoring Well / Test Hole
- Unknown / Unfinished Well



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DRAWING TITLE:

MOECC WATER WELL
RECORDS MAP

PROJECT No.:
BRM-00038305-C0

DWN:
AC

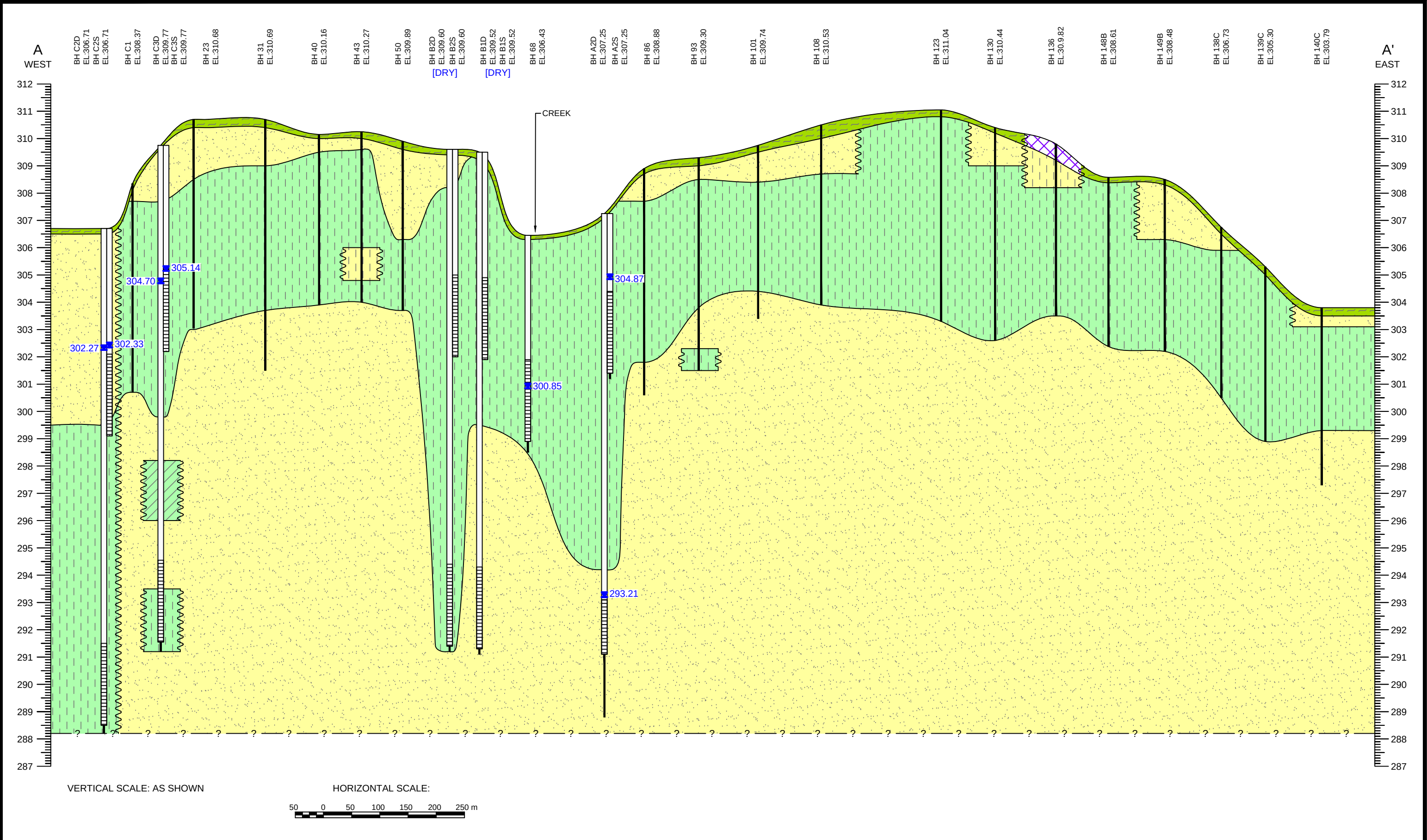
SCALE:
AS NOTED

CHKD:
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DATE:
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DWG. No.:
6

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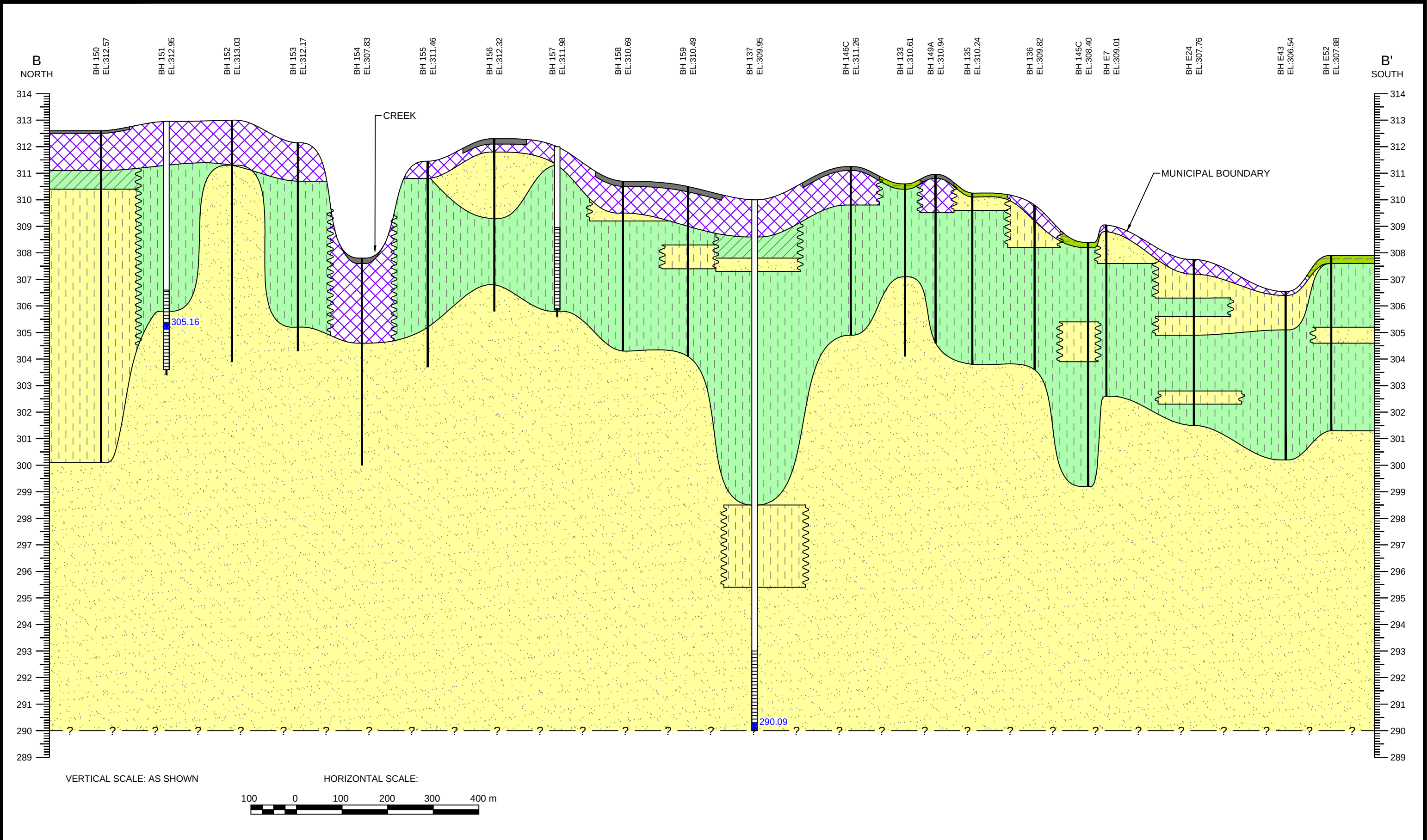
LEGEND:

- TOPSOIL
- FILL
- SAND
- SILT
- SILTY CLAY
- SILTY SAND TILL
- GROUNDWATER ELEVATION AS MEASURED ON AUGUST 9 & 10, 2017

CROSS SECTION A-A'
HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

JOB NO.: BRM-00038305-C0	DRAWN BY: AS
SCALE: AS NOTED	CHECKED BY: RS
DATE: OCTOBER 2017	FIG NO.: 7A

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LEGEND:

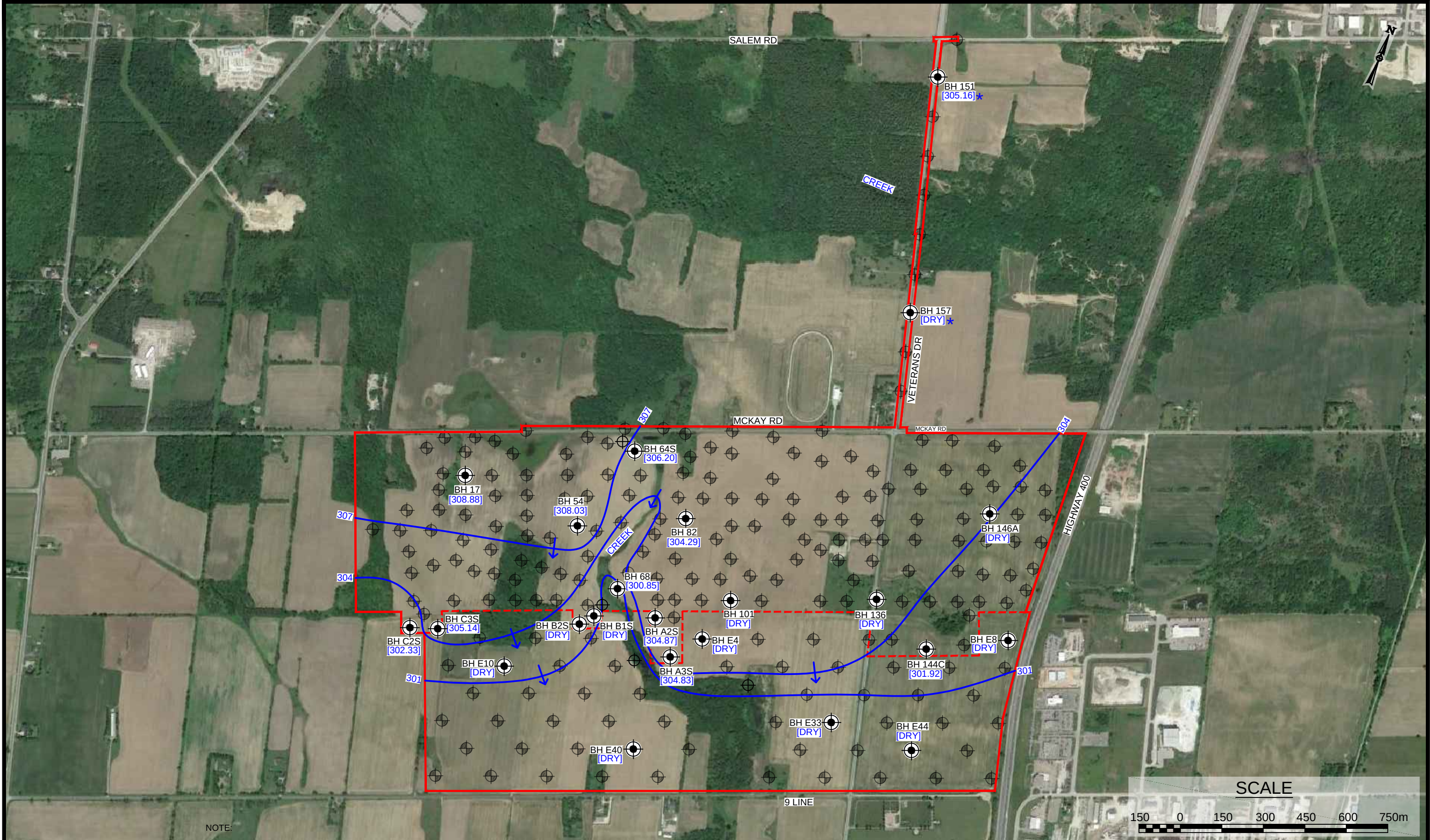
	ASPHALT		SILT
	TOPSOIL		SILTY CLAY
	FILL		SILTY SAND TILL
	SAND		GROUNDWATER ELEVATION AS MEASURED ON AUGUST 18, 2017

TITLE AND LOCATION:

CROSS SECTION B-B'
HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

JOB NO.: BRM-00038305-C0	DRAWN BY: AS
SCALE: AS NOTED	CHECKED BY: RS
DATE: OCTOBER 2017	FIG NO.: 7B

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NOTE:

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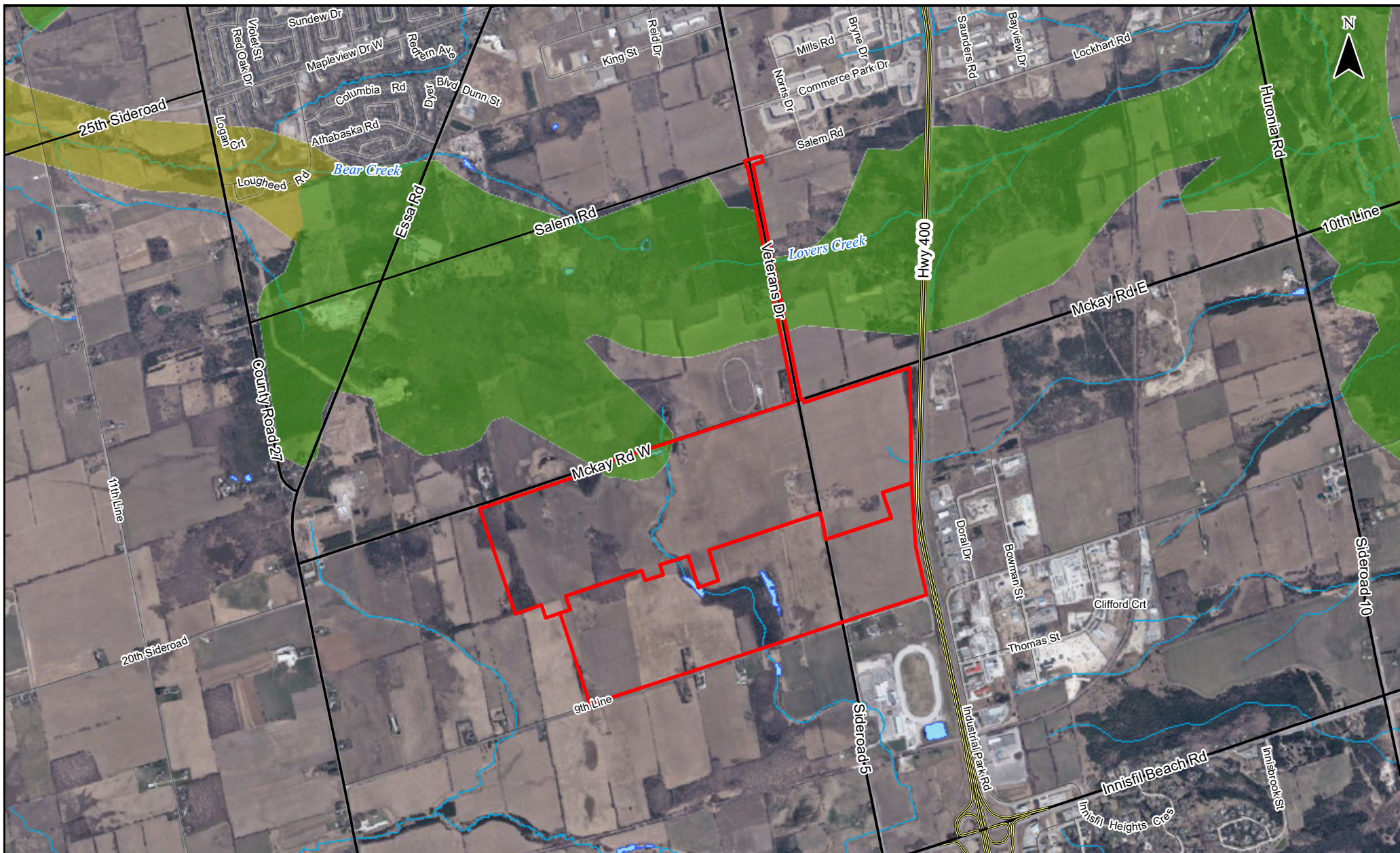
- LEGEND:
- APPROXIMATE SITE BOUNDARY
 - MUNICIPAL BOUNDARY
 - MINI-PIEZOMETER LOCATION (SEE FIGURE 2B, 2C FOR DETAILS)
 - BOREHOLE / MONITORING WELL LOCATION
 - BOREHOLE LOCATION (SEE FIGURE 2A, 2B, 2C FOR DETAILS)

- GROUNDWATER CONTOURS
- GROUNDWATER FLOW DIRECTION
- GROUNDWATER ELEVATIONS AS MEASURED ON AUGUST 9 & 10, 2017
- GROUNDWATER ELEVATION AS MEASURED ON AUGUST 18, 2017

NOTE: GROUNDWATER DATA FOR MONITORING WELLS MARKED AS [DRY] WAS OBTAINED BETWEEN JUNE 22, 2017 AND AUGUST 18, 2017

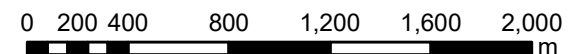
TITLE AND LOCATION:
SHALLOW GROUNDWATER CONTOURS
HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

JOB NO.: BRM-00038305-C0	DRAWN BY: AS
SCALE: AS NOTED	CHECKED BY: RS
DATE: OCTOBER 2017	FIG NO.: 9



Data Source: Schedule 5.4 - The County of Simcoe Official Plan, County of Simcoe, 2007

- Approximate Site Boundary
- County Official Plan 2007 Greenlands
- County Official Plan 2007 Greenland Linkages



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PROJECT TITLE:

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WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

NATURAL HERITAGE
SYSTEMS

PROJECT No.: BRM-00038305-C0	DWN: AC
SCALE: AS NOTED	CHKD: RS
DATE: SEPTEMBER 2017	DWG. No.: 10

Appendix A: Borehole Logs

Log of Borehole 136

Project No. BRM-00038305-B0

Drawing No. 245

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

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

☐

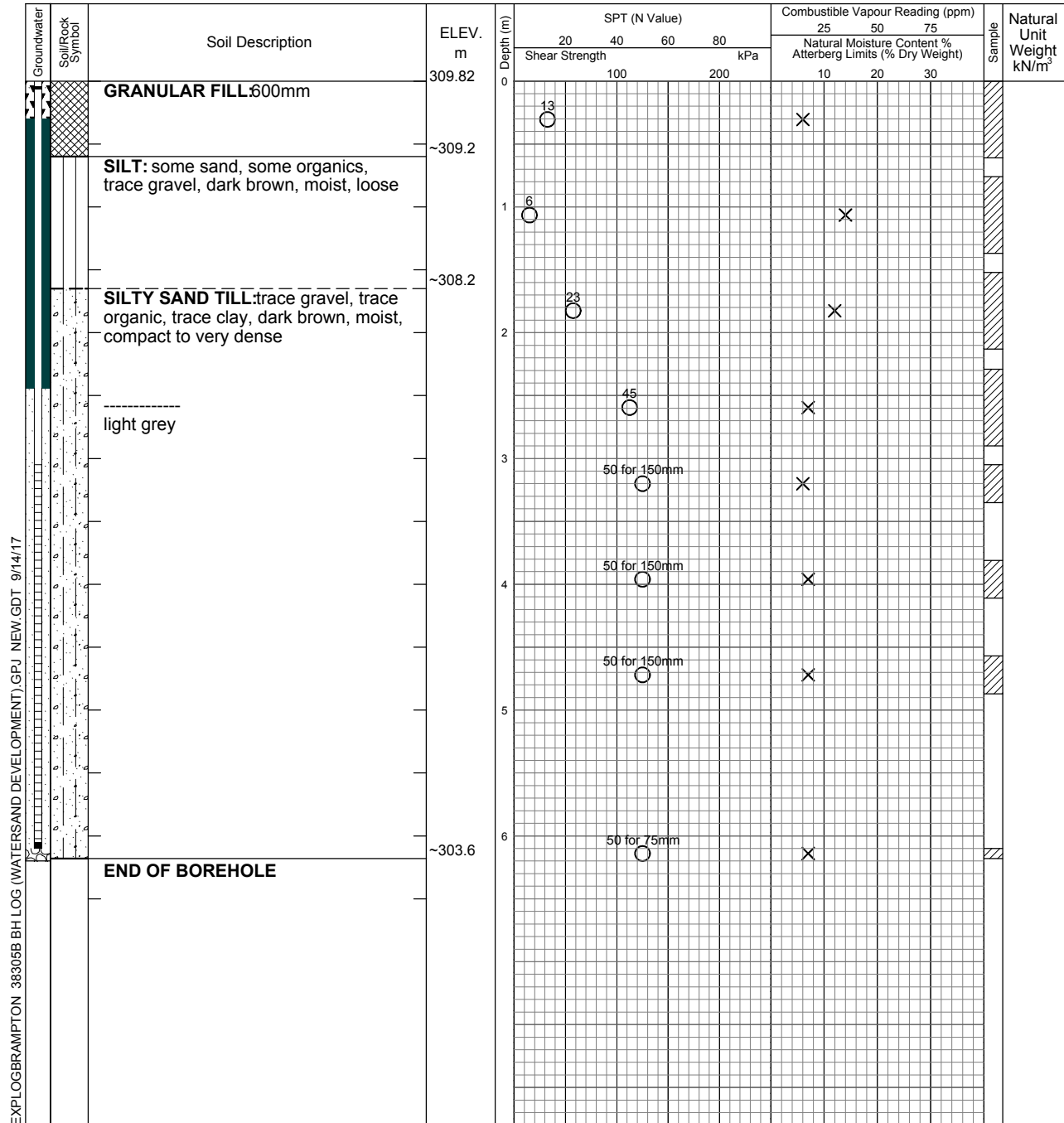
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
August 2, 2017	Dry	-
August 18, 2017	Dry	-

Log of Borehole 146C

Project No. BRM-00038305-B0

Drawing No. 246

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

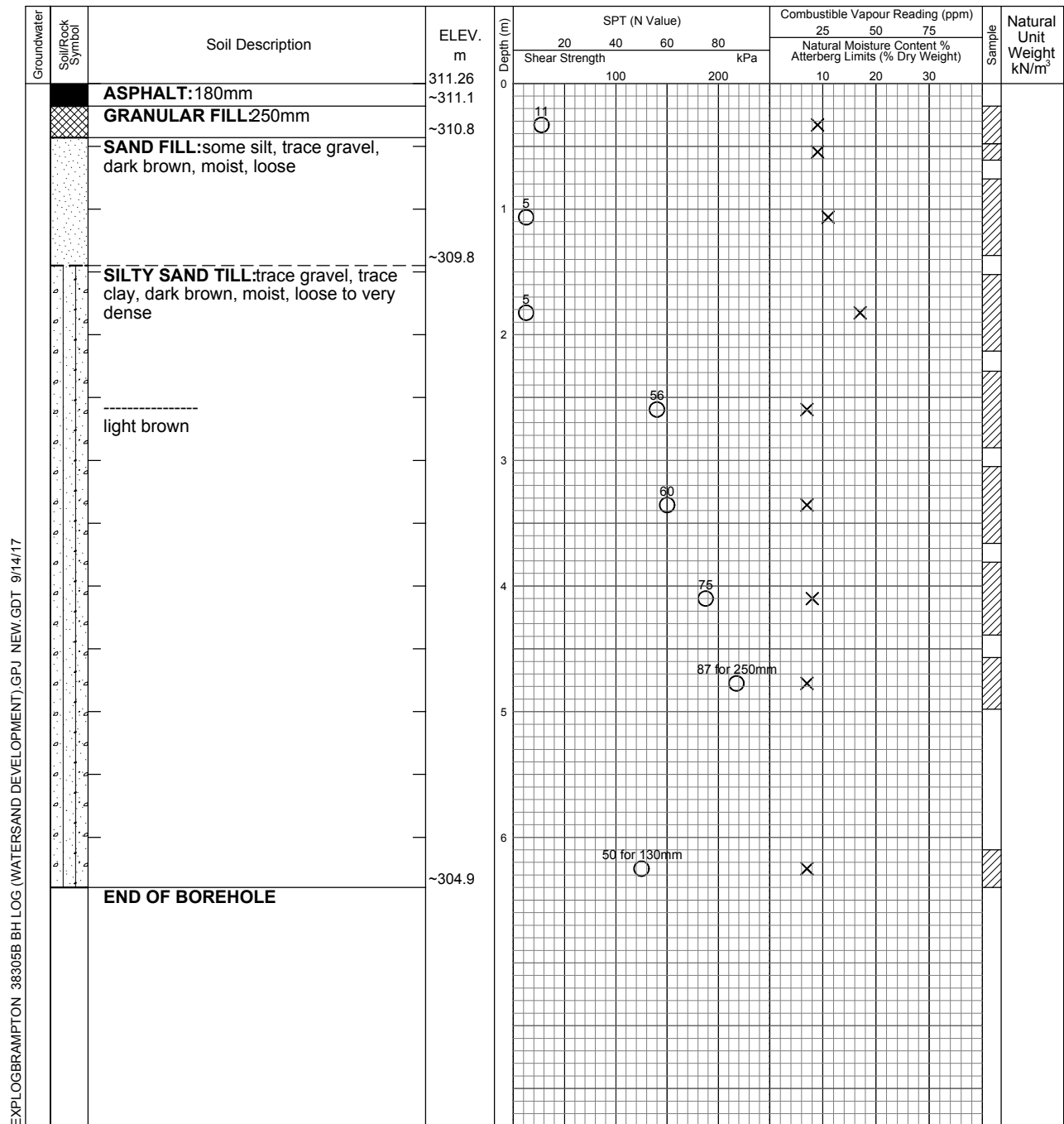
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Drill Type: CME55 - Track MountDatum: Geodetic

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40



Log of Borehole 149A

Project No. BRM-00038305-B0

Drawing No. 247

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

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

☐

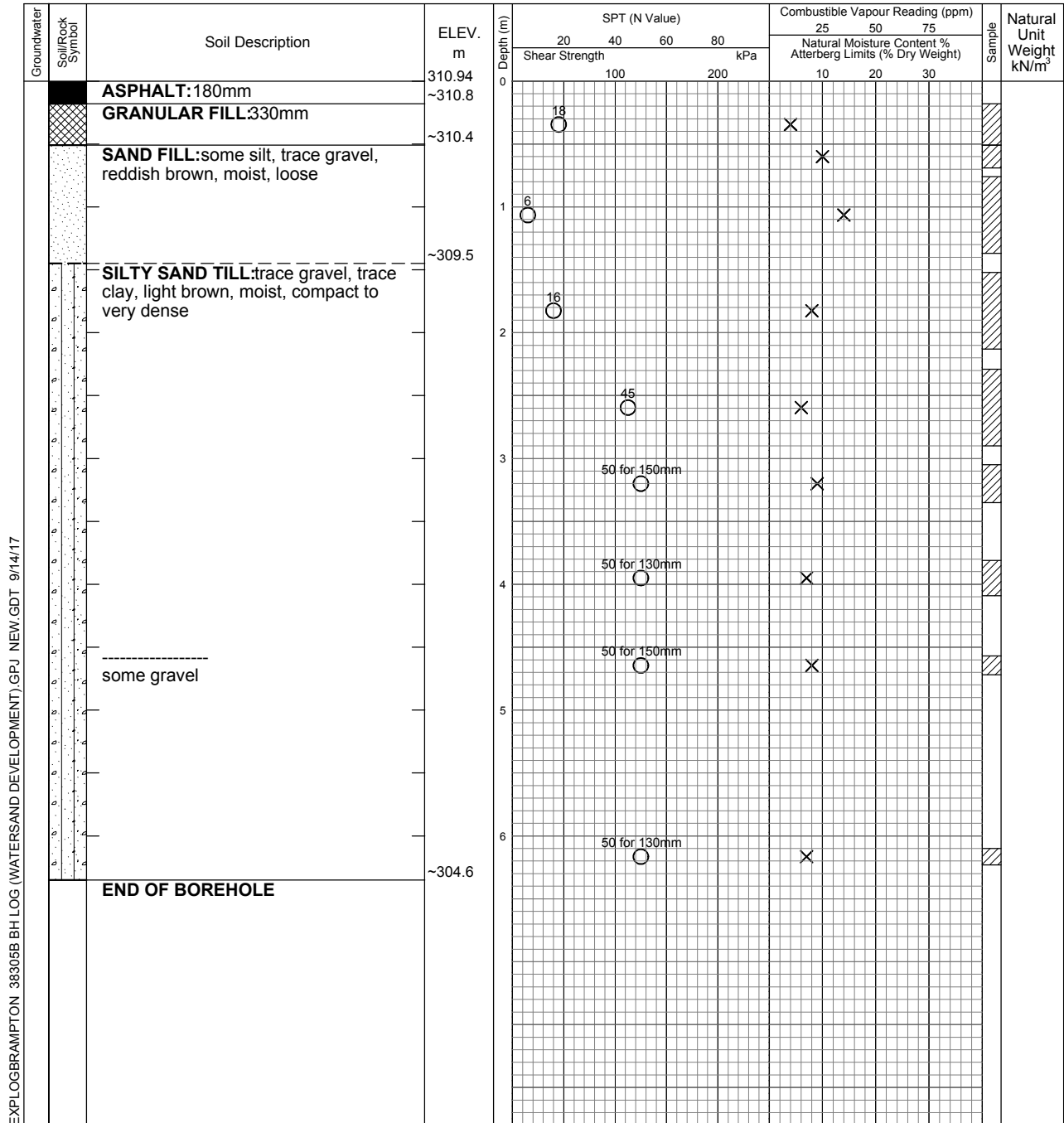
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

Log of Borehole 150

Project No. BRM-00038305-B0

Drawing No. 248

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 31, 2017

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

☐

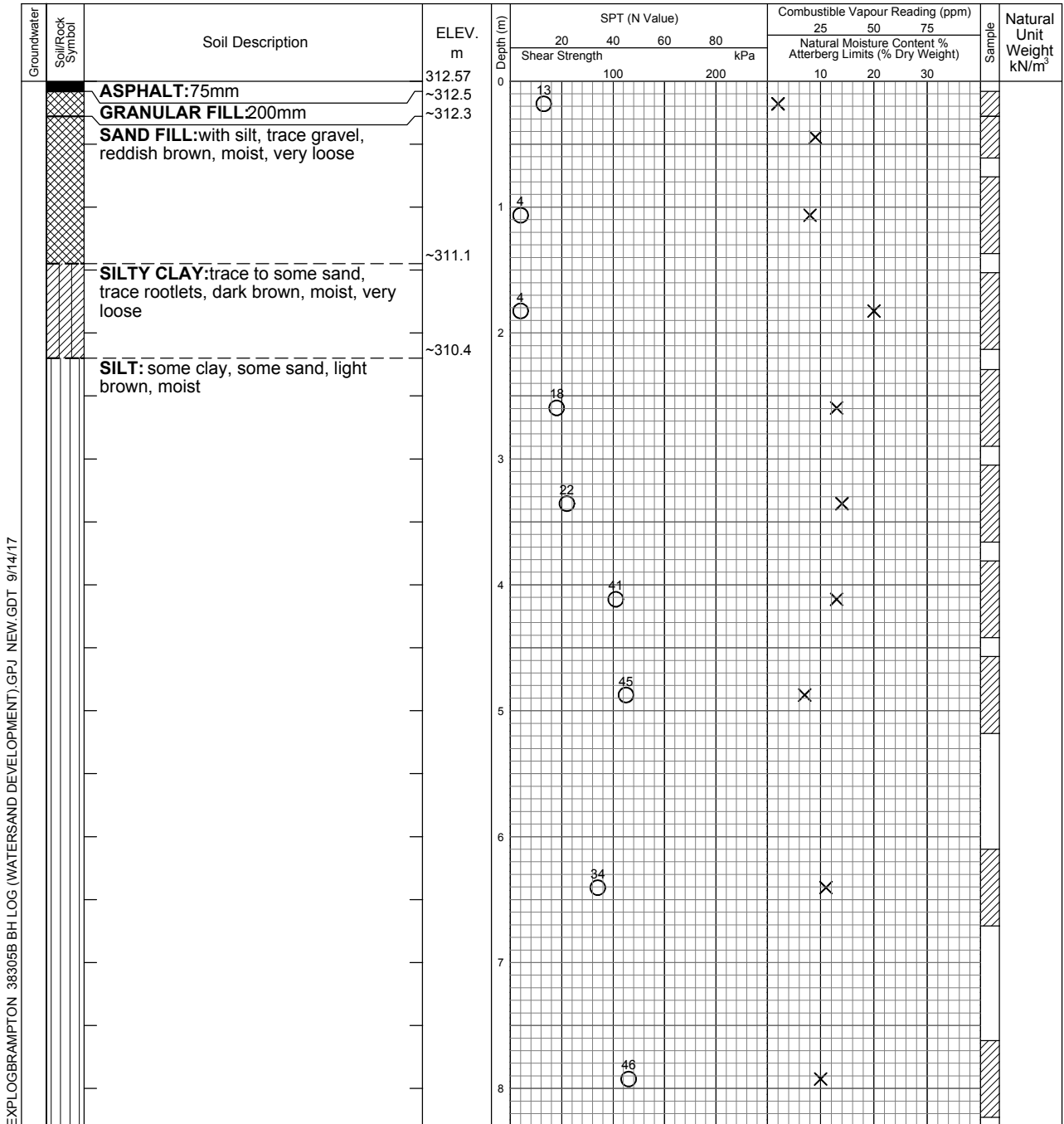
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	12.47



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Log of Borehole 151

Project No. BRM-00038305-B0

Drawing No. 249

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

☐

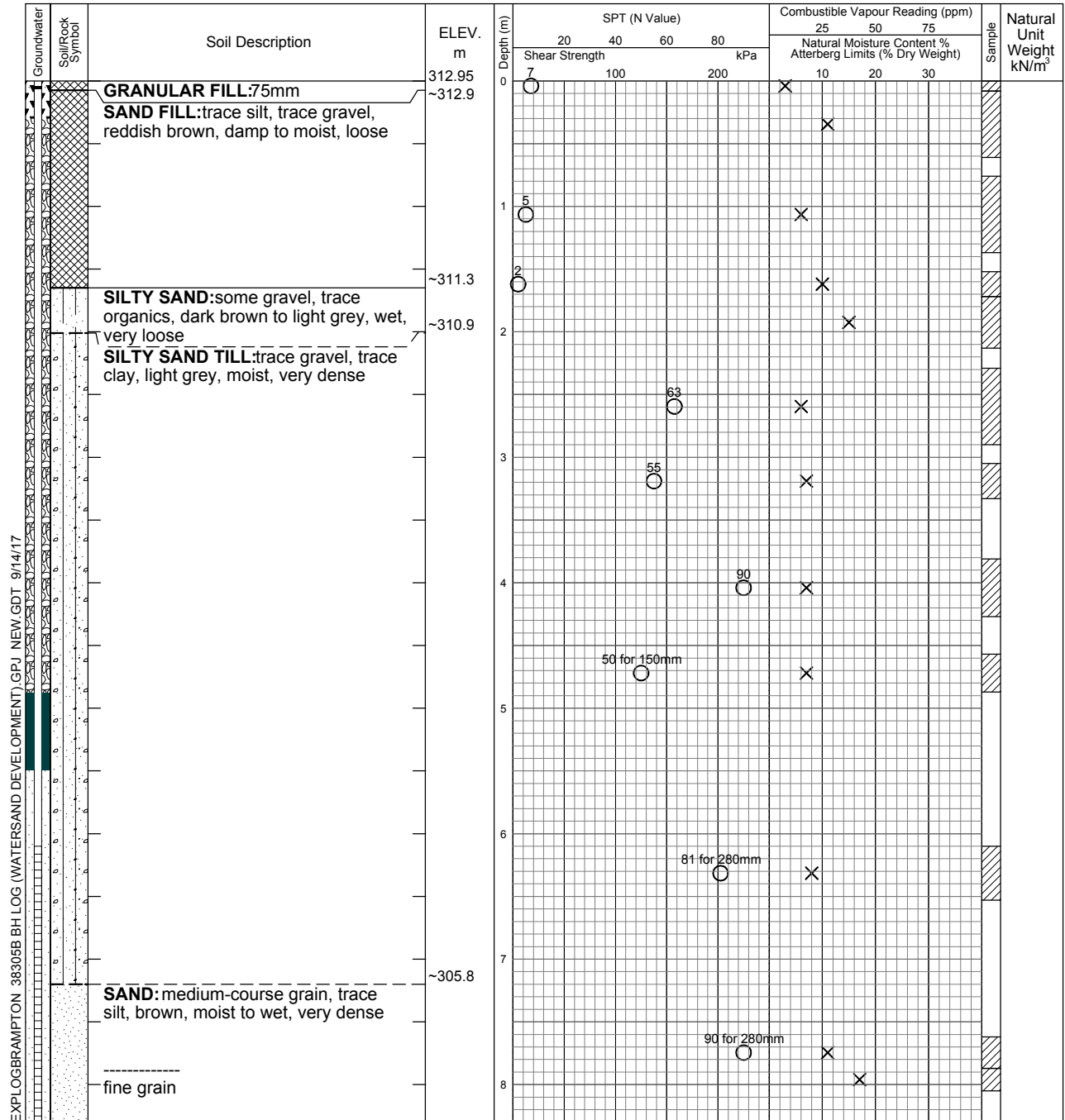
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Datum: Geodetic



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	7.16	-
August 18, 2017	7.79	-

Log of Borehole 151

Project No. BRM-00038305-B0

Drawing No. 249

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

Groundwater Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
				20	40	60	80	25	50	75		
		304.65		Shear Strength				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
		~304.6		100 200				10 20 30				
	SILTY SAND TILL: trace gravel, trace clay, light grey, wet, very dense		9	50 for 75mm				X				
	END OF BOREHOLE	~303.6										

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 18, 2017	7.16 7.79	- -

Log of Borehole 152

Project No. BRM-00038305-B0

Drawing No. 250

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

☐

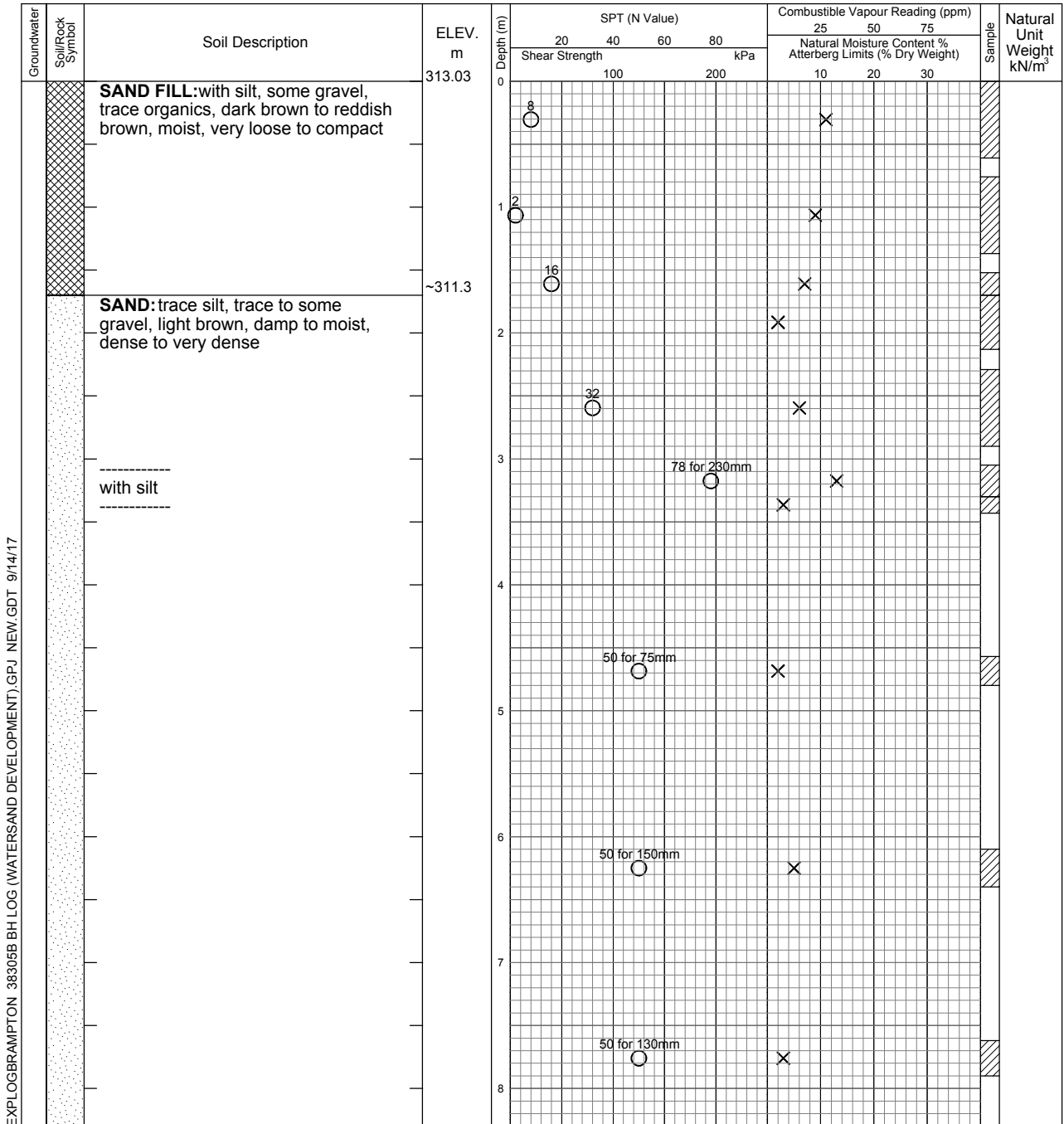
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.14



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17

Log of Borehole 152

Project No. BRM-00038305-B0

Drawing No. 250

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

[illegible]

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.14



Log of Borehole 153

Project No. BRM-00038305-B0

Drawing No. 251

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

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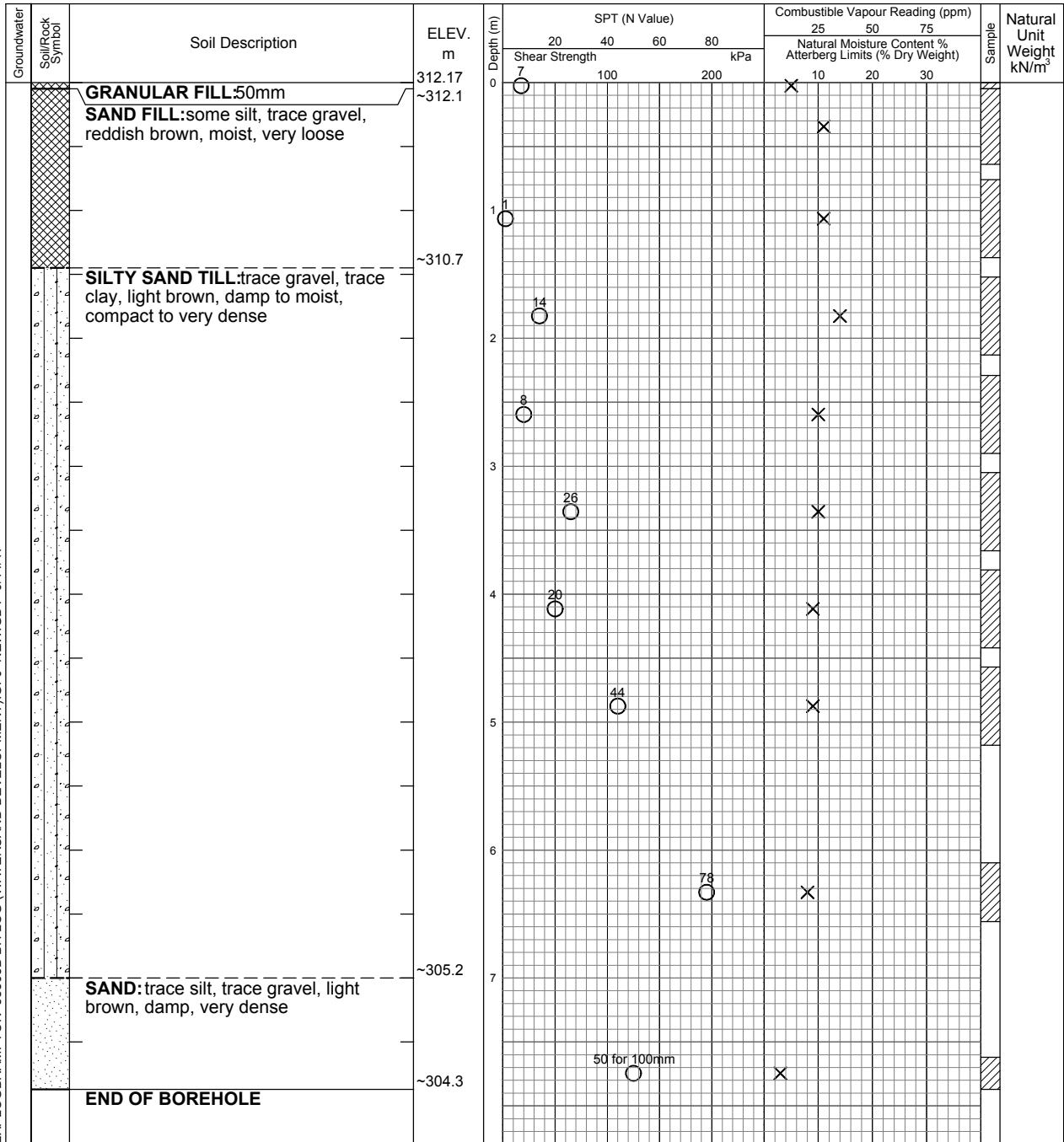
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.87



Log of Borehole 154

Project No. BRM-00038305-B0

Drawing No. 252

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

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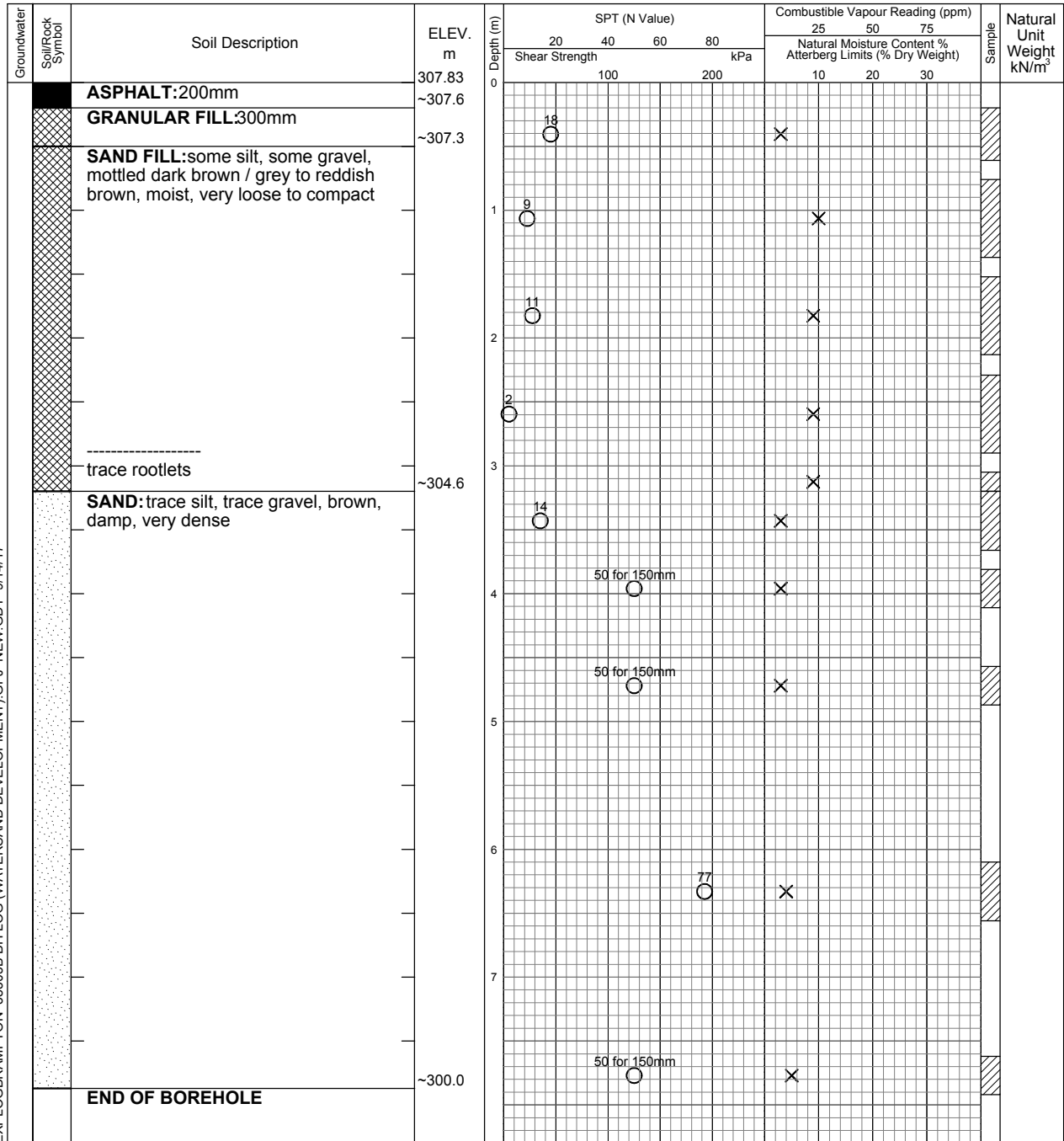
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.92



Log of Borehole 155

Project No. BRM-00038305-B0

Drawing No. 253

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

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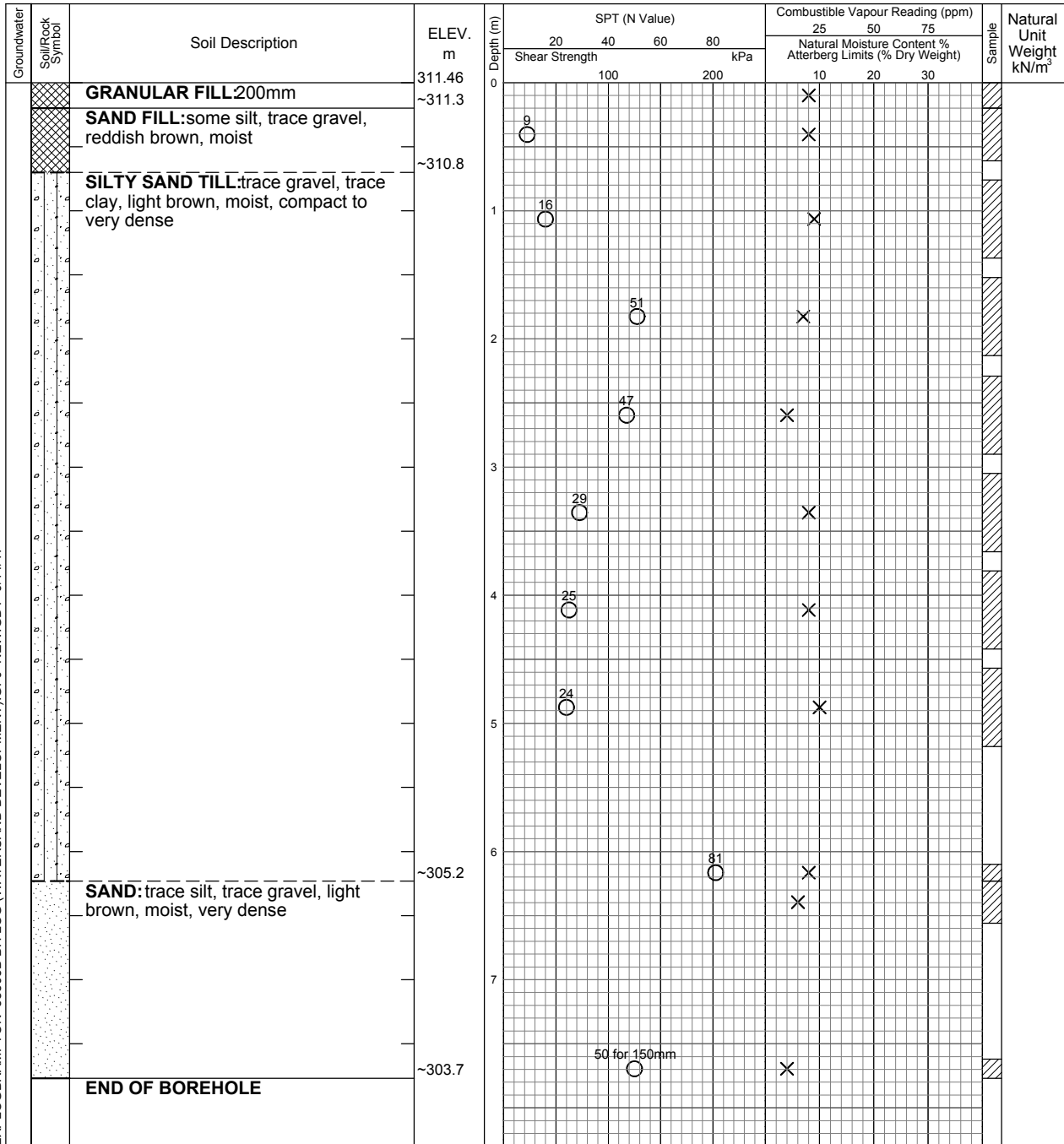
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.77



Log of Borehole 156

Project No. BRM-00038305-B0

Drawing No. 254

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

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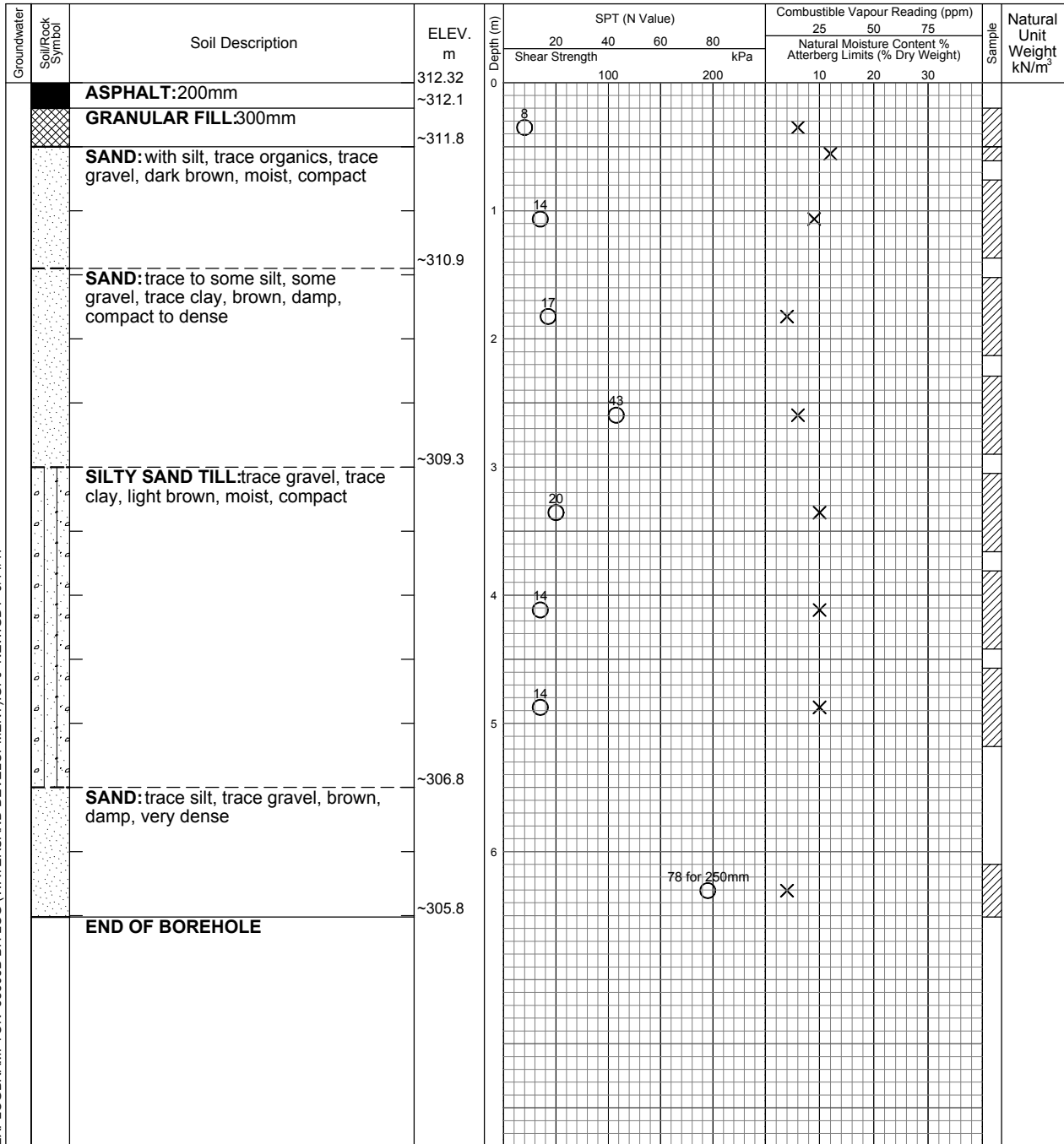
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



Log of Borehole 157

Project No. BRM-00038305-B0

Drawing No. 255

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 26, 2017

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

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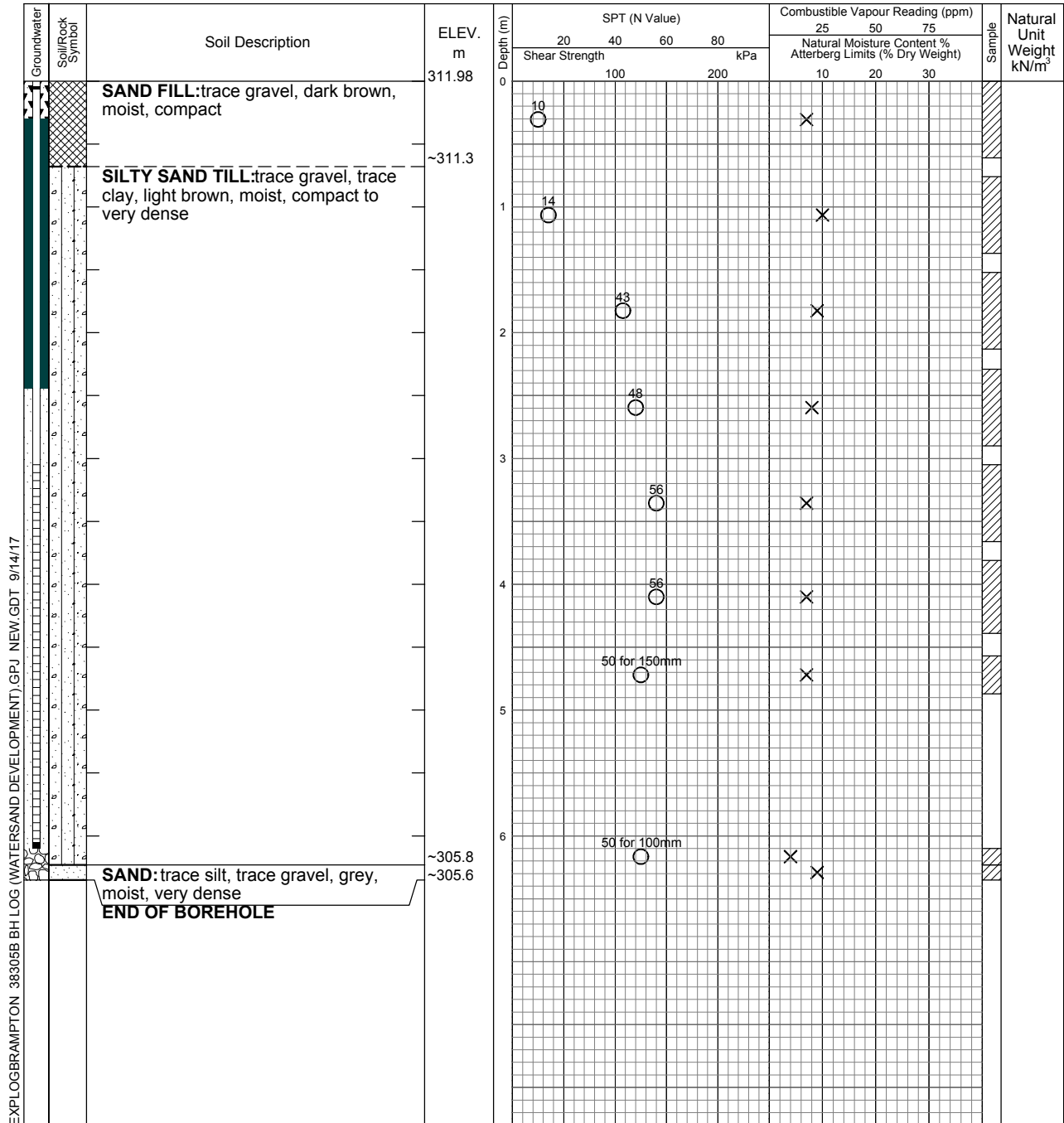
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 18, 2017	Dry Dry	-

Log of Borehole 158

Project No. BRM-00038305-B0

Drawing No. 256

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

Auger Sample

SPT (N) Value

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Shelby Tube

Datum: Geodetic

Field Vane Test

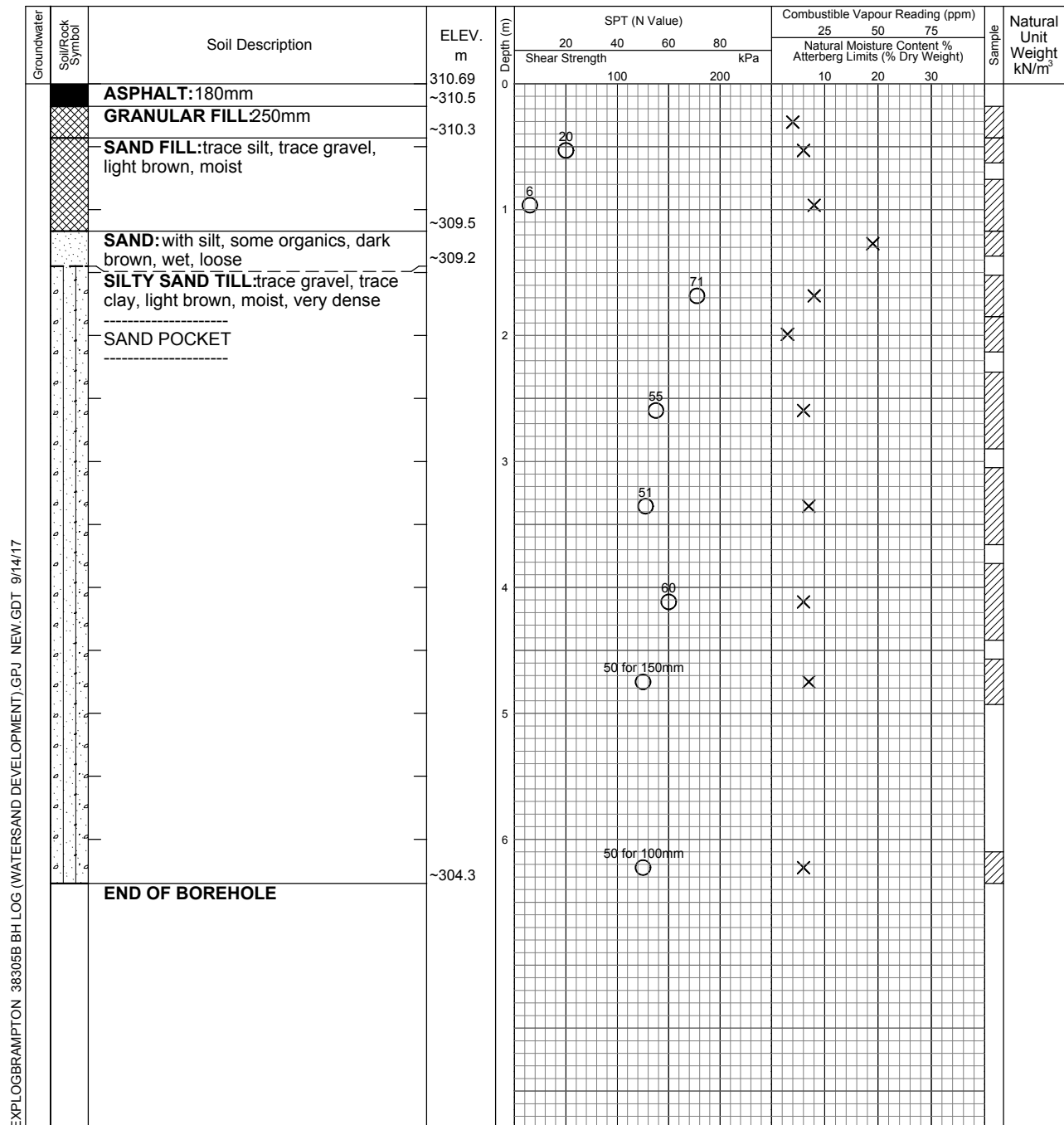
Combustible Vapour Reading

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



Log of Borehole 159

Project No. BRM-00038305-B0

Drawing No. 257

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

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

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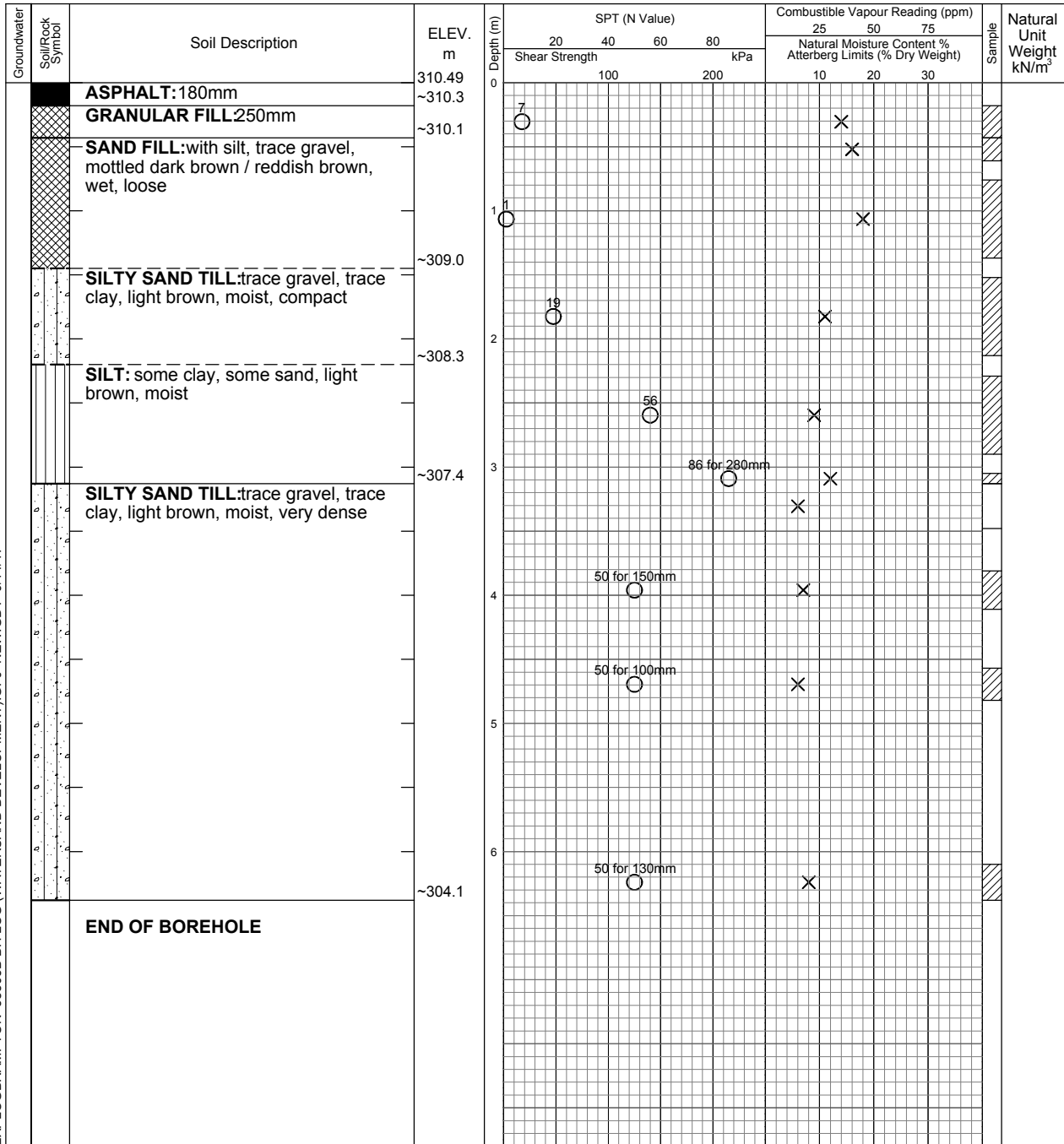
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.38

Log of Borehole E7

Project No. BRM-00038305-B0

Drawing No. 258

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

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

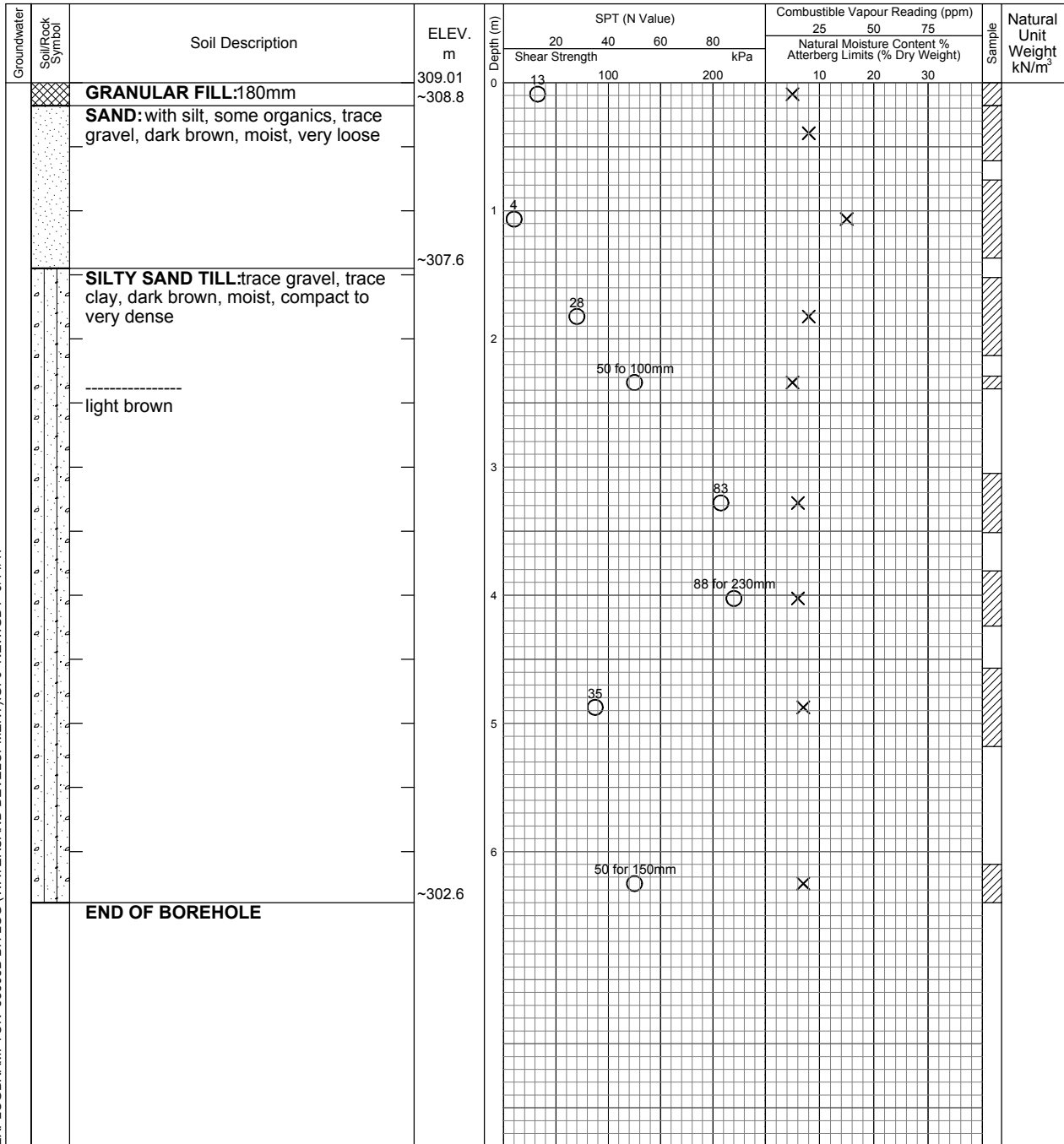


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.4



Log of Borehole E24

Project No. BRM-00038305-B0

Drawing No. 259

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

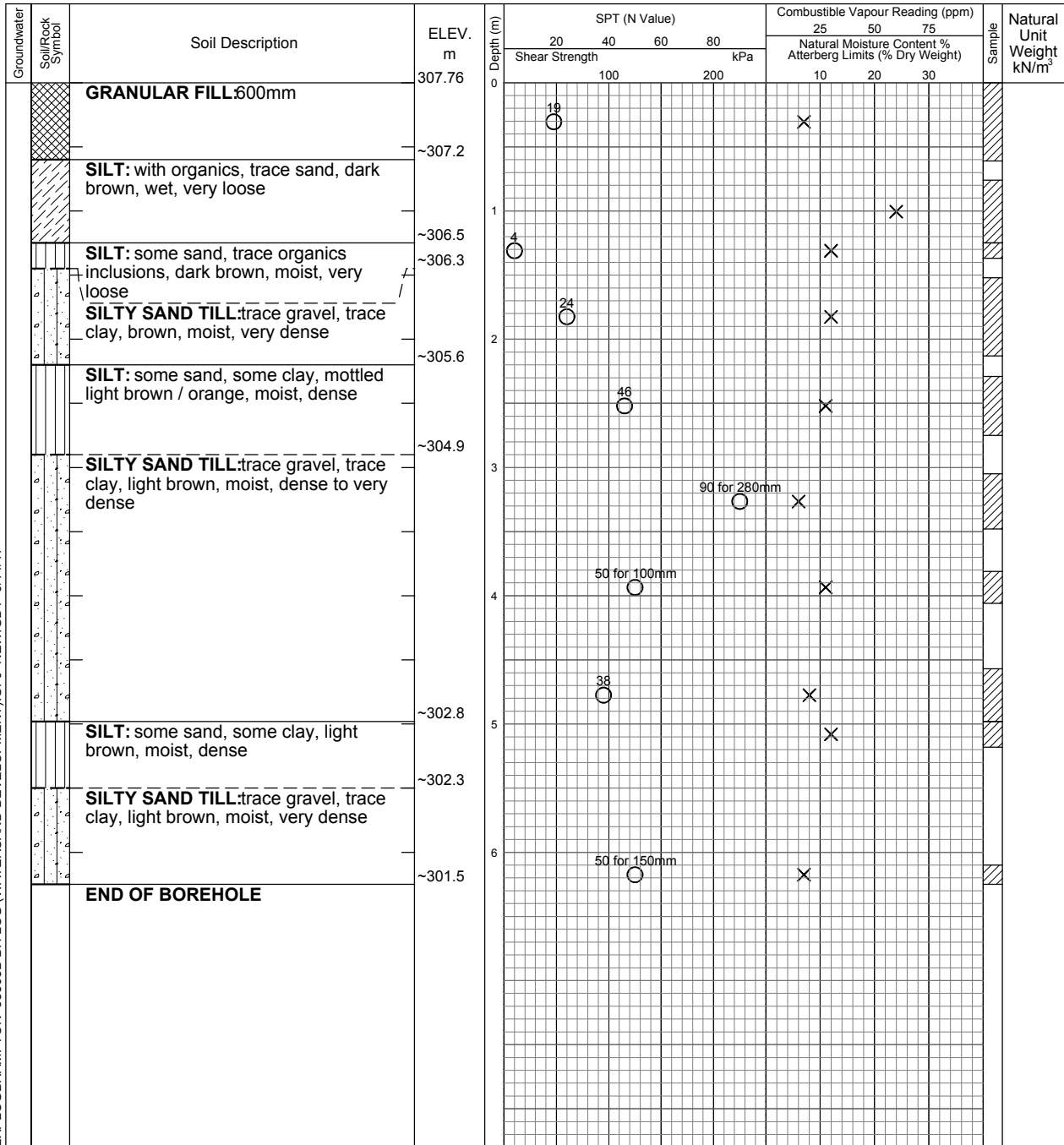
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

Log of Borehole E43

Project No. BRM-00038305-B0

Drawing No. 260

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 27, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

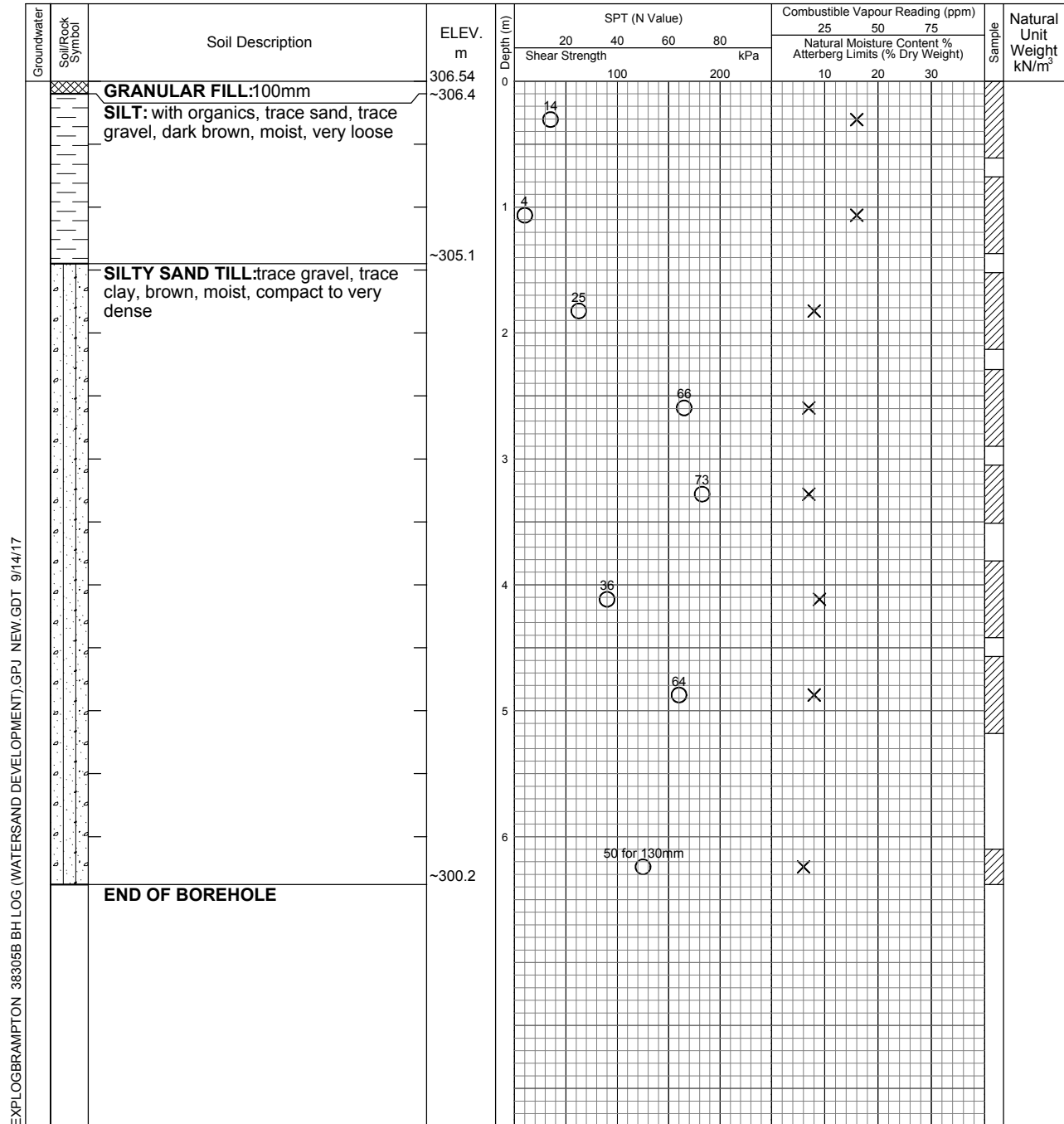
Undrained Triaxial at

% Strain at Failure

Penetrometer

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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.38



Log of Borehole 32

Project No. BRM-00038305-B0

Drawing No. 239

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 28, 2017

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

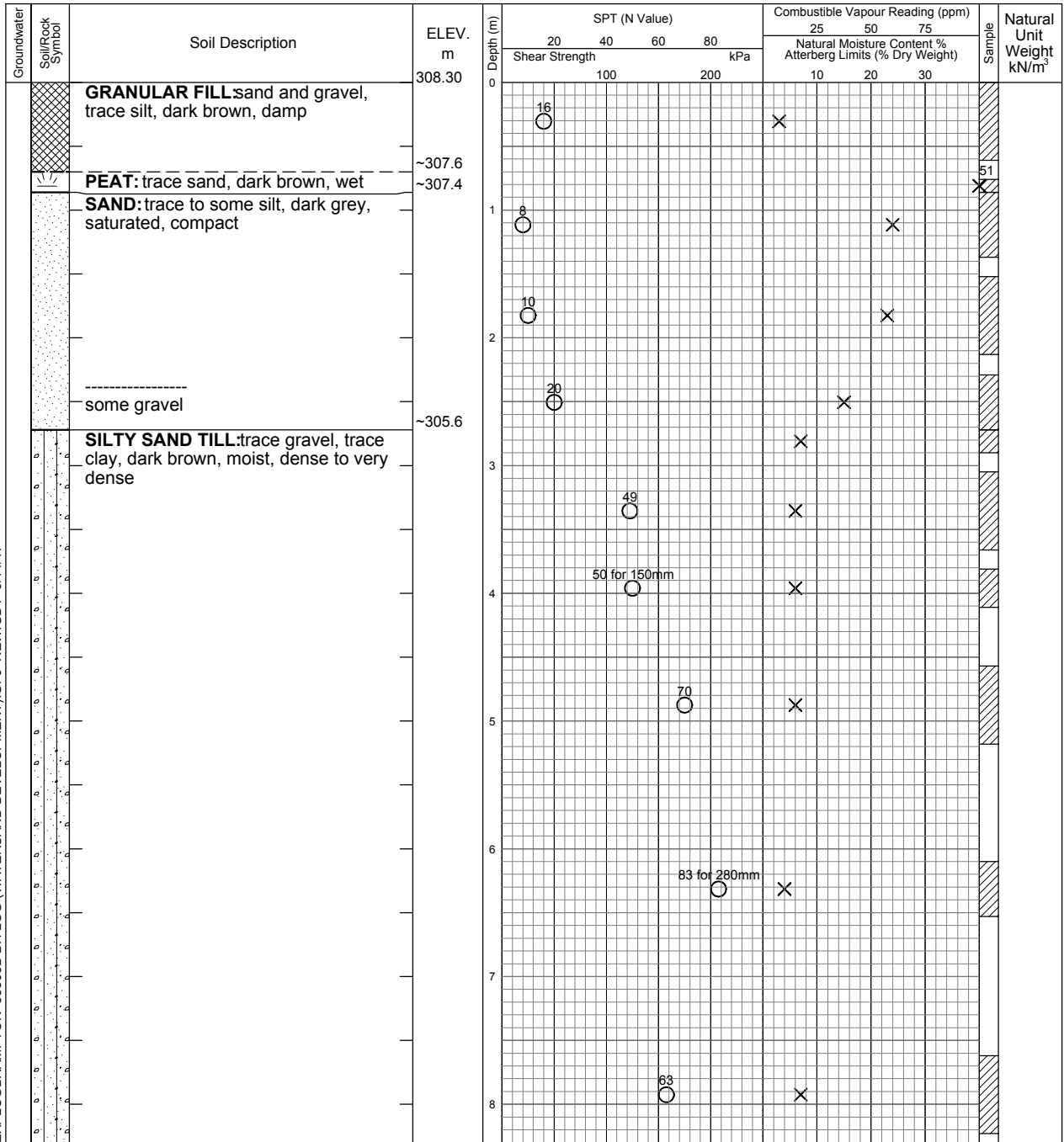


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Continued Next Page

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



Log of Borehole 32

Project No. BRM-00038305-B0

Drawing No. 239

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

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



Log of Borehole 63

Project No. BRM-00038305-B0

Drawing No. 240

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 25, 2017

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

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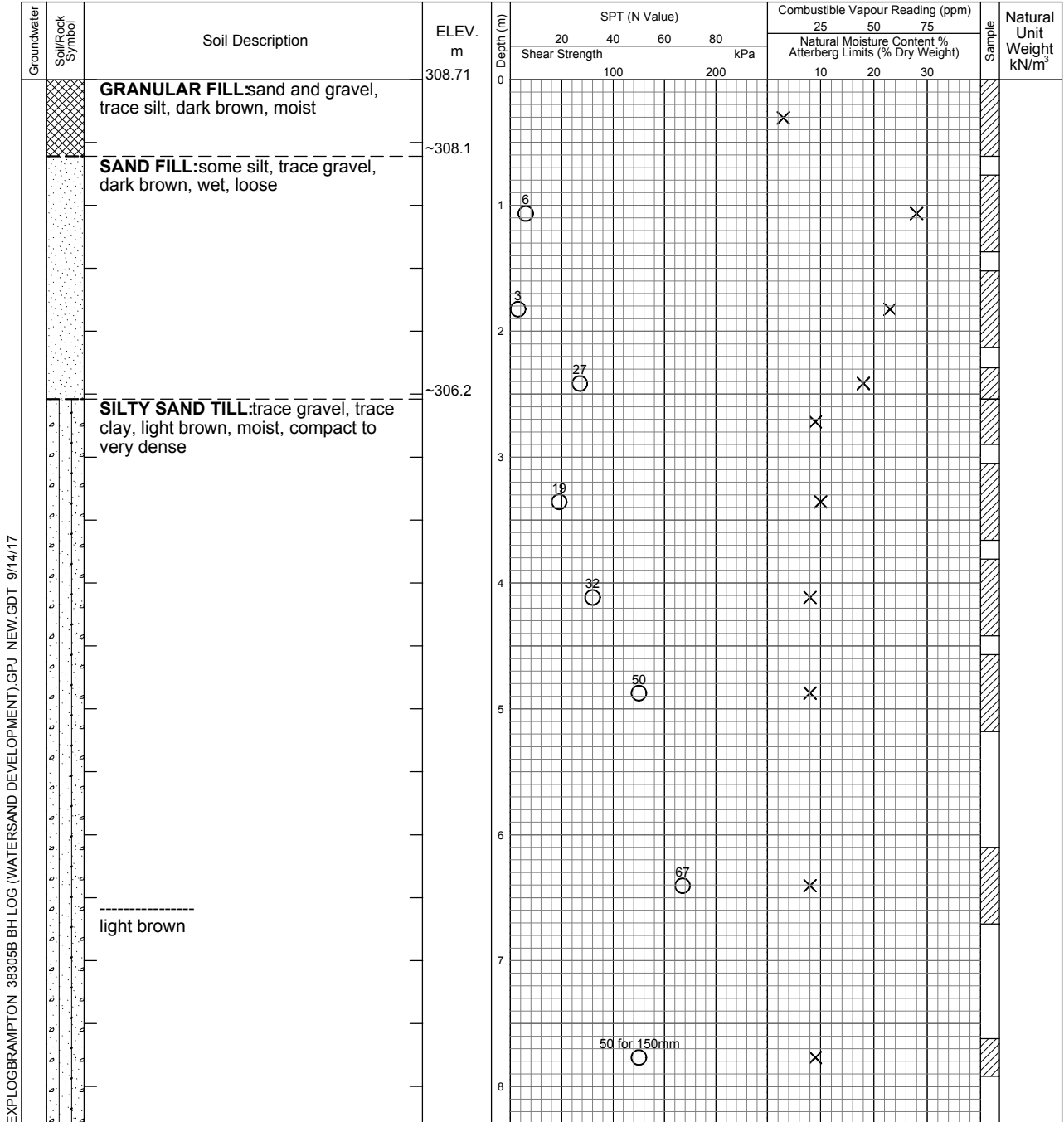
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	2.44	10.67



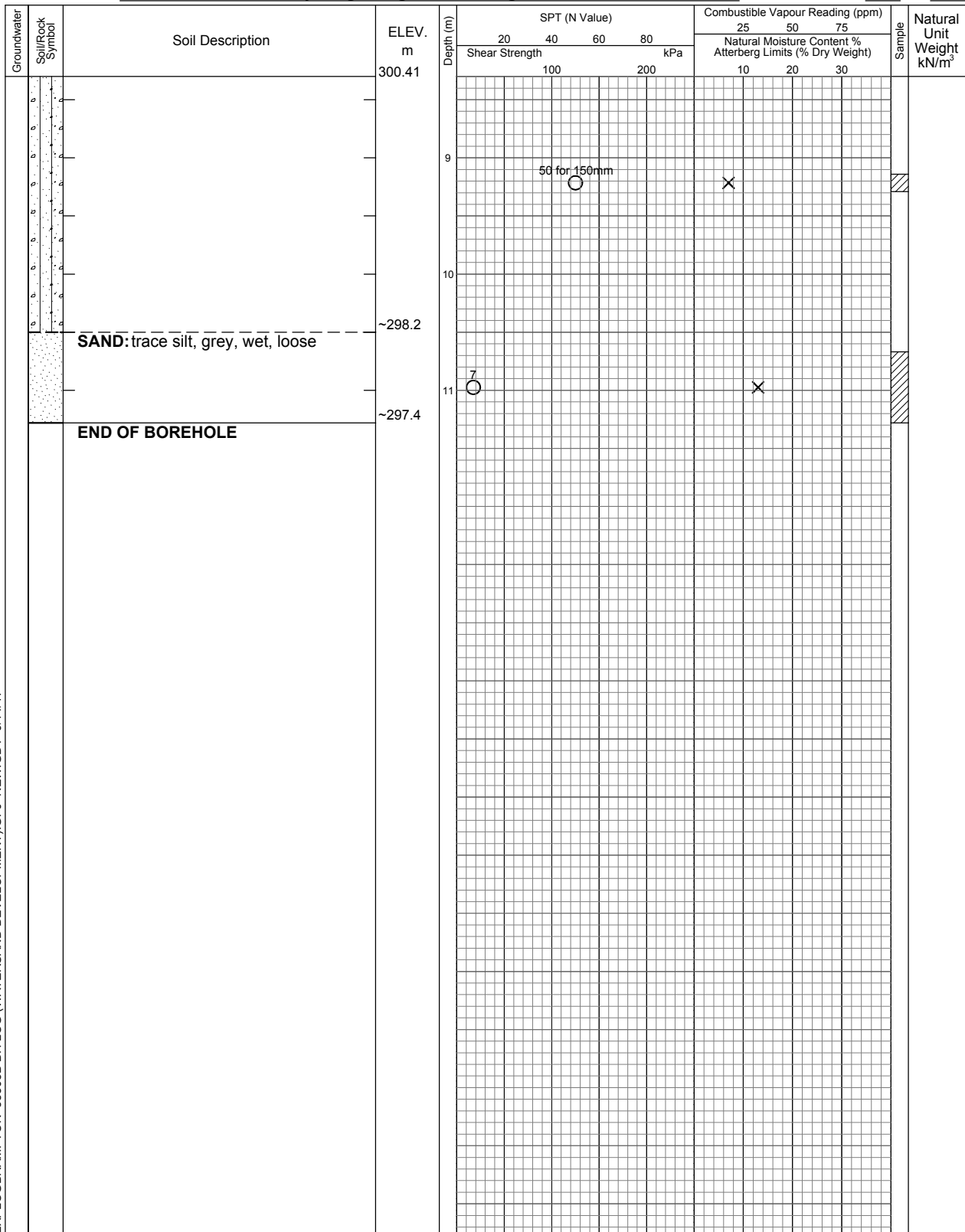
Log of Borehole 63

Project No. BRM-00038305-B0

Drawing No. 240

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	2.44	10.67

Log of Borehole 76

Project No. BRM-00038305-B0

Drawing No. 241

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 31, 2017

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

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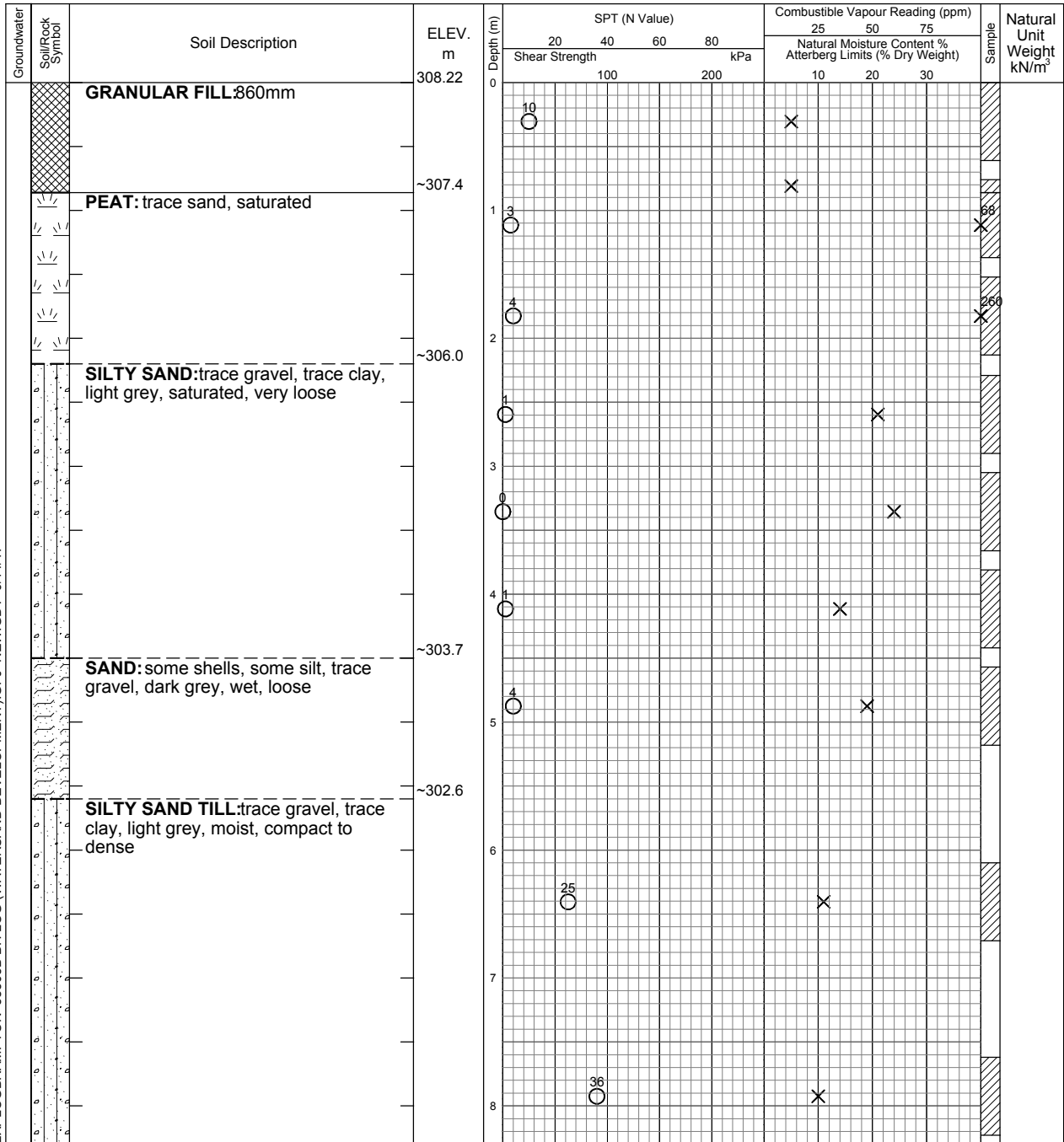
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	3.66	4.57



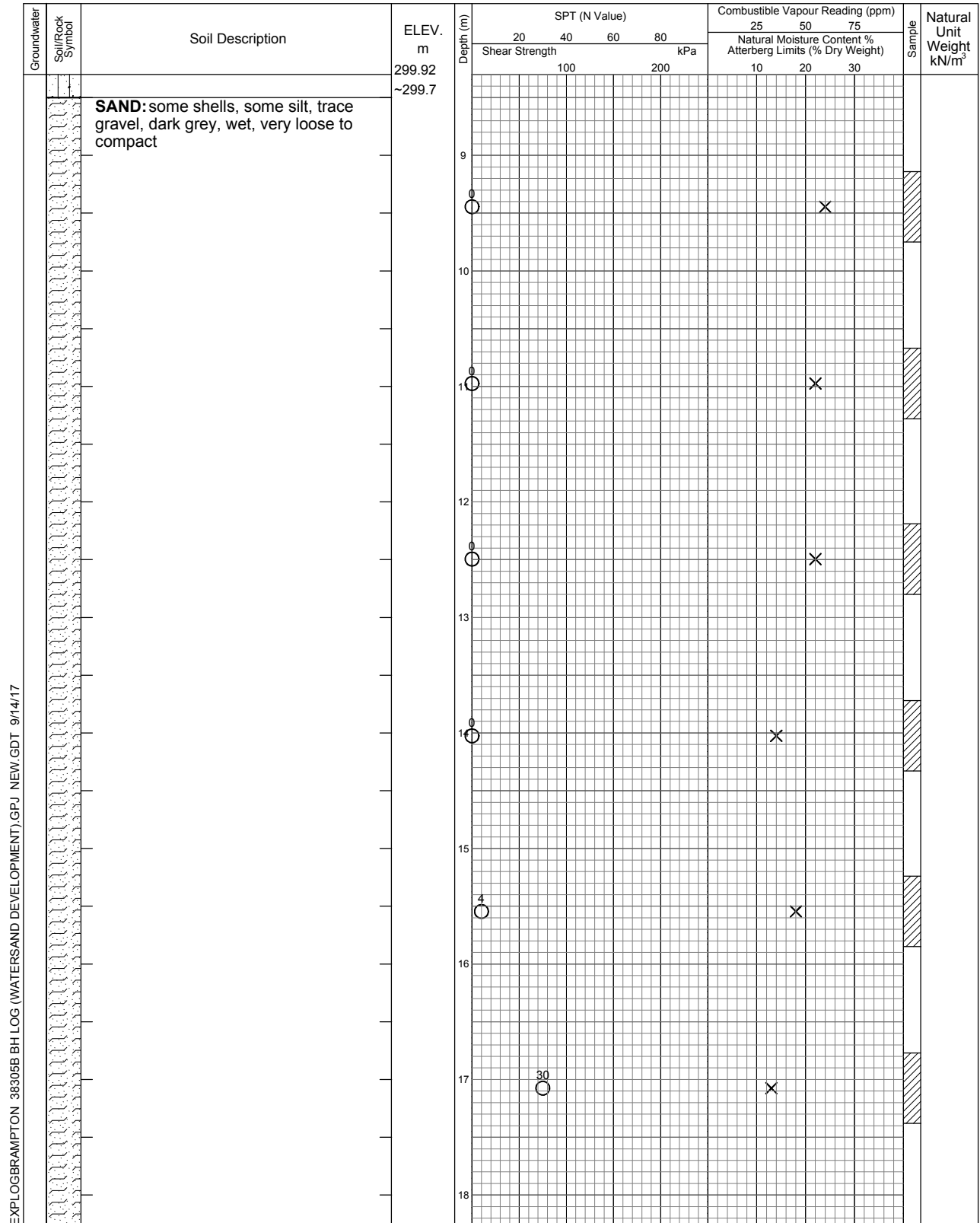
Log of Borehole 76

Project No. BRM-00038305-B0

Drawing No. 241

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	3.66	4.57

Log of Borehole 76

Project No. BRM-00038305-B0

Drawing No. 241

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 3 of 3

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					Shear Strength	100	200	kPa	25	50	75		
									Natural Moisture Content %				
									Atterberg Limits (% Dry Weight)				
		SAND: some gravel, trace silt, light grey, moist, compact to very dense	289.96 ~289.8	15						X			
				19									

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW_GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	3.66	4.57

Log of Borehole 117

Project No. BRM-00038305-B0

Drawing No. 242

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 2

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 28, 2017

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

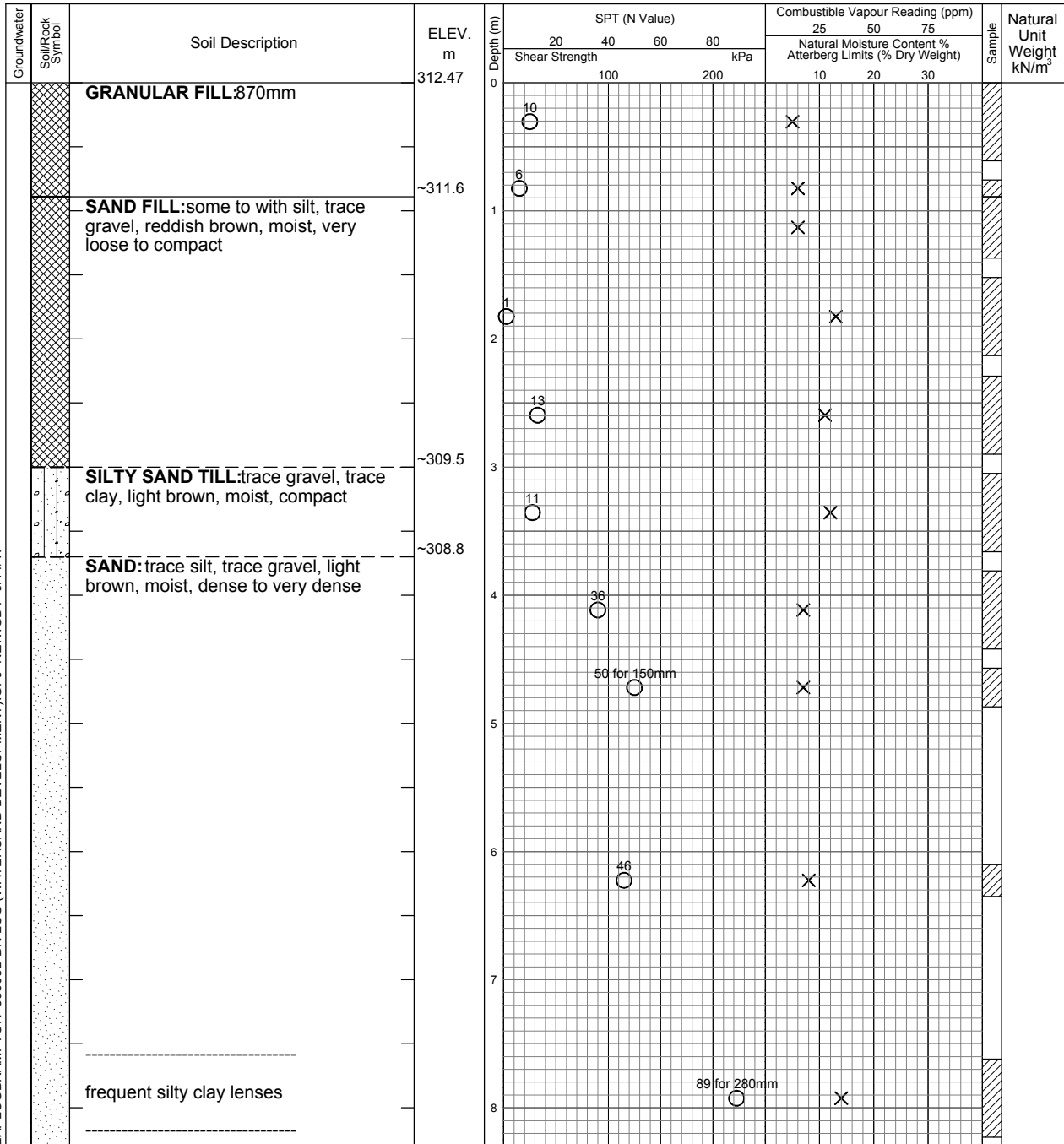


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	15.47



Log of Borehole 117

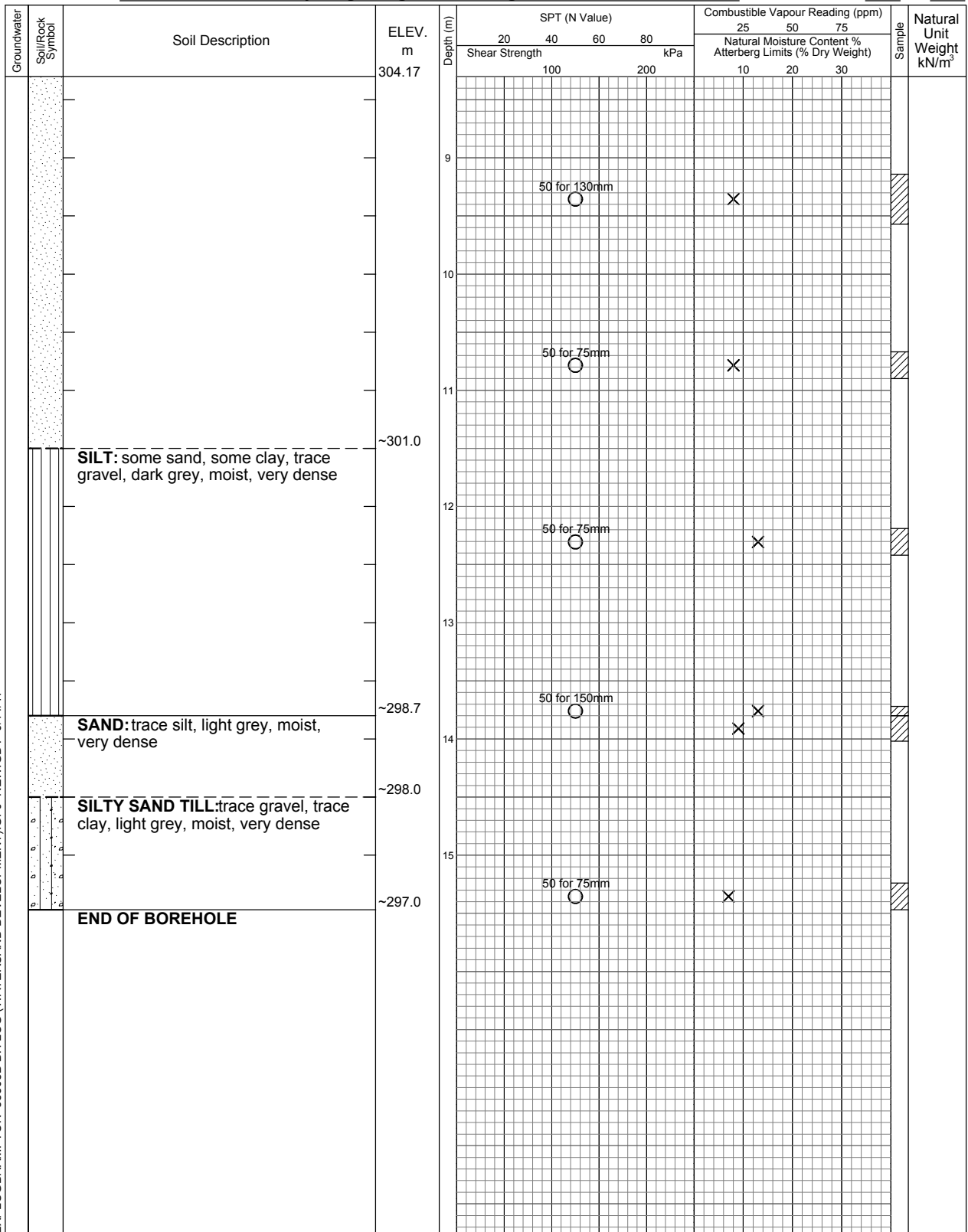
Project No. BRM-00038305-B0

Drawing No. 242

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	15.47

Log of Borehole 137

Project No. BRM-00038305-B0

Drawing No. 243

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 25, 2017

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

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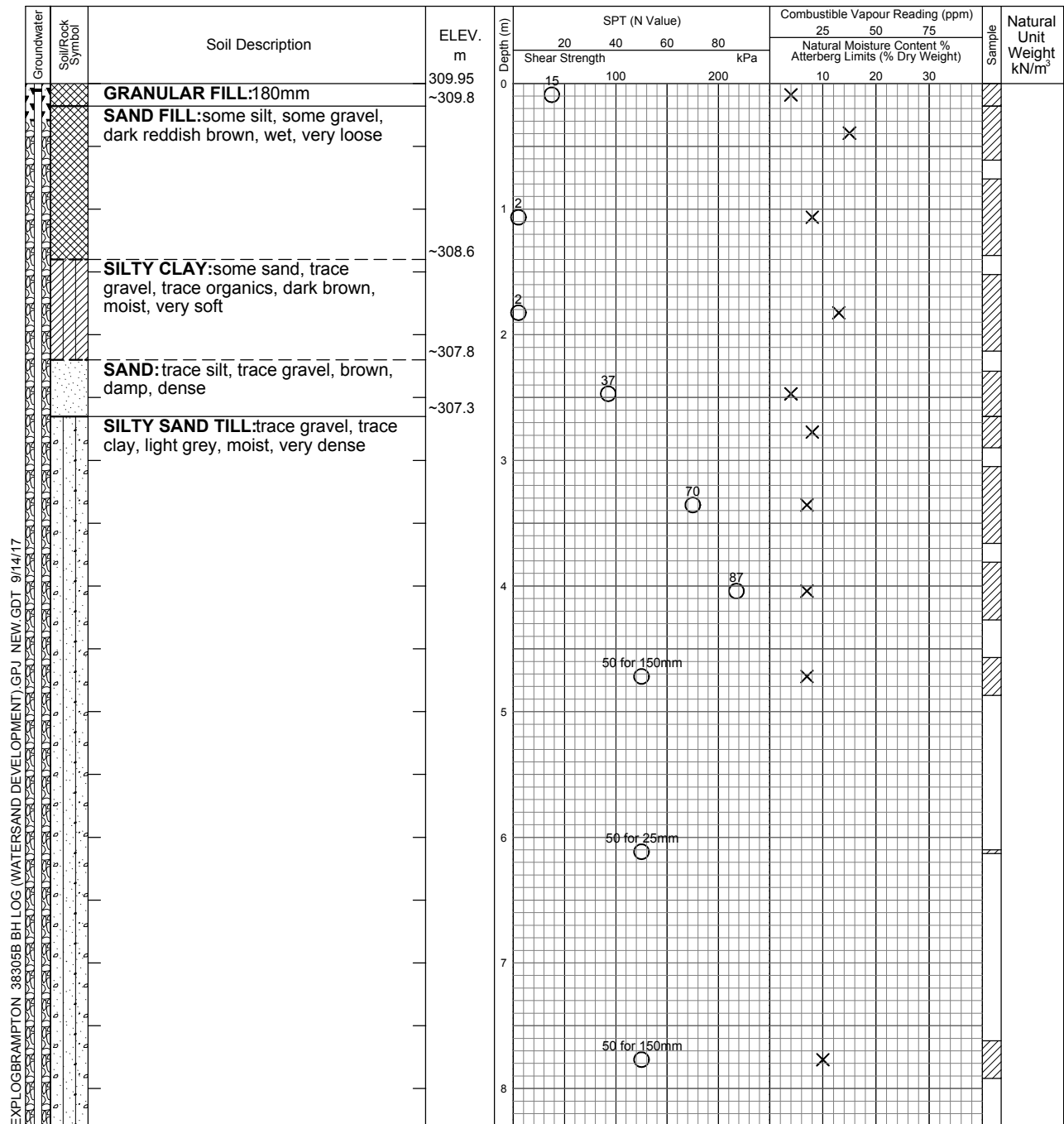
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Datum: Geodetic



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EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT) GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 18, 2017	Dry 19.87	- -

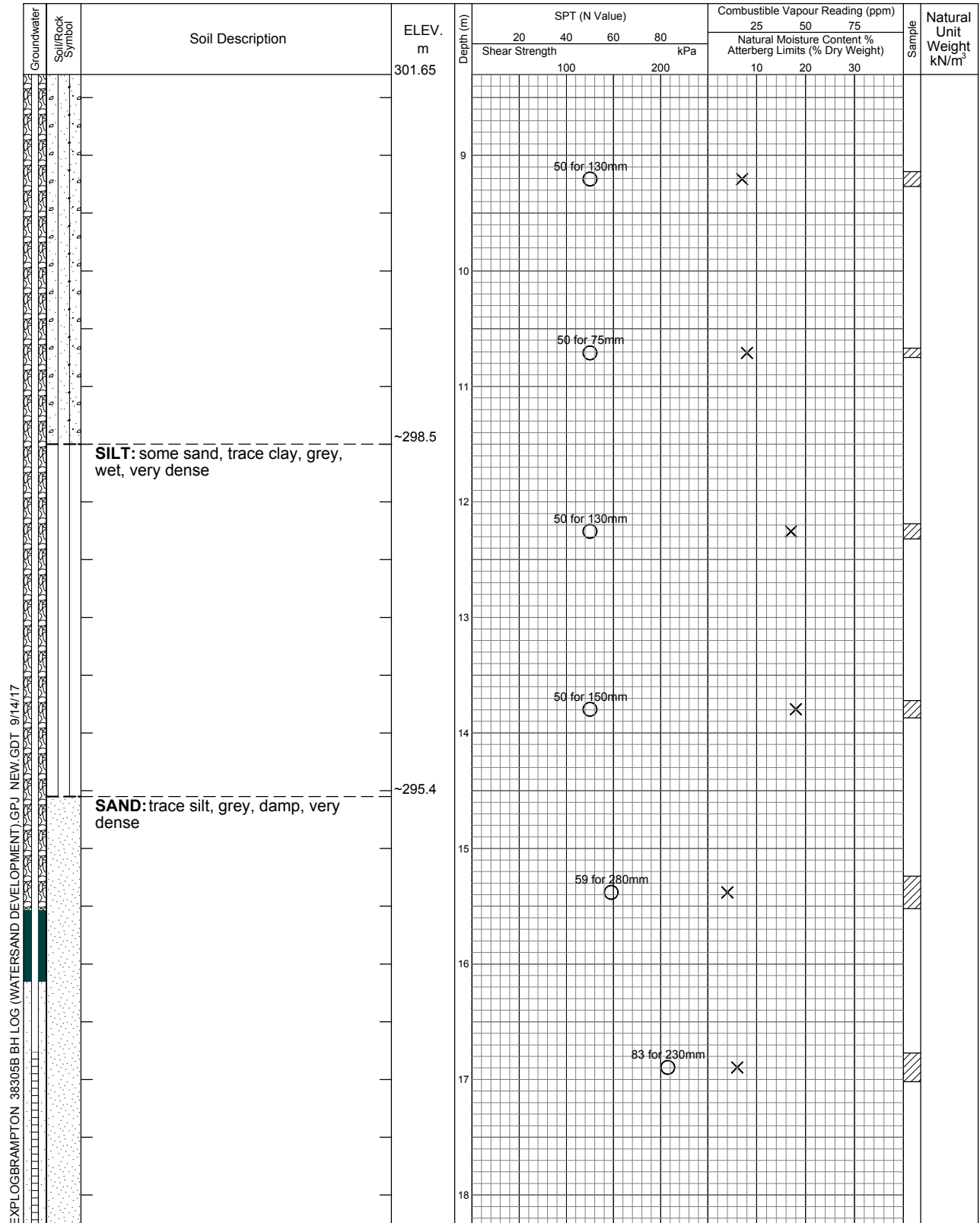
Log of Borehole 137

Project No. BRM-00038305-B0

Drawing No. 243

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 18, 2017	Dry 19.87	- -

Log of Borehole 137

Project No. BRM-00038305-B0

Drawing No. 243

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 3 of 3

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)		Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³		
					20	40	60	80	25			50	75
					Shear Strength				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
					100		200		10			20	30
			291.69										
				19									
			~290.0										
		END OF BOREHOLE LOG											

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 18, 2017	Dry 19.87	- -

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

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

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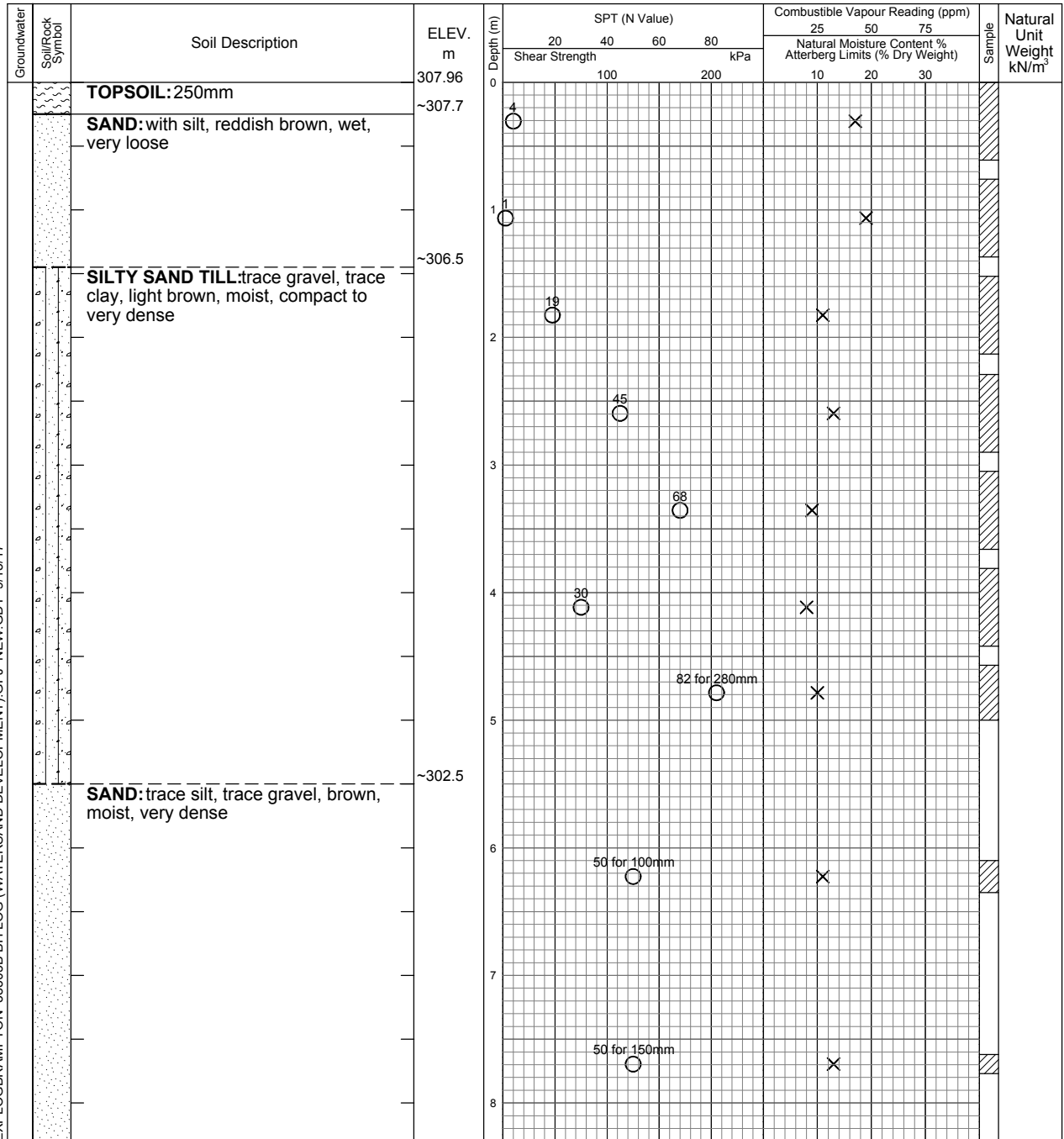
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



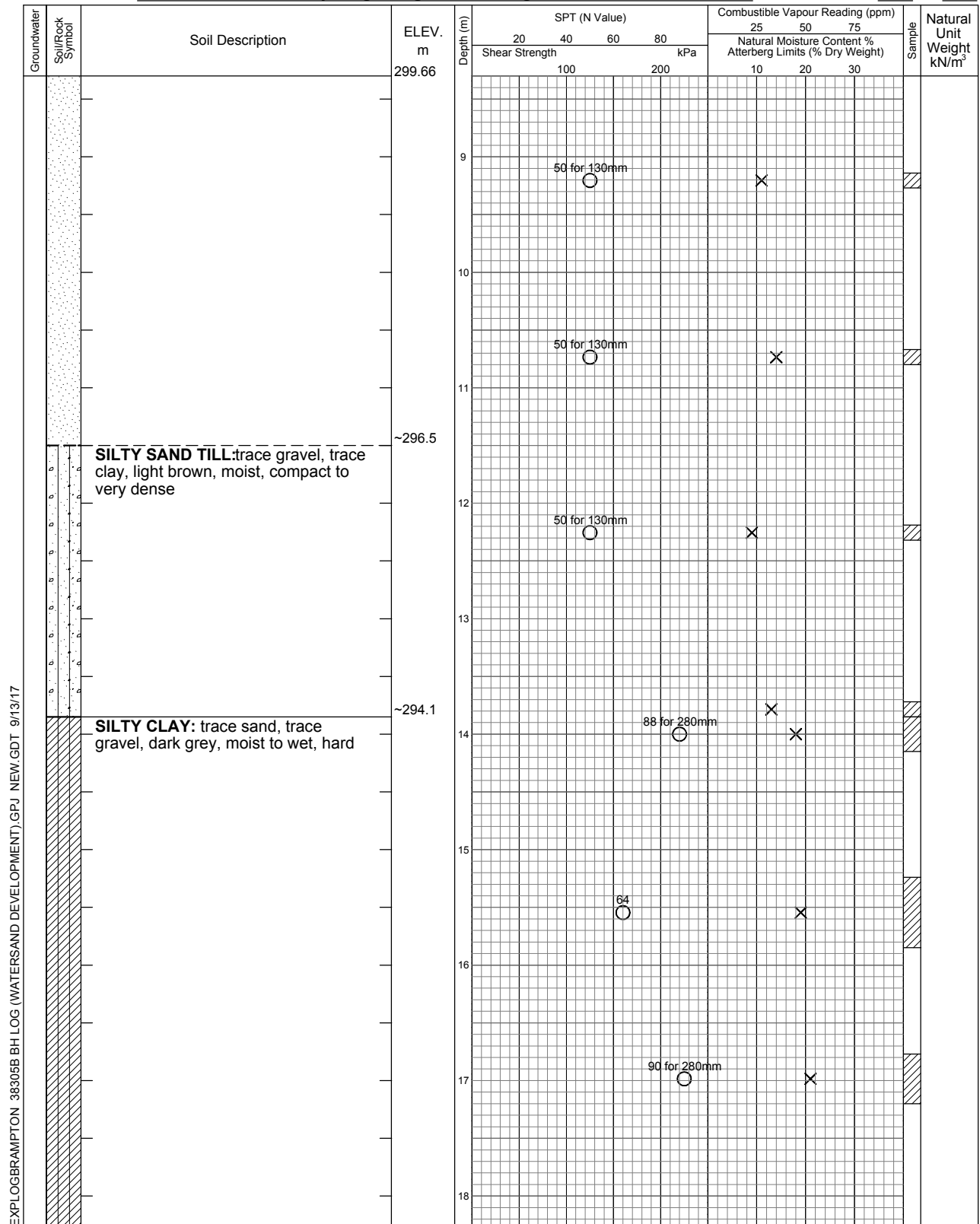
Log of Borehole 1

Project No. BRM-00038305-B0

Drawing No. 3

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



Continued Next Page

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



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17

Log of Borehole 1

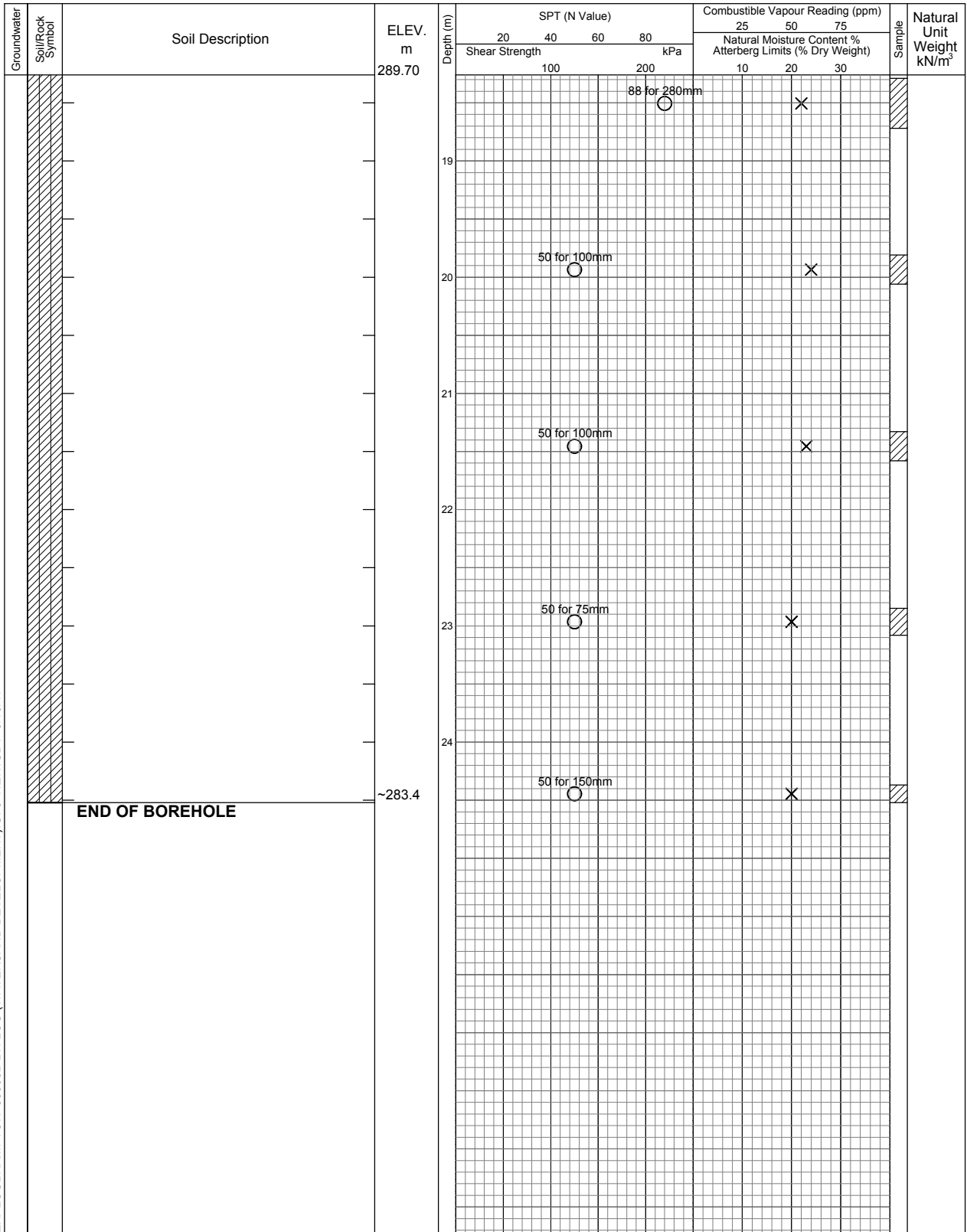
Project No. BRM-00038305-B0

Drawing No. 3

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 3 of 3

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

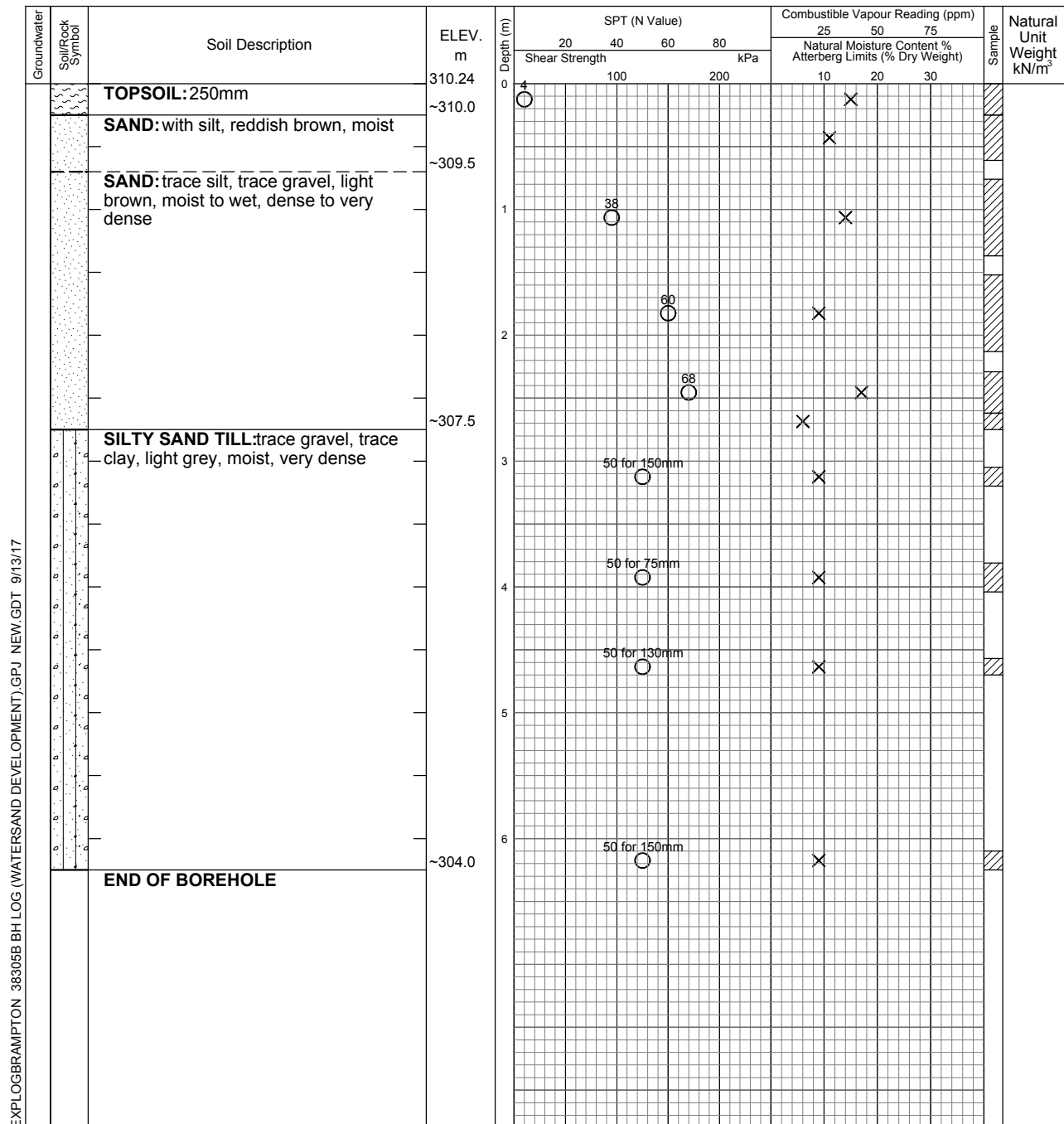
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer



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



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

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



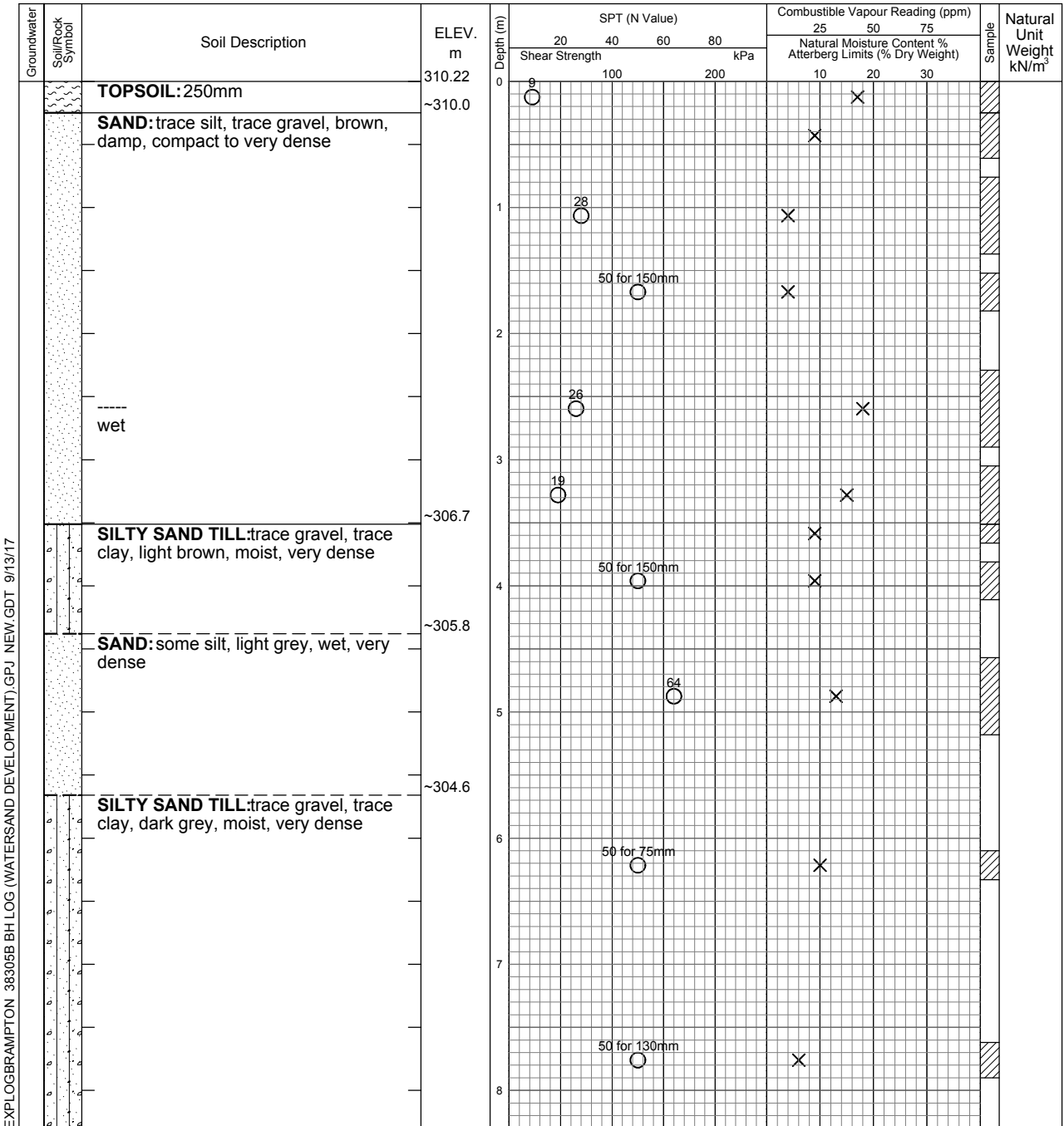
% Strain at Failure



Penetrometer



Datum: Geodetic



Continued Next Page

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



Log of Borehole 3

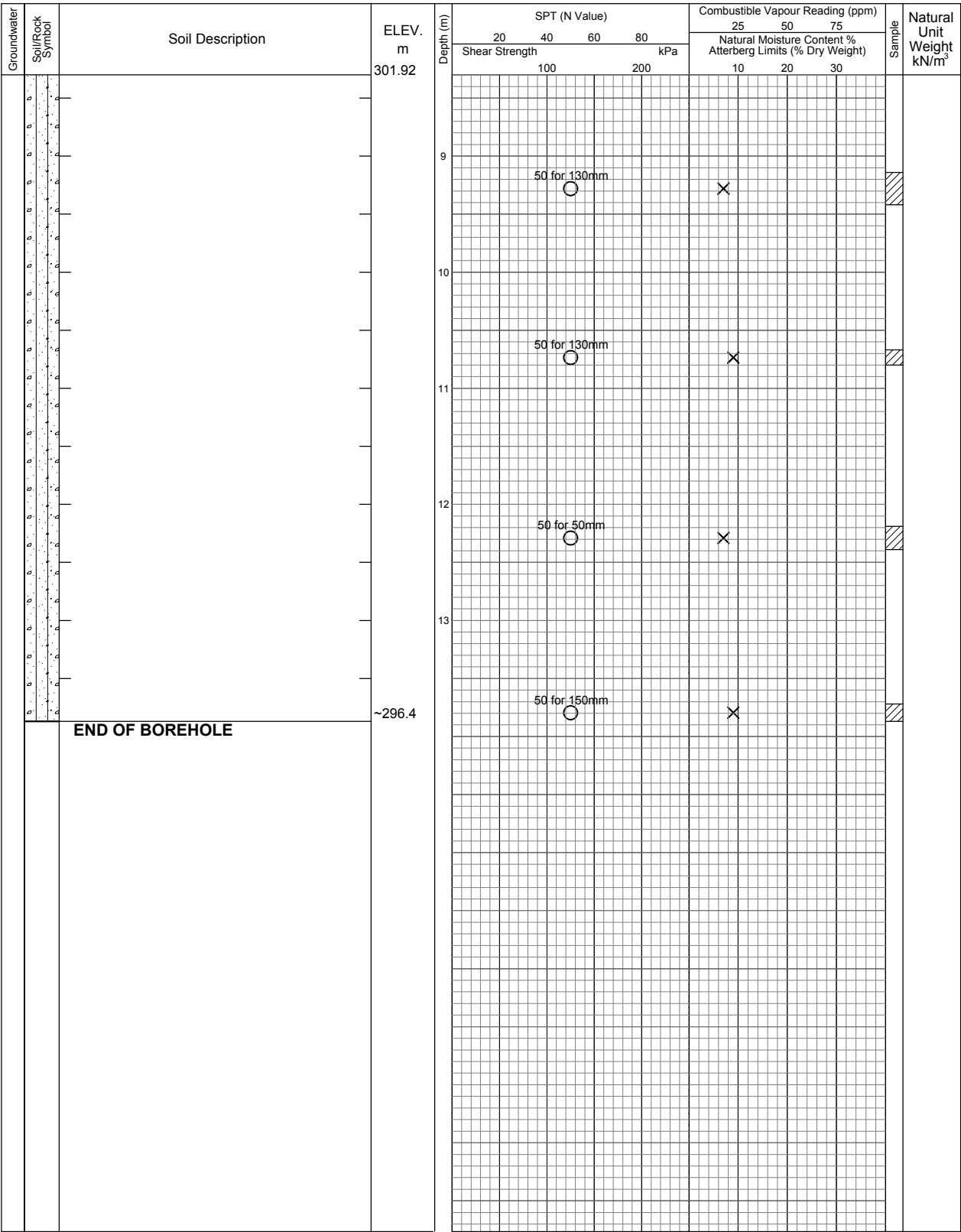
Project No. BRM-00038305-B0

Drawing No. 5

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

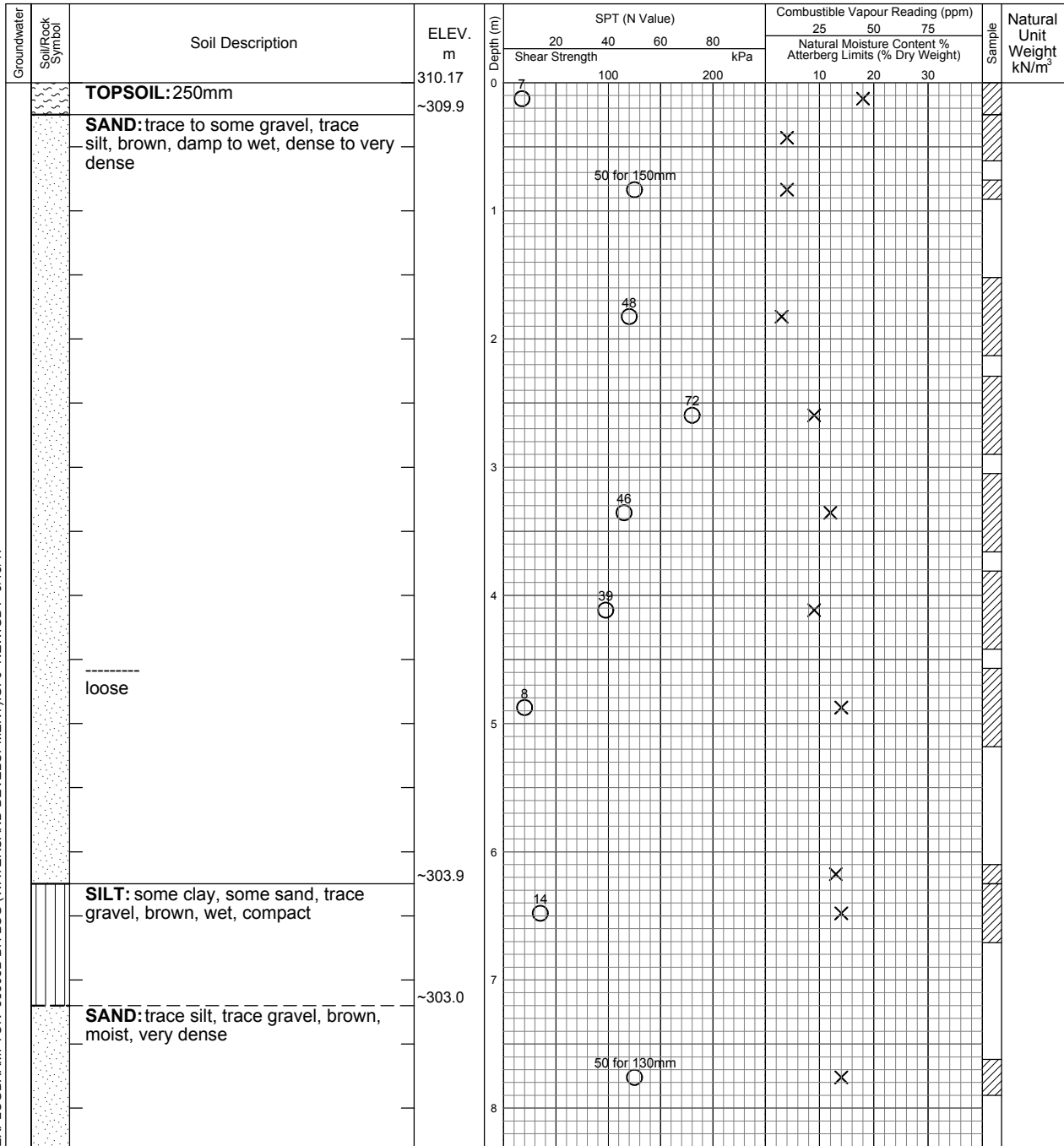


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Continued Next Page

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



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

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

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

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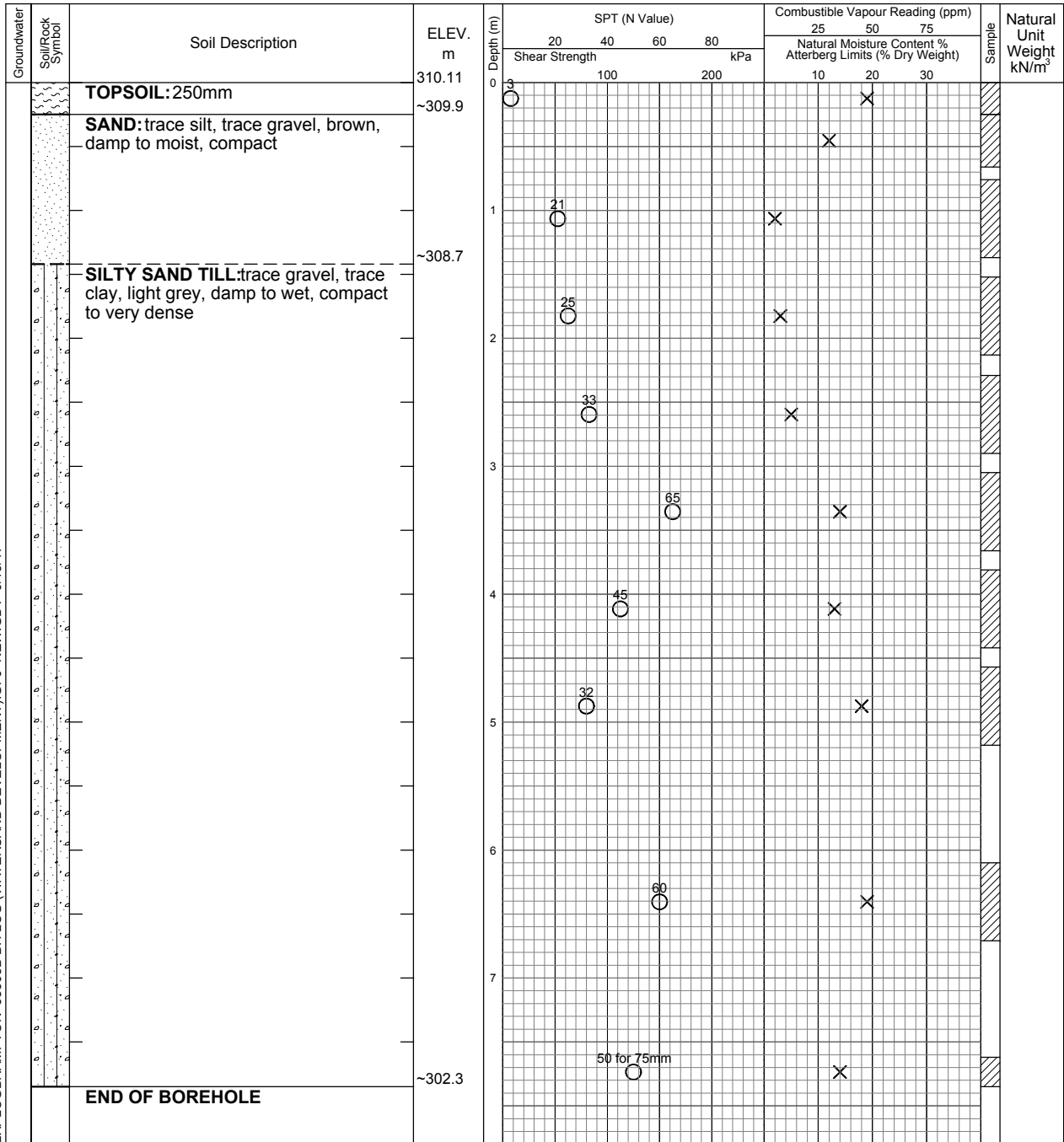
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Datum: Geodetic



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



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

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

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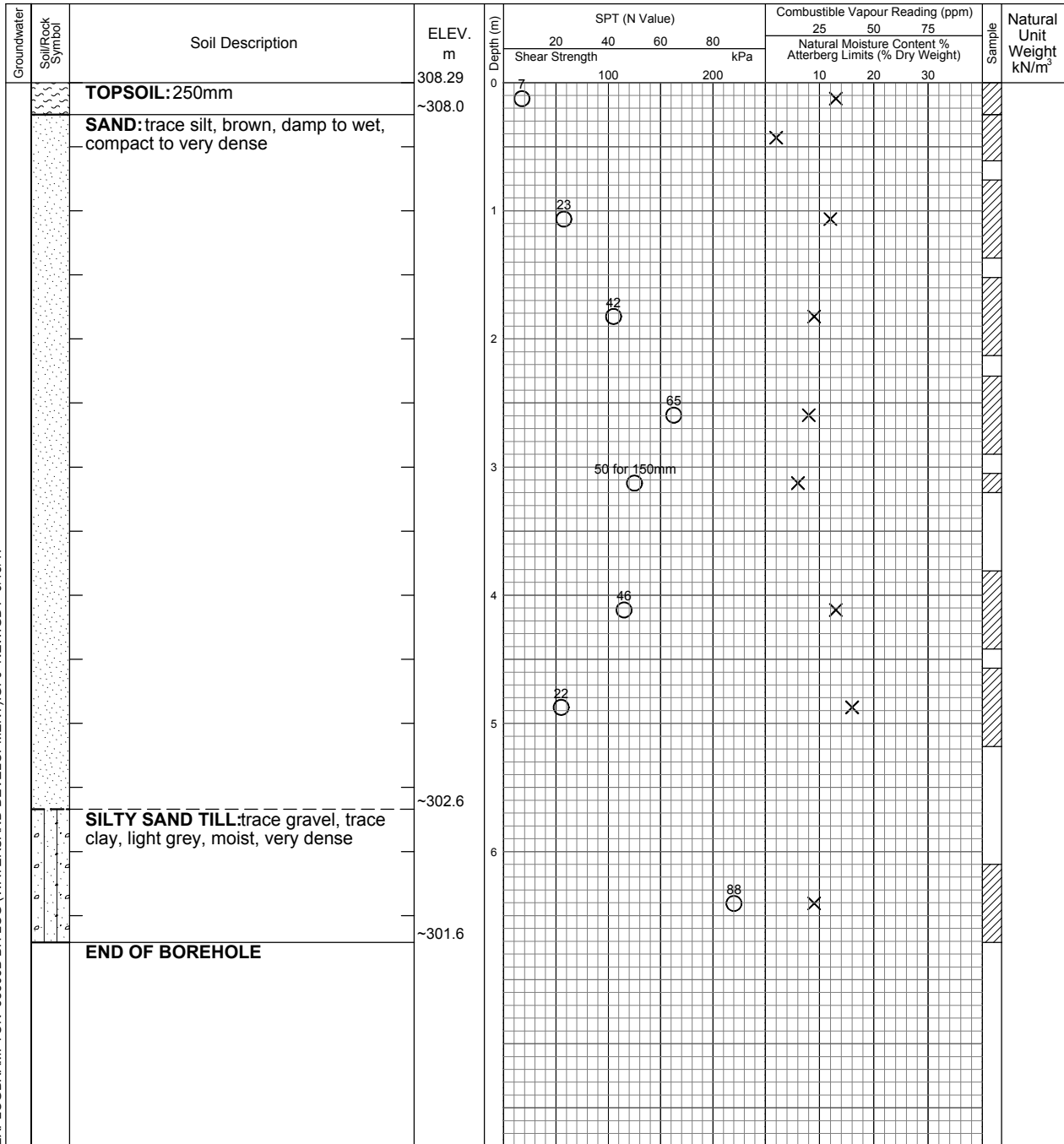
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

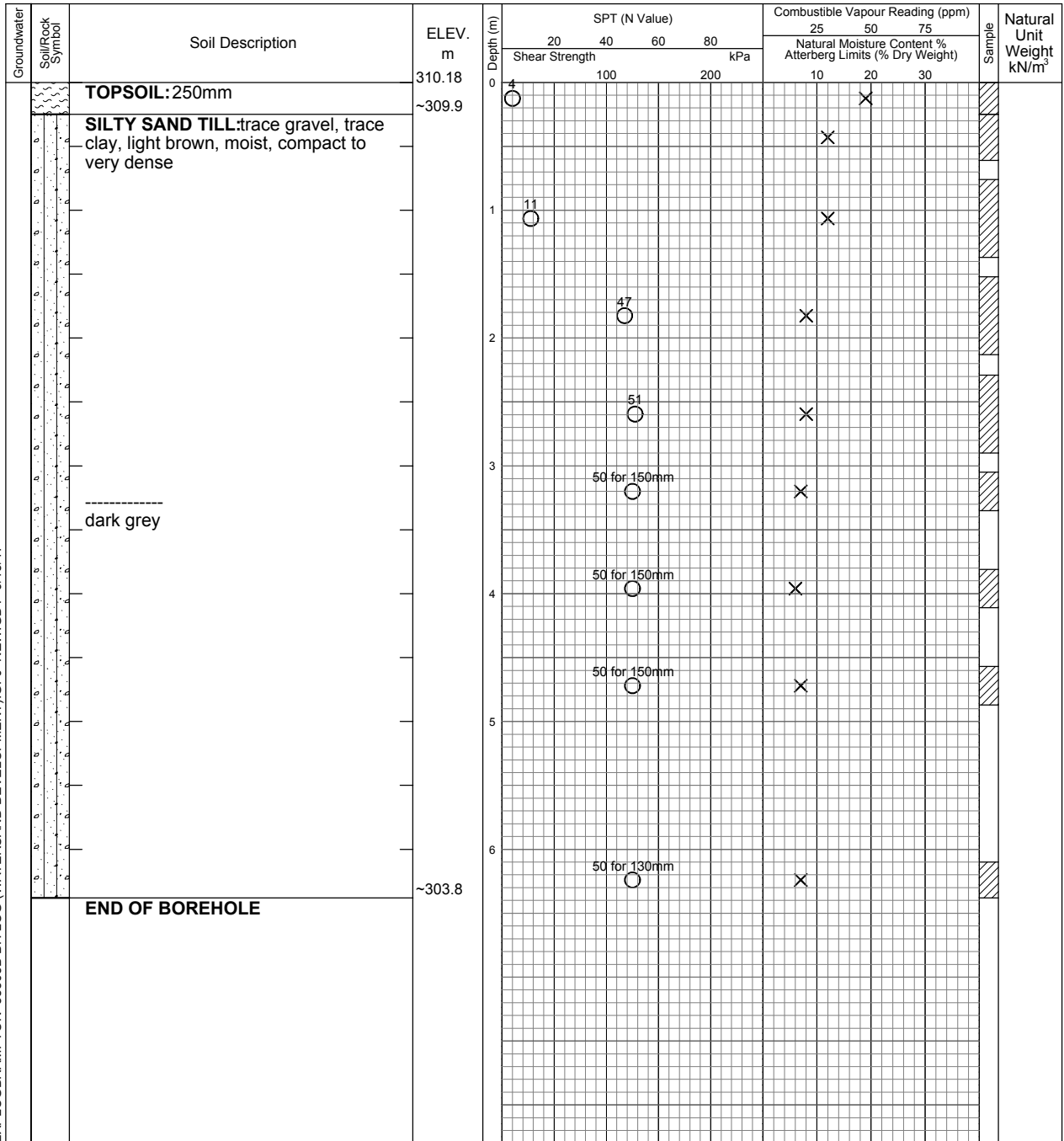


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

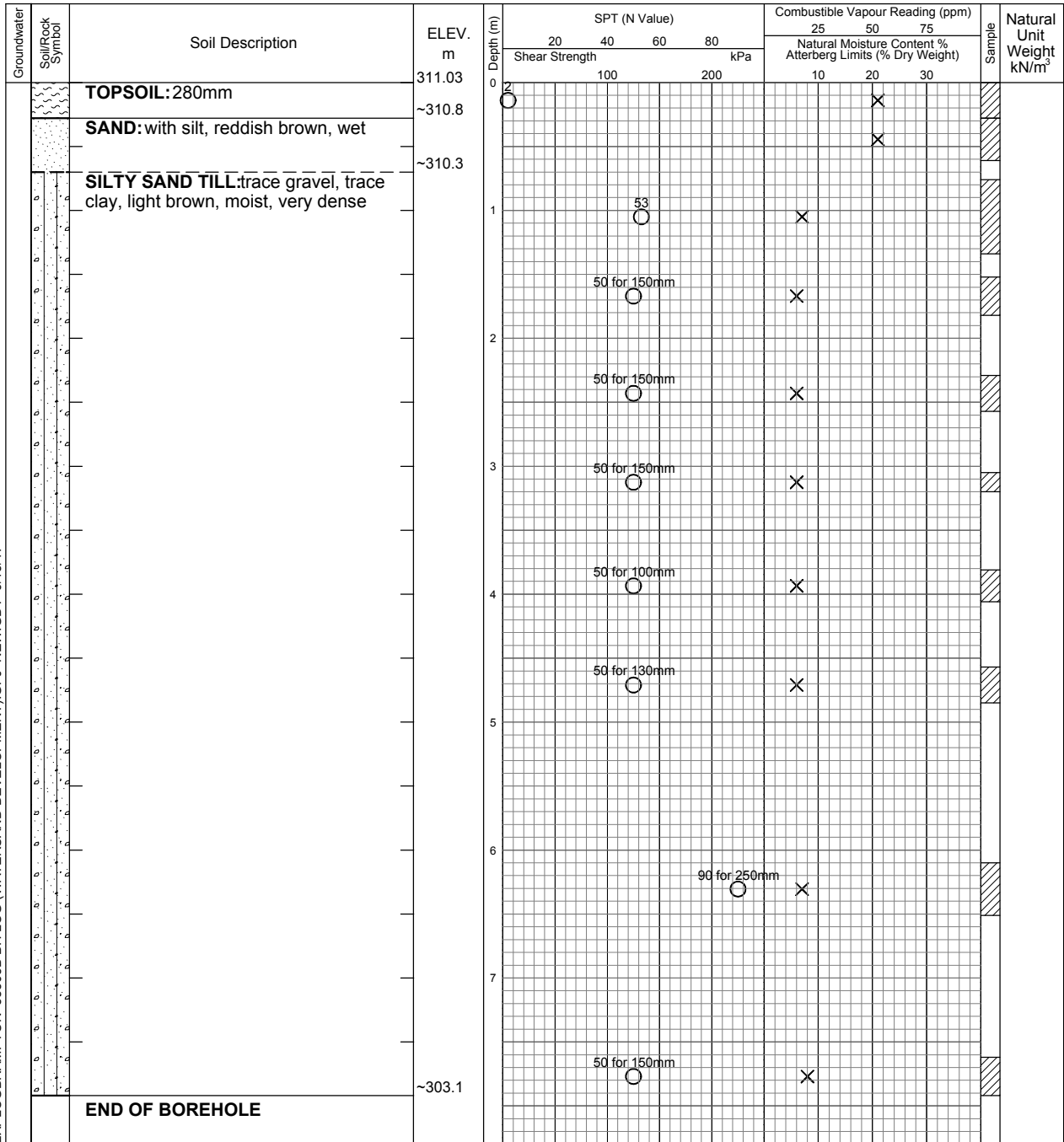


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

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

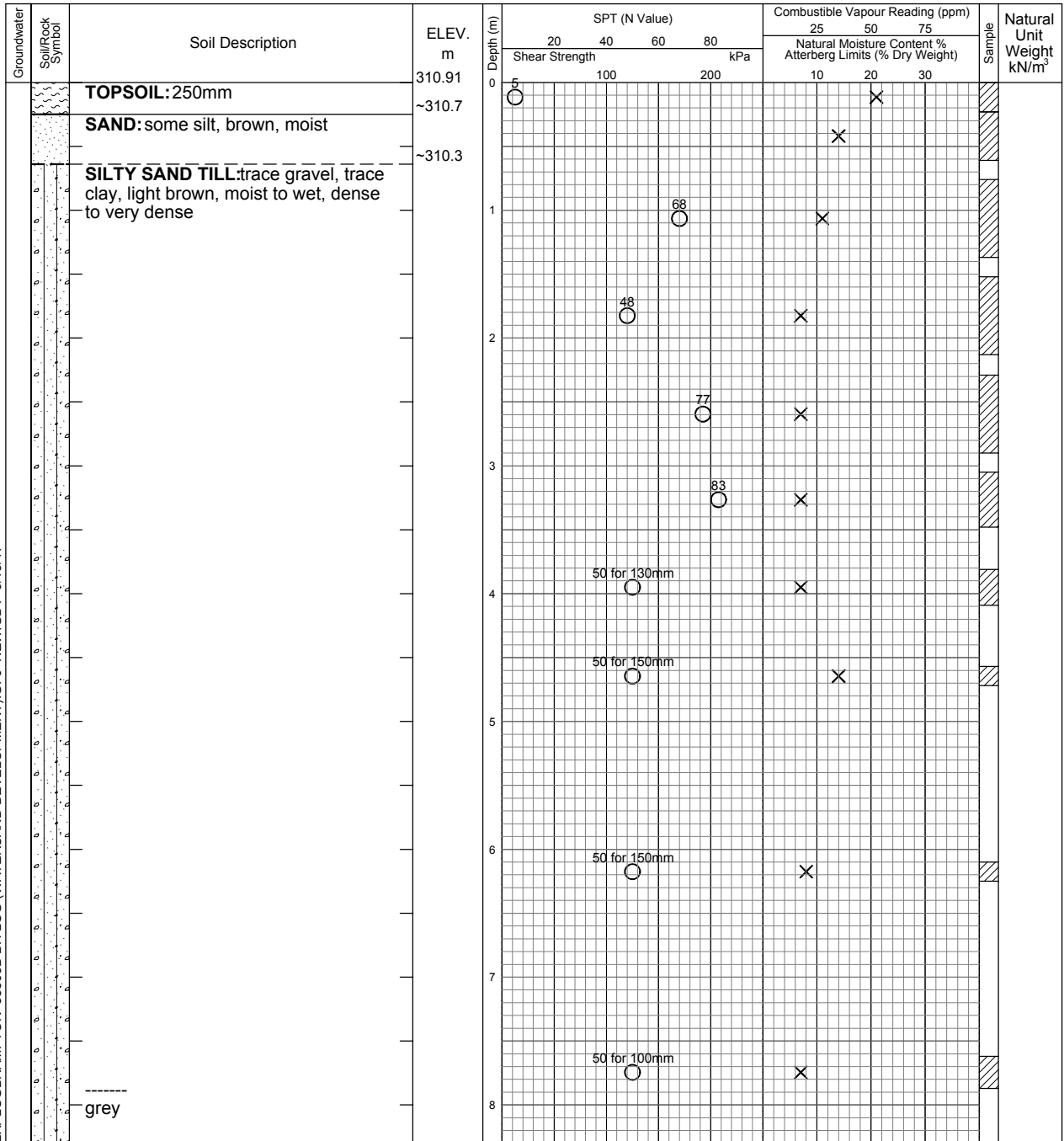


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

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

[illegible]

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



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

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

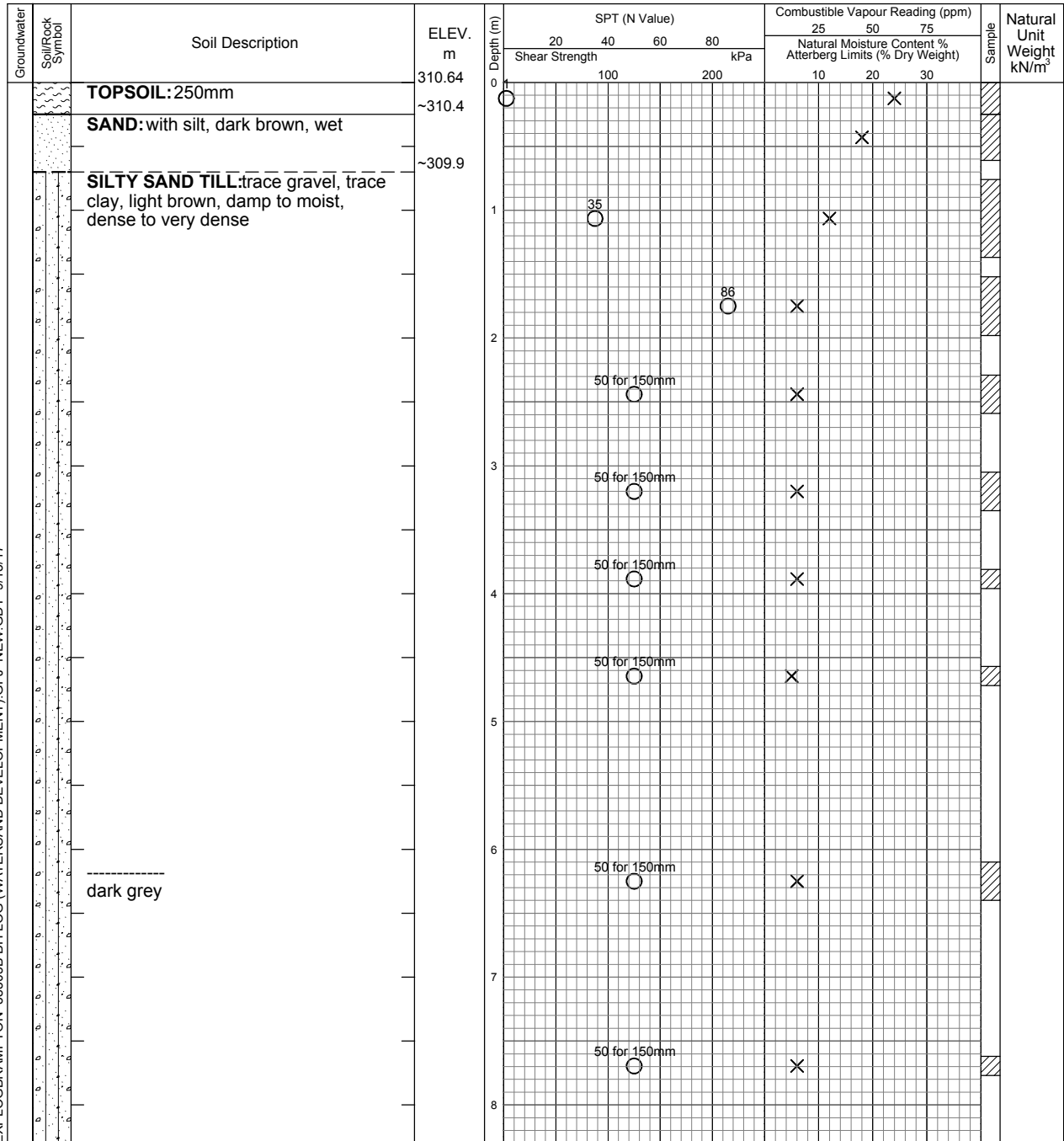


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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

[illegible]

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



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

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

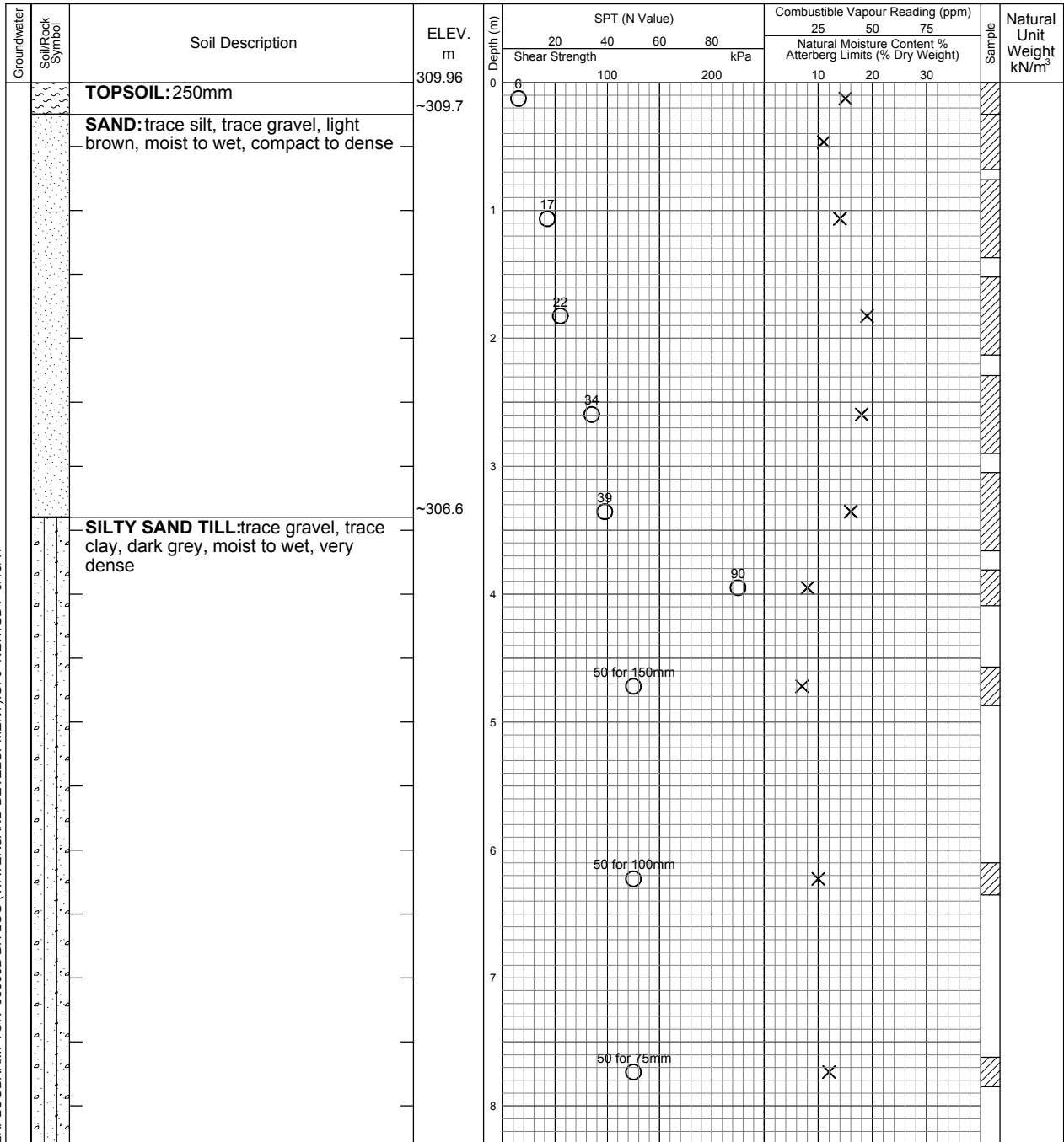


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

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



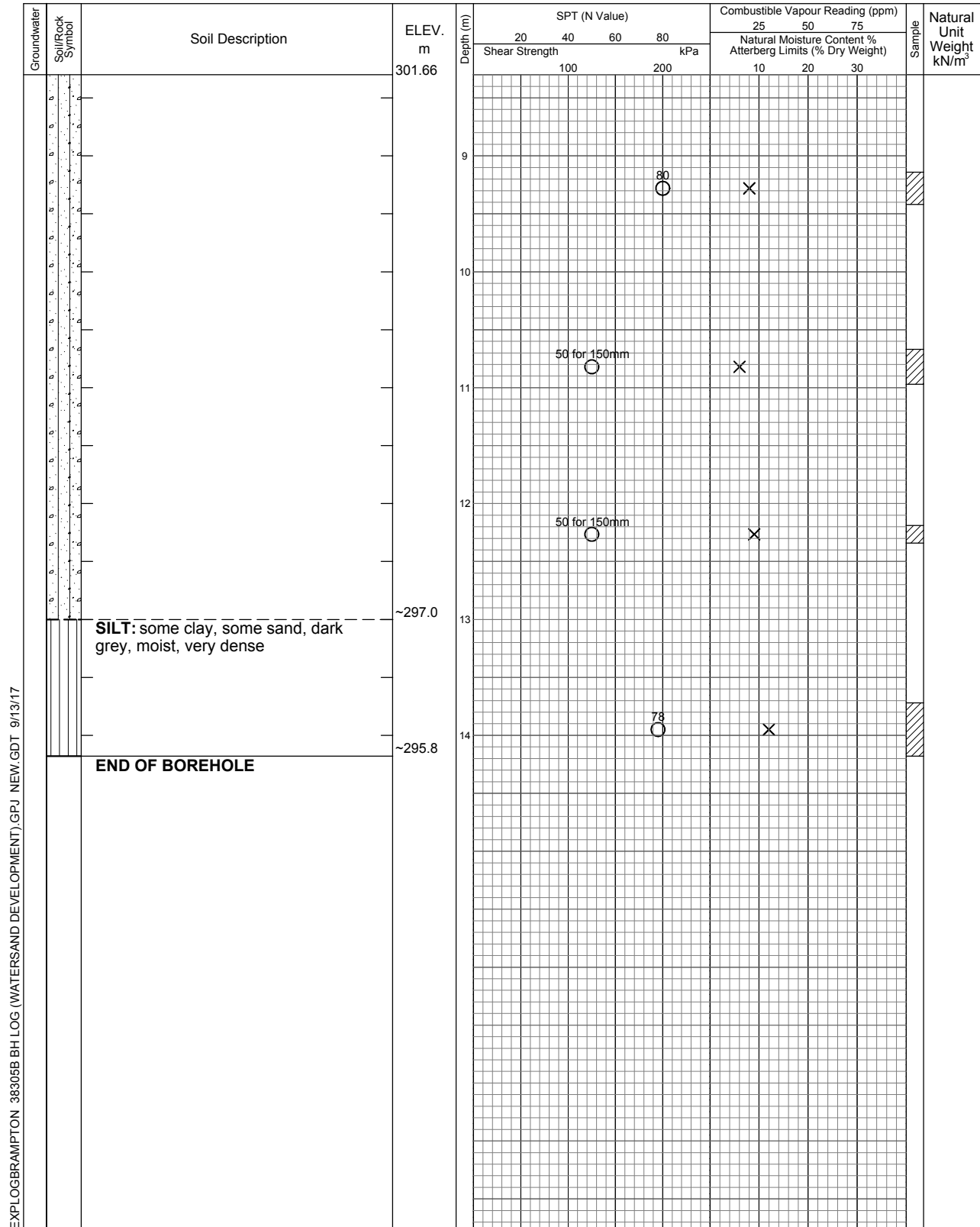
Log of Borehole 12

Project No. BRM-00038305-B0

Drawing No. 14

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW, GDT 9/13/17



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

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

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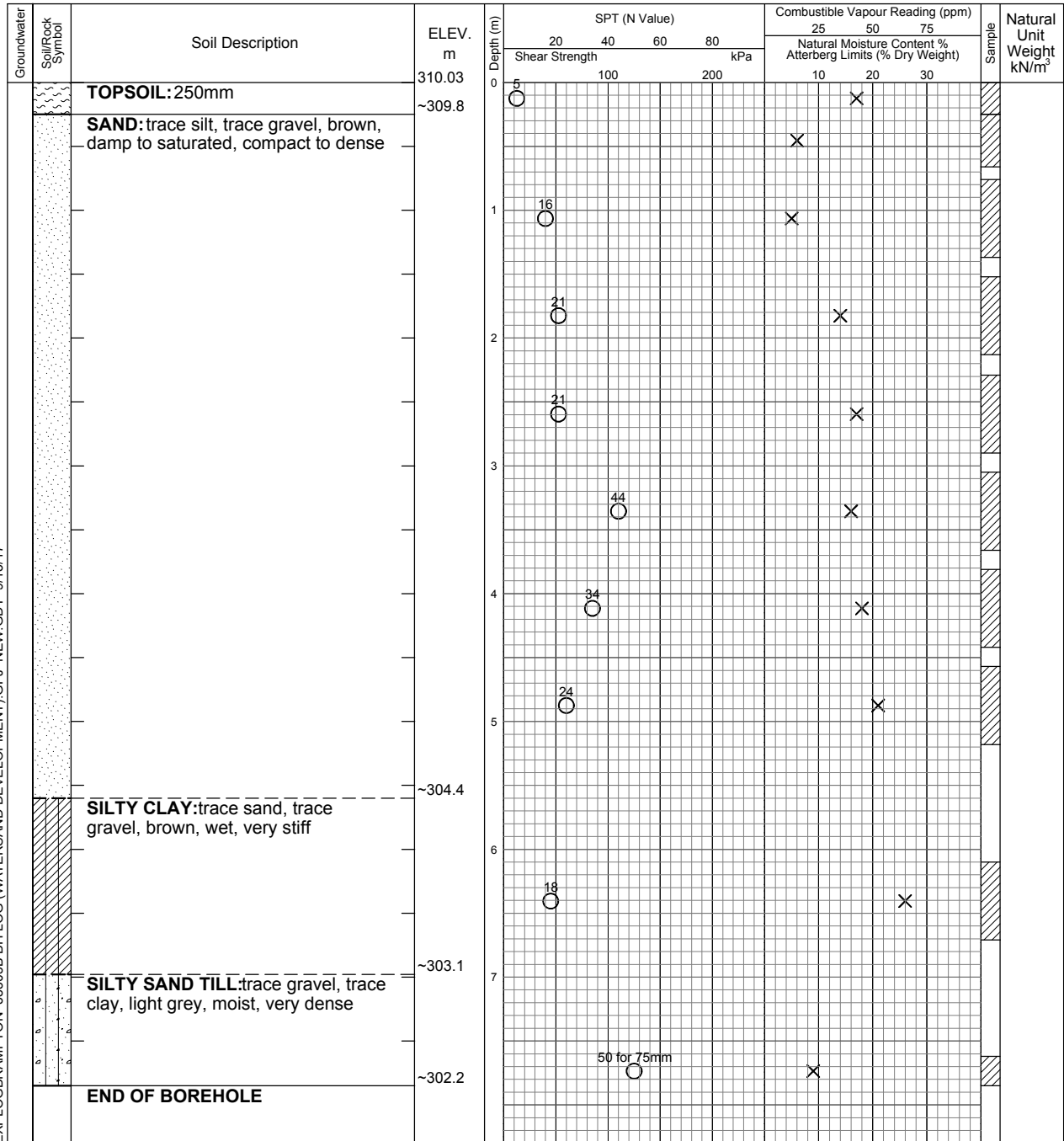
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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



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

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

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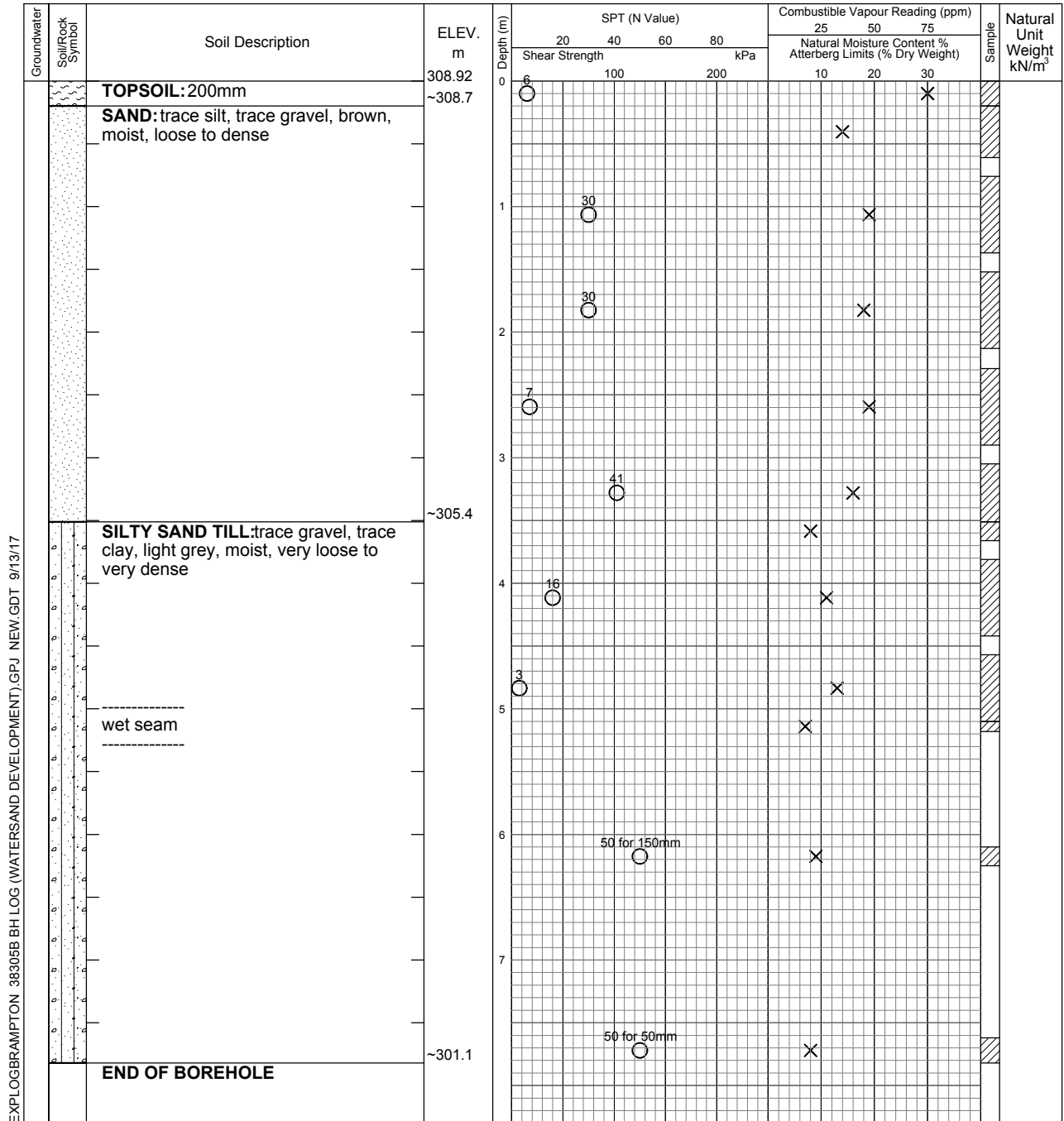
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Datum: Geodetic



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

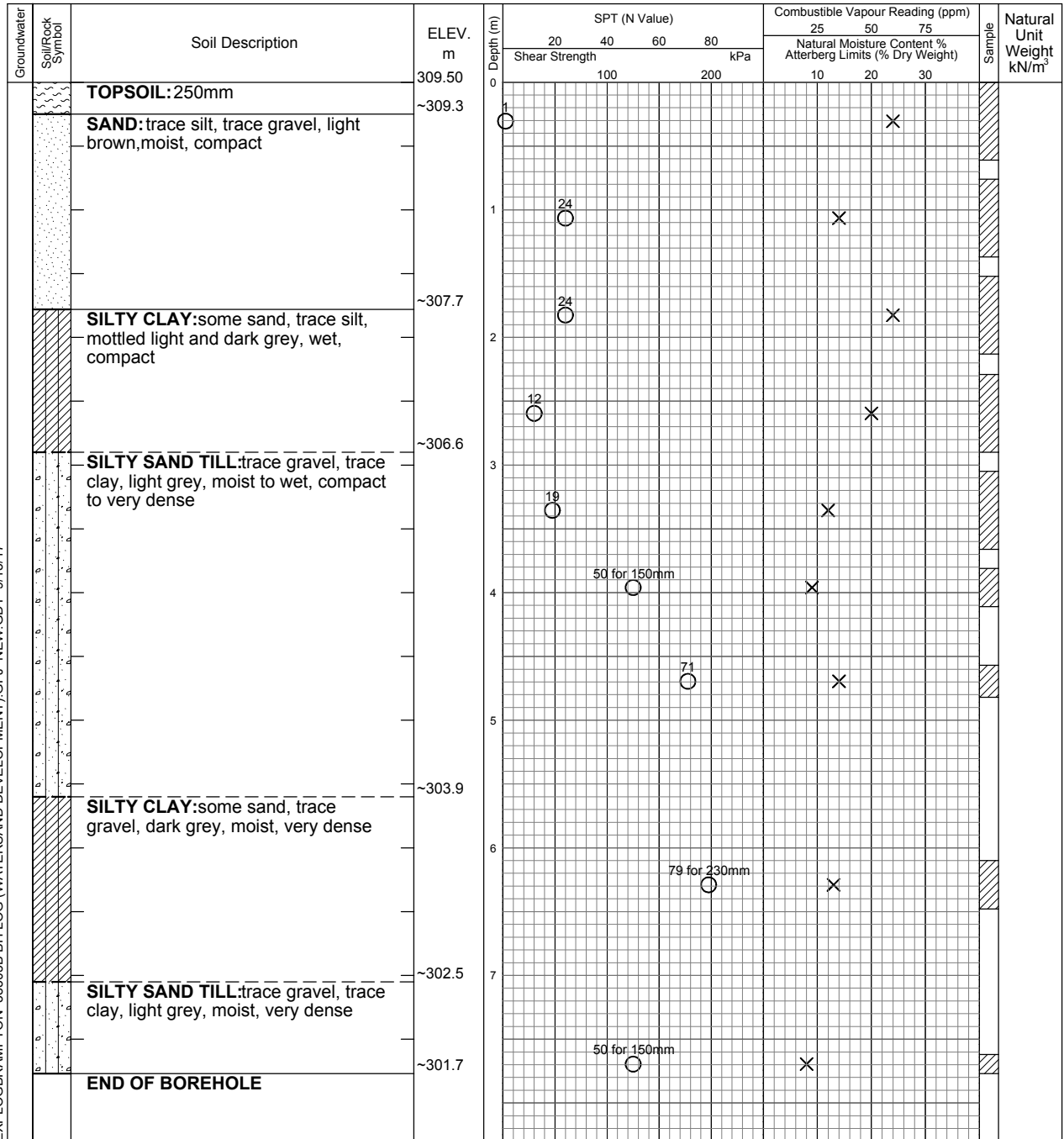
Undrained Triaxial at

% Strain at Failure

Penetrometer

Drill Type: CME55 - Track Mount

Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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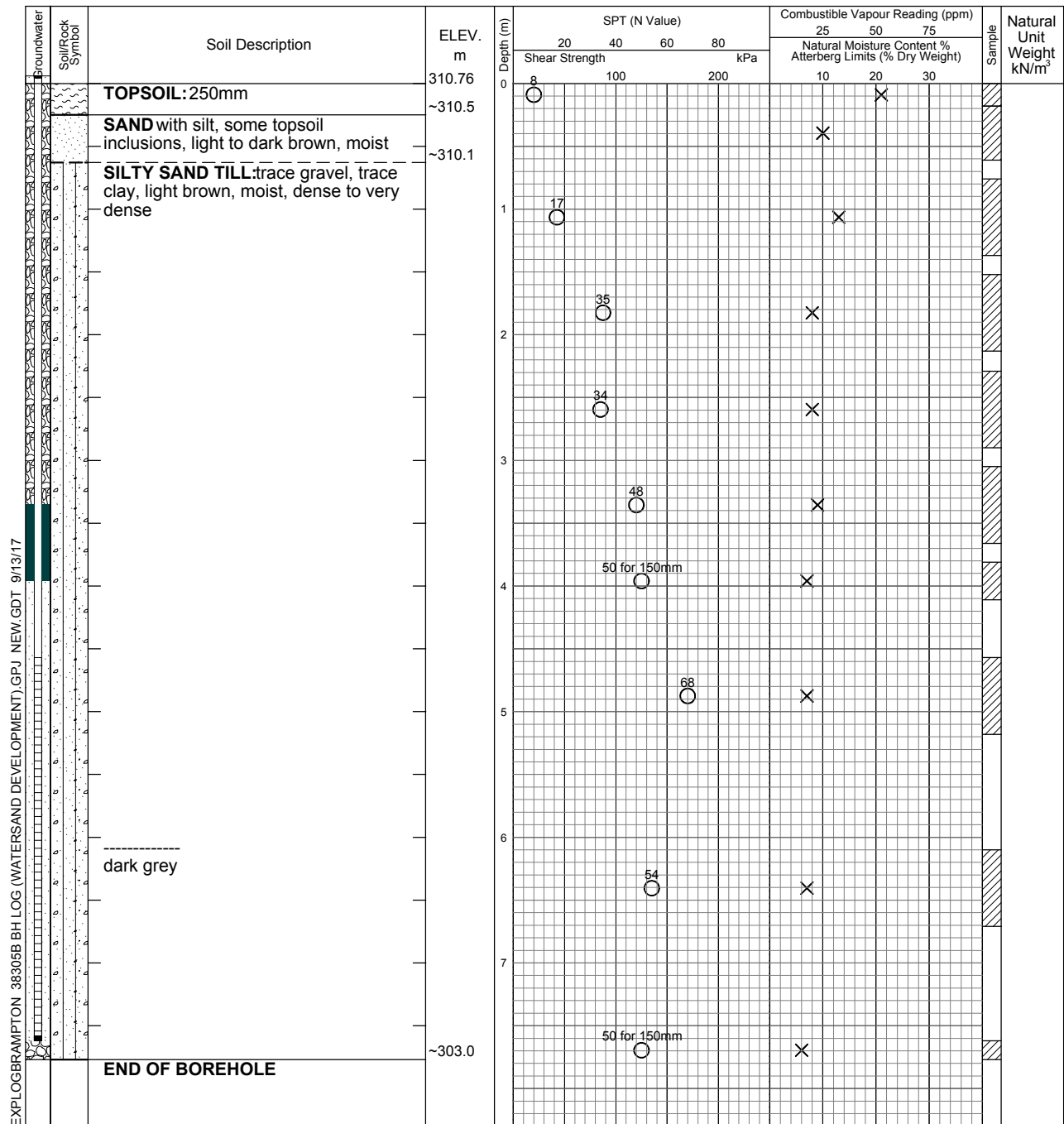
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Datum: Geodetic



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

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

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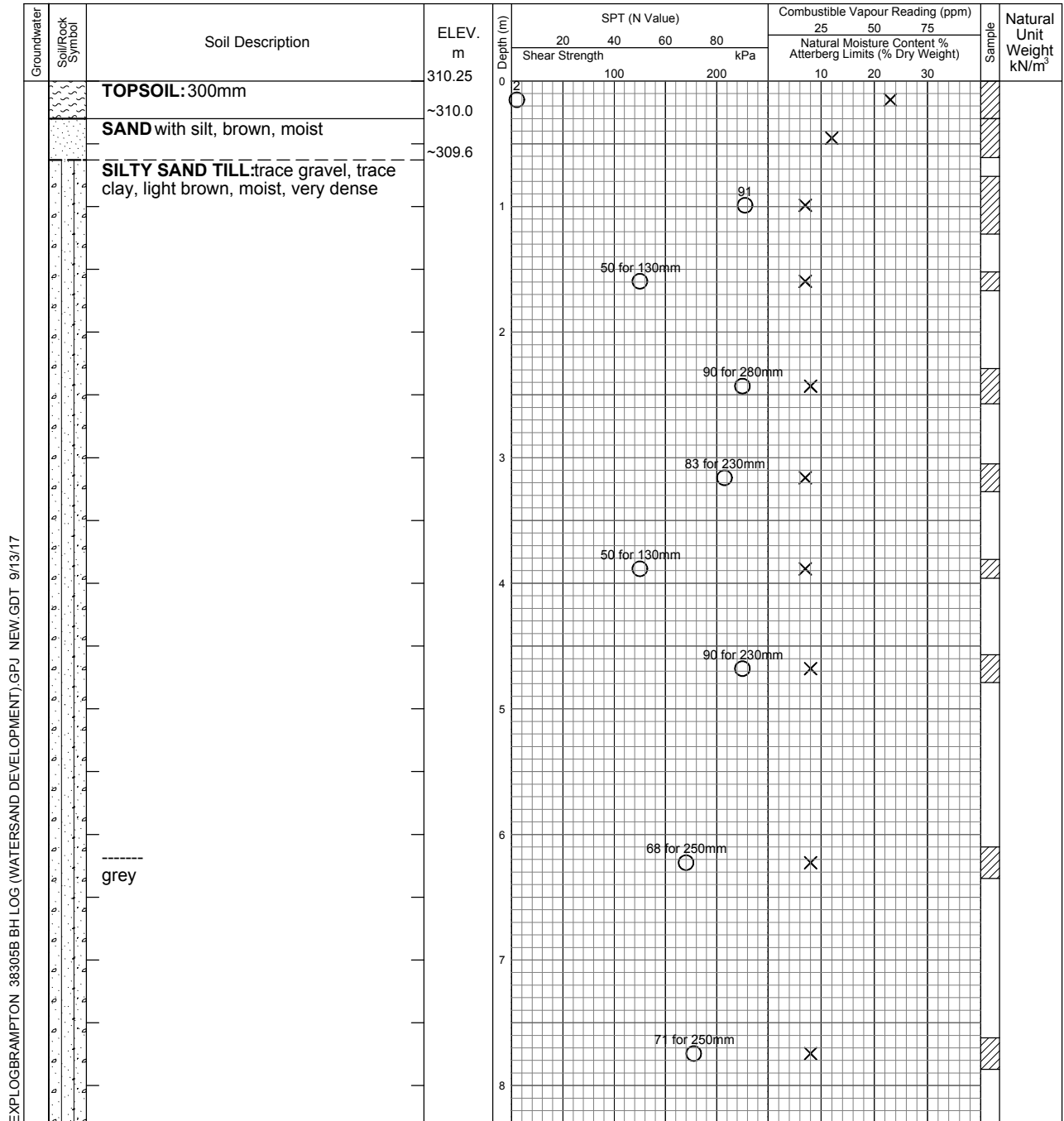
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Datum: Geodetic



Continued Next Page

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



Log of Borehole 19

Project No. BRM-00038305-B0

Drawing No. 19

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

[illegible]

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



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

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

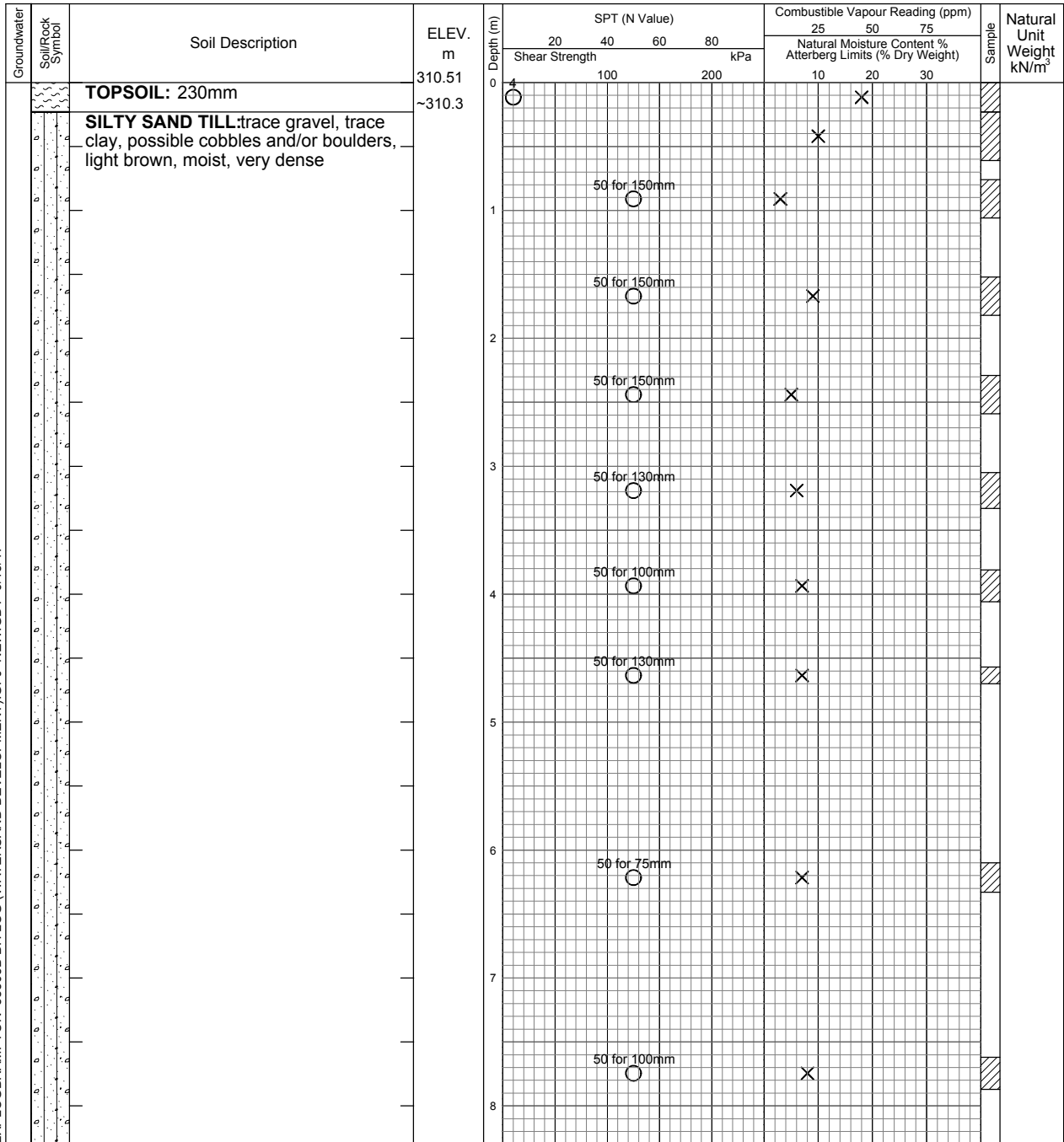


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

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





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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

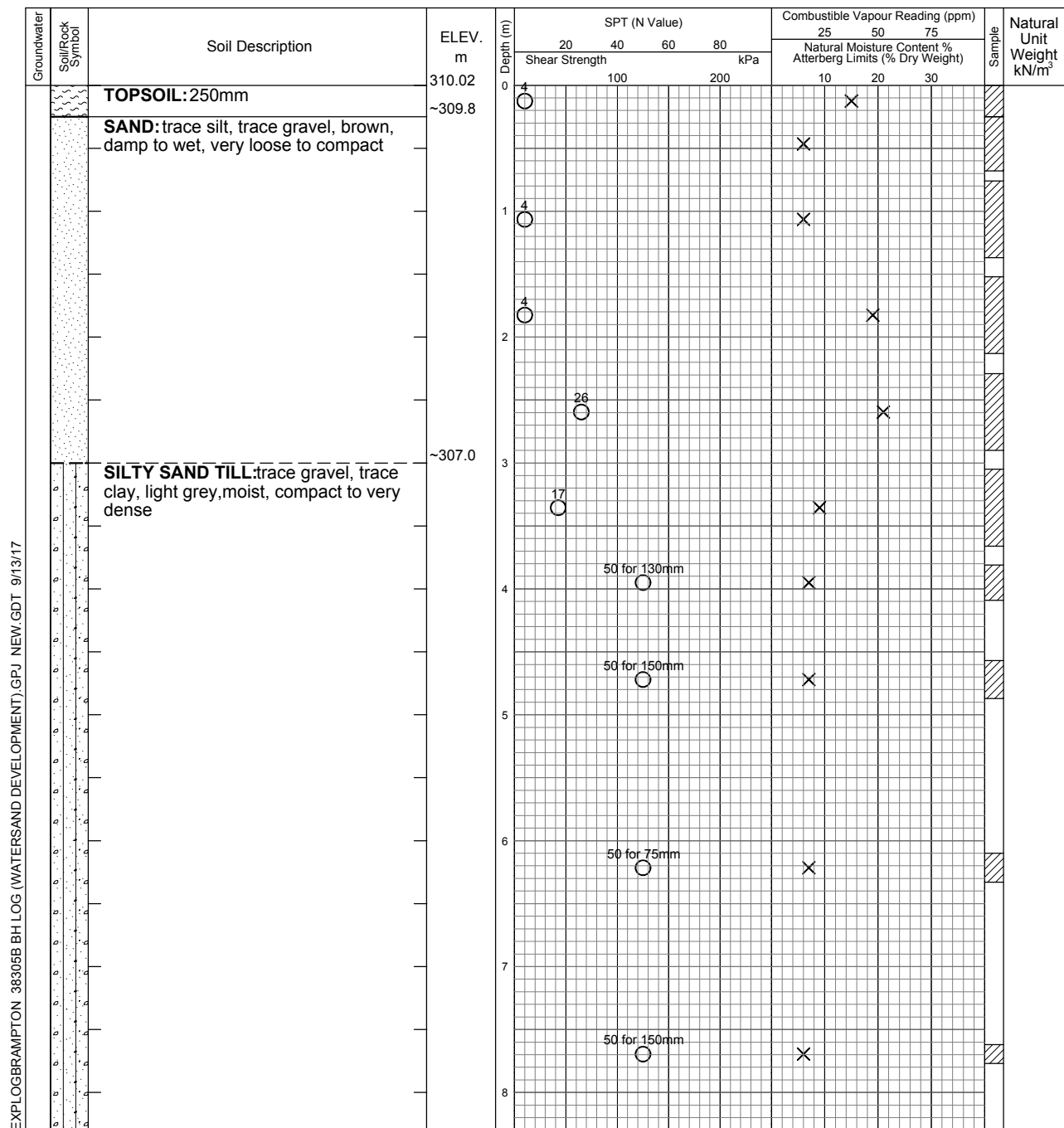
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic

Continued Next Page

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



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)		Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20 40 60 80		25	50	75		
					Shear Strength kPa		Natural Moisture Content % Atterberg Limits (% Dry Weight)				
			301.72		100	200	10	20	30		
				9	50 for 150mm		X				
			~300.3	10							
		SILT: some sand, some clay, trace gravel, dark grey, moist, very dense		11	50 for 150mm		X				
				12	50 for 150mm		X				
		END OF BOREHOLE	~297.7								

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



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

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

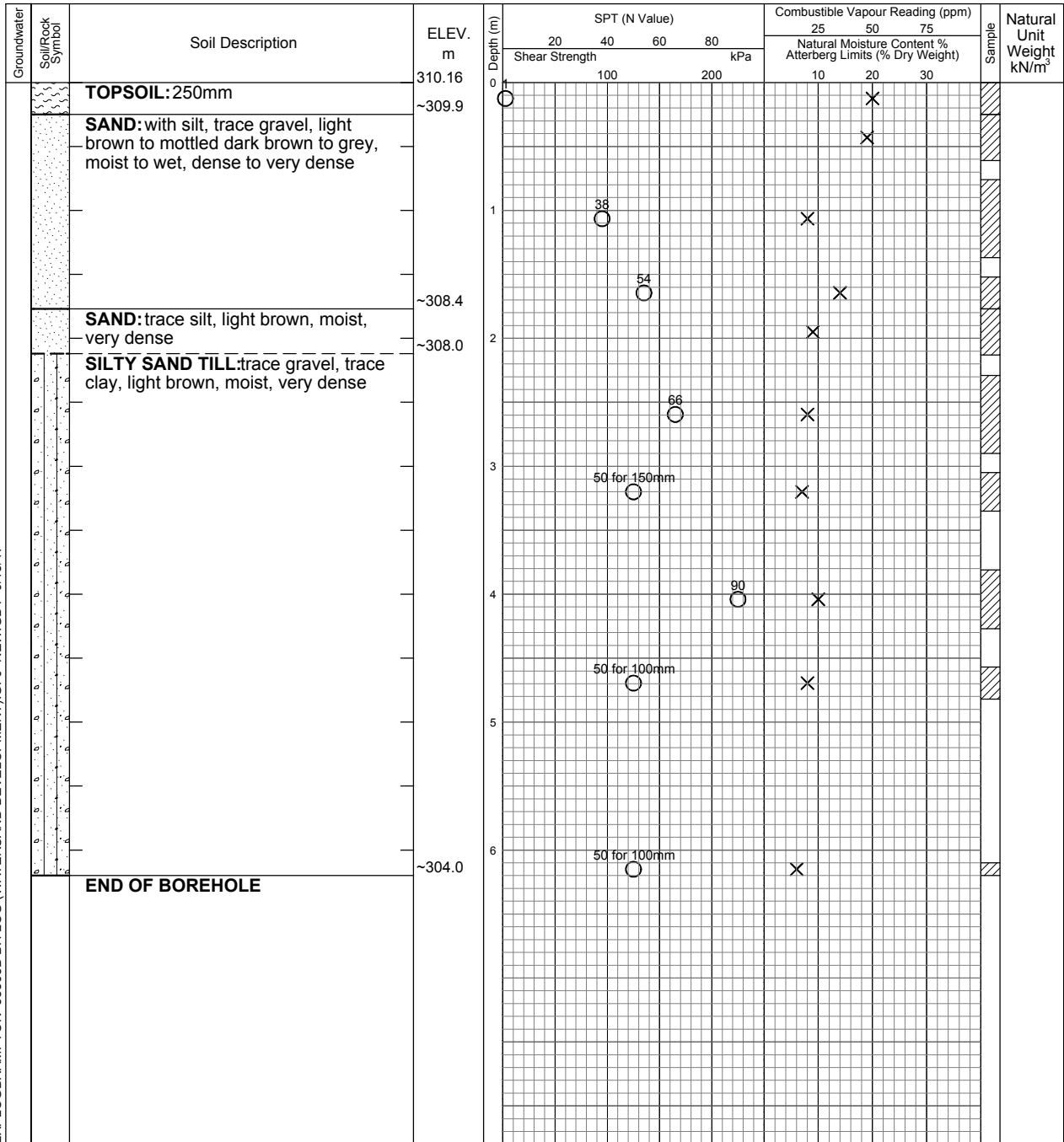


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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

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

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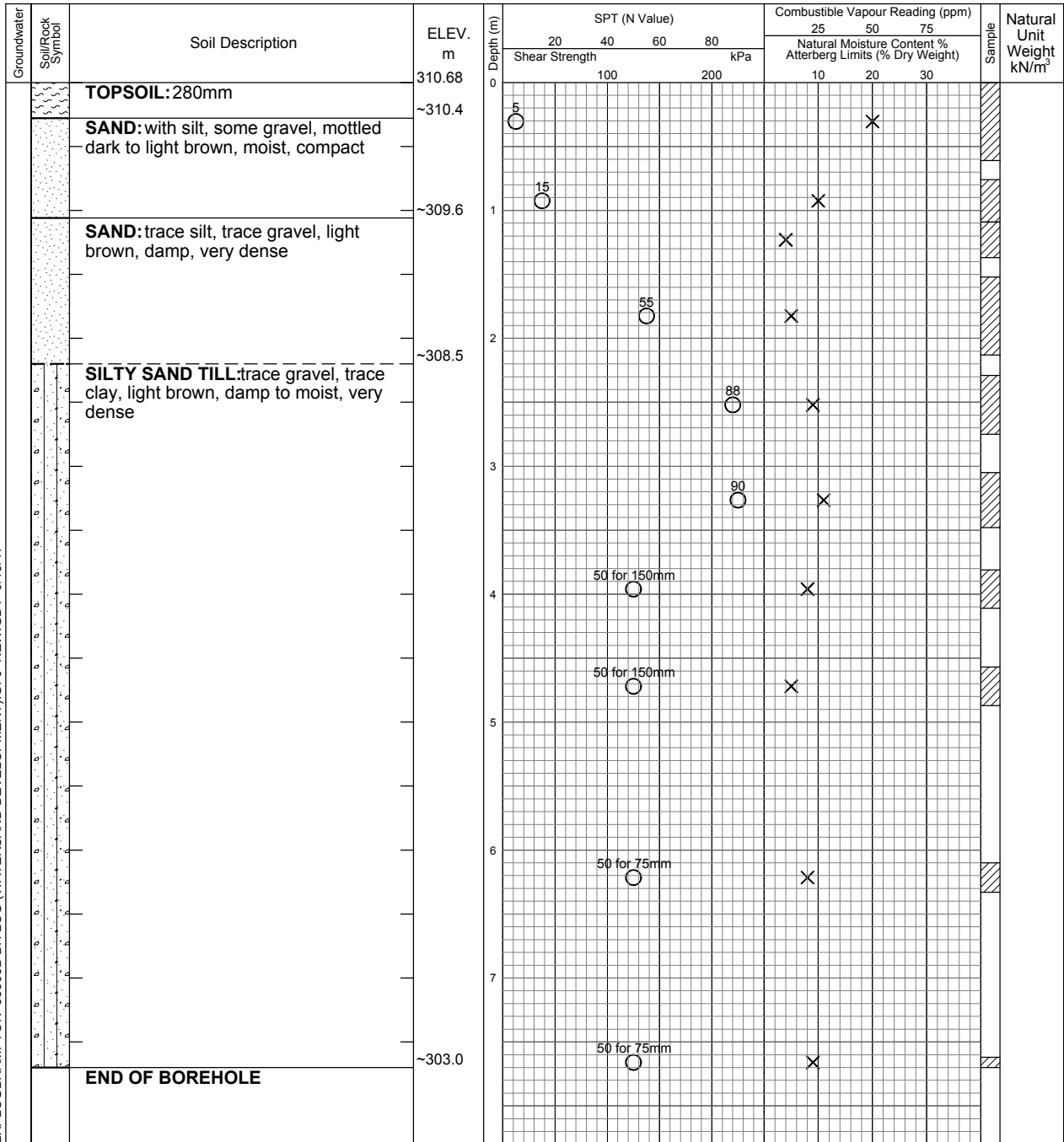
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

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

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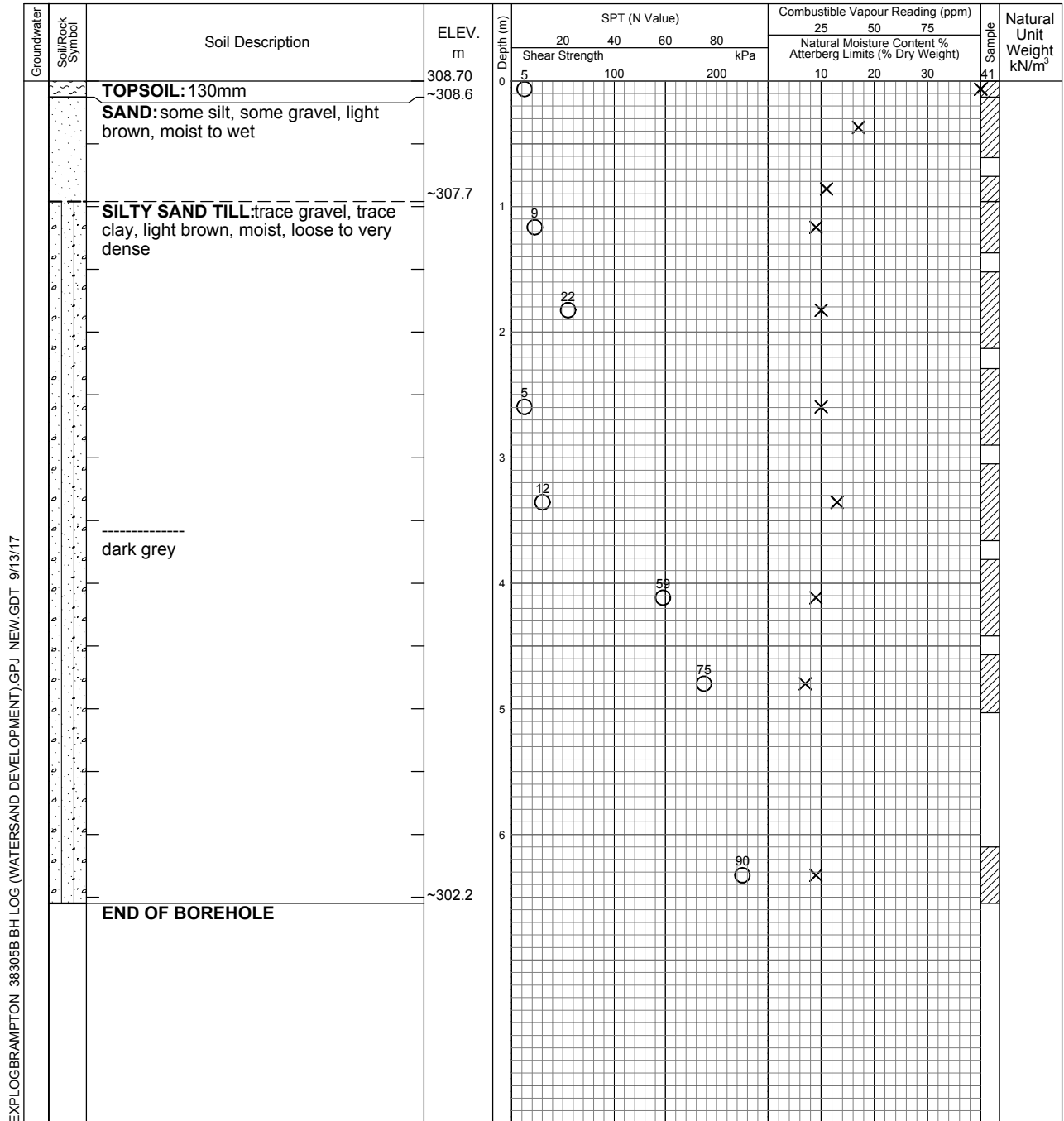
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Datum: Geodetic



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

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

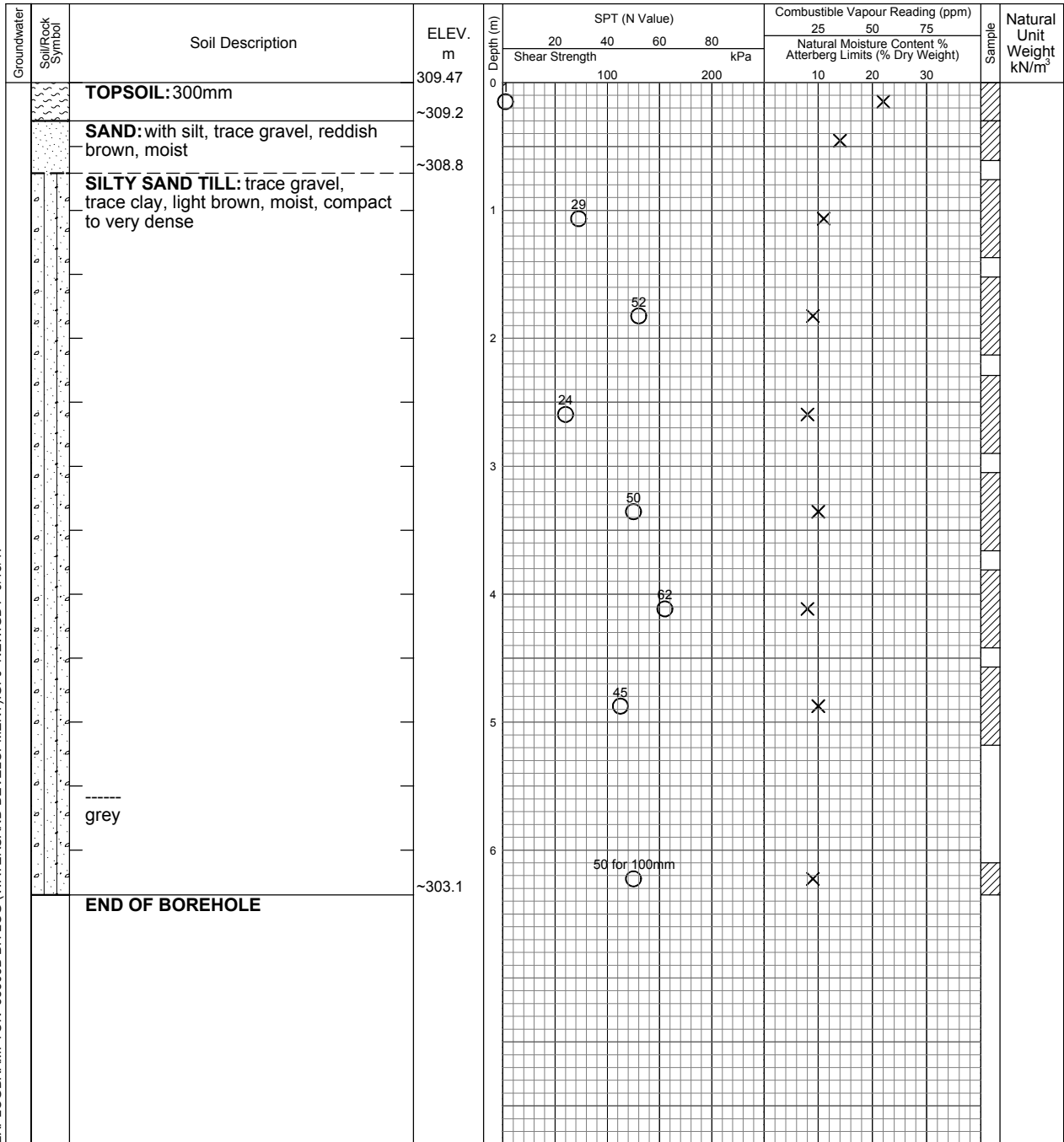


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

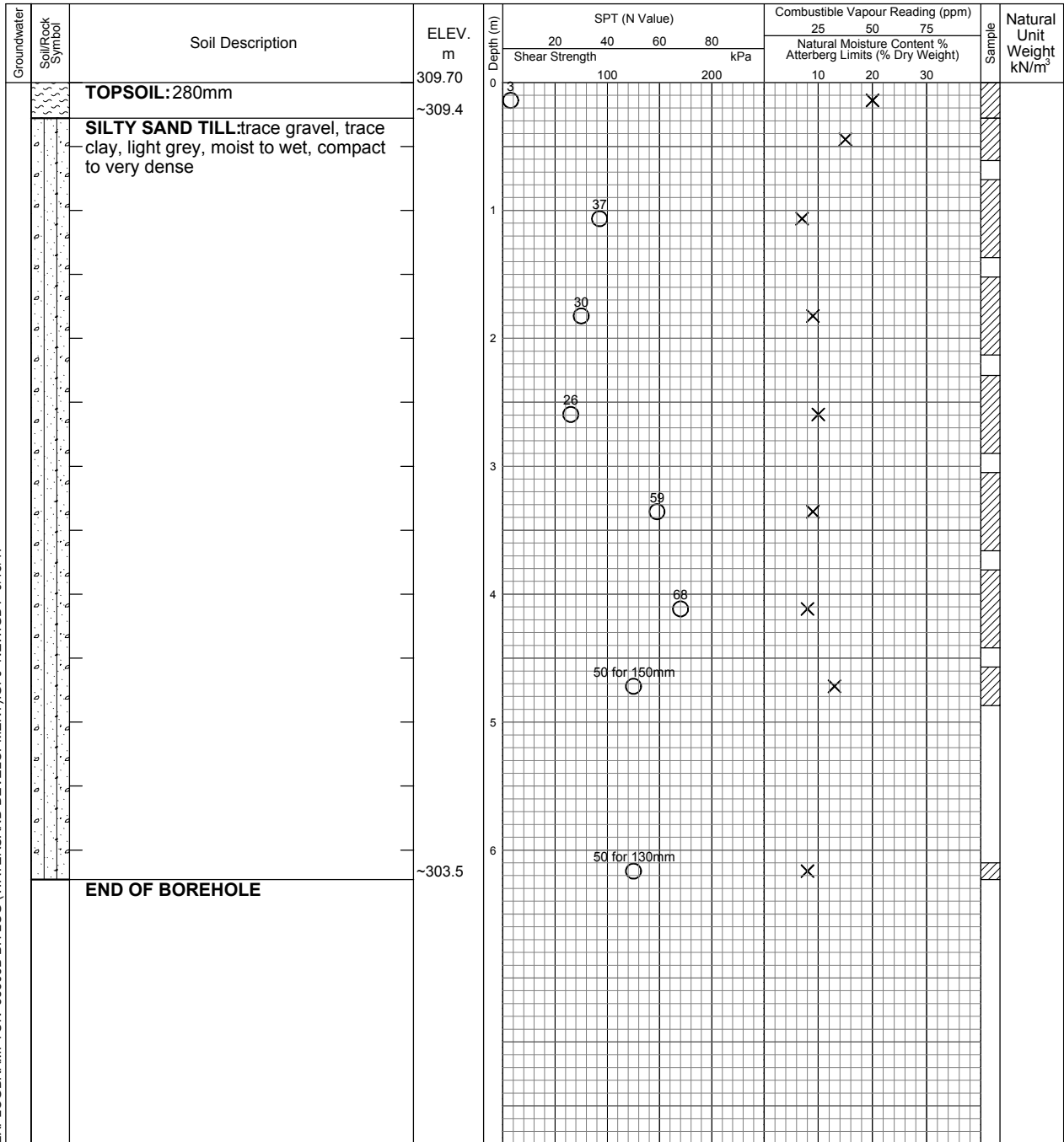


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

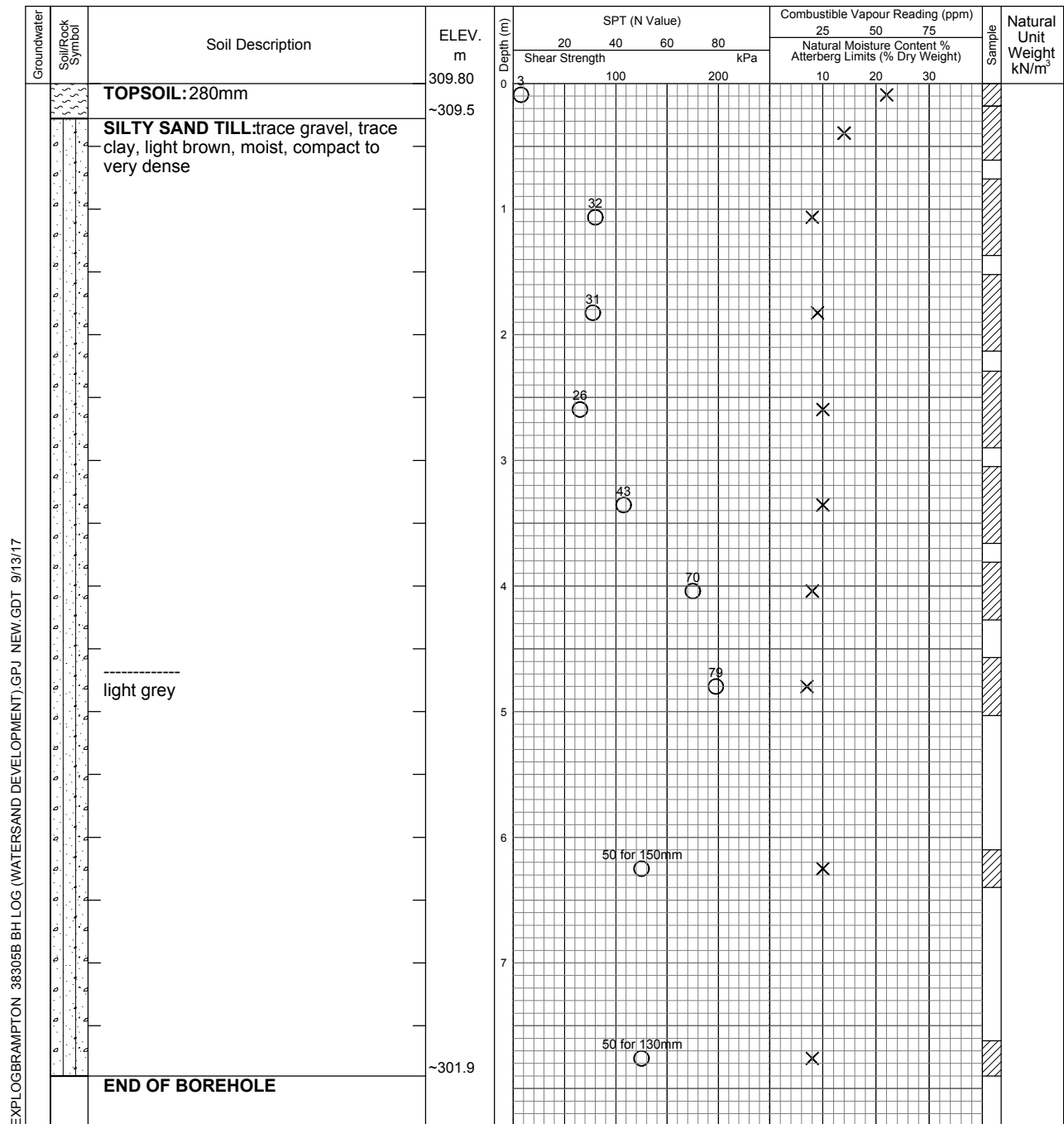
Datum: Geodetic

Shelby Tube

Undrained Triaxial at

Field Vane Test

Penetrometer



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

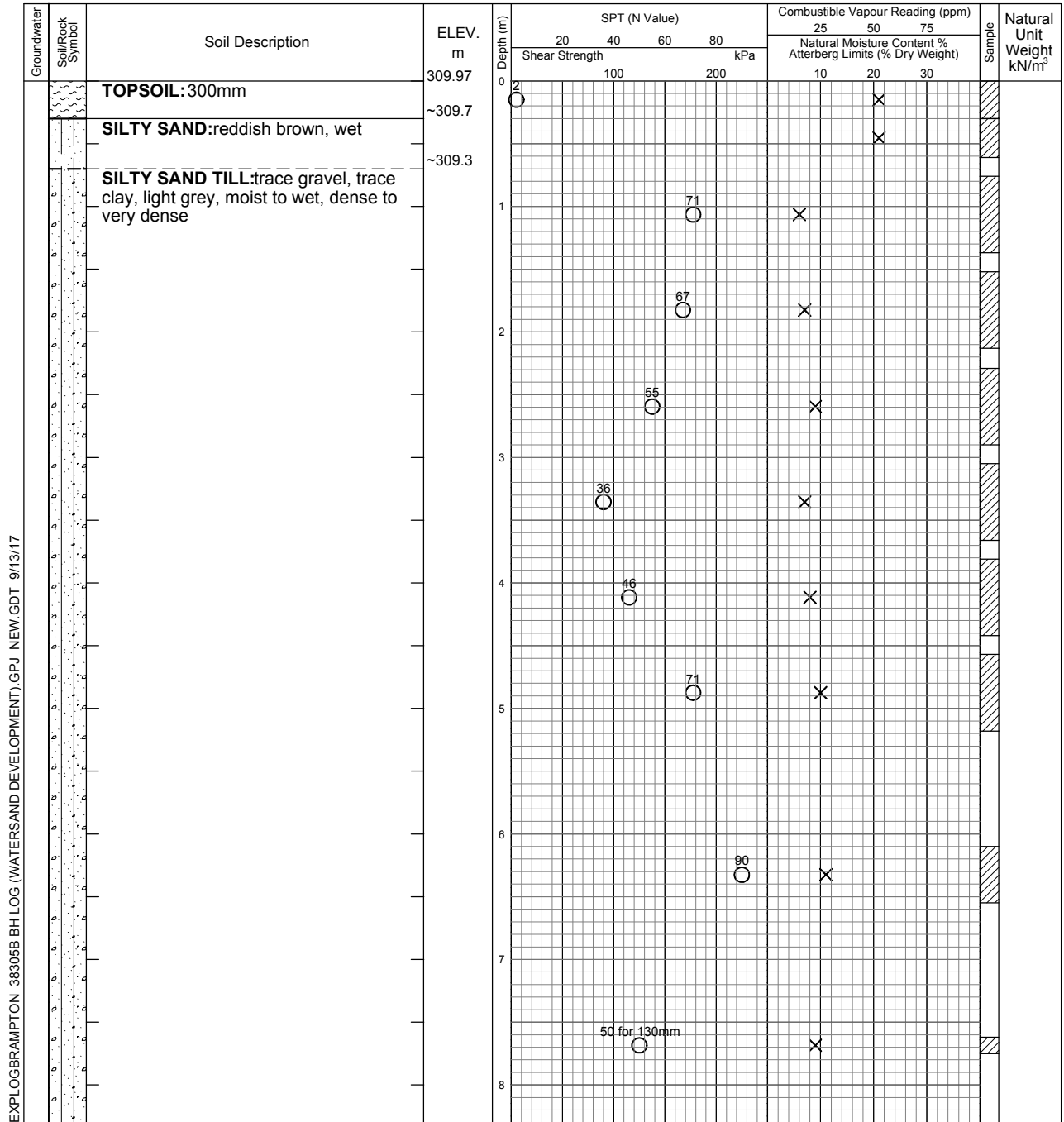
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic

Continued Next Page

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



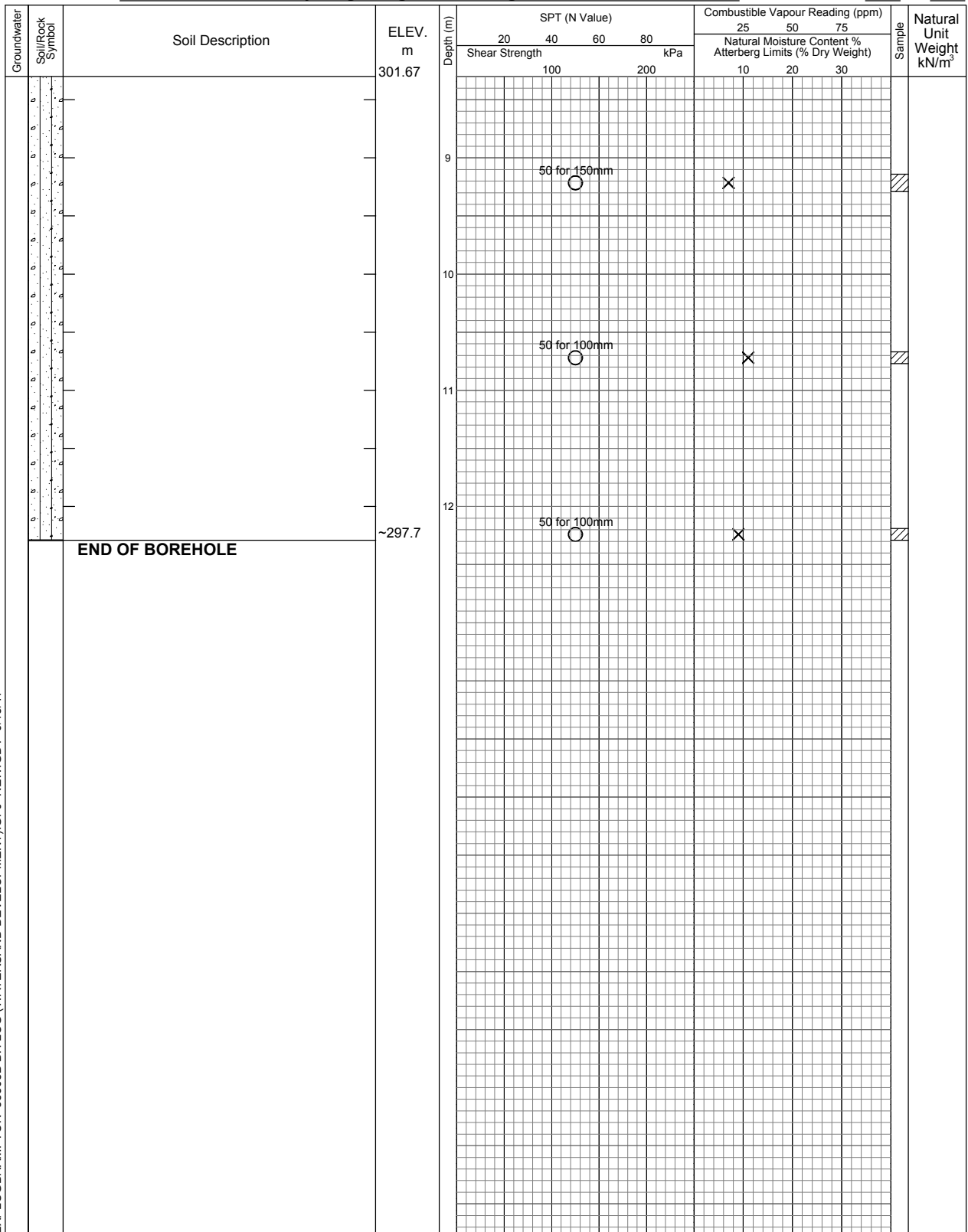
Log of Borehole 29

Project No. BRM-00038305-B0

Drawing No. 28

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

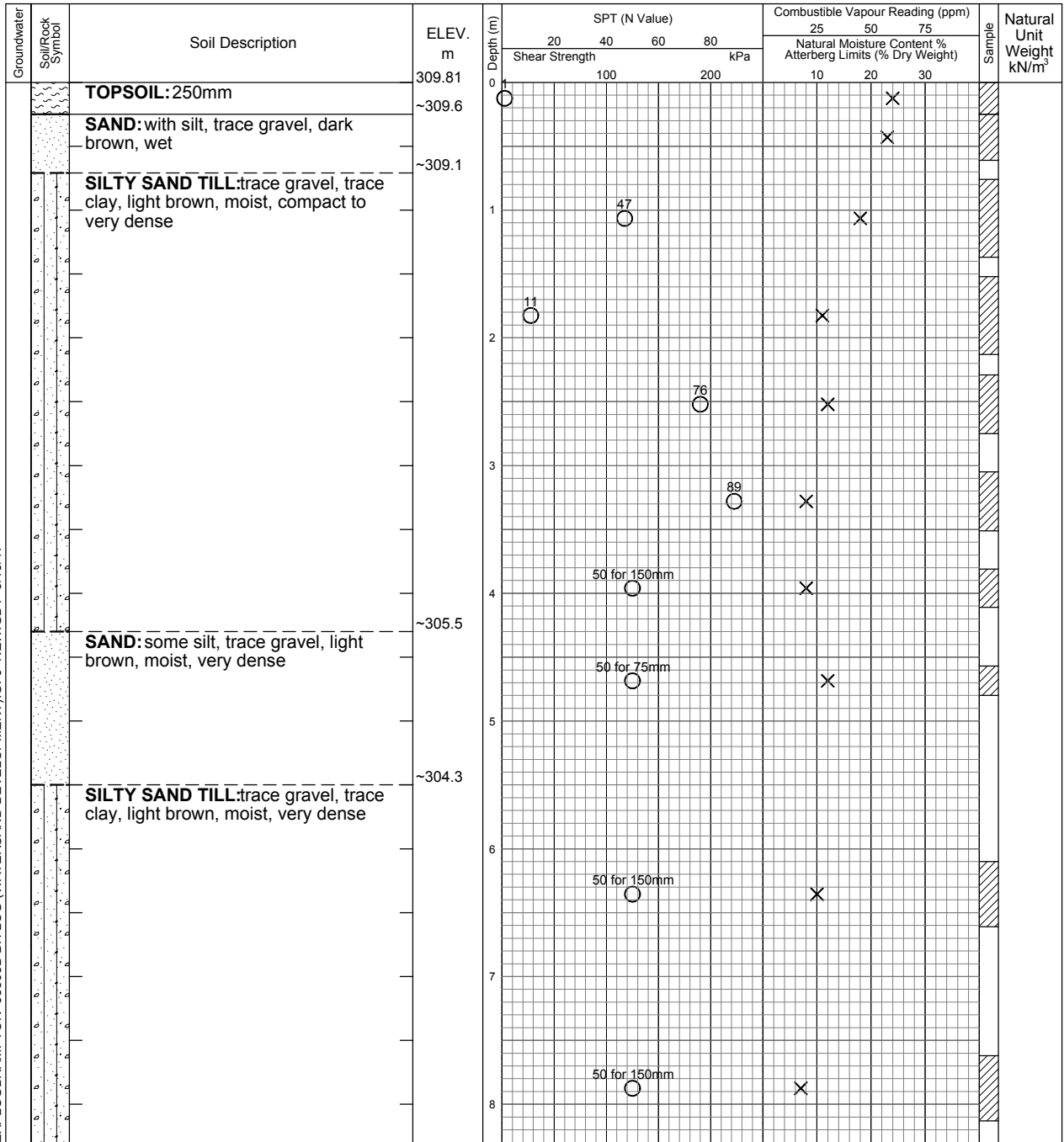


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

[illegible]

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



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

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

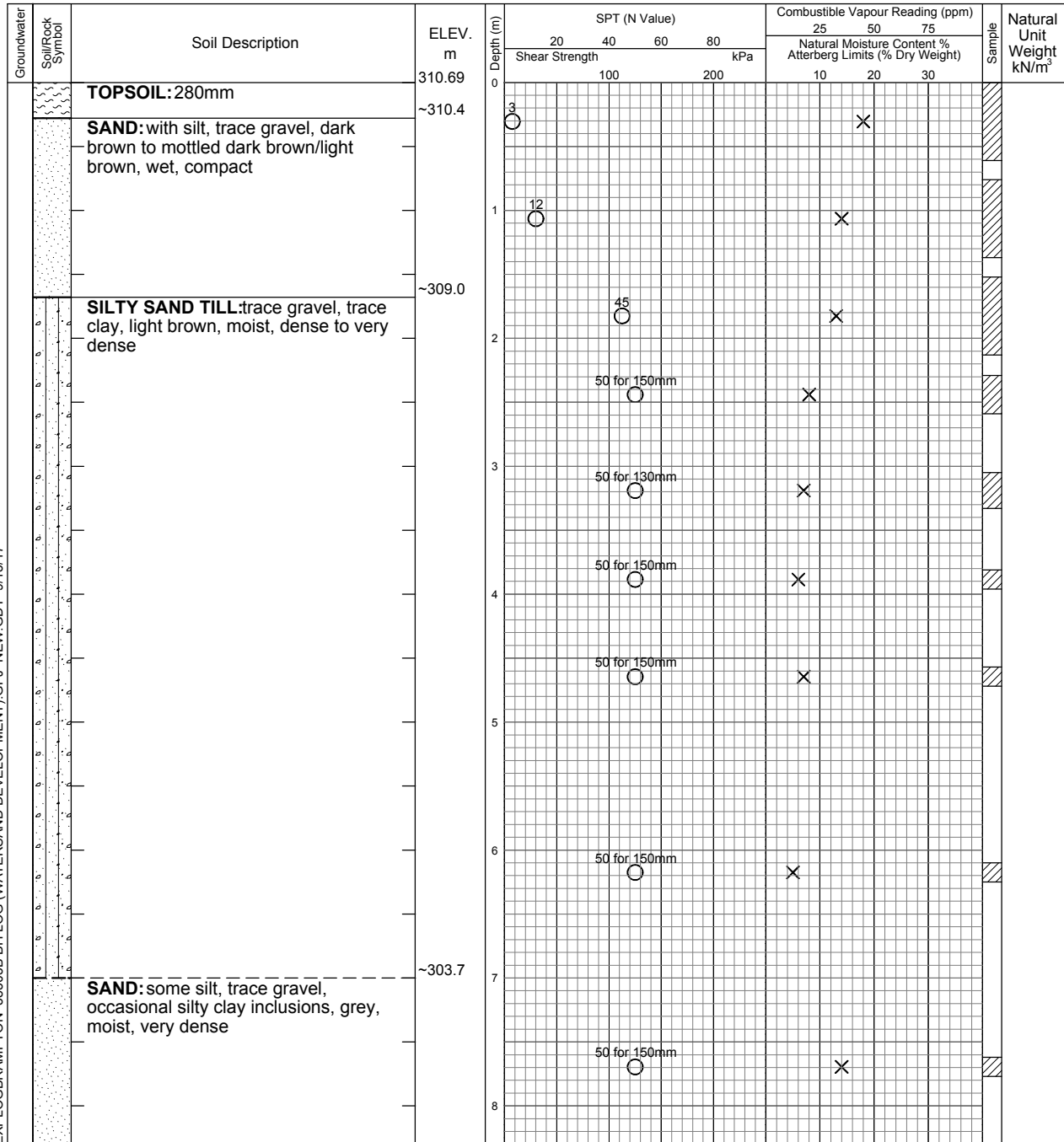


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Continued Next Page

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



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
					Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
			302.39		100		200		10	20	30		
				9		50 for 100mm			X				
		END OF BOREHOLE	~301.5										

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



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

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

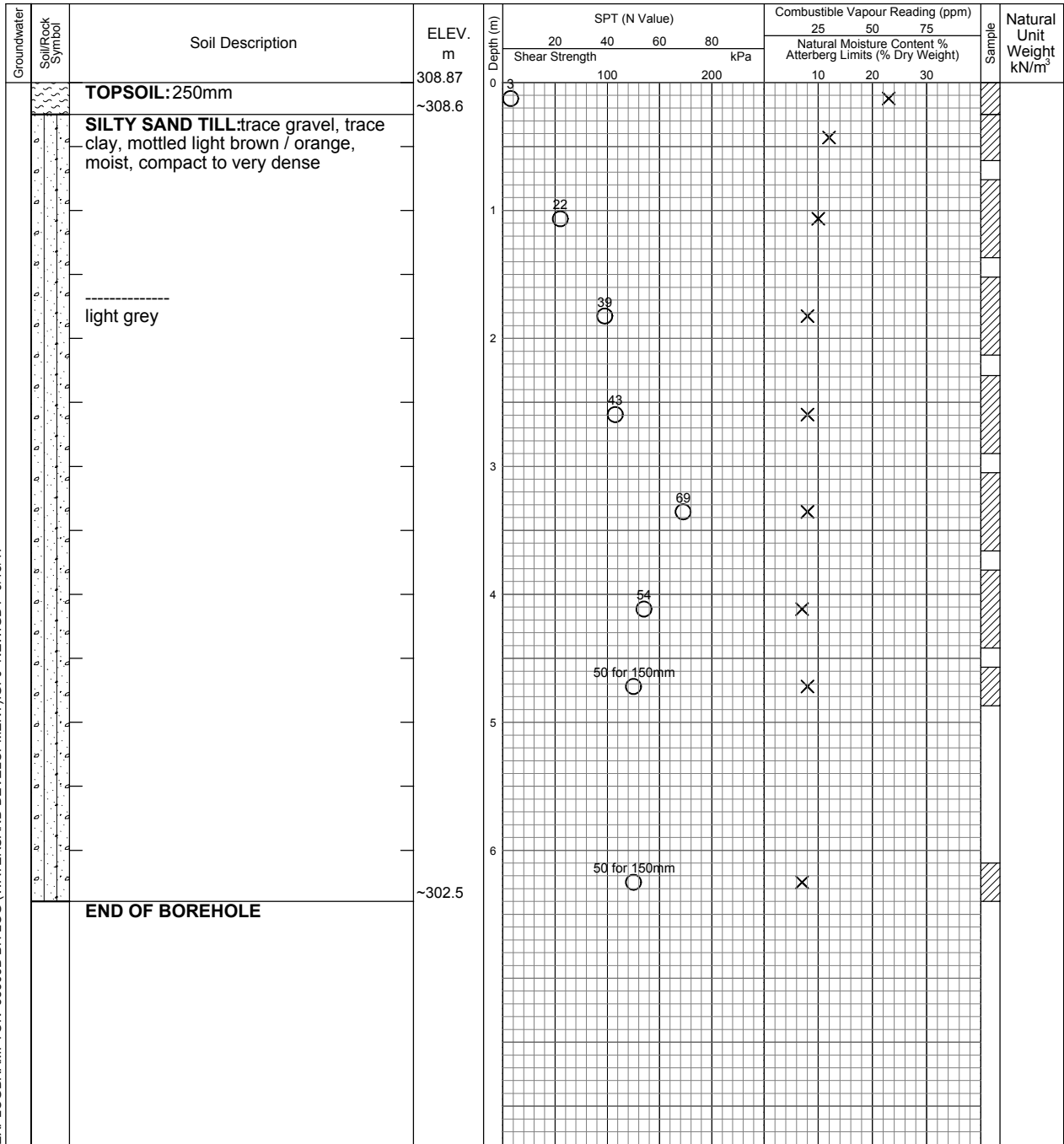


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

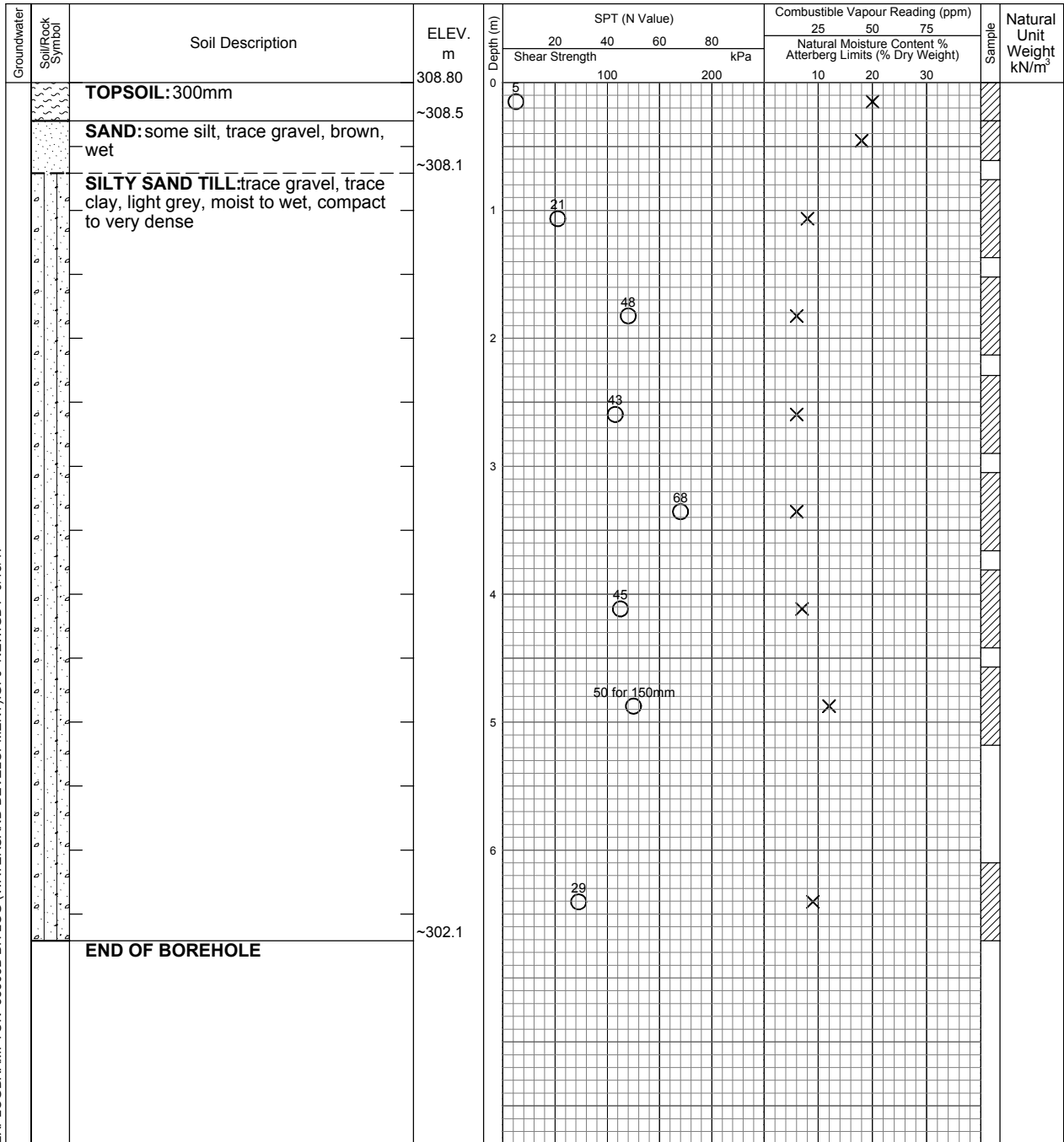


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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

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

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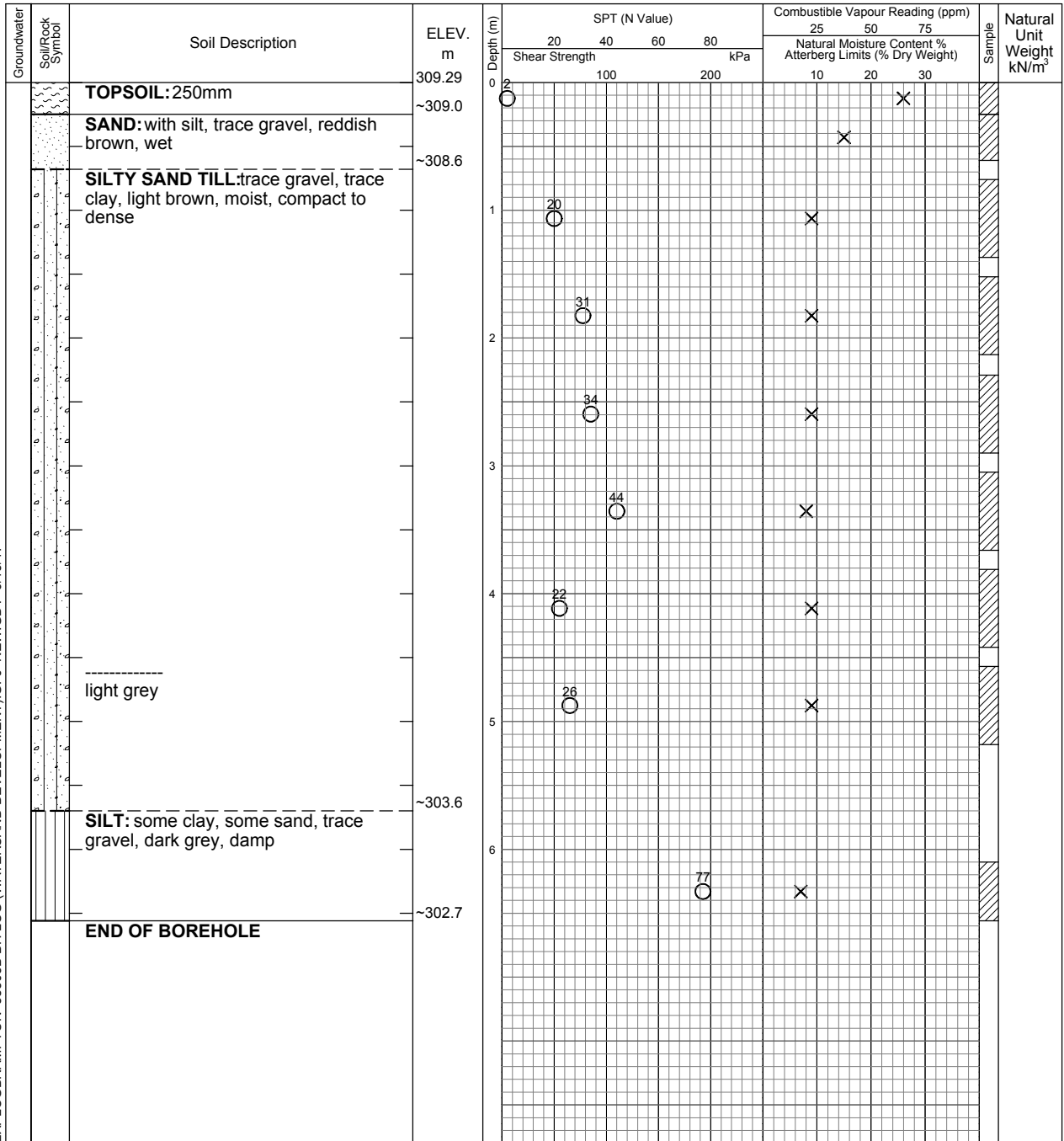
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Datum: Geodetic



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

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

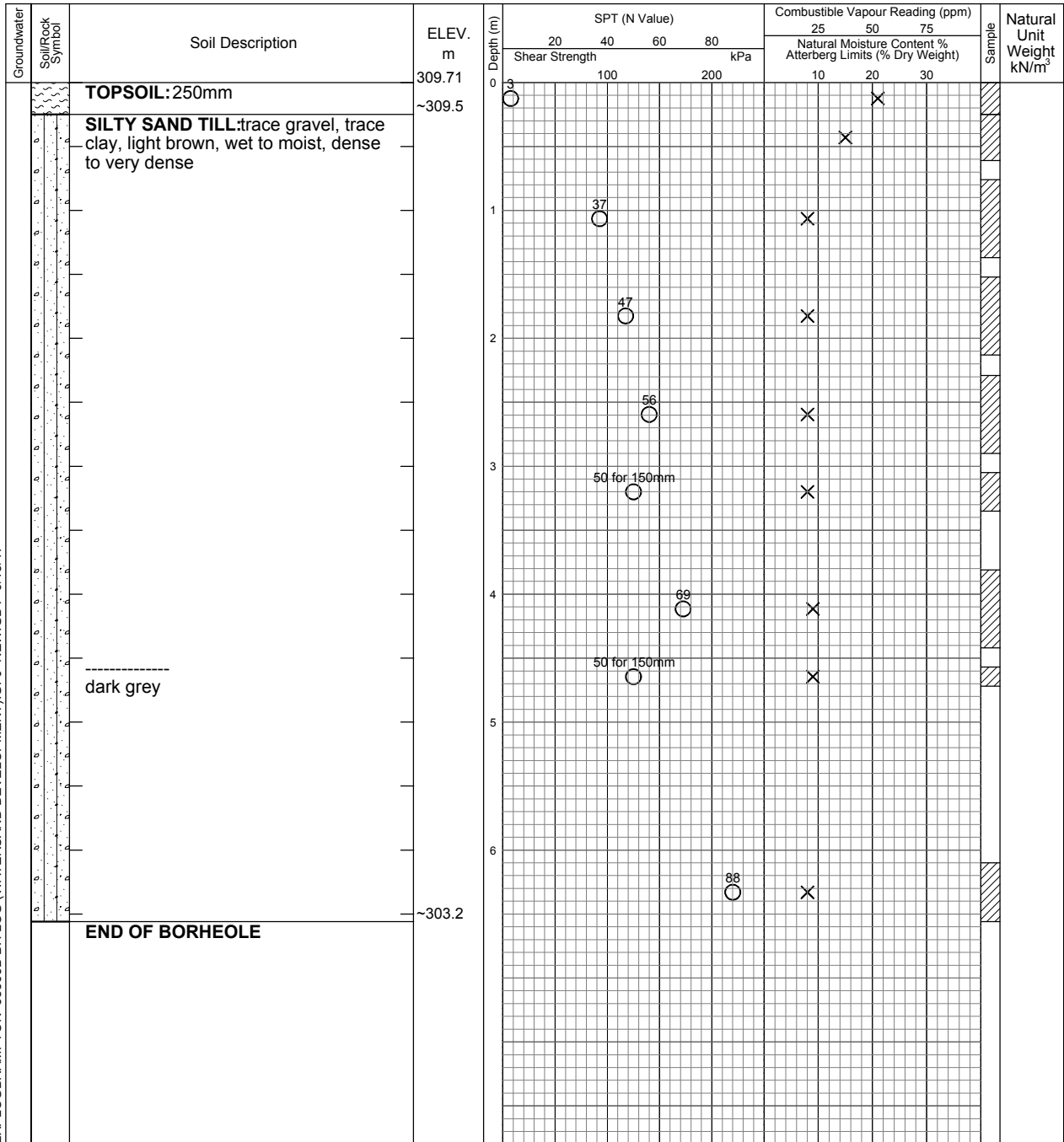


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

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

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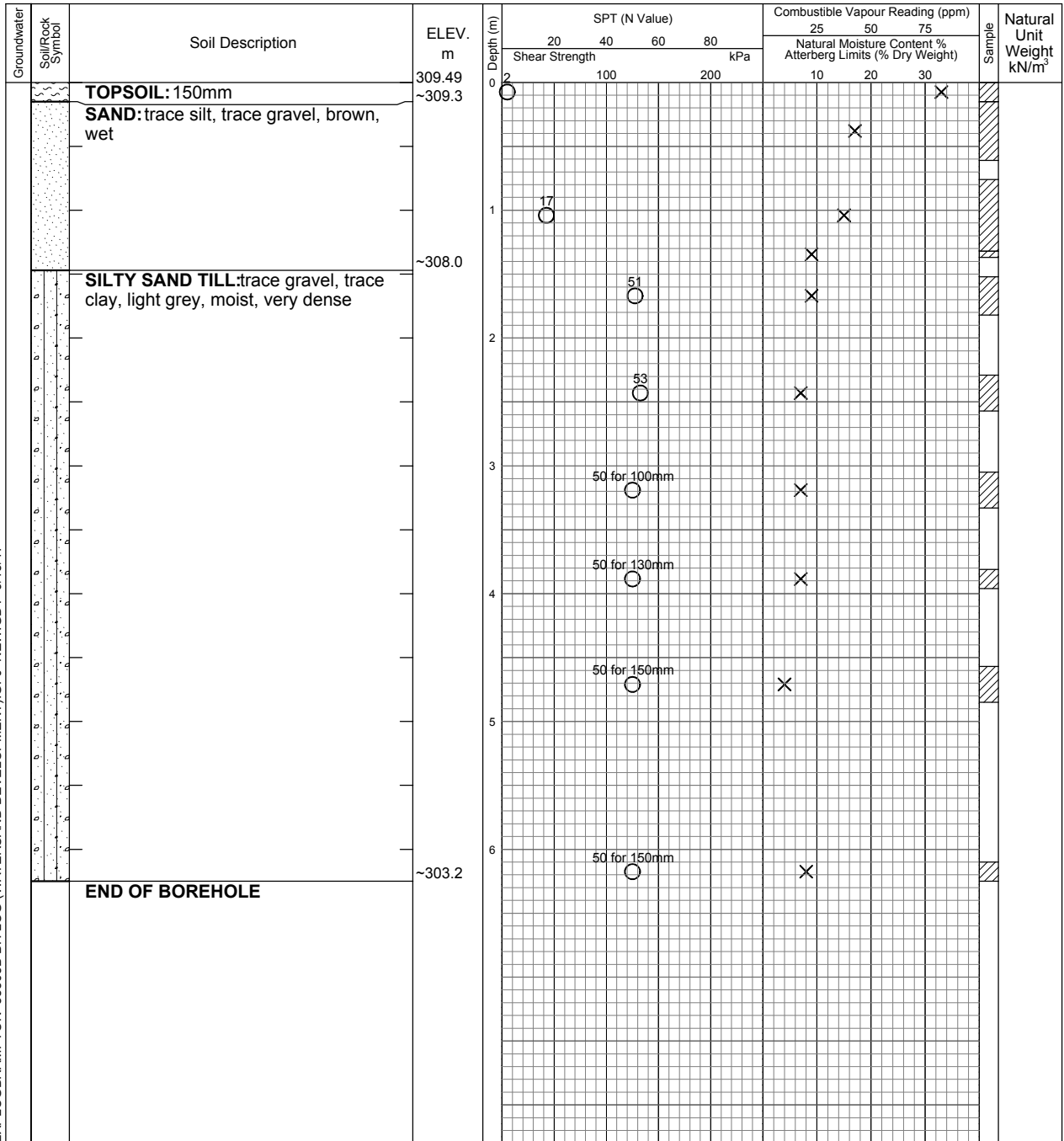
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

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

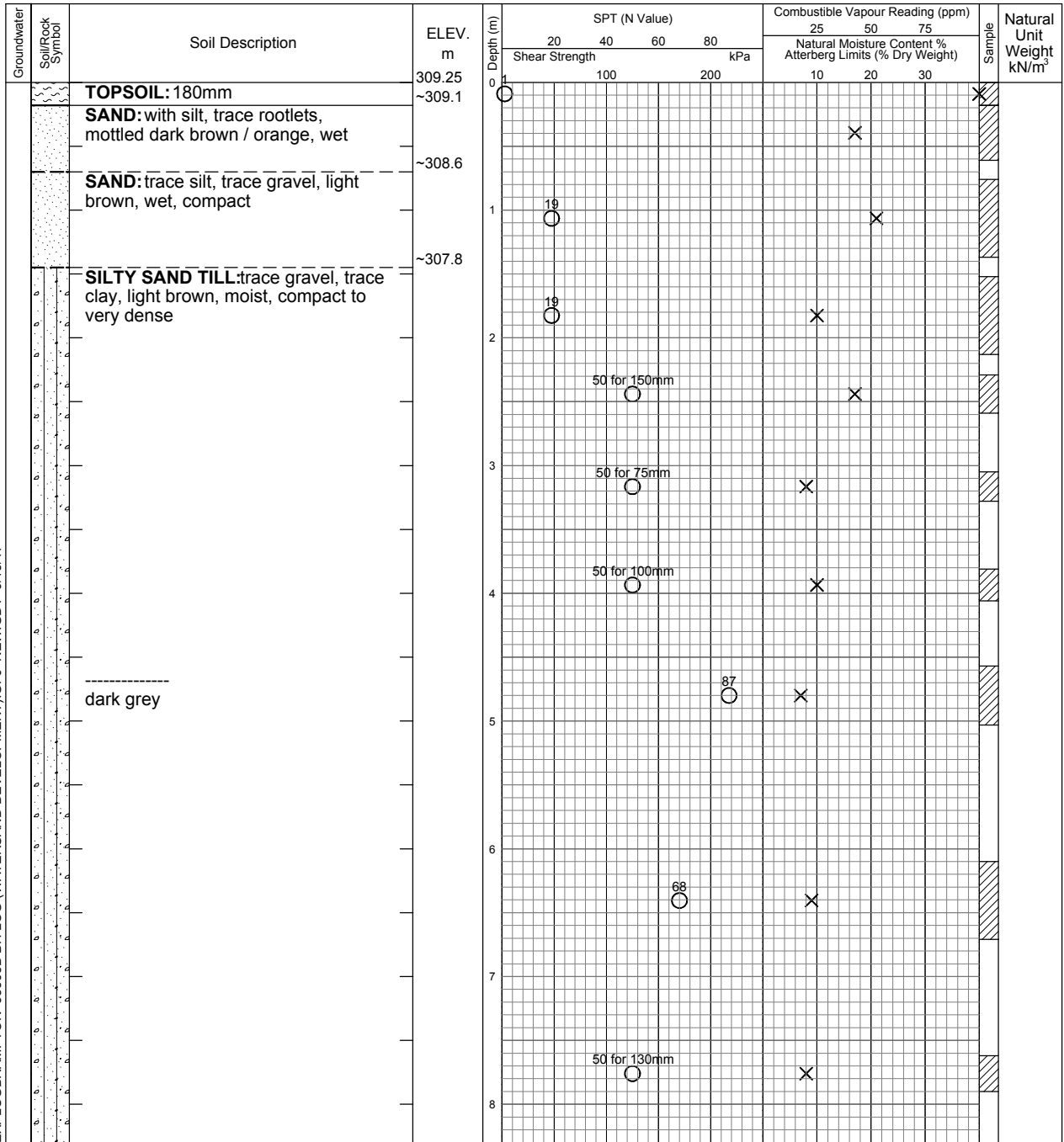


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Continued Next Page

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



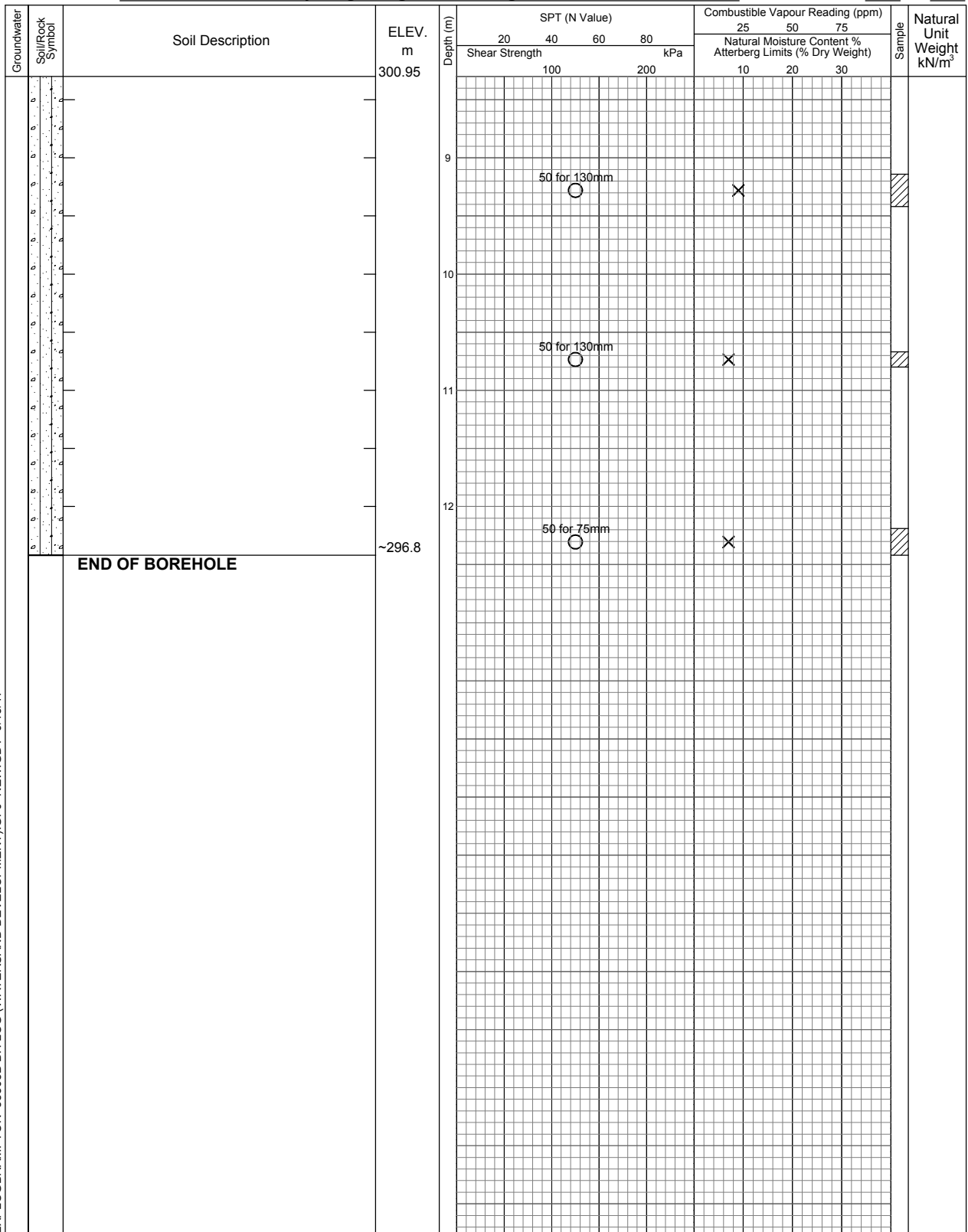
Log of Borehole 38

Project No. BRM-00038305-B0

Drawing No. 36

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

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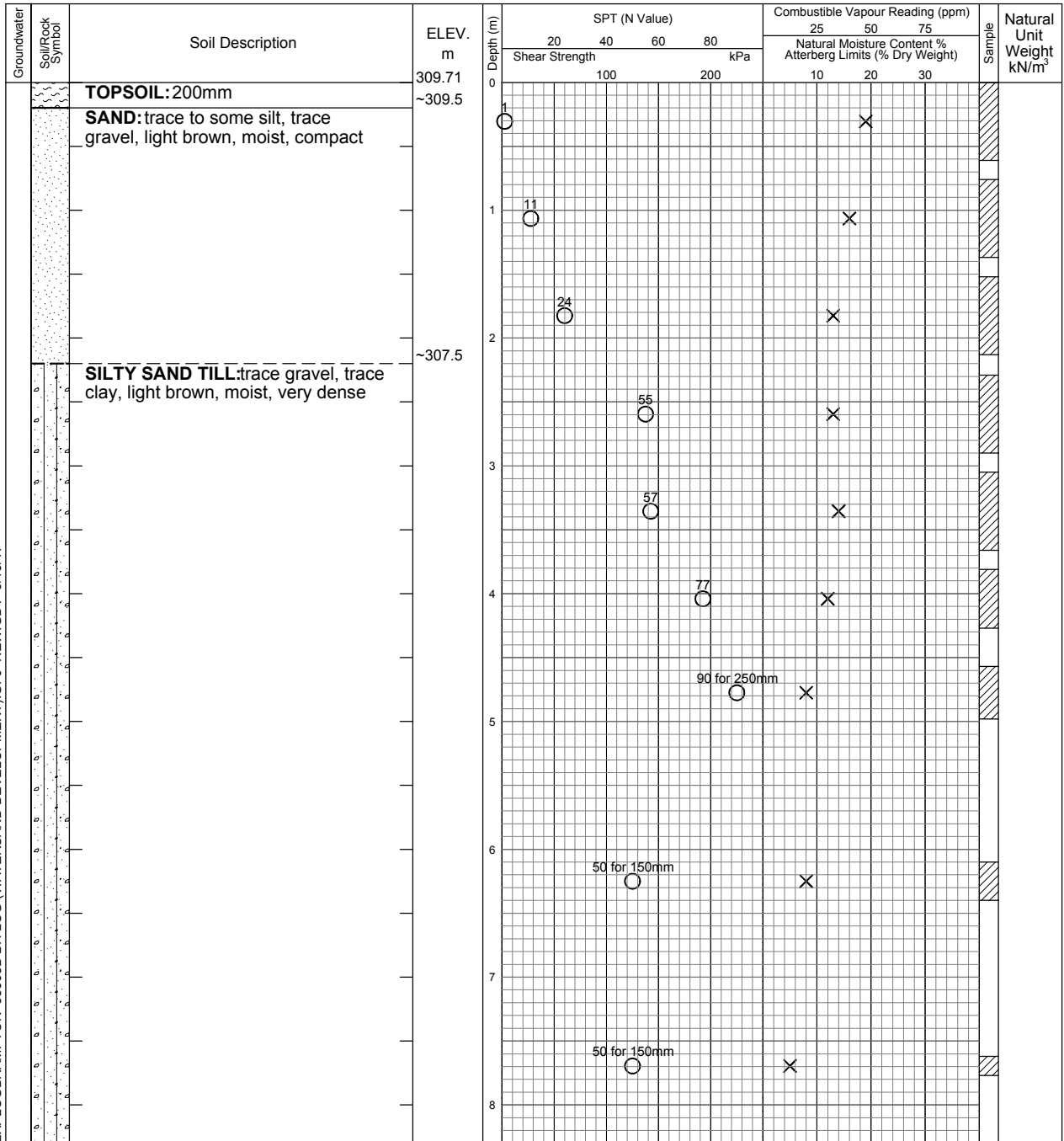
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

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



Log of Borehole 39

Project No. BRM-00038305-B0

Drawing No. 37

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

[illegible]

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



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

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

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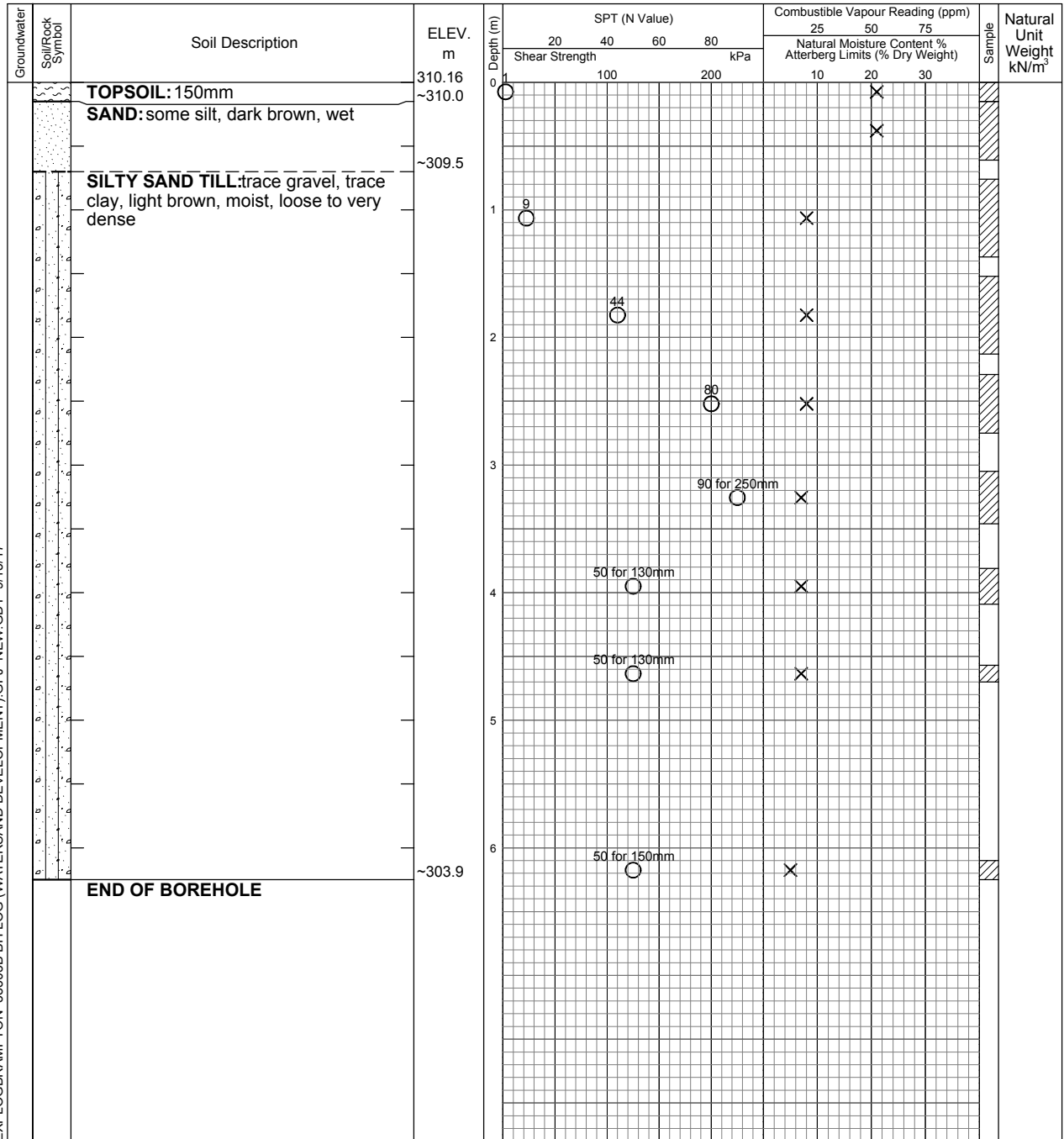
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

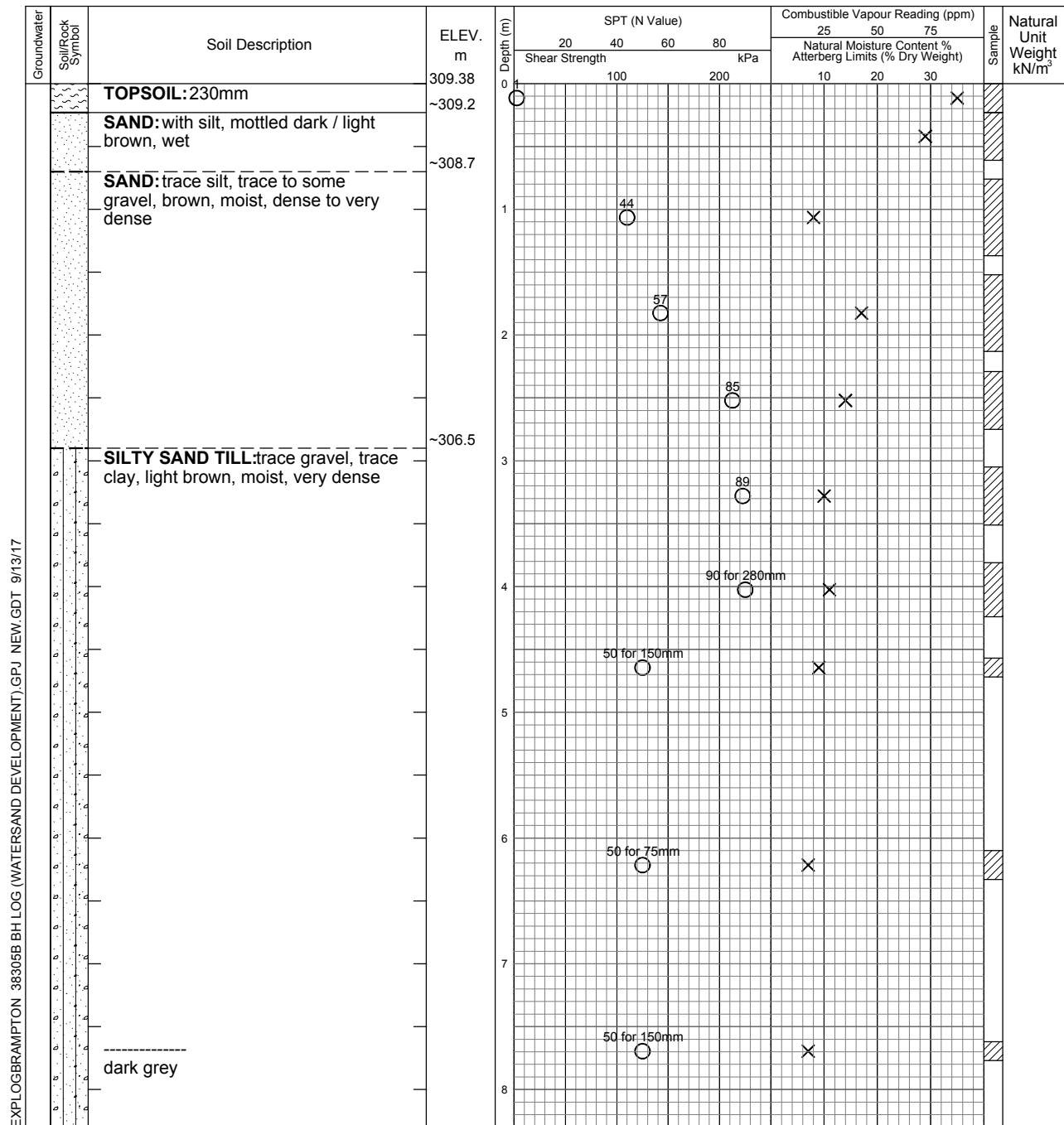
Natural Moisture

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	1.52	1.52



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)		Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³		
					20	40	60	80	25			50	75
					Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
			301.08		100	200		10	20	30			
				9									
				10									
			~298.6										
		END OF BOREHOLE											

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



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

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

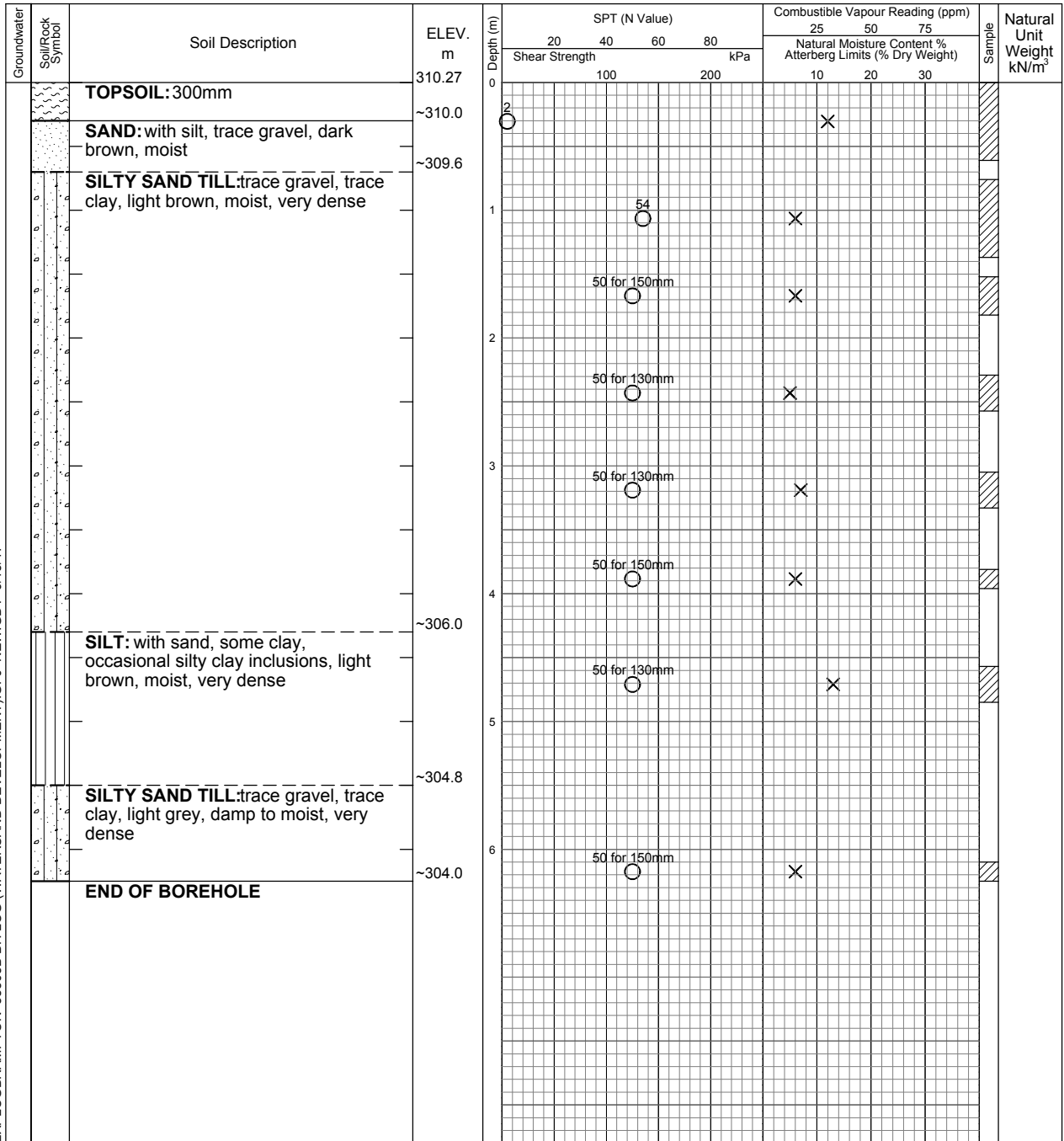


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

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

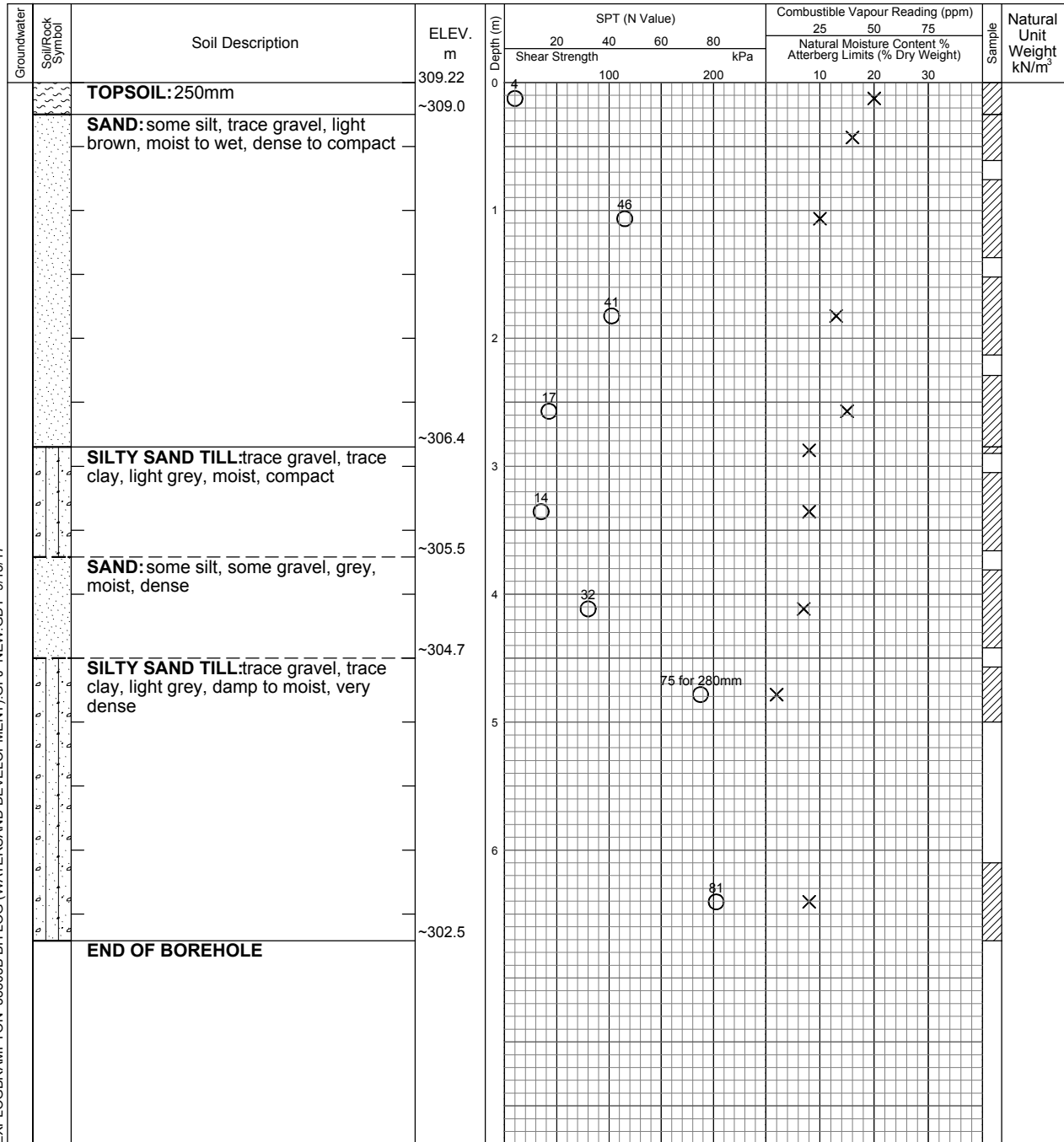


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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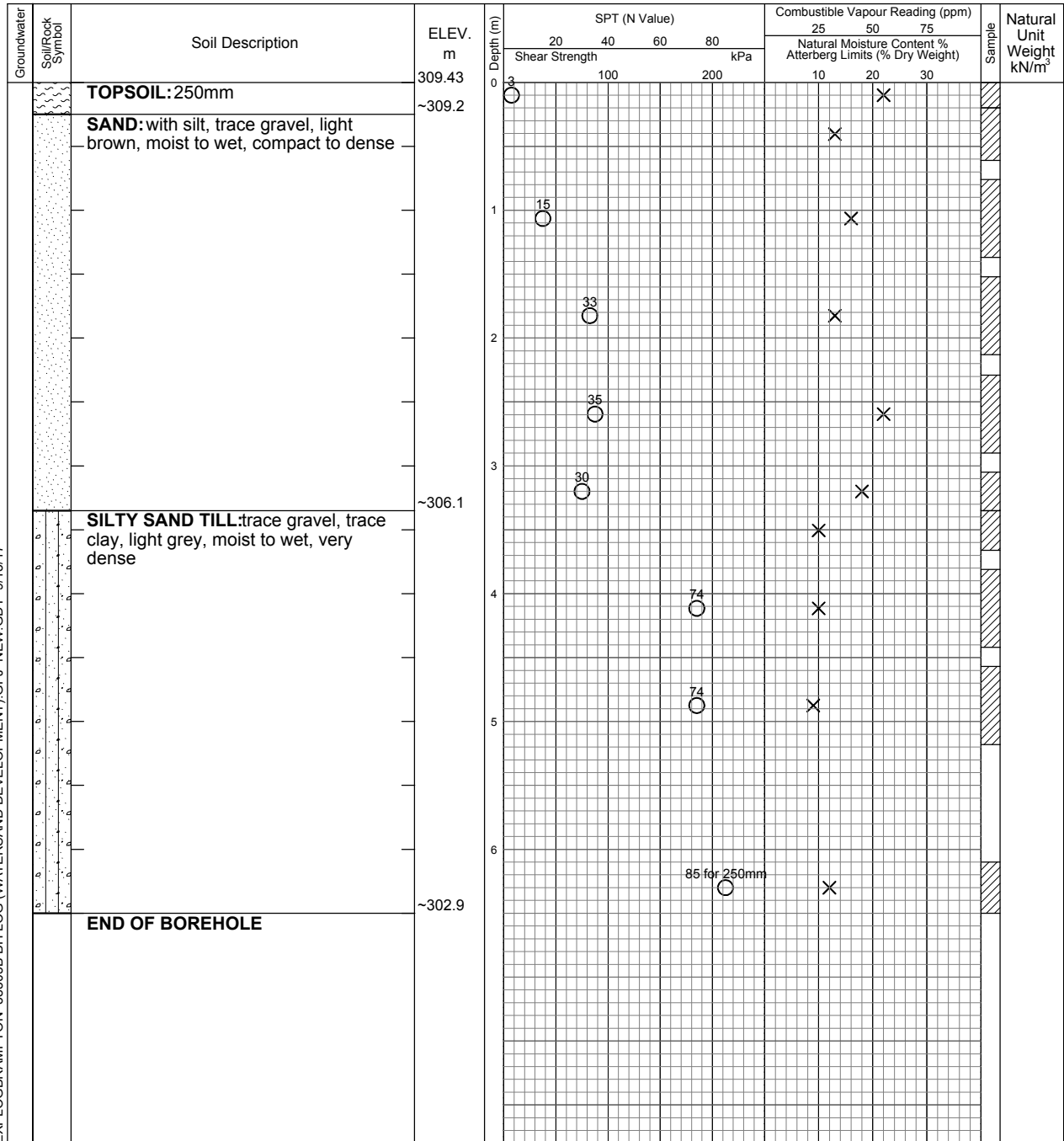
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

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

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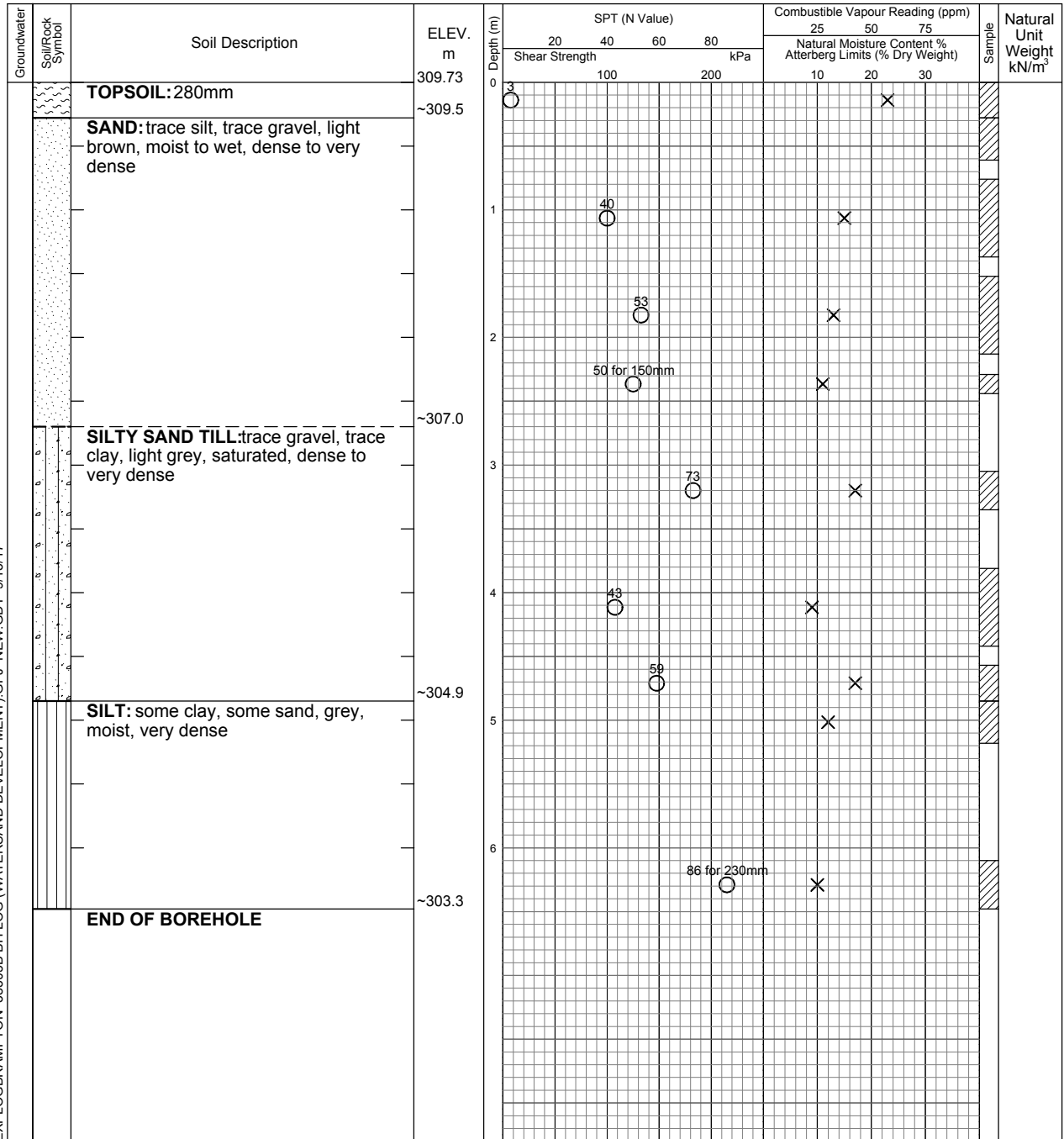
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

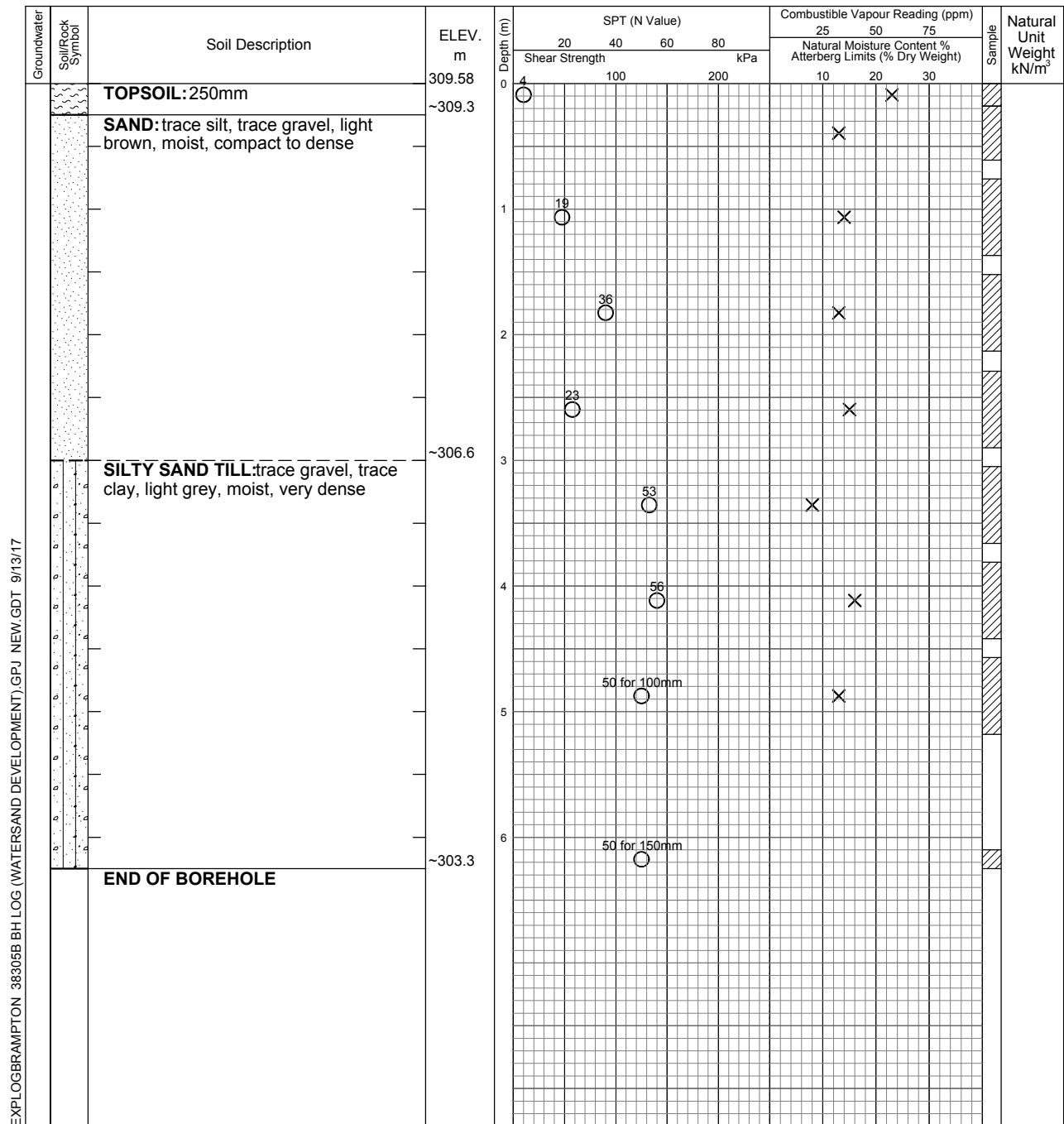
Datum: Geodetic

Shelby Tube

Undrained Triaxial at
% Strain at Failure

Field Vane Test

Penetrometer



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

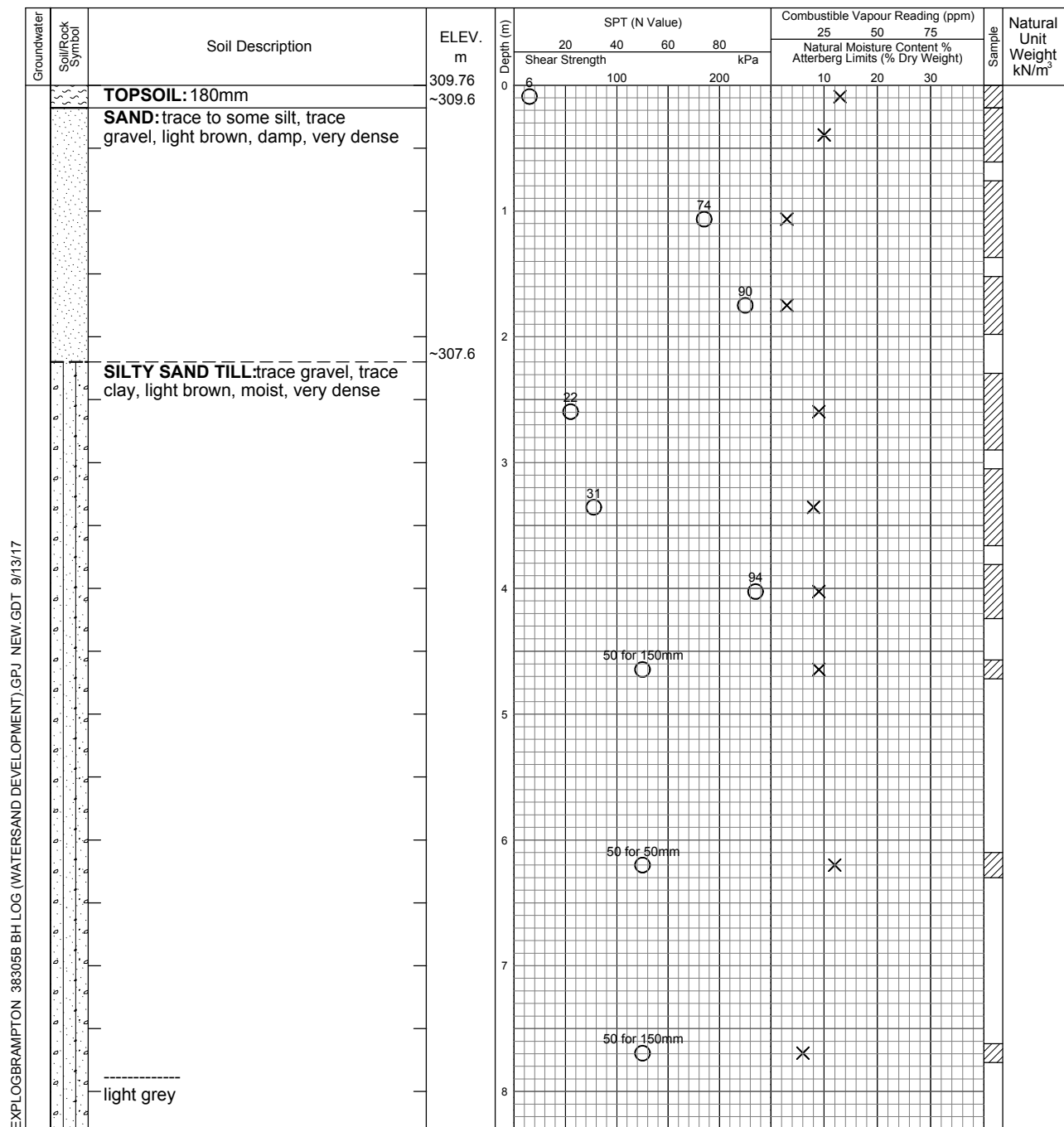
Natural Moisture

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	5.79	5.79



Log of Borehole 49

Project No. BRM-00038305-B0

Drawing No. 45

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

[illegible]

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



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

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

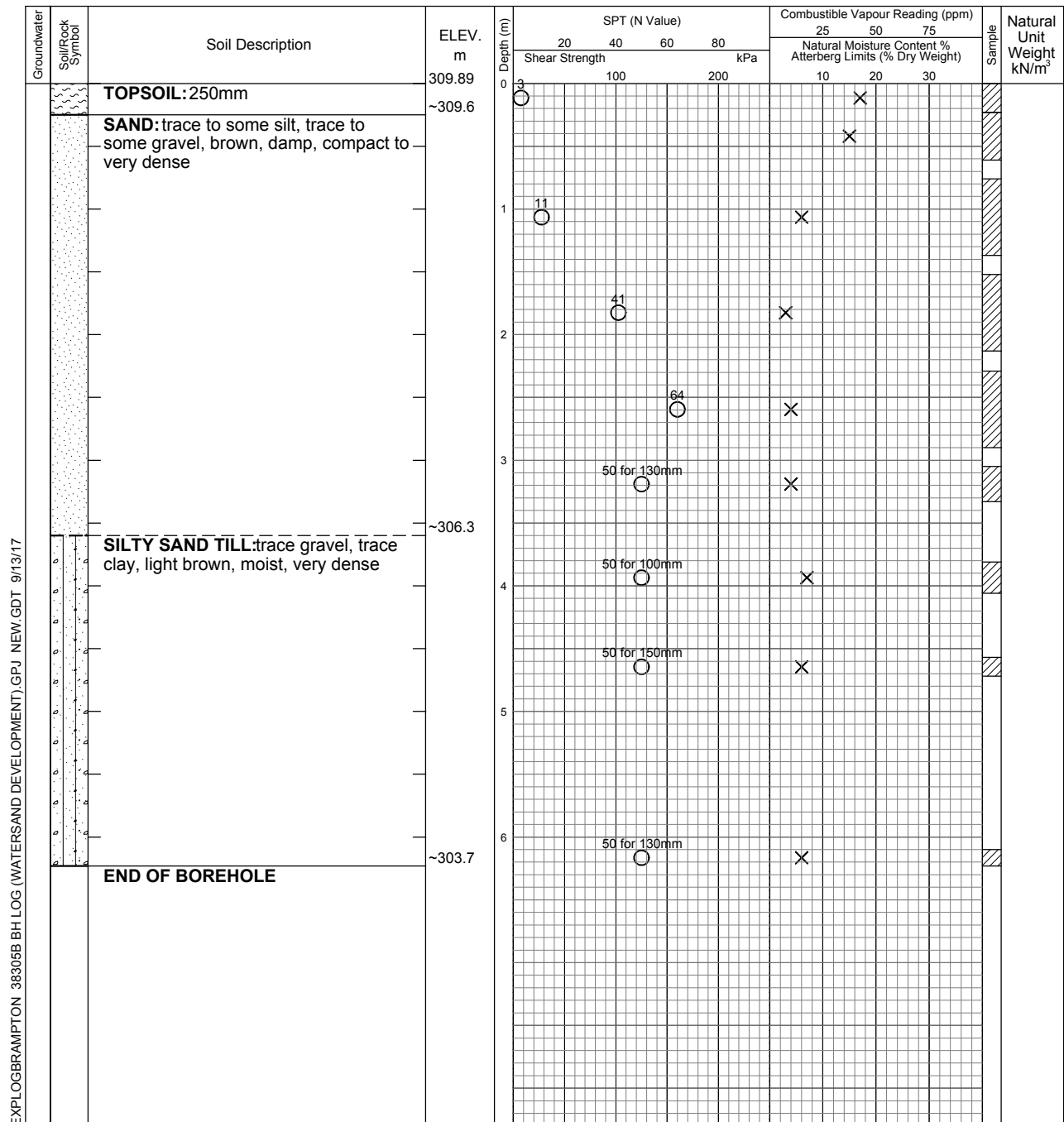
Datum: Geodetic

Shelby Tube

Undrained Triaxial at
% Strain at Failure

Field Vane Test

Penetrometer



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



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

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

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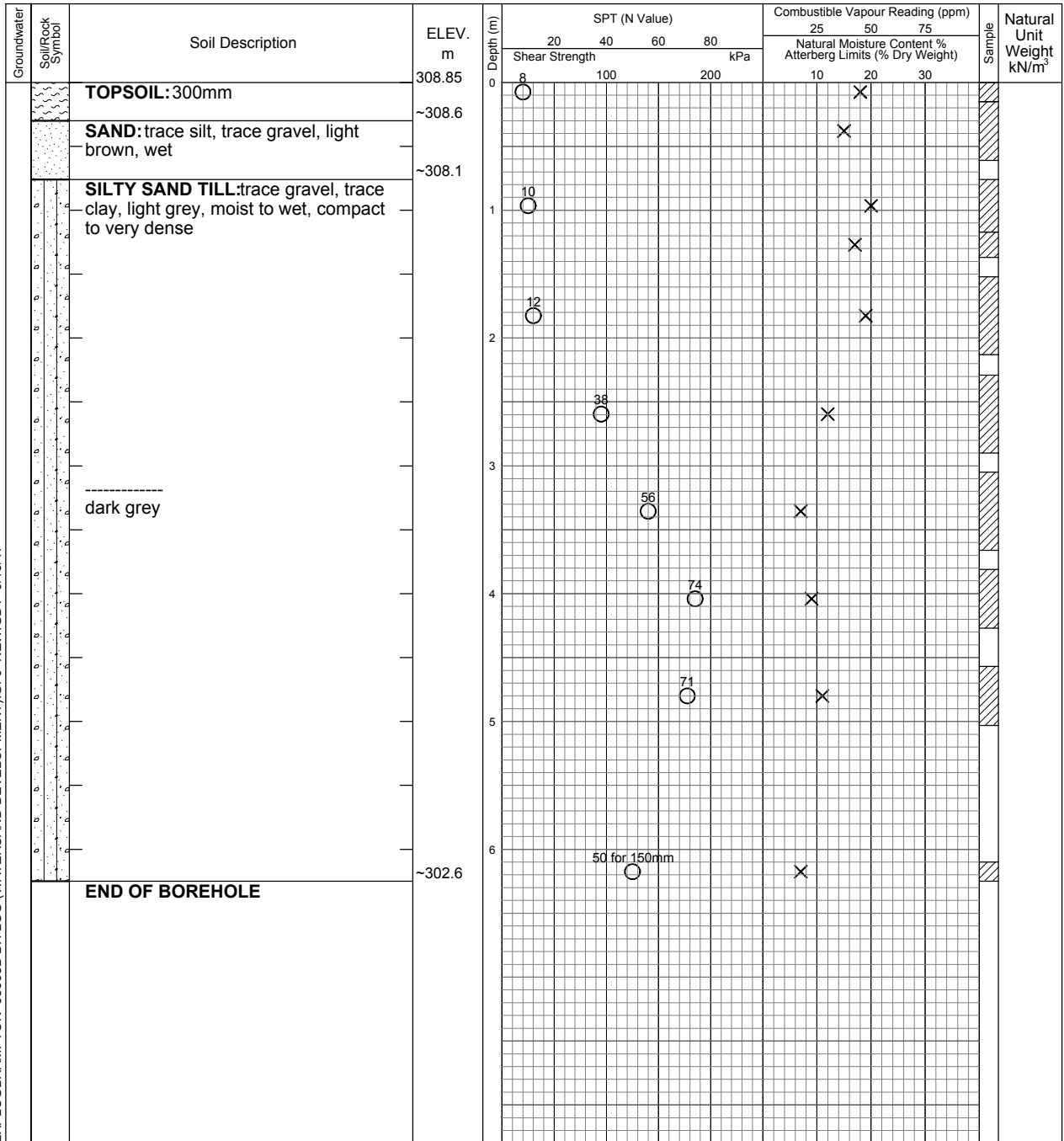
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

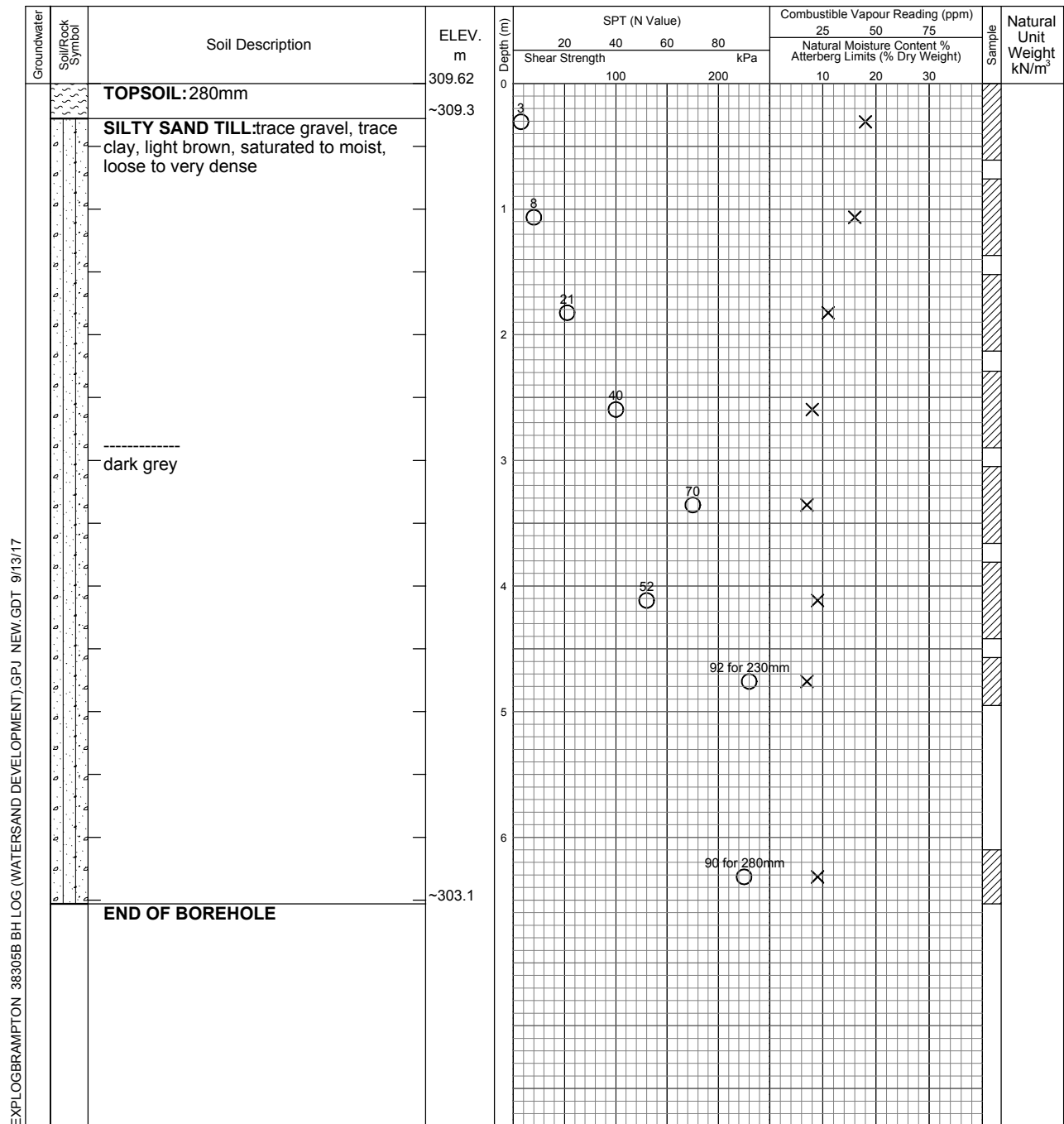
Datum: Geodetic

Shelby Tube

Undrained Triaxial at

Field Vane Test

% Strain at Failure



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



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

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

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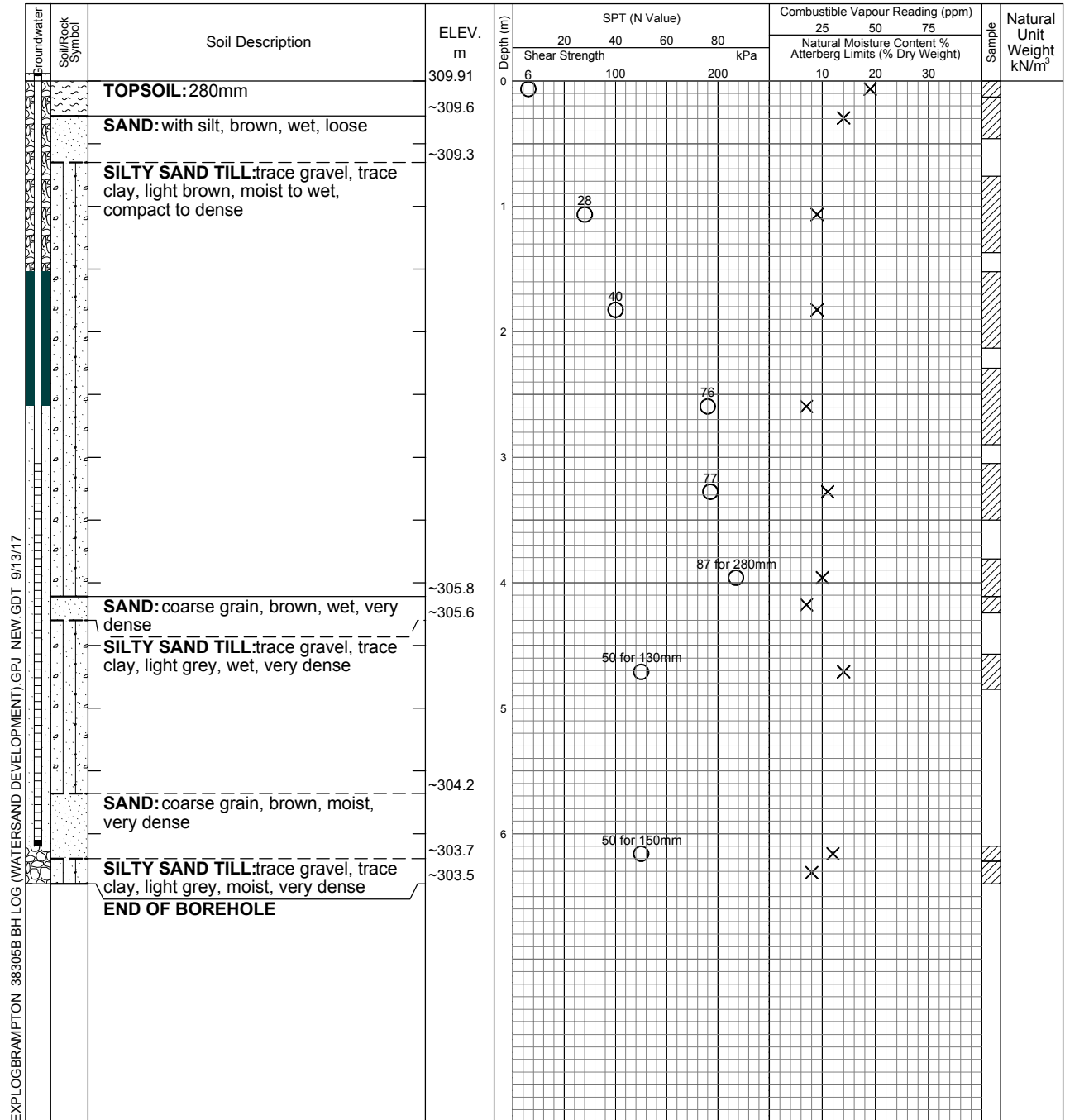
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Datum: Geodetic



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

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

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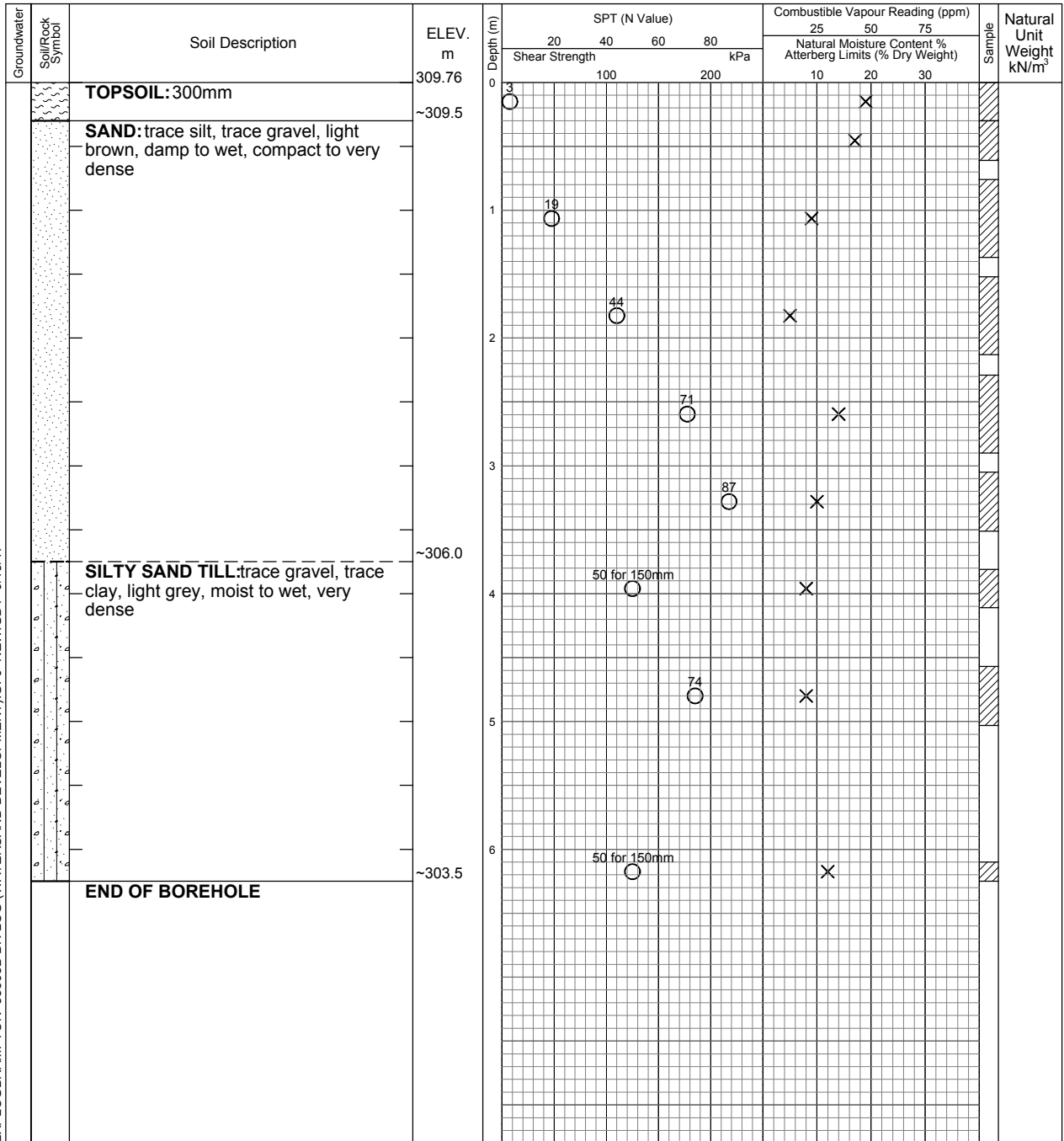
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Datum: Geodetic



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



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

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

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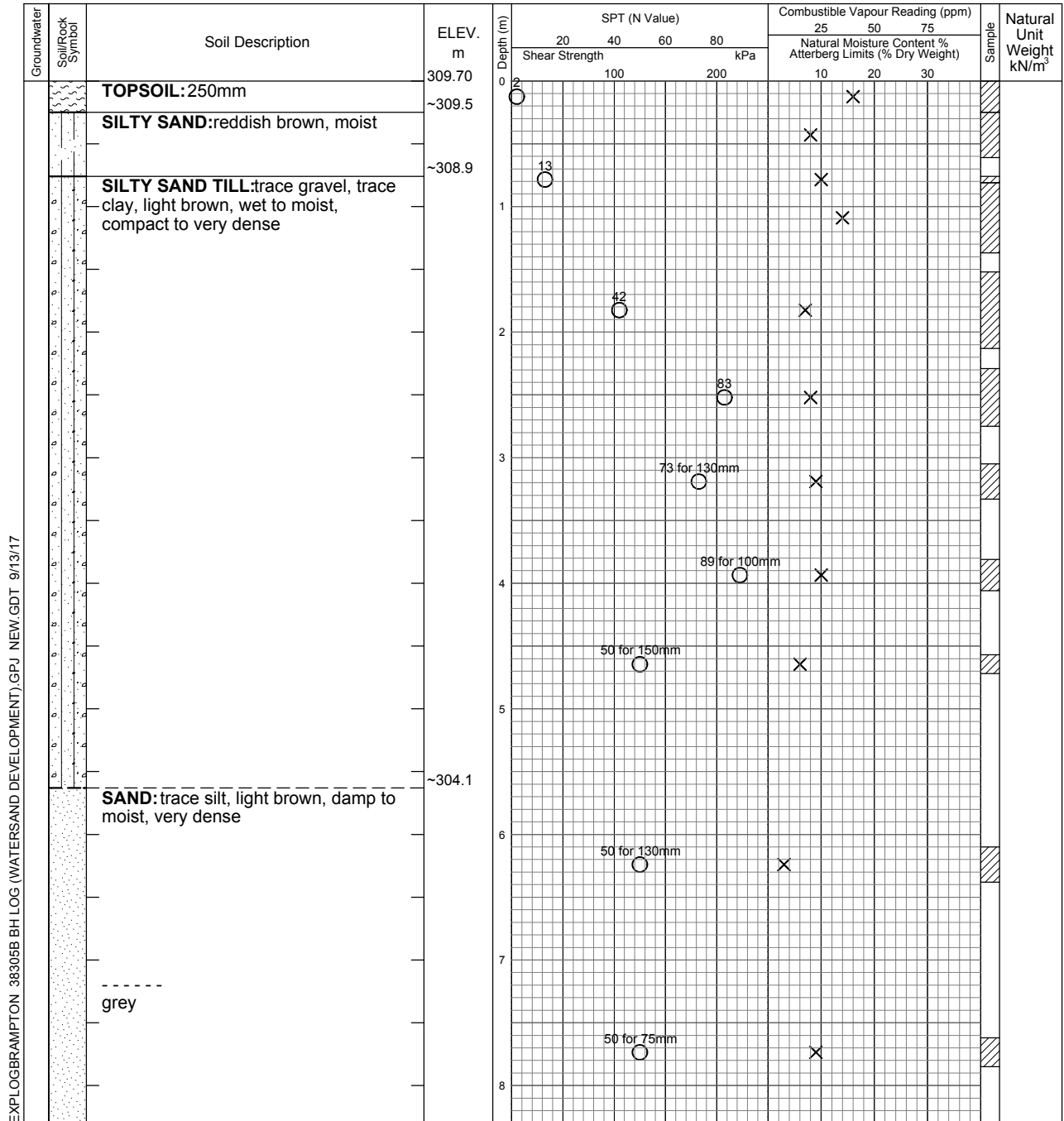
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Datum: Geodetic



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



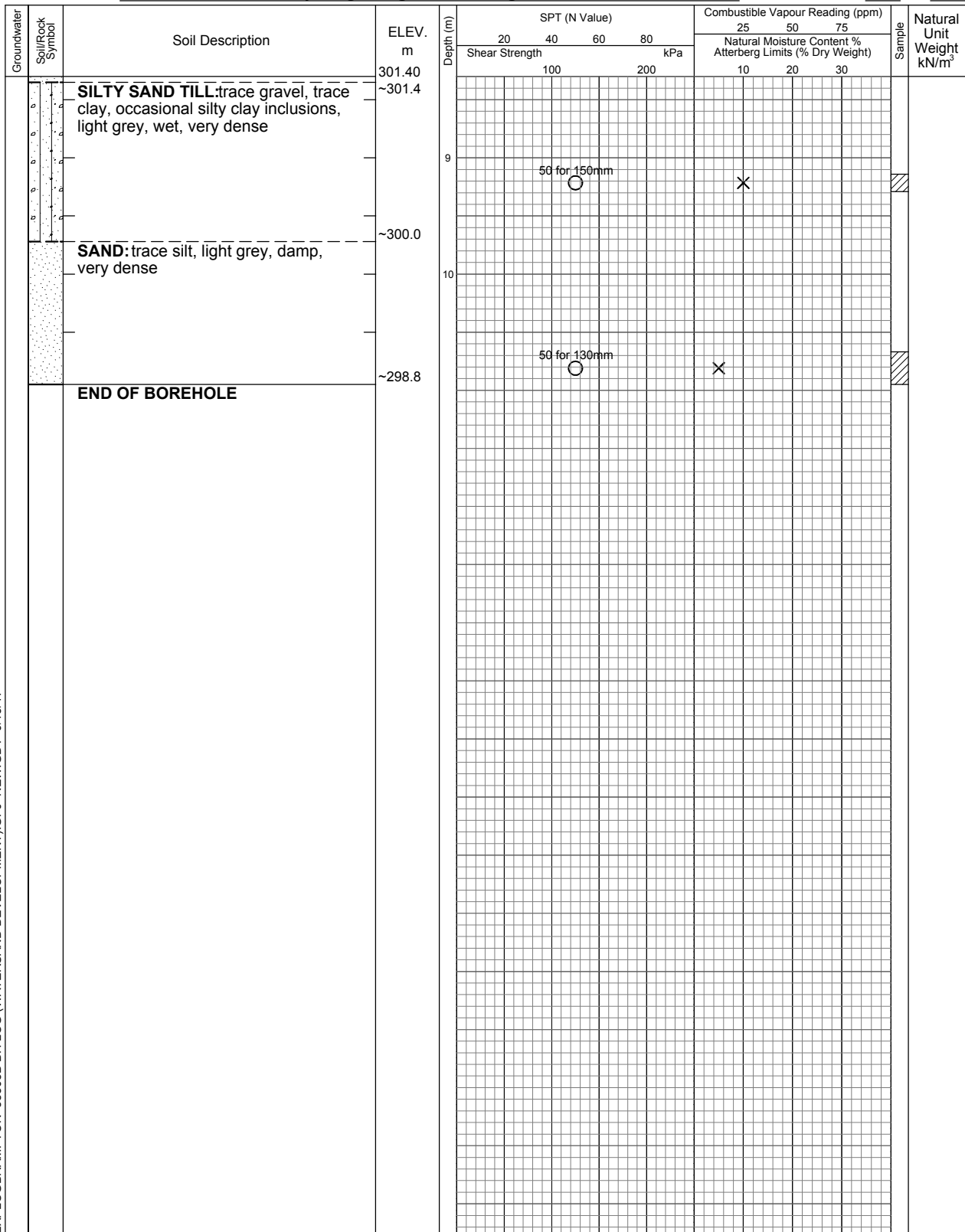
Log of Borehole 57

Project No. BRM-00038305-B0

Drawing No. 61

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

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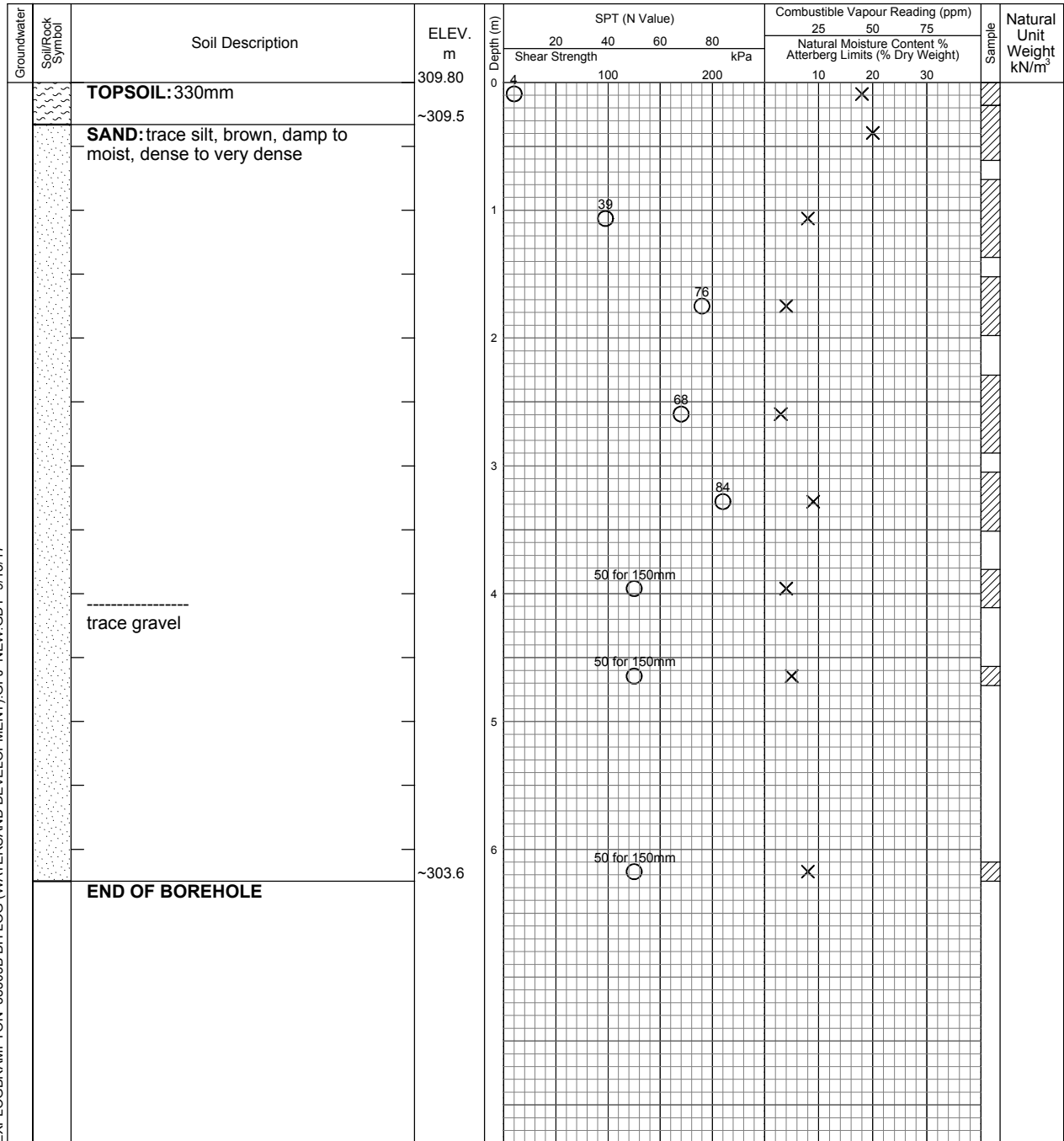
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

Auger Sample

SPT (N) Value

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Datum: Geodetic

Shelby Tube

Field Vane Test

Combustible Vapour Reading

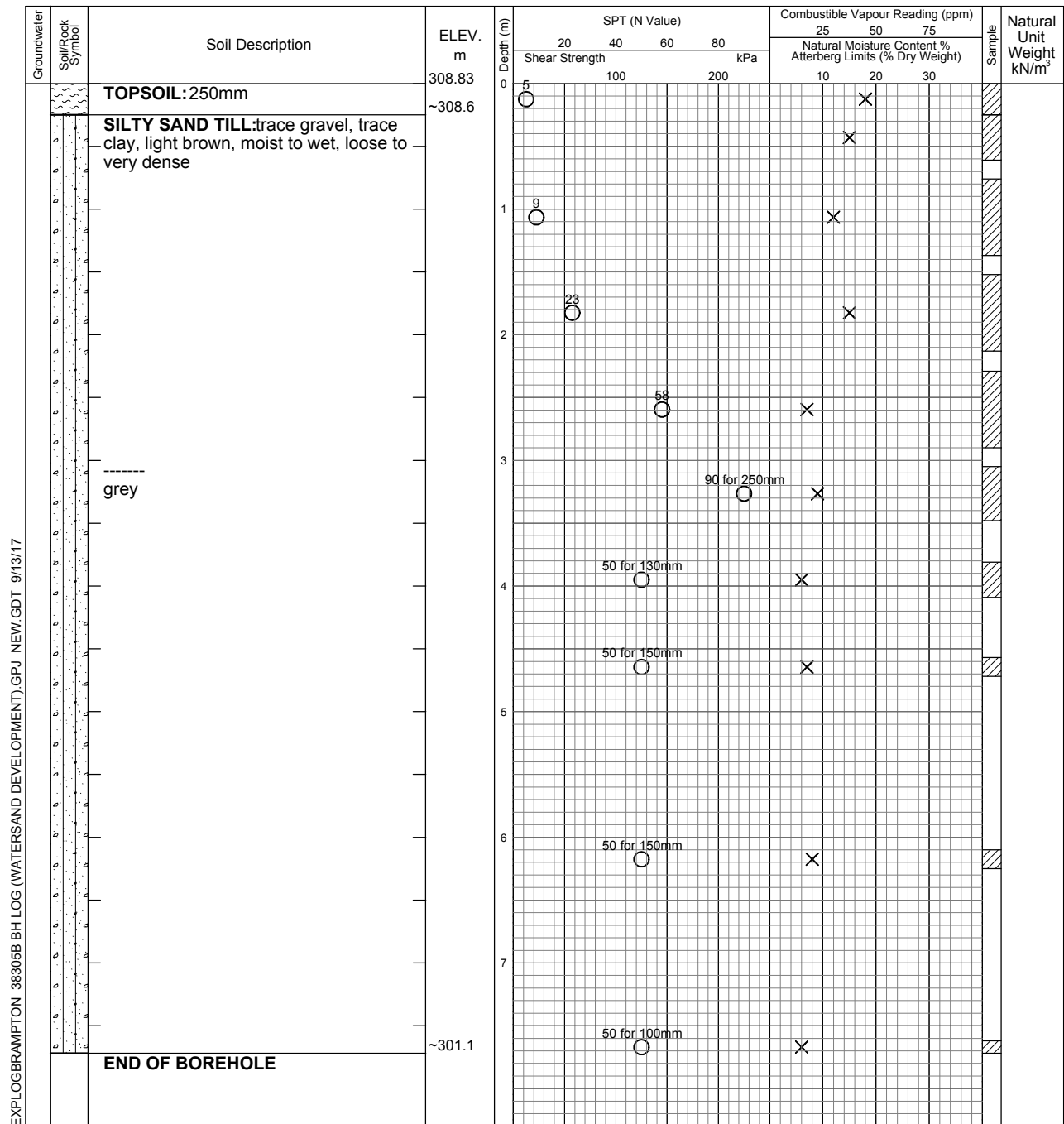
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer



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



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

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

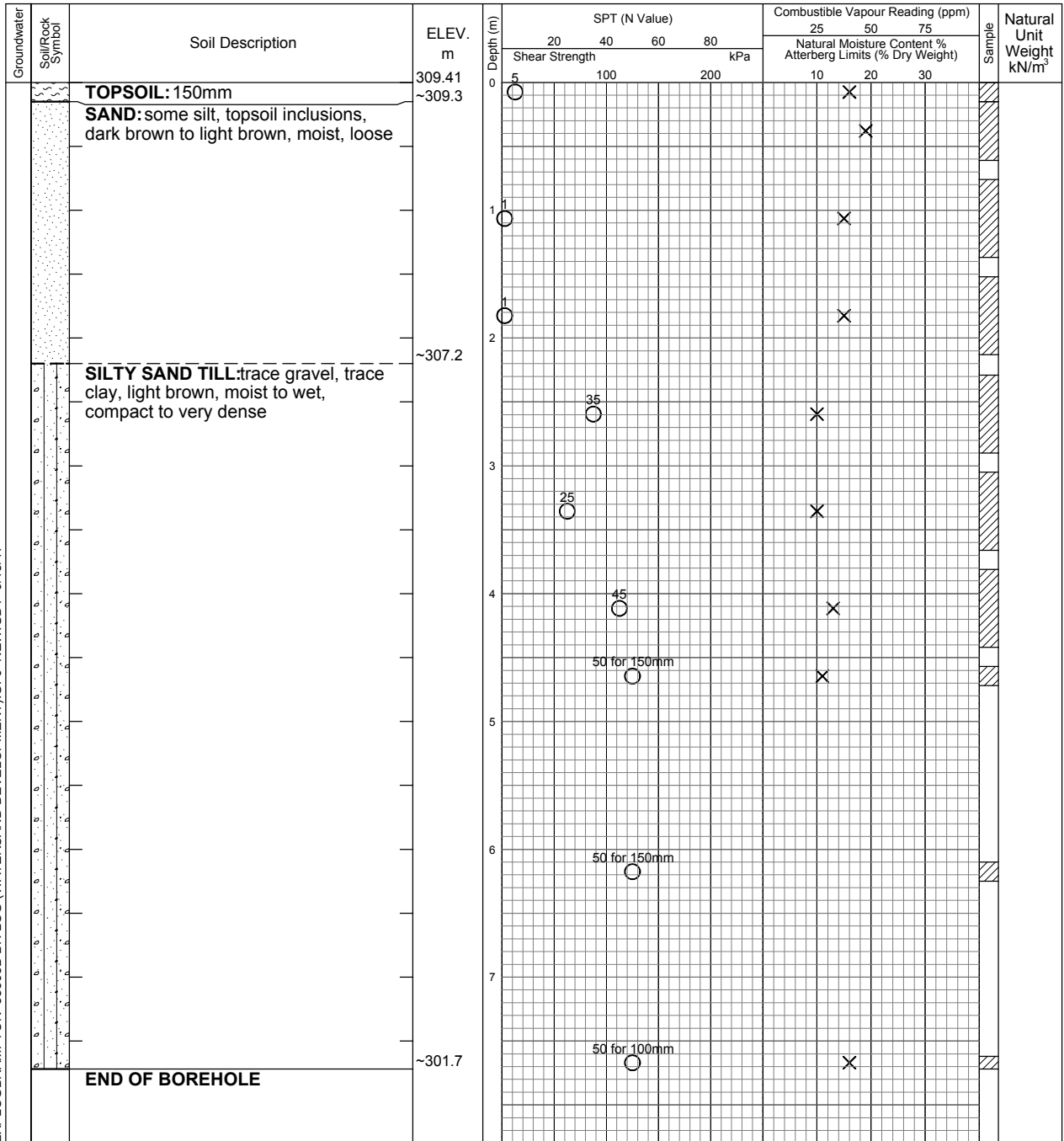


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



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

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

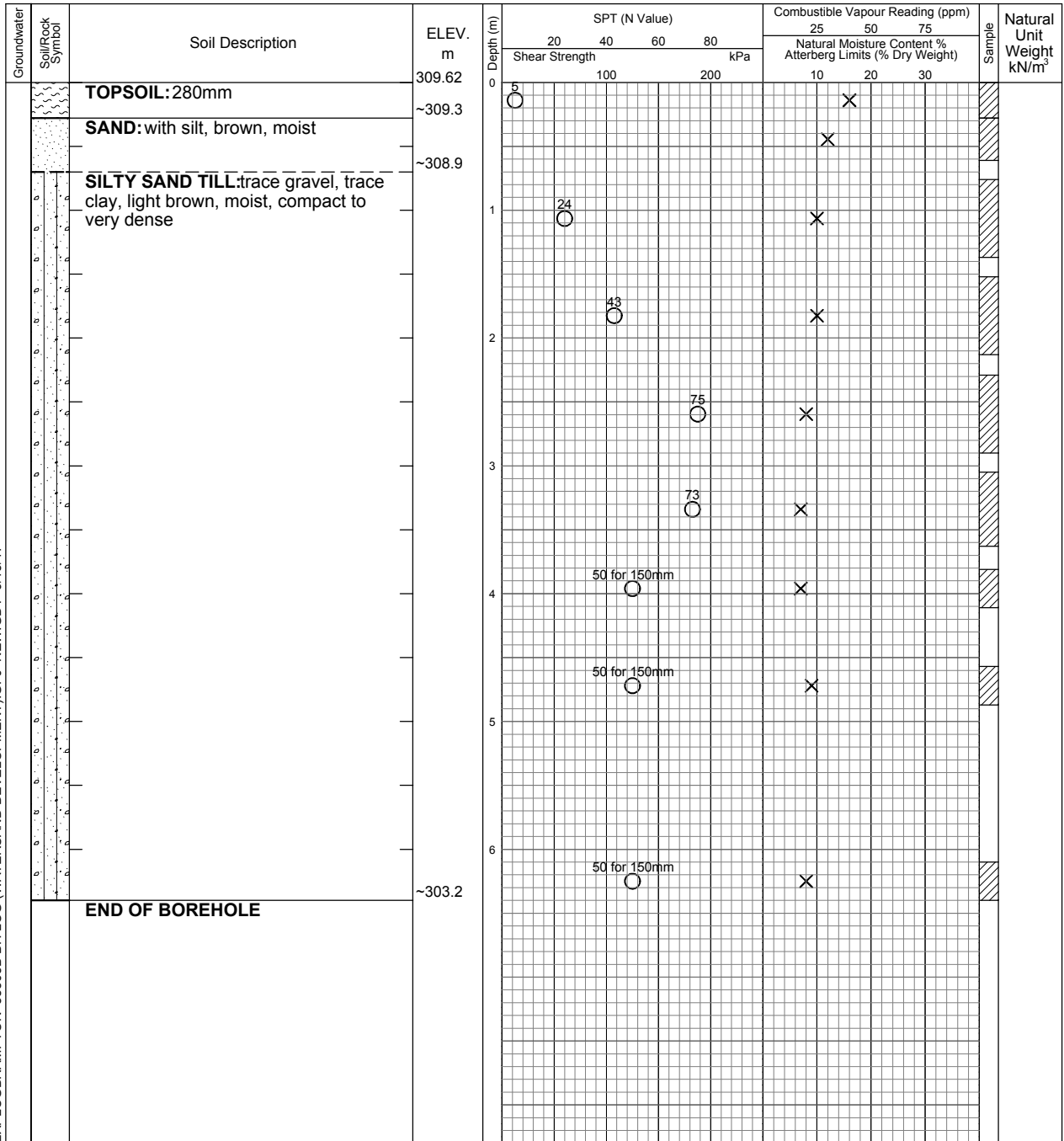


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

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



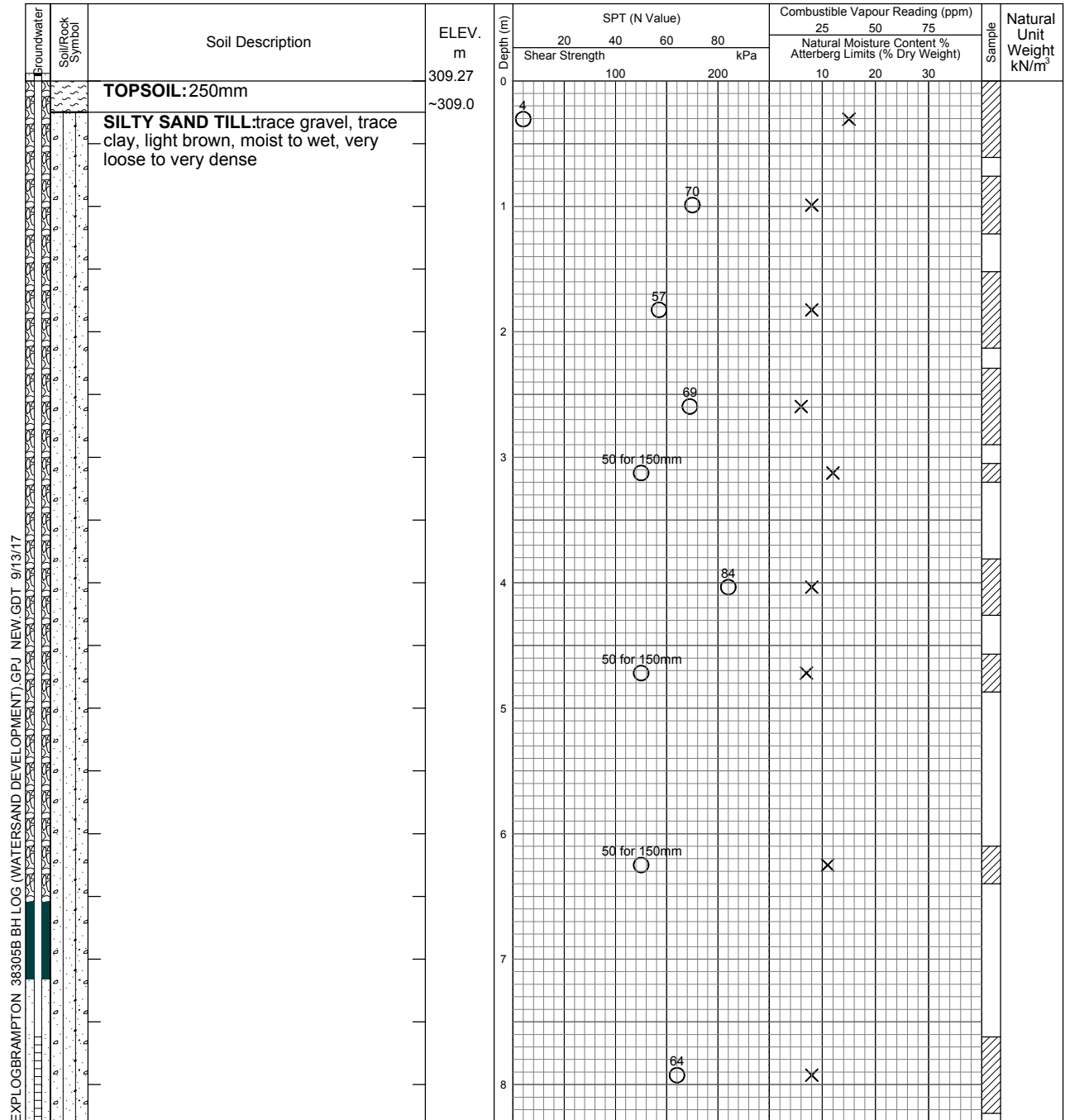
% Strain at Failure



Penetrometer



Datum: Geodetic



Continued Next Page



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	-

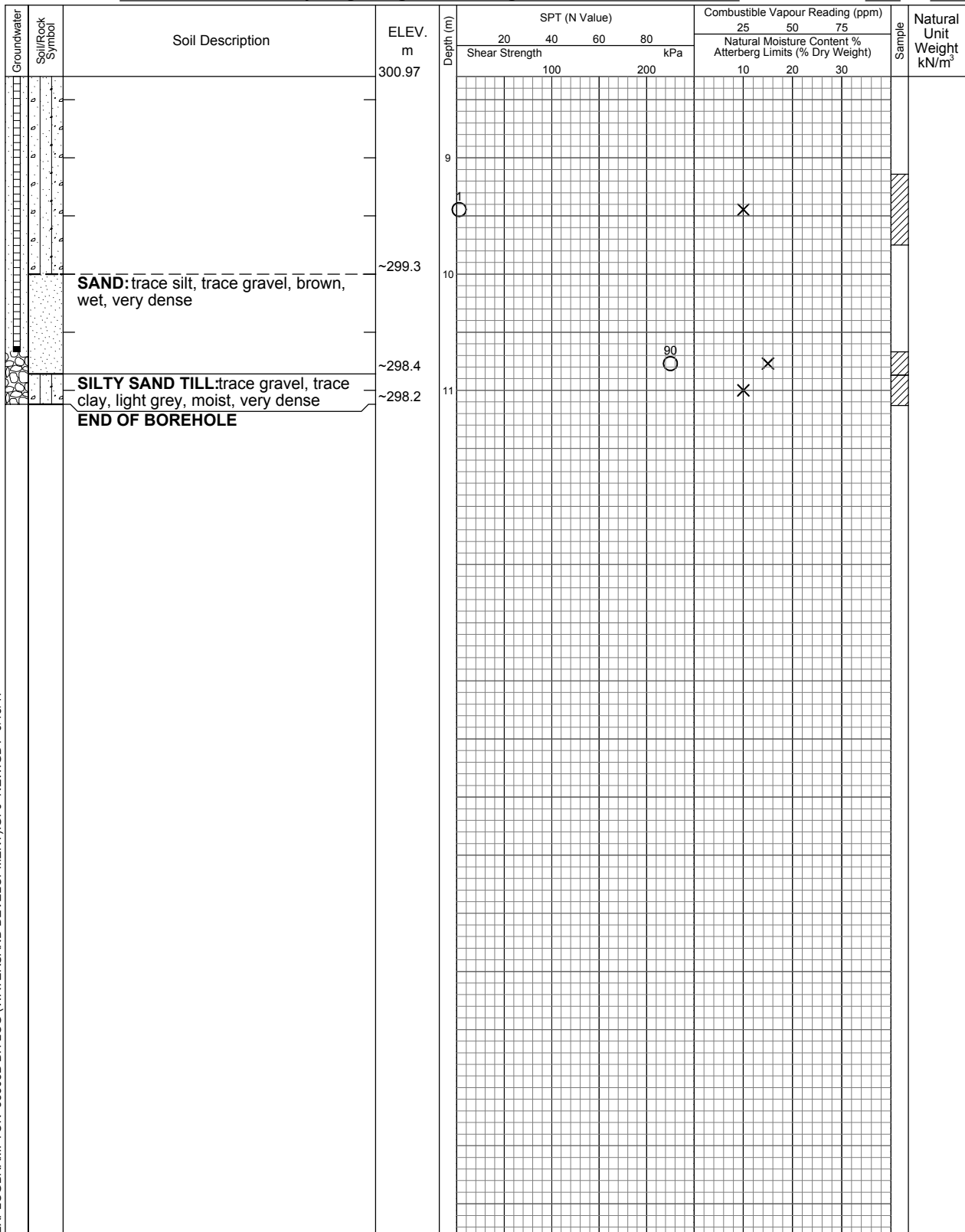
Log of Borehole 62

Project No. BRM-00038305-B0

Drawing No. 66

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW GDT 9/13/17



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	-

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

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

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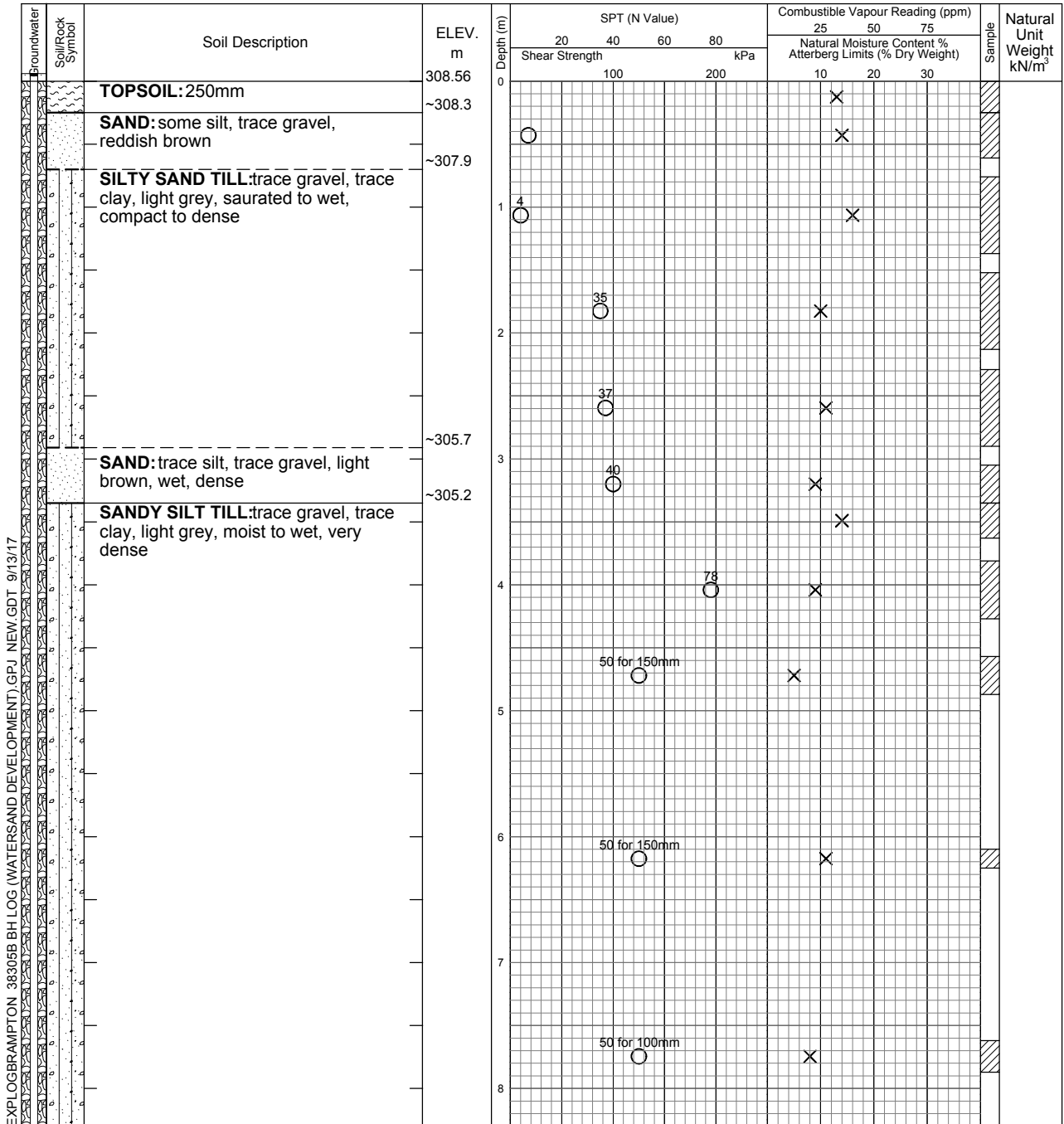
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Datum: Geodetic



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



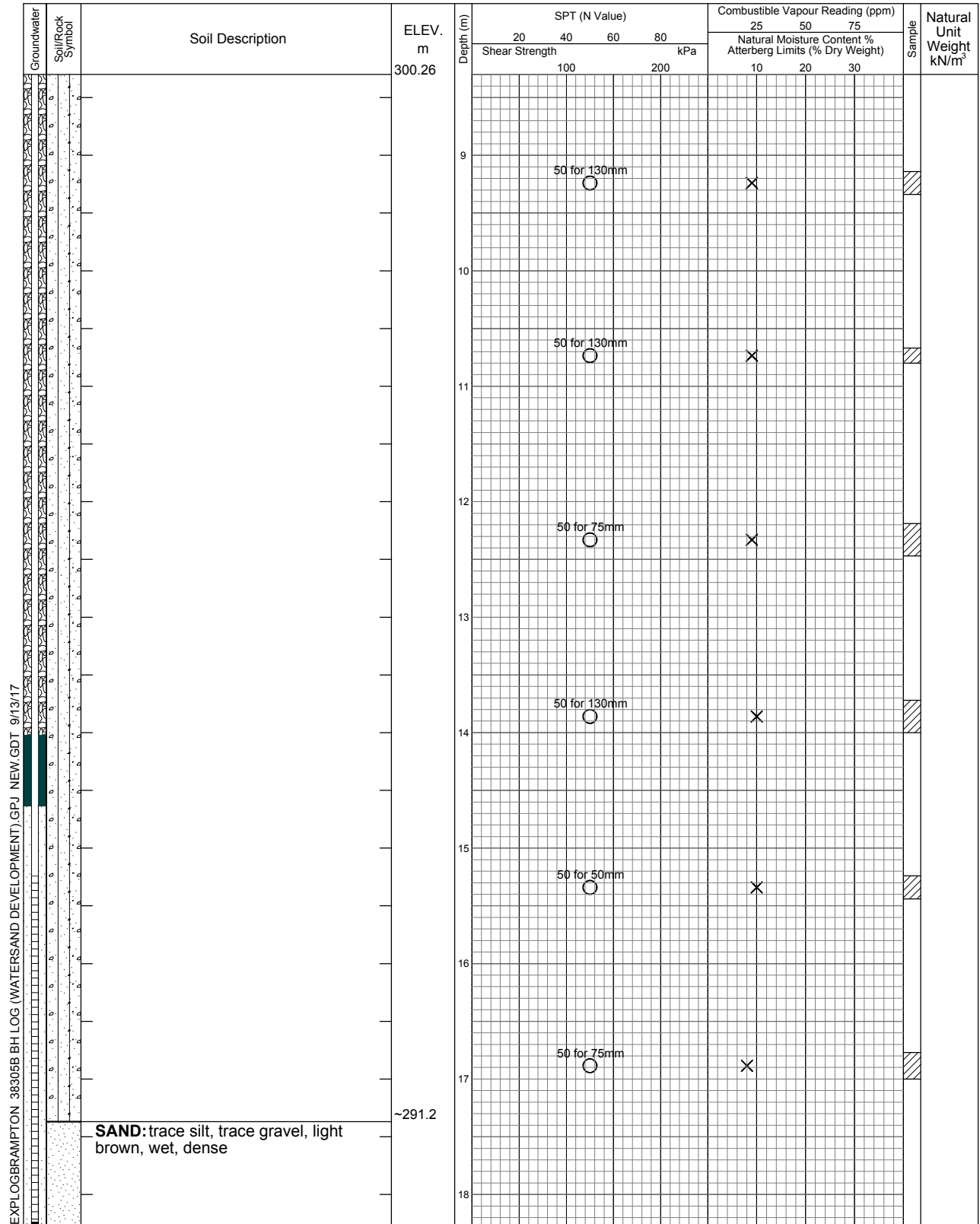
Log of Borehole 64-D

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	-

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

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



Datum: Geodetic

Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
				20	40	60	80	25	50	75		
				Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
				100		200		10	20	30		
Groundwater		308.56	0									
	TOPSOIL: 250mm	~308.3										
	SAND: some silt, trace gravel, reddish brown	~307.9										
	SILTY SAND TILL: trace gravel, trace clay, light grey, saturated to wet, compact to dense		1									
			2									
		~305.7	3									
	SAND: trace silt, trace gravel, light brown, wet, dense	~305.2										
	SANDY SILT TILL: trace gravel, trace clay, light grey, moist to wet, very dense		4									
			5									
		~302.5	6									
	END OF BOREHOLE											

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

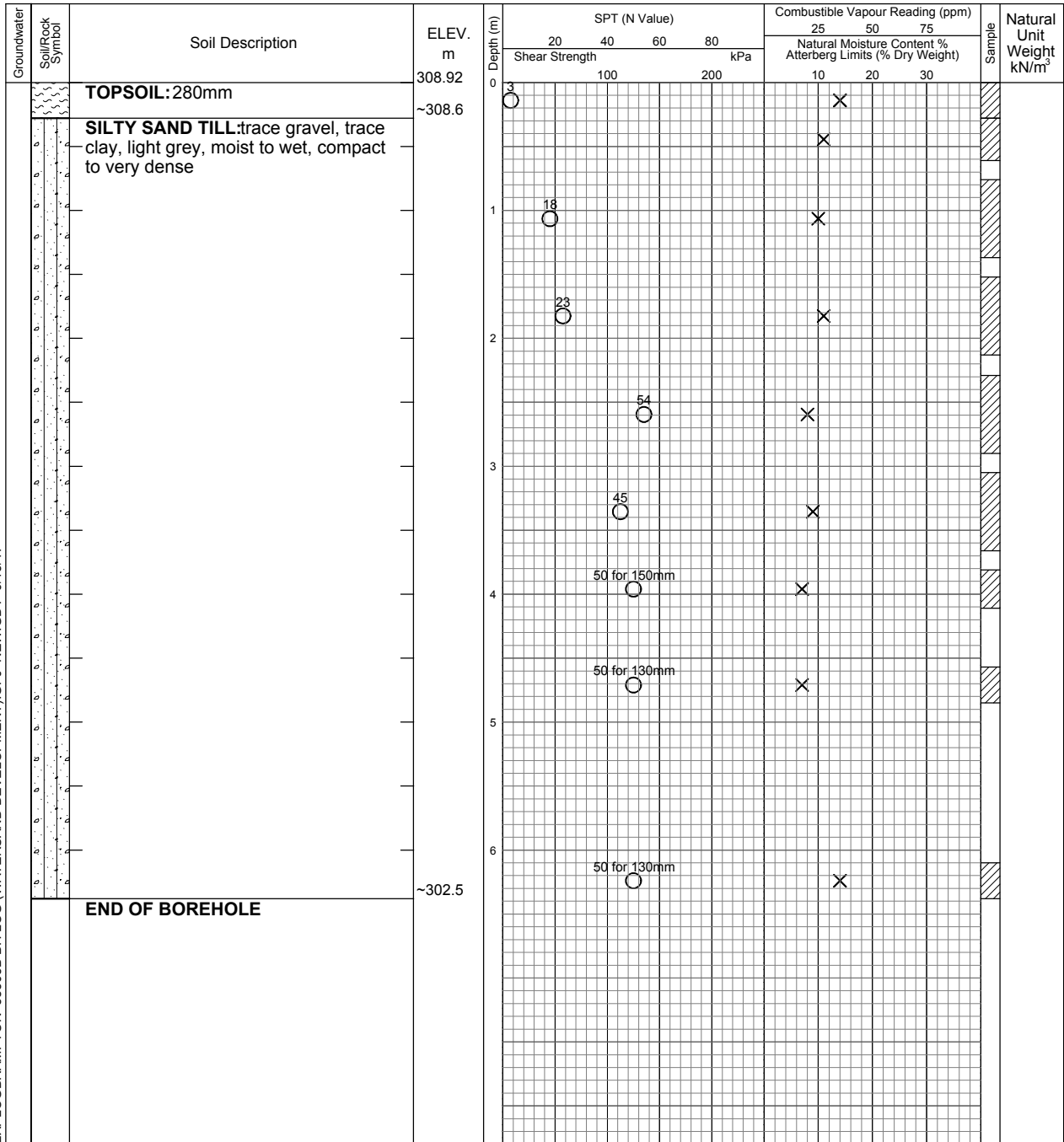


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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



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

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

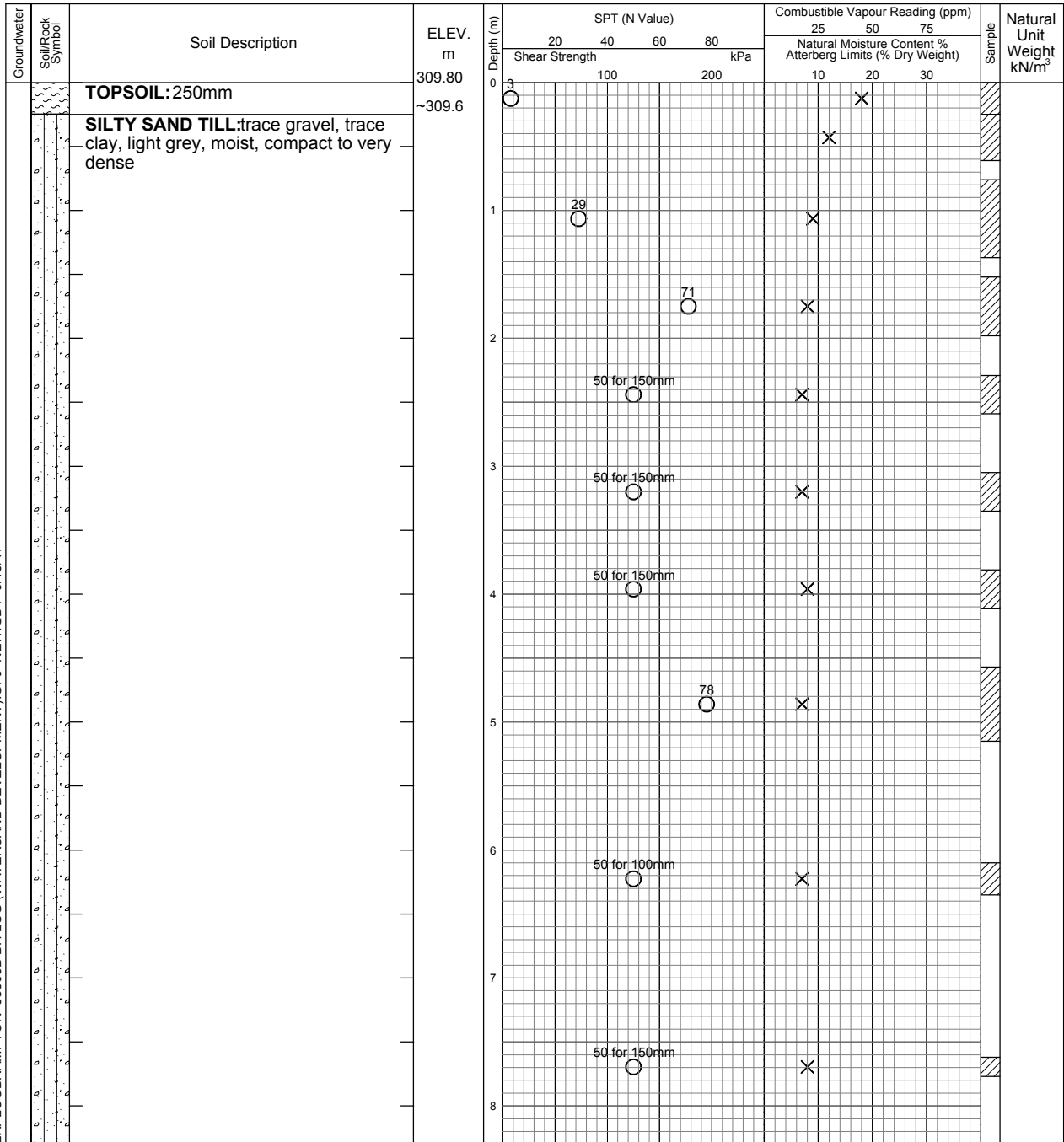


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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)		Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³		
					20	40	60	80	25			50	75
					Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
			301.50		100	200	10	20	30				
			~300.5	9	50 for 150mm			X					
		END OF BOREHOLE											

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



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

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

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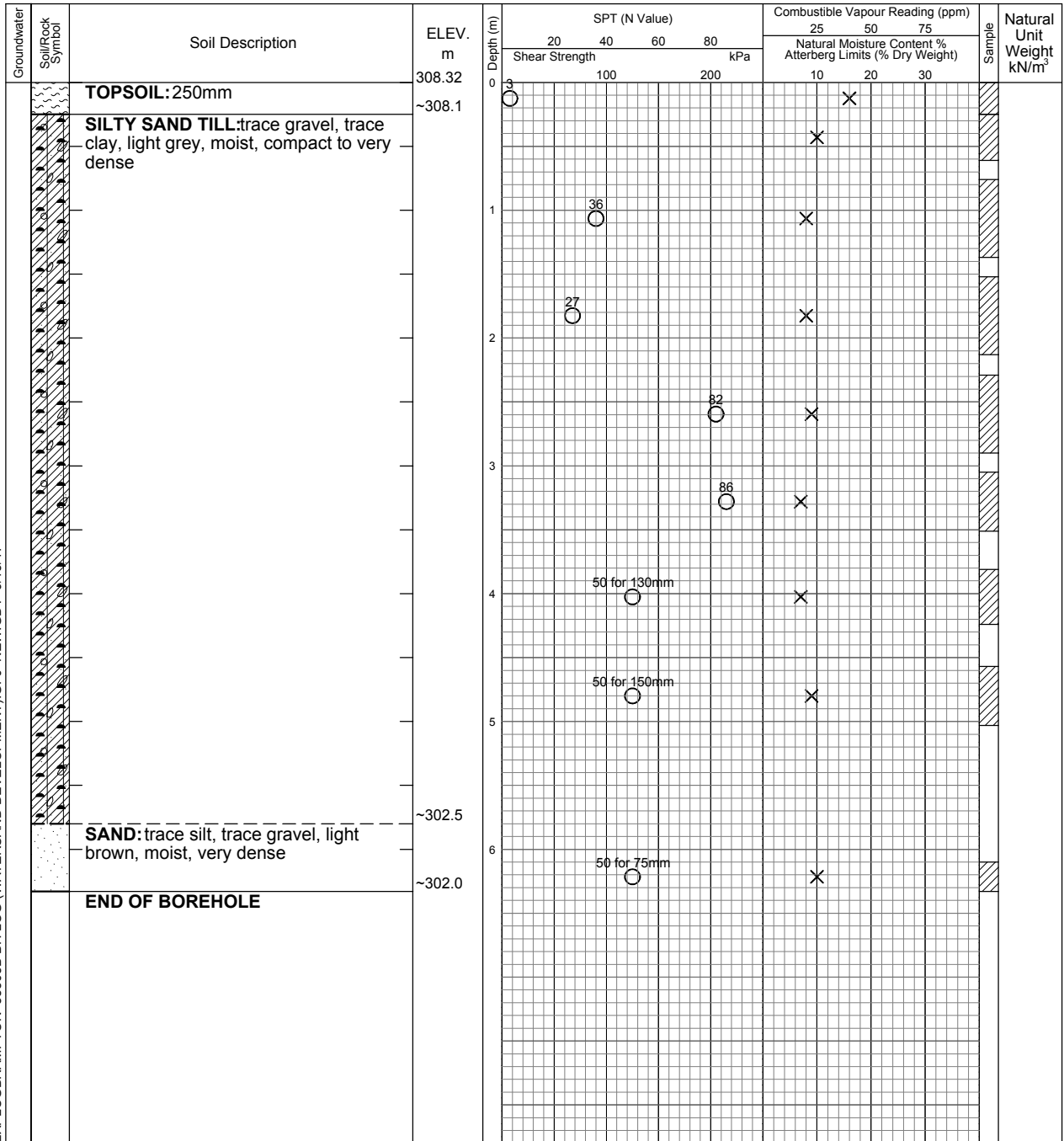
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.50

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

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



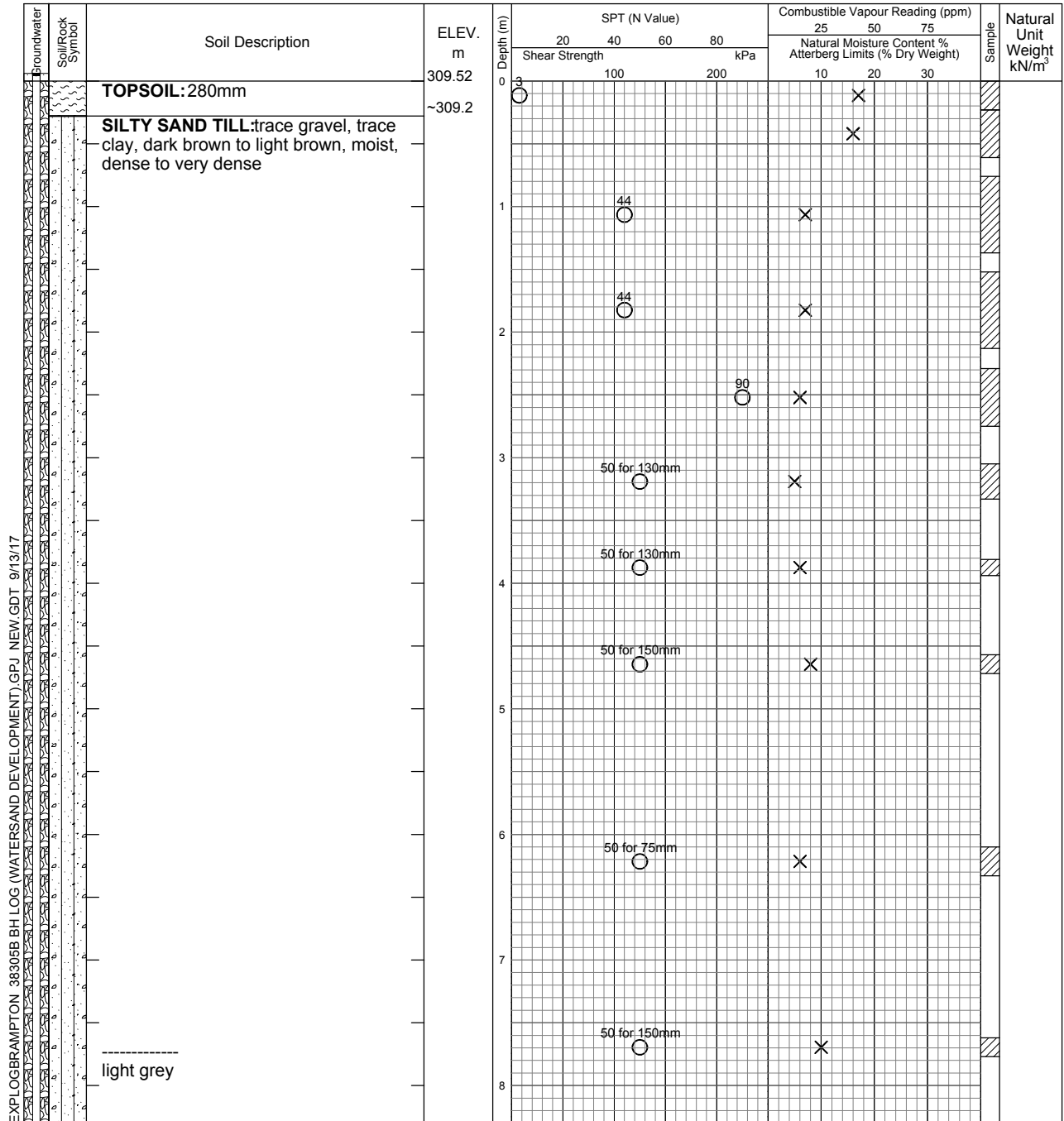
% Strain at Failure



Penetrometer



Datum: Geodetic



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

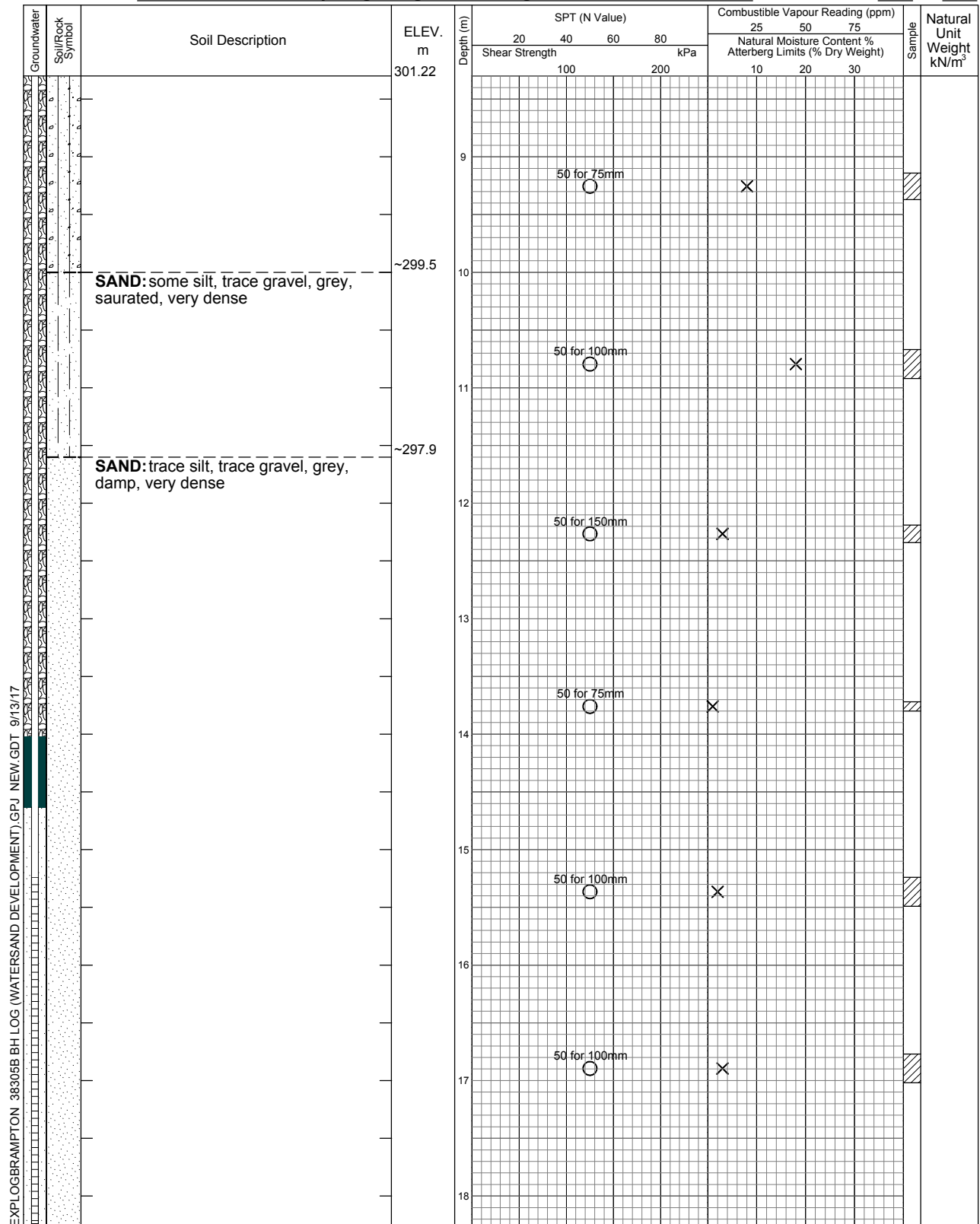
Log of Borehole B1-D

Project No. BRM-00038305-B0

Drawing No. 72

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

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

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



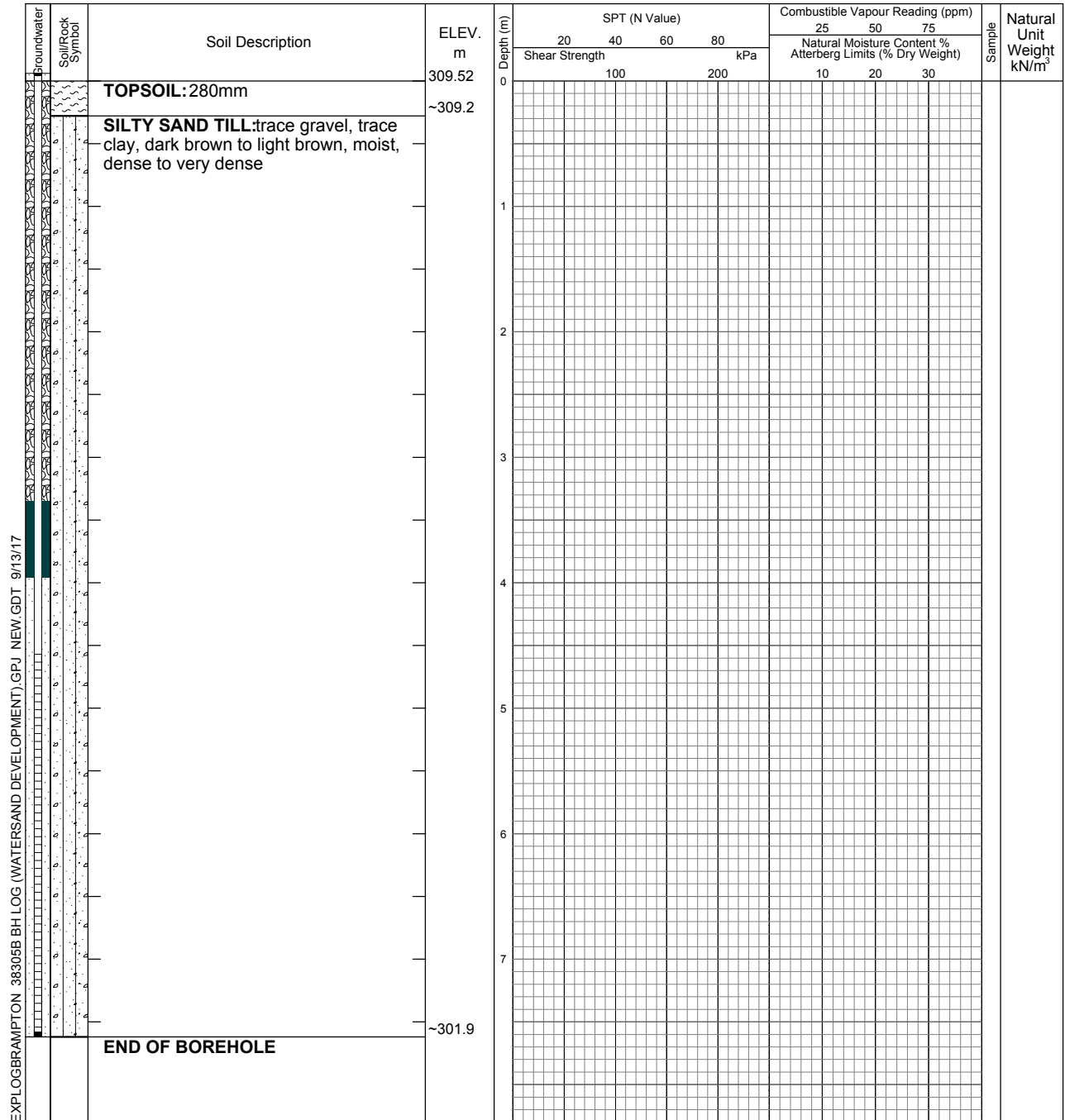
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
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. 1 of 3

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: July 5, 2017

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

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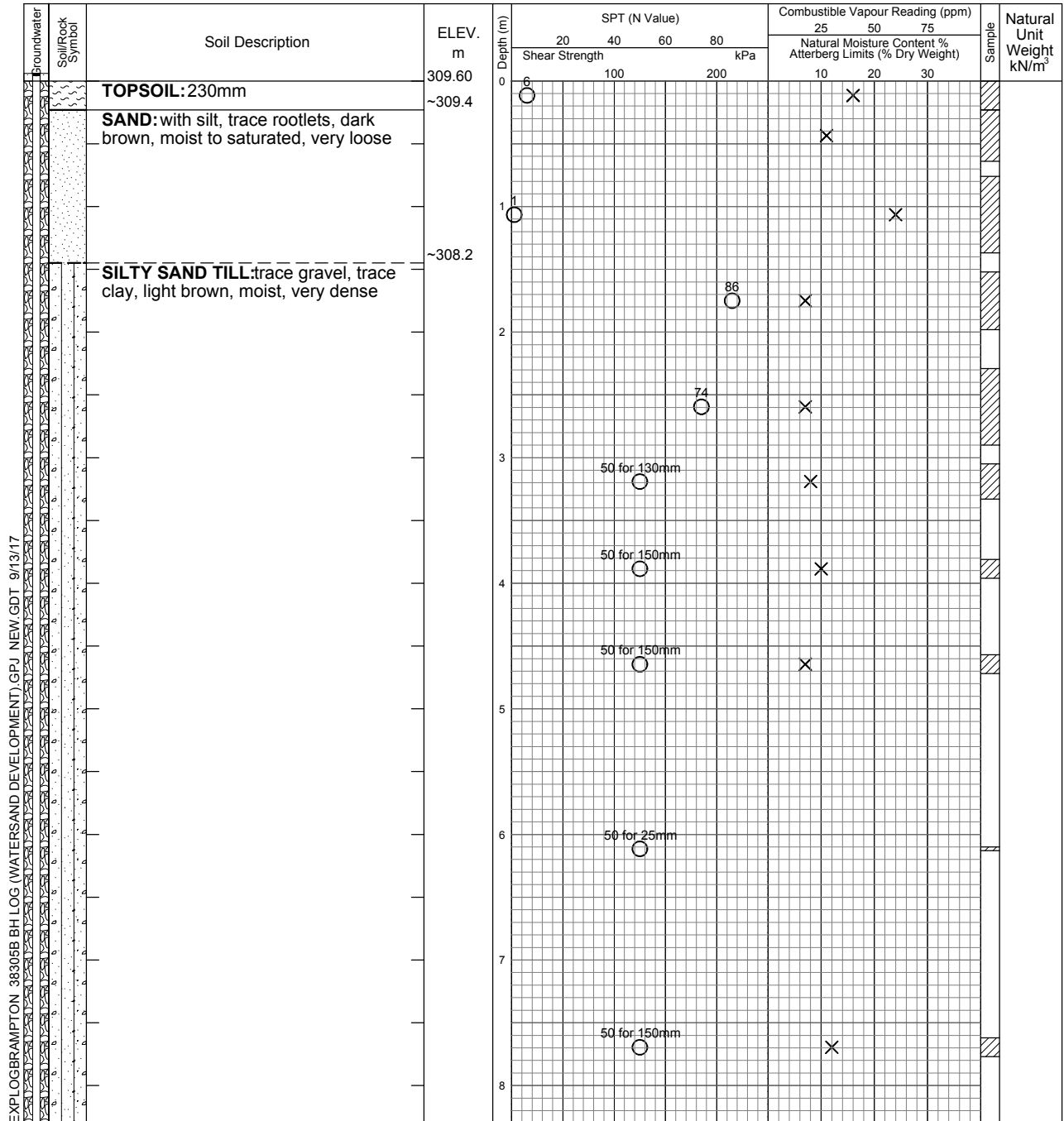
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

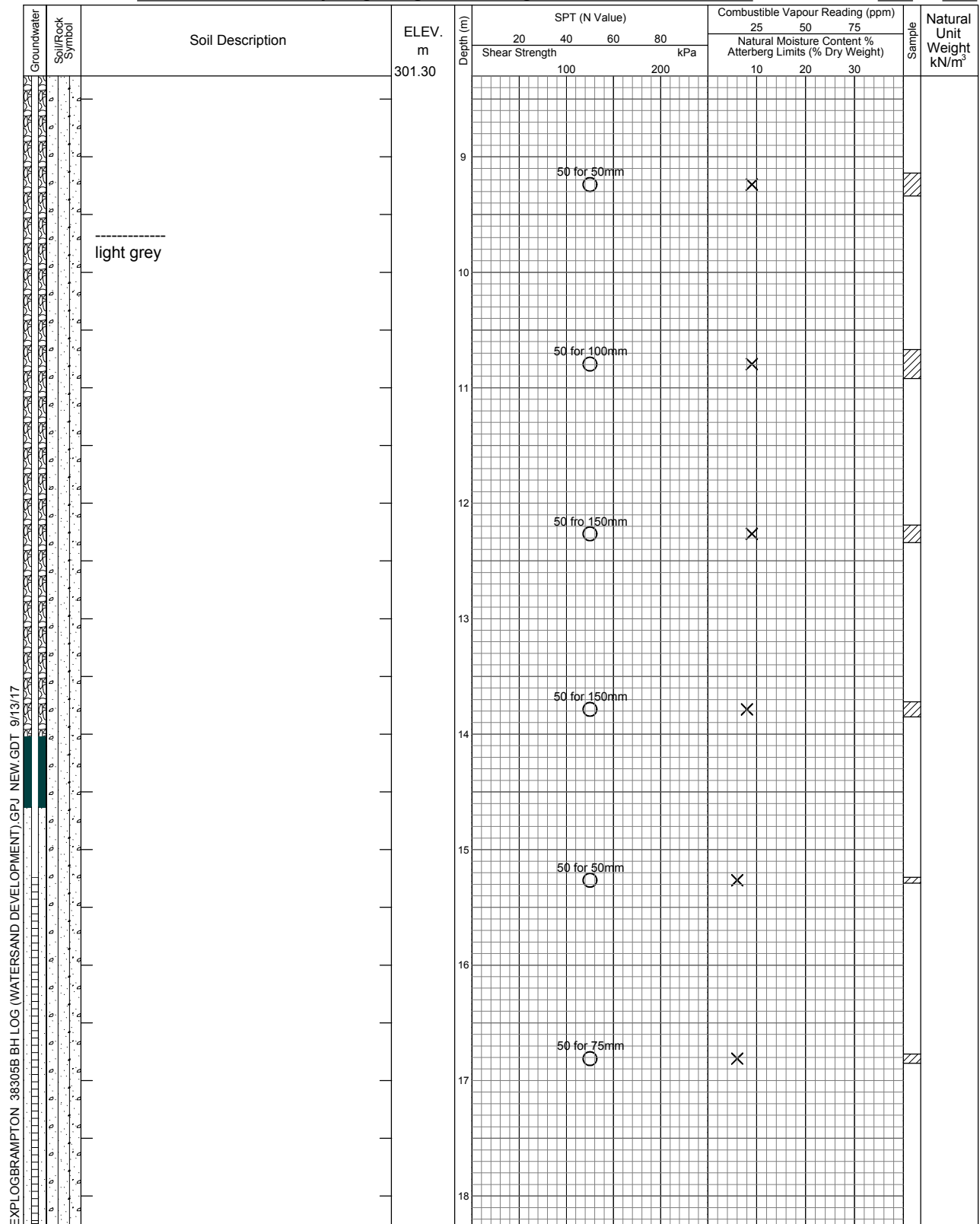
Log of Borehole B2-D

Project No. BRM-00038305-B0

Drawing No. 74

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



Continued Next Page



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-

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

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



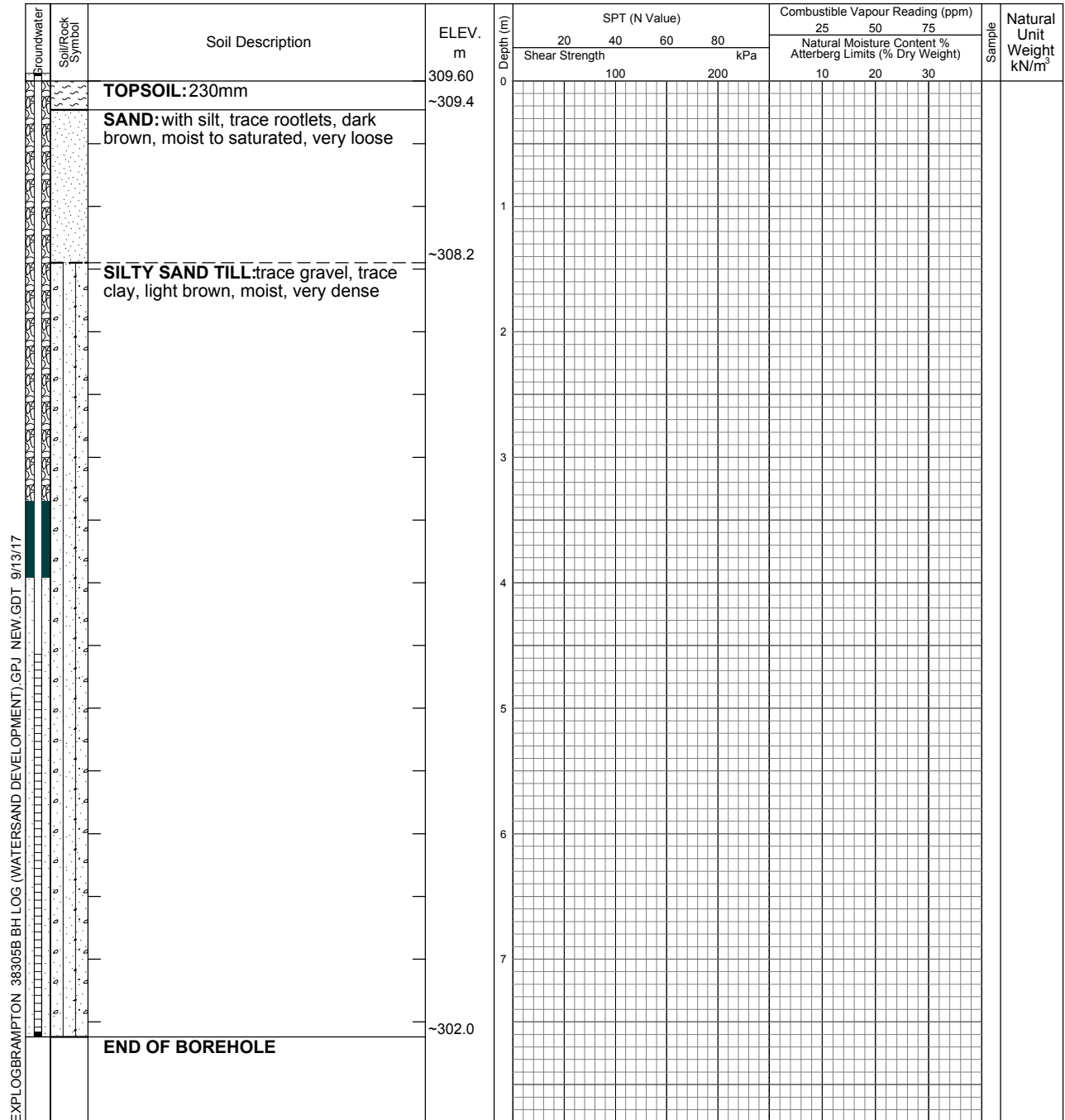
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	Dry	-
August 17, 2017	Dry	-

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

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

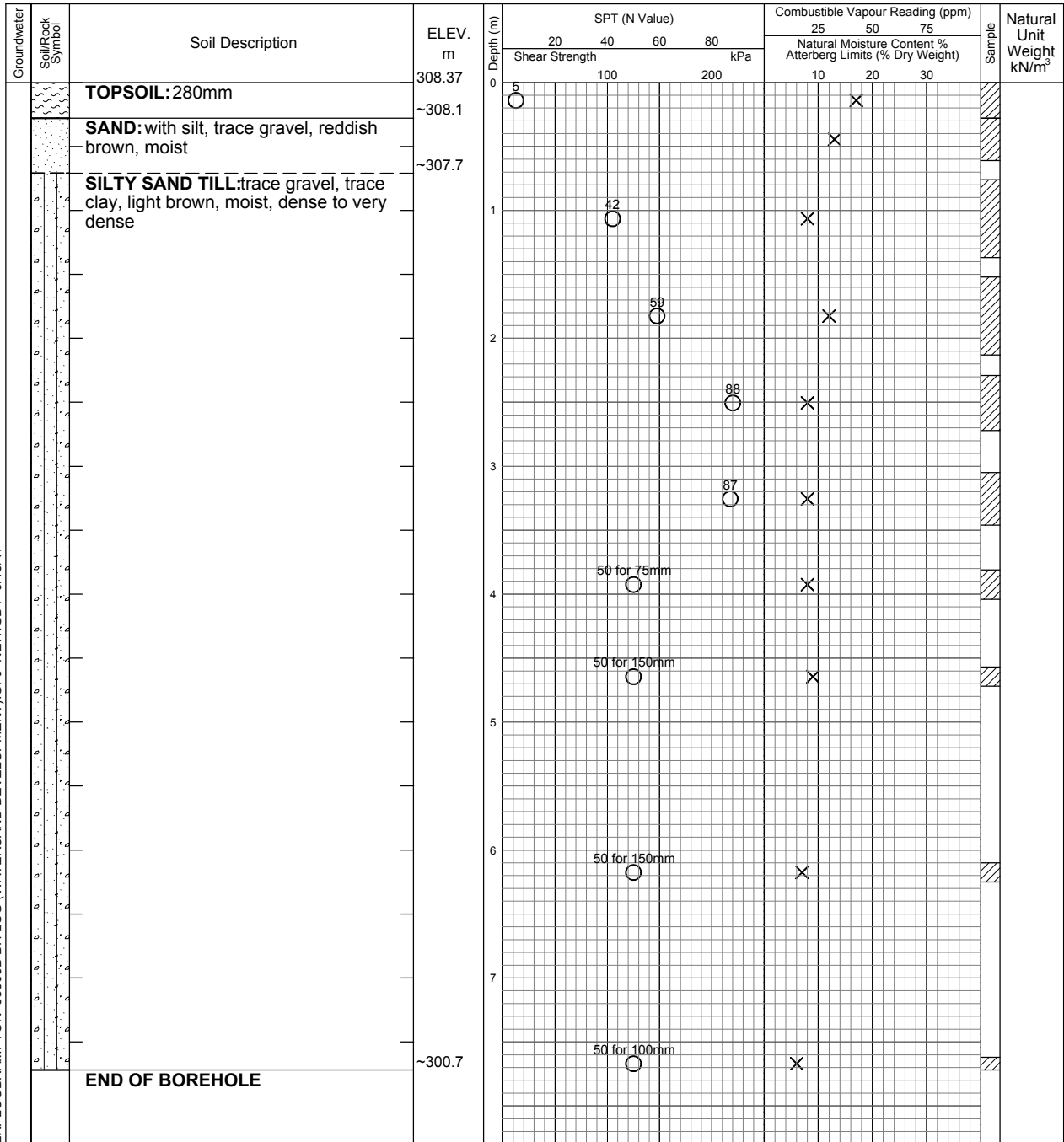


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

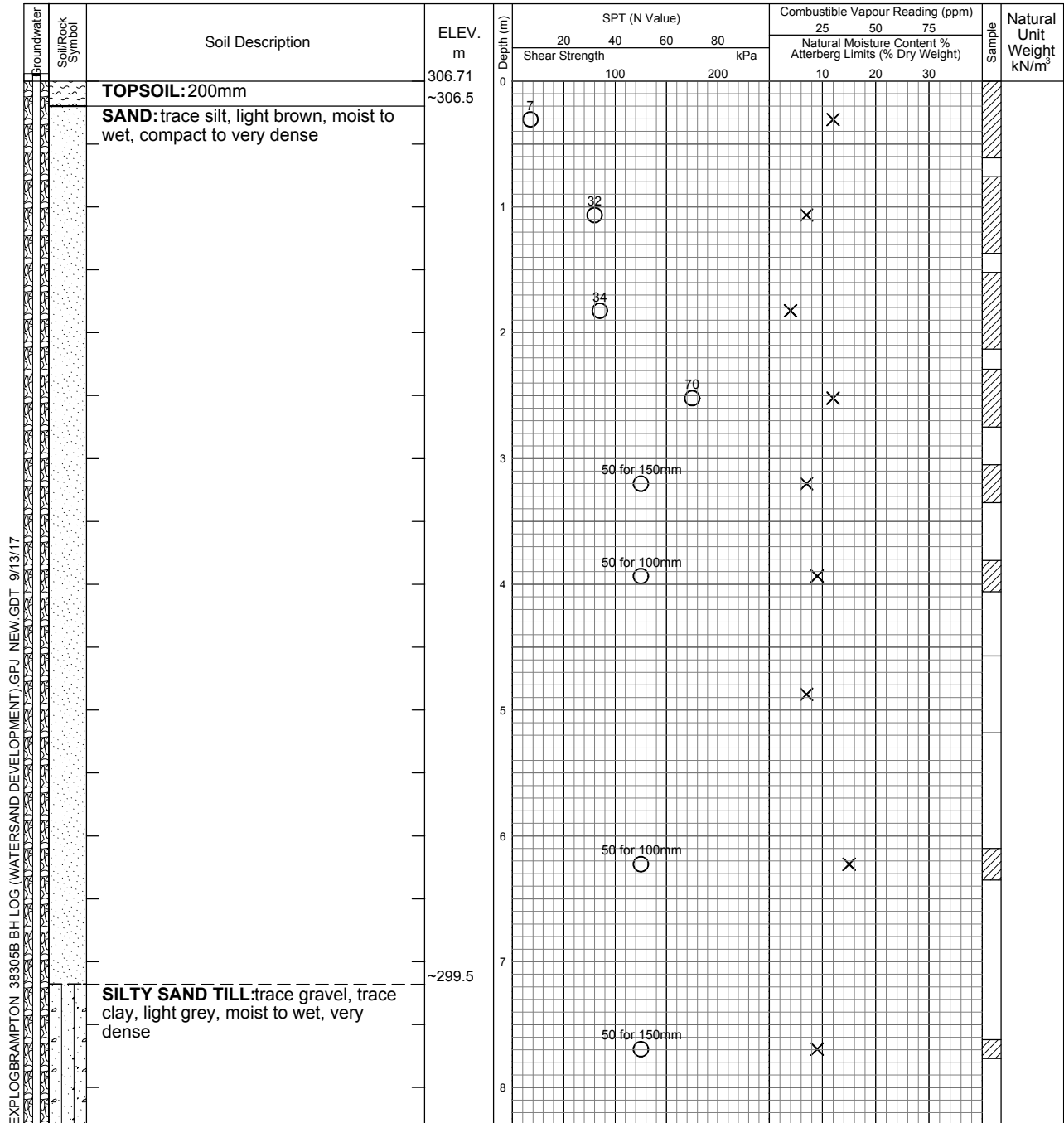
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
August 2, 2017	4.34	-
August 9, 2017	4.45	-

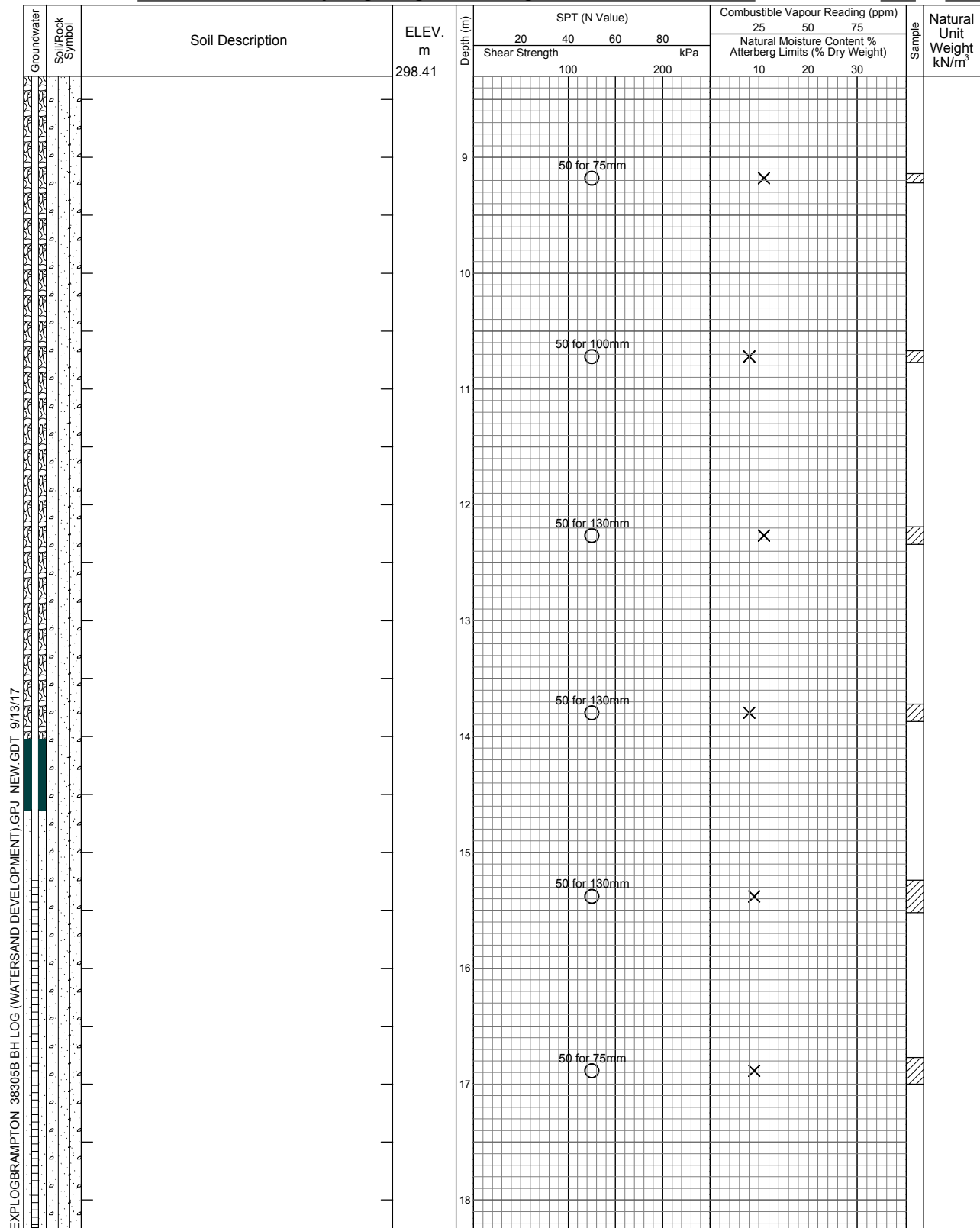
Log of Borehole C2-D

Project No. BRM-00038305-B0

Drawing No. 77

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



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-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

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



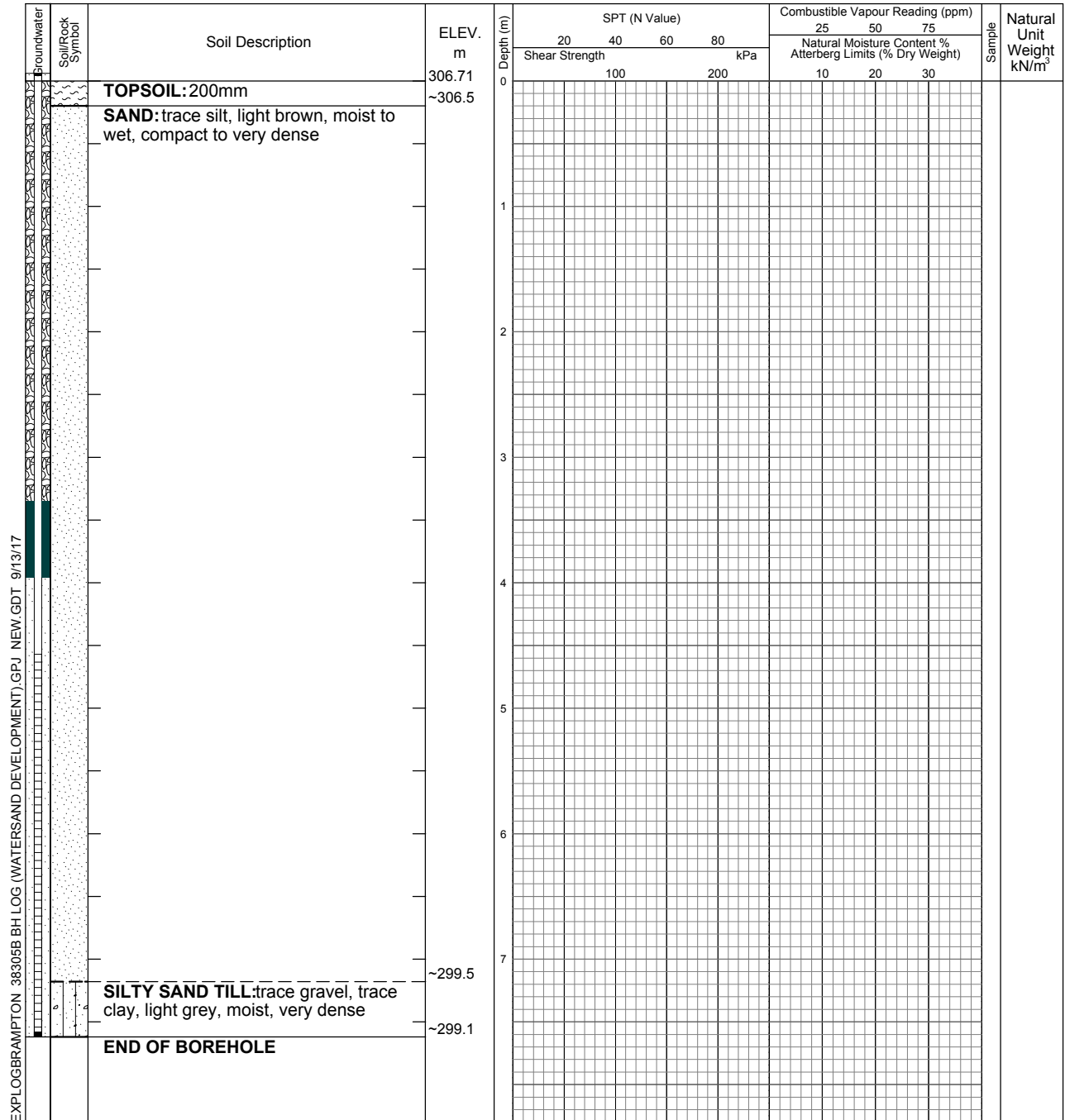
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
August 2, 2017	4.31	-
August 9, 2017	4.39	-
August 17, 2017	4.47	-

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

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



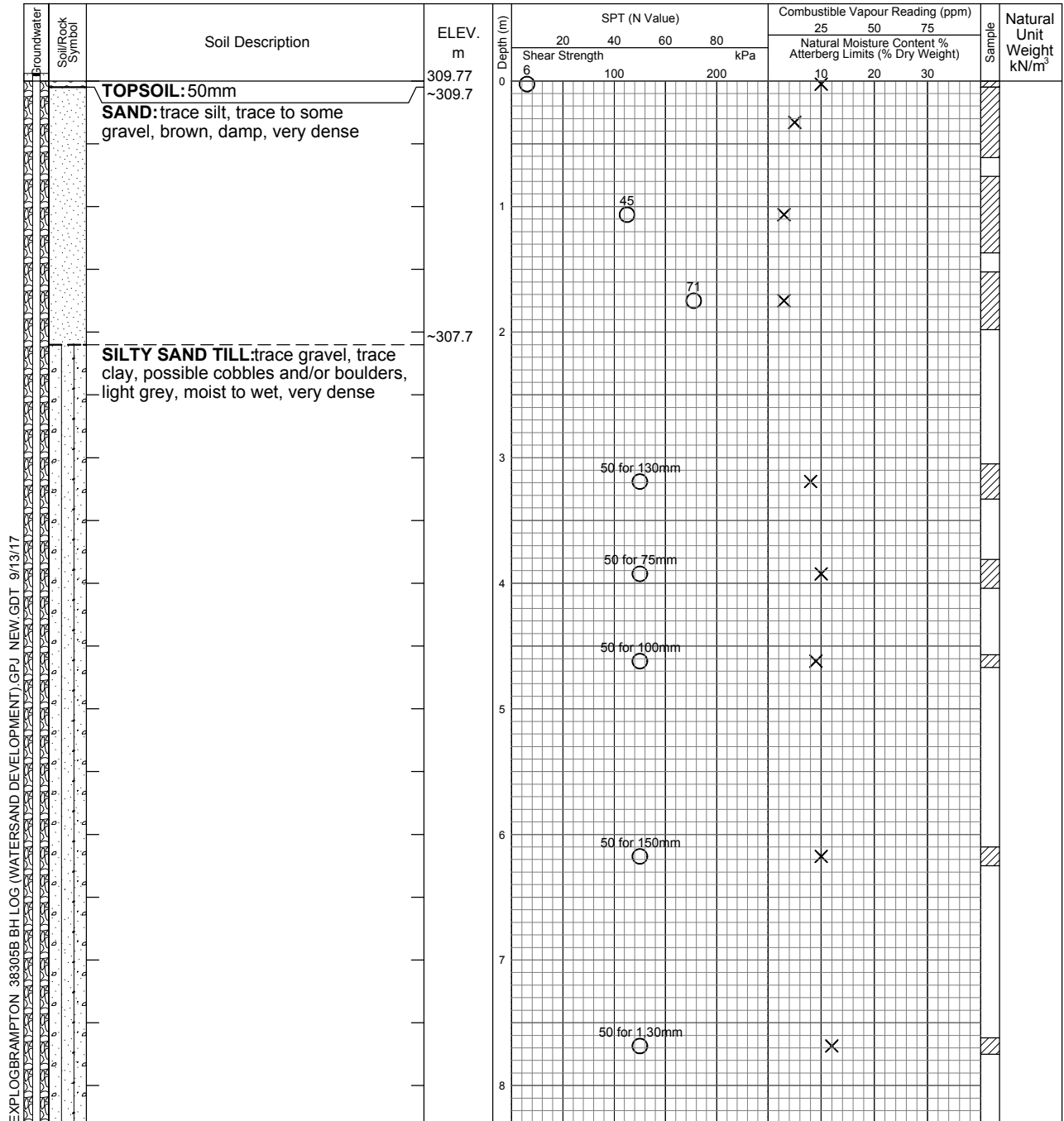
% Strain at Failure



Penetrometer



Datum: Geodetic



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	-



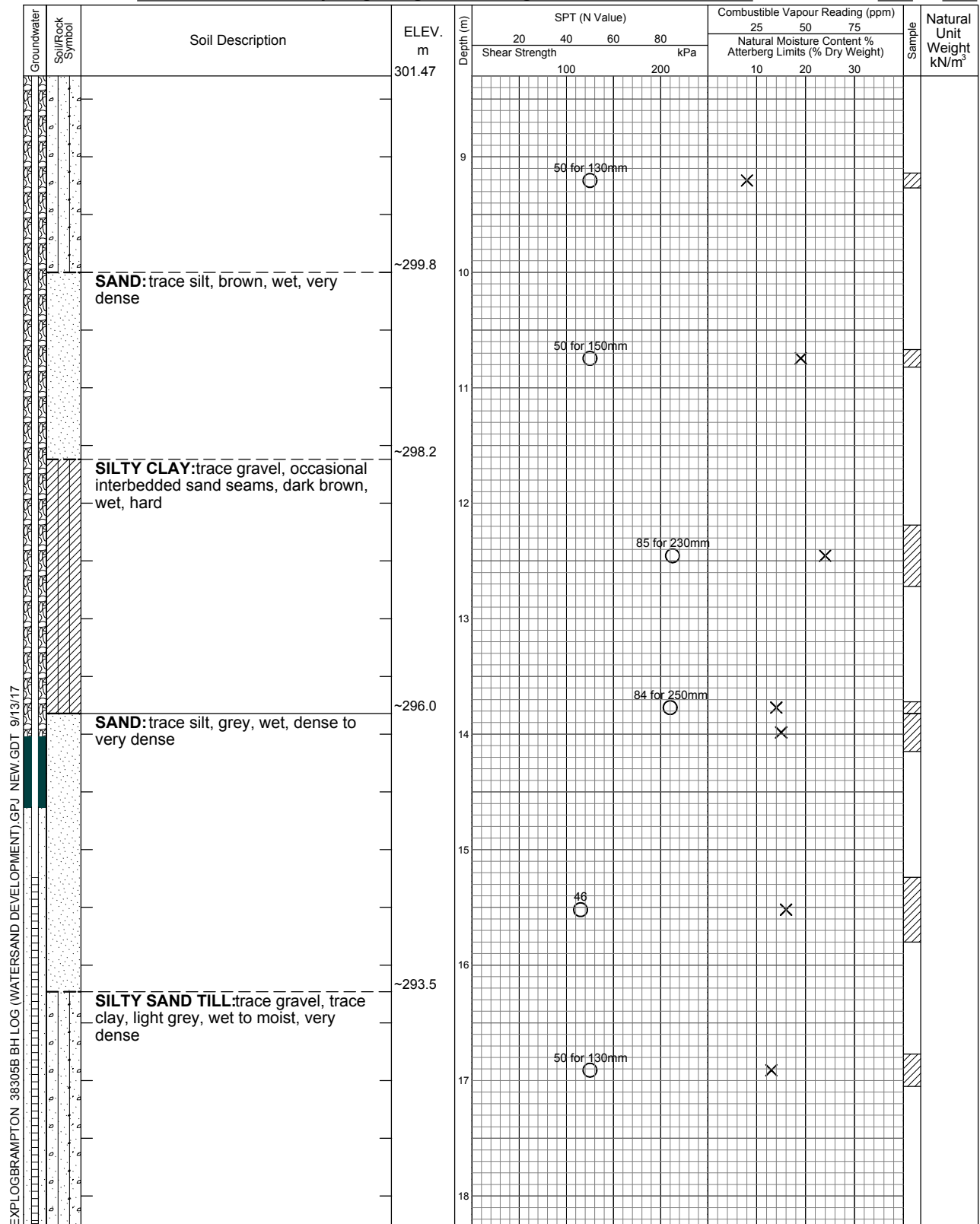
Log of Borehole C3-D

Project No. BRM-00038305-B0

Drawing No. 79

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



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-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

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



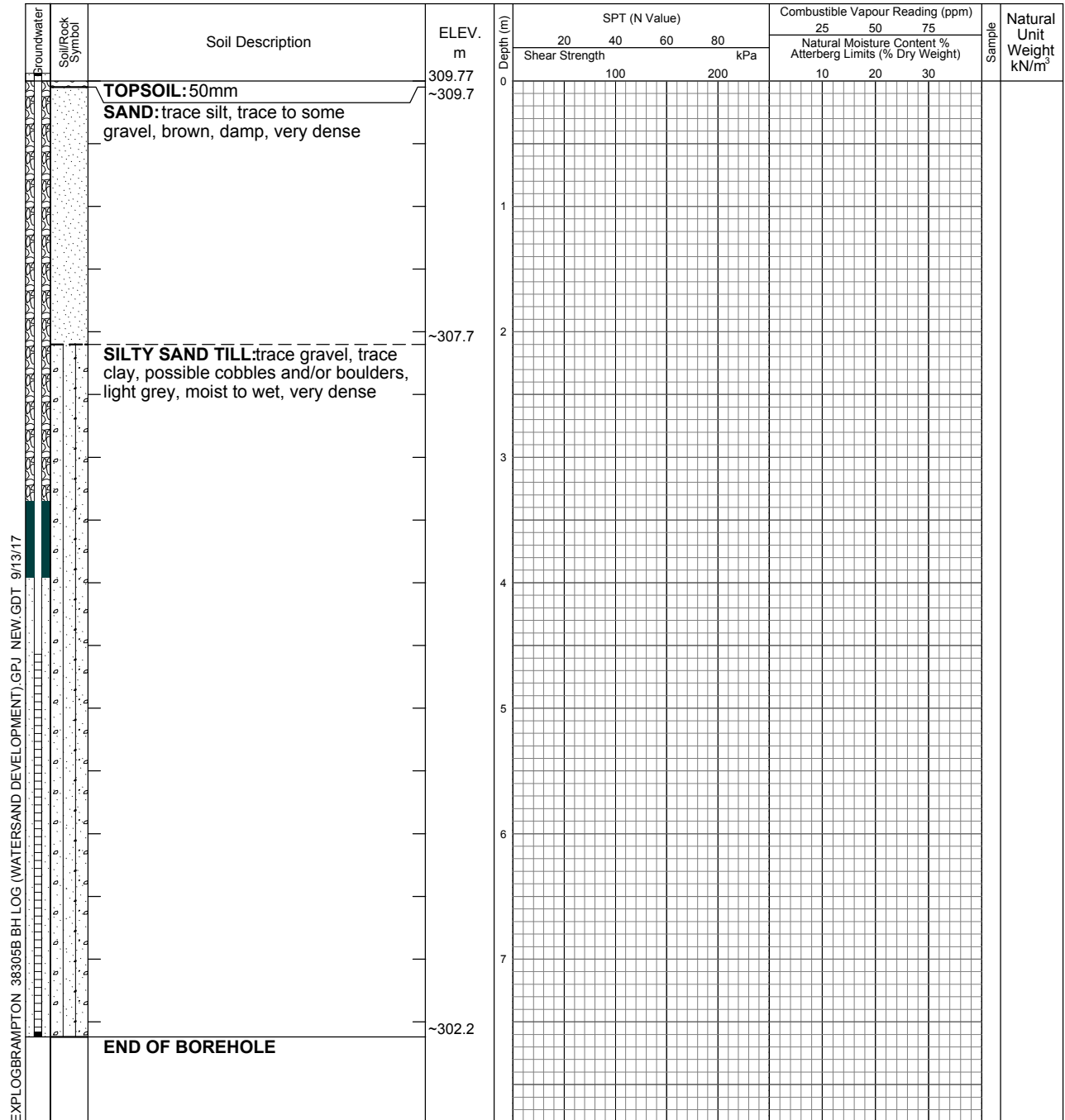
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
August 2, 2017	4.49	-
August 9, 2017	4.63	-

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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

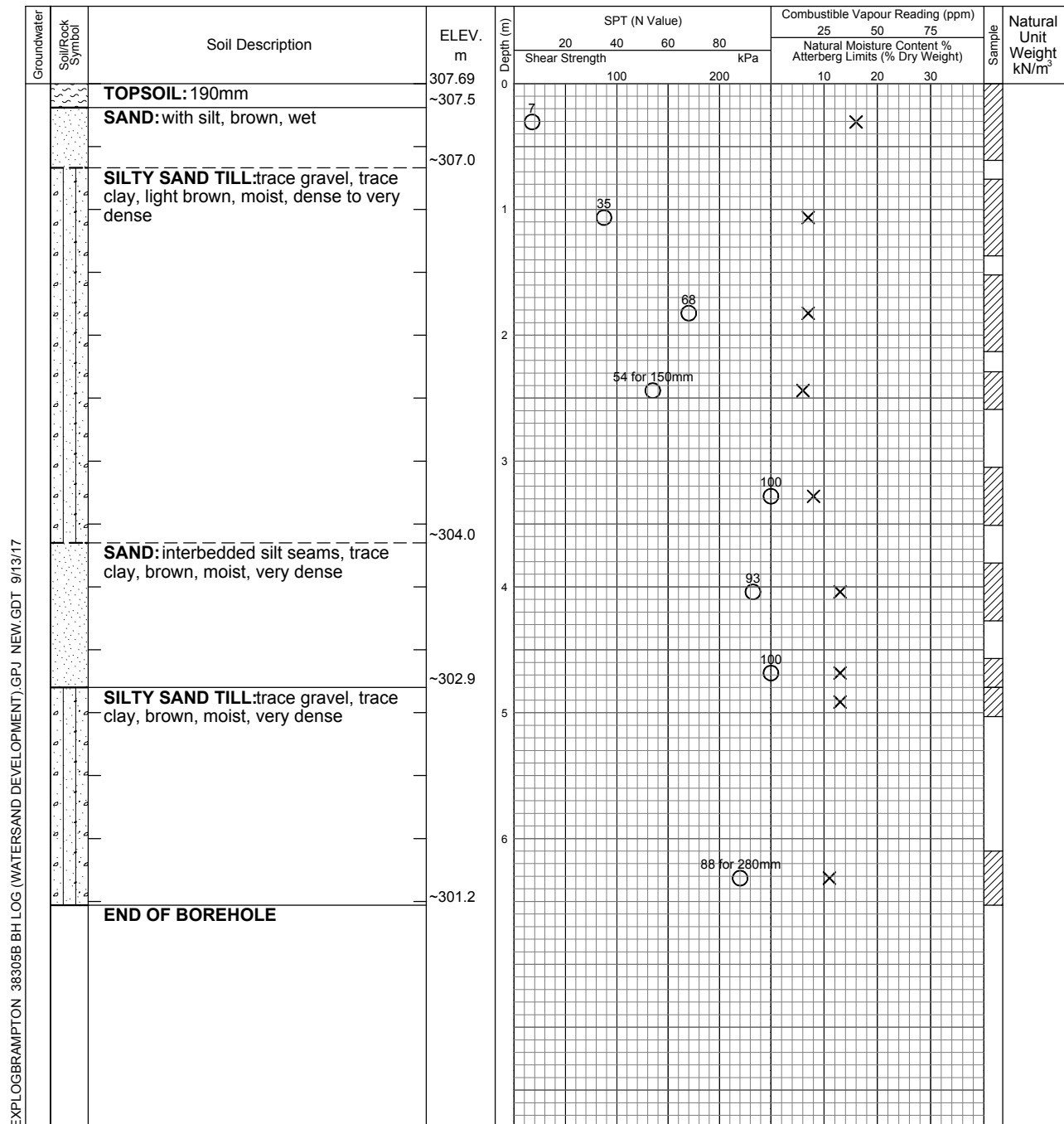
Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at
% Strain at Failure

Penetrometer

Datum: Geodetic

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

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

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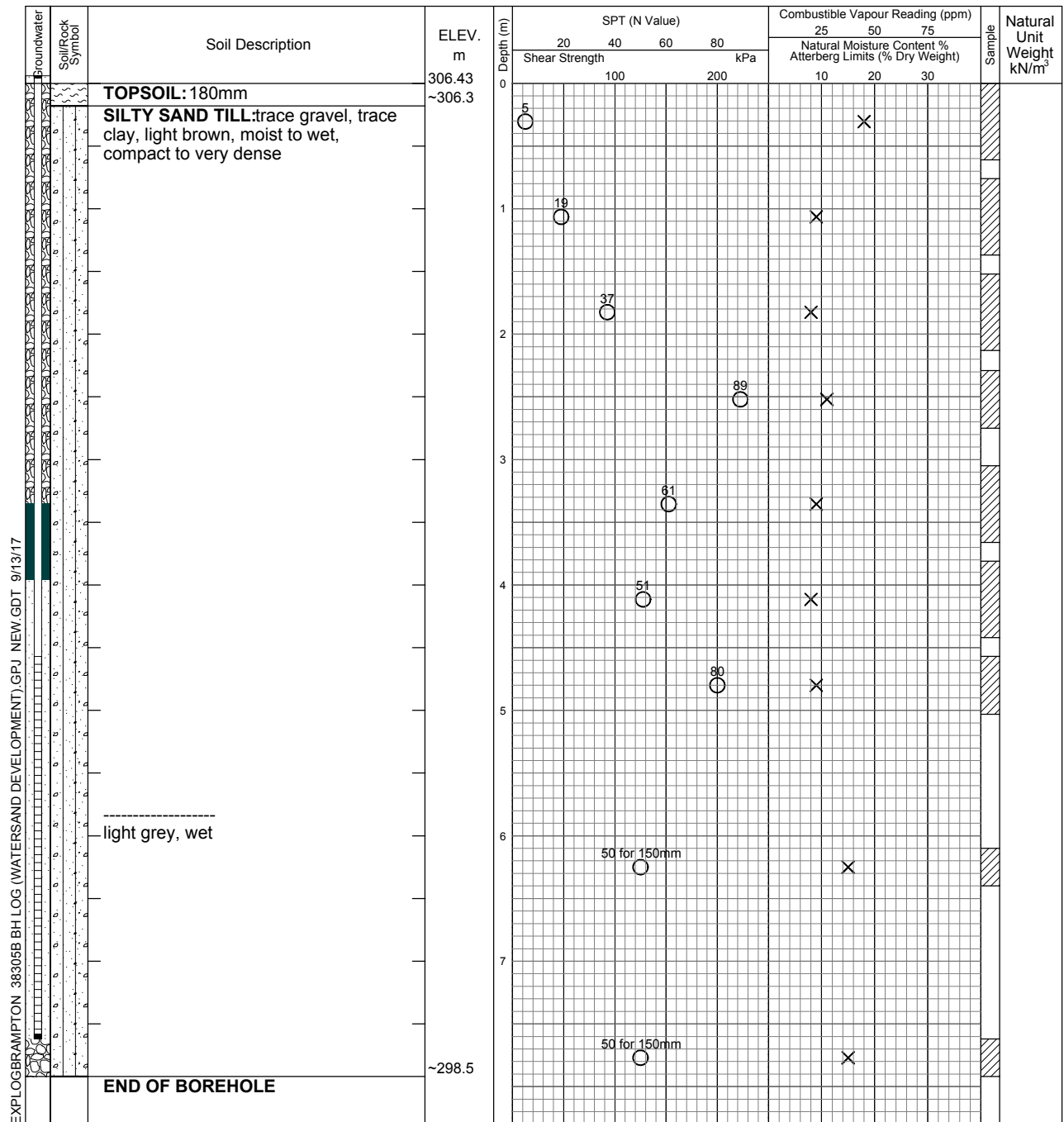
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Datum: Geodetic



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

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

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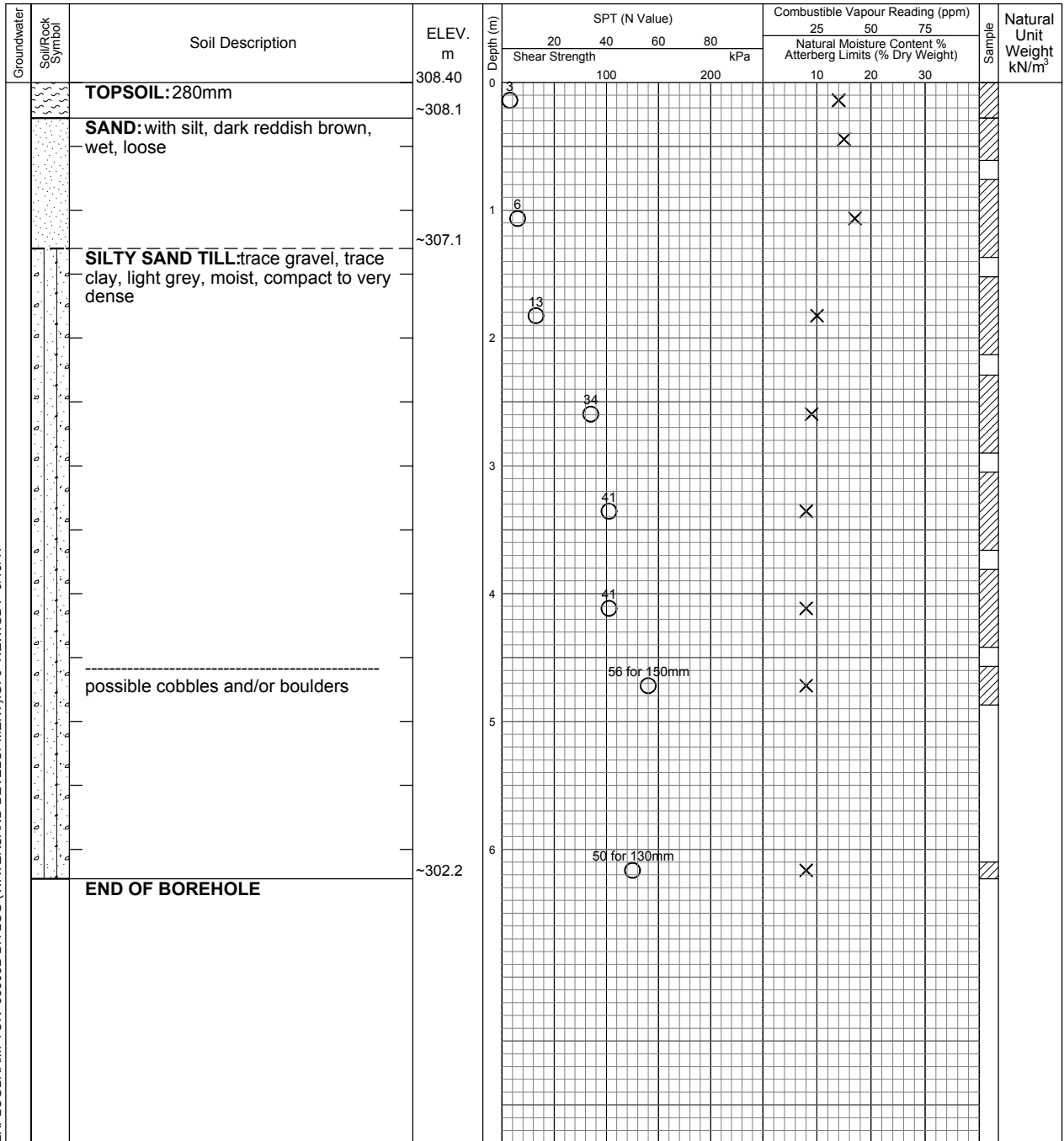
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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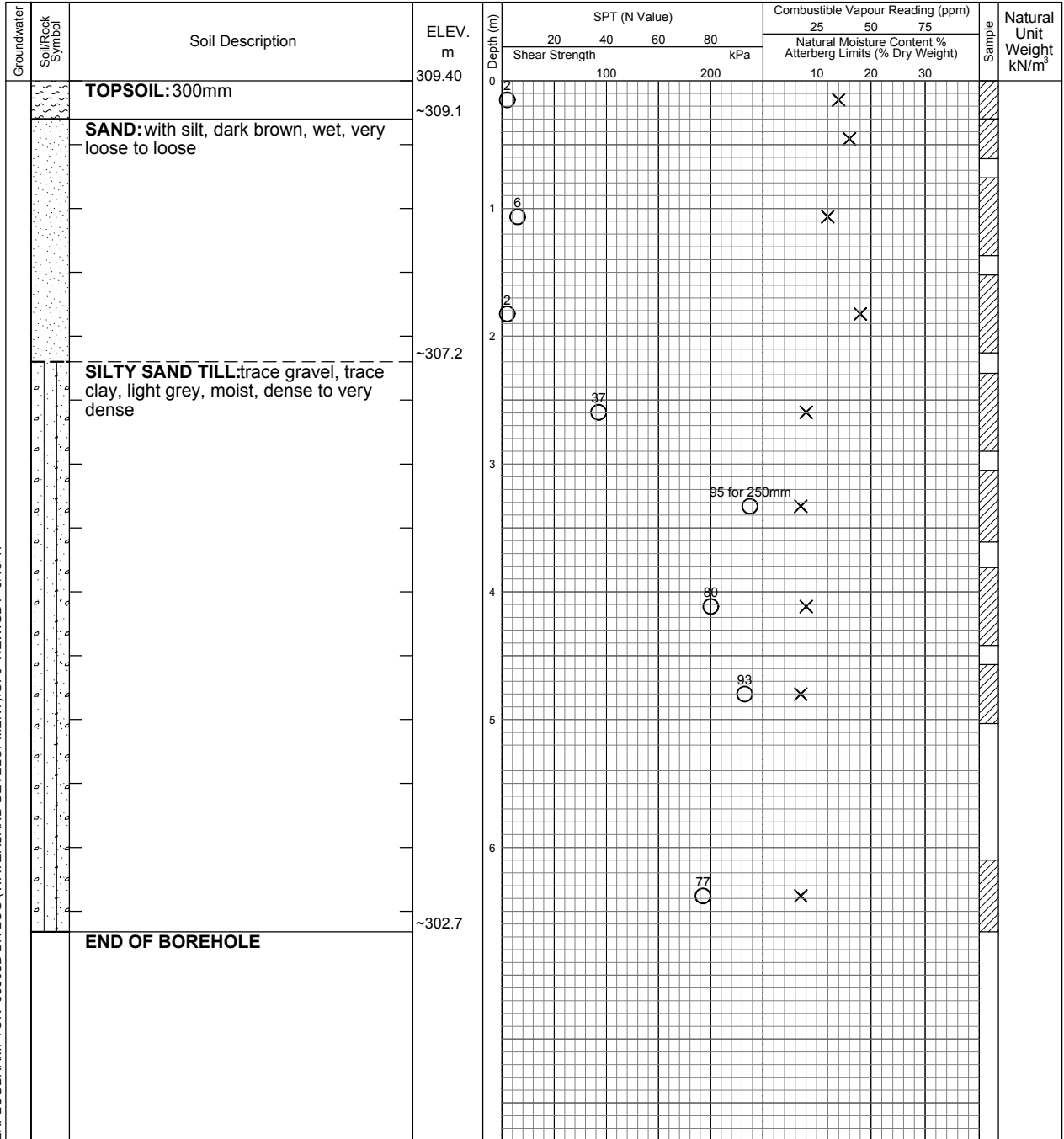
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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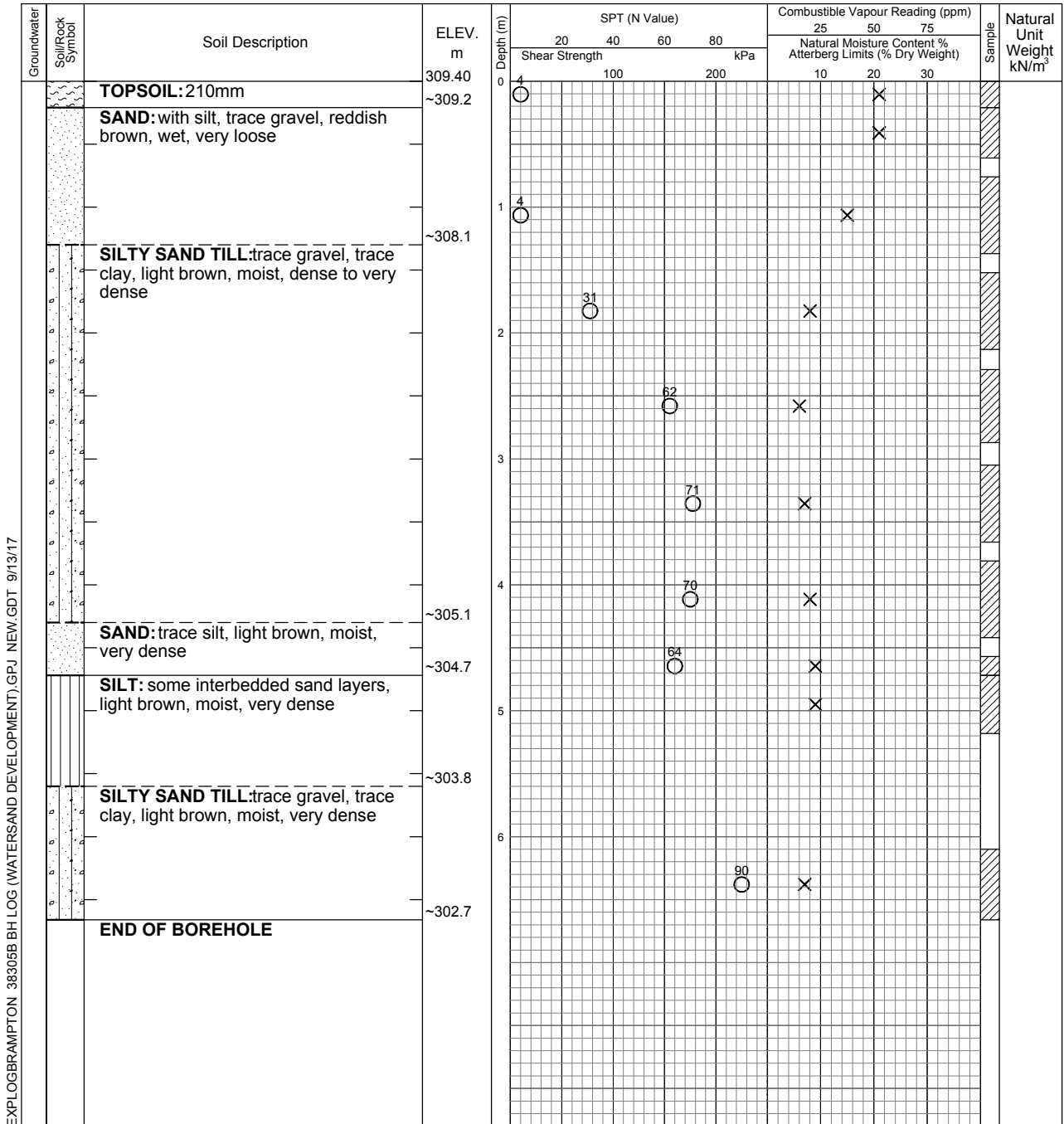
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

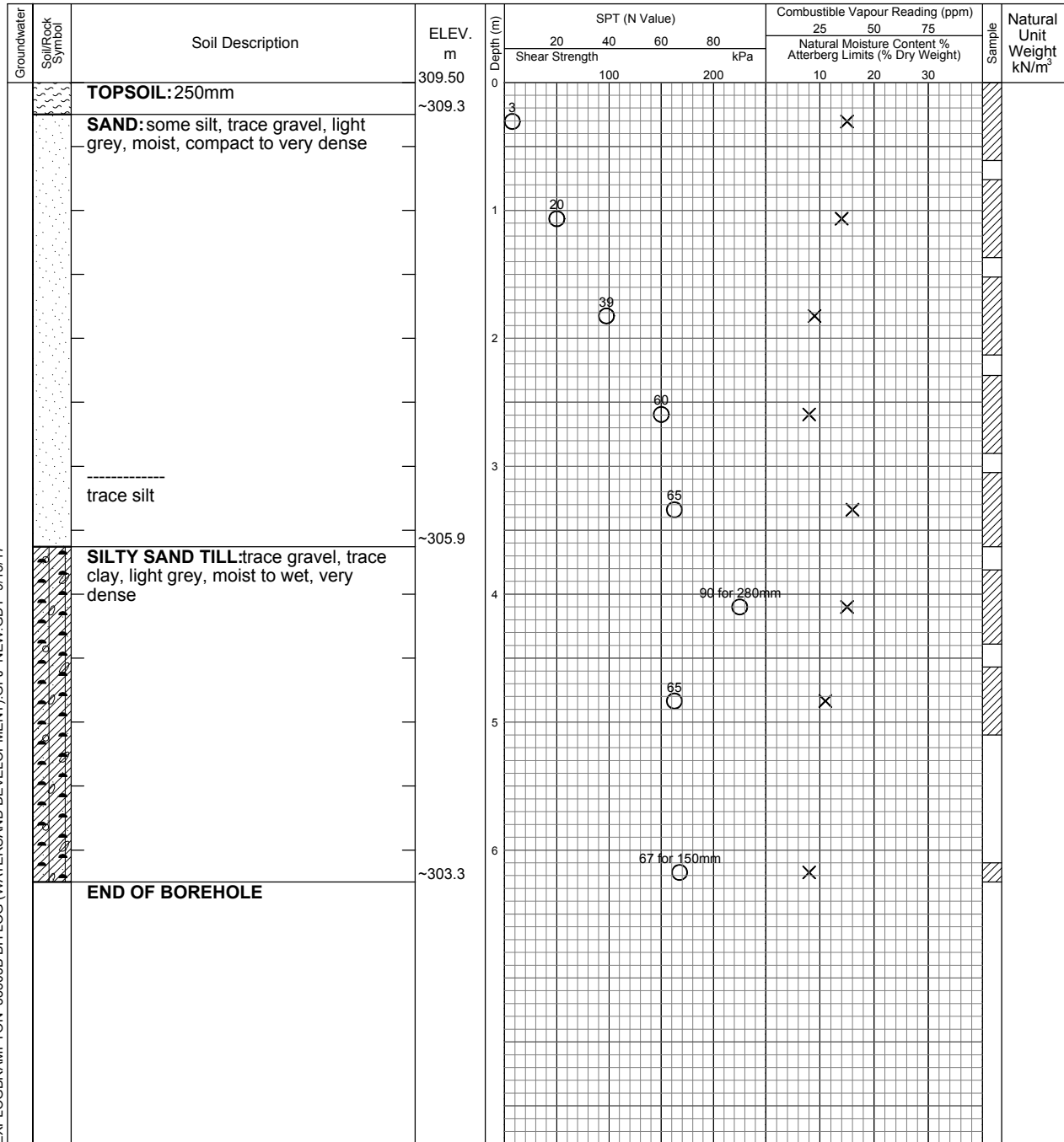


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



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

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

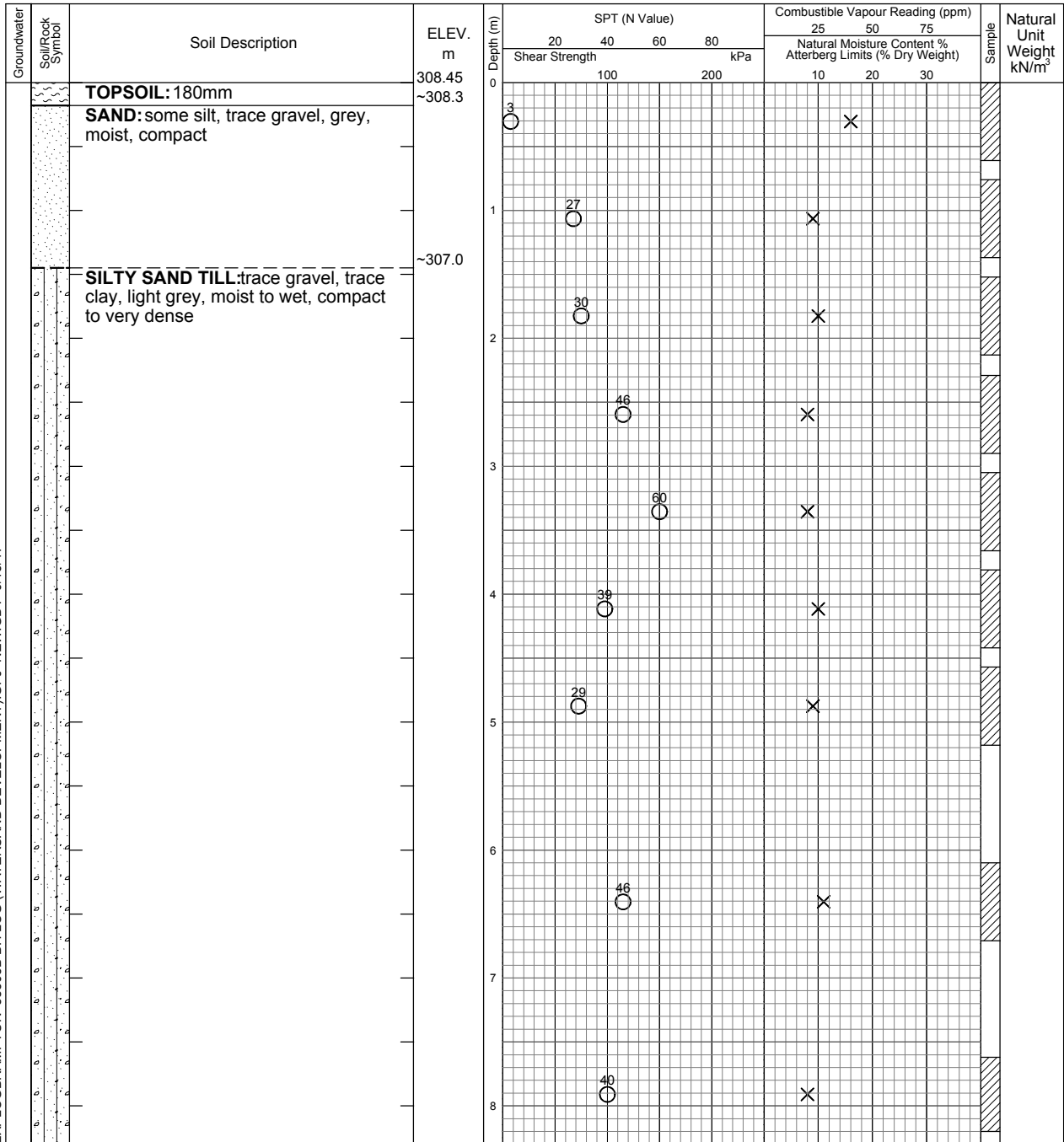


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	4.27	4.57



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
			300.15		Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
					100		200		10	20	30		
				9									
			~298.8					95		X			
		END OF BOREHOLE											

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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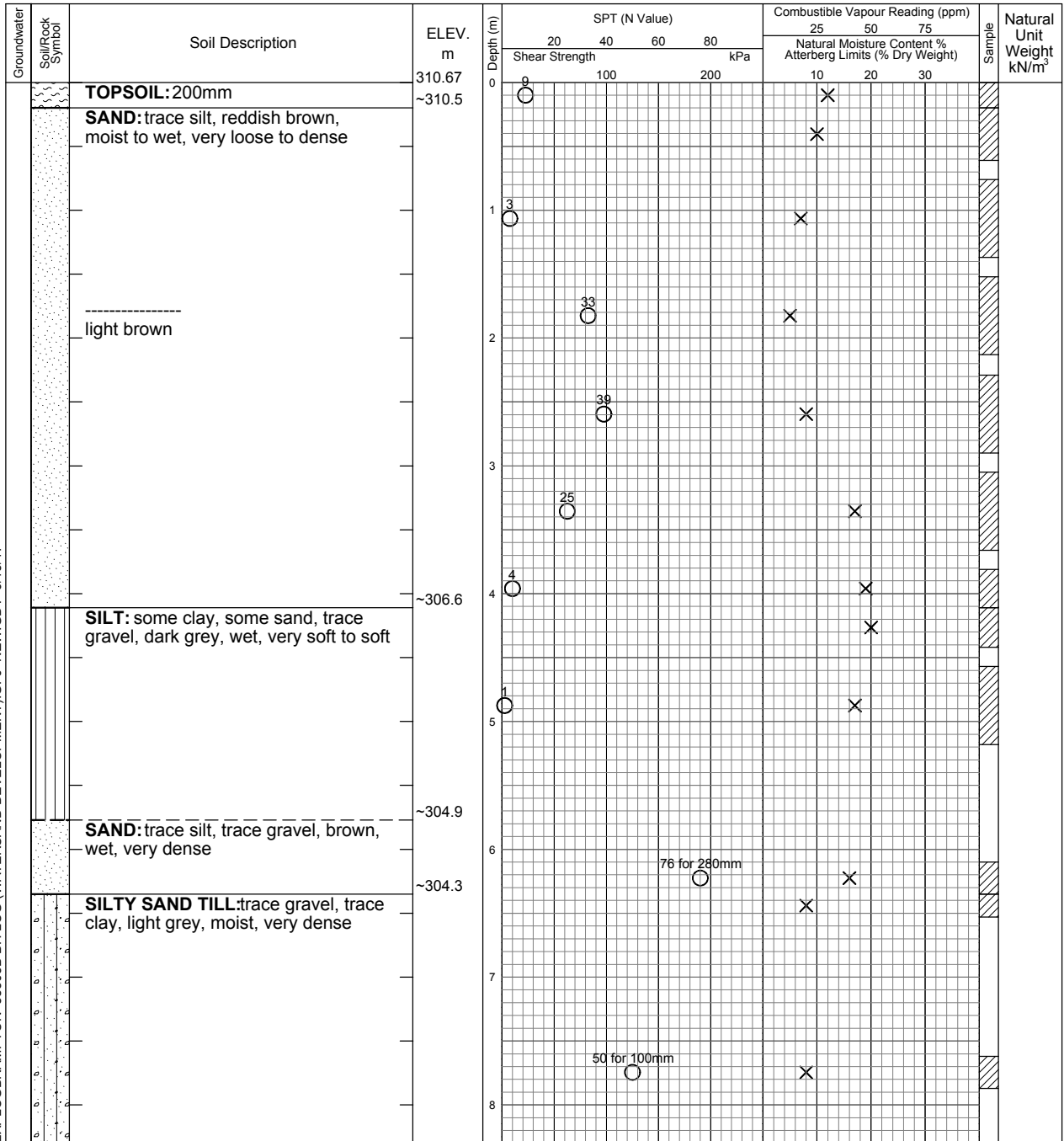
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



Continued Next Page

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



Log of Borehole 77

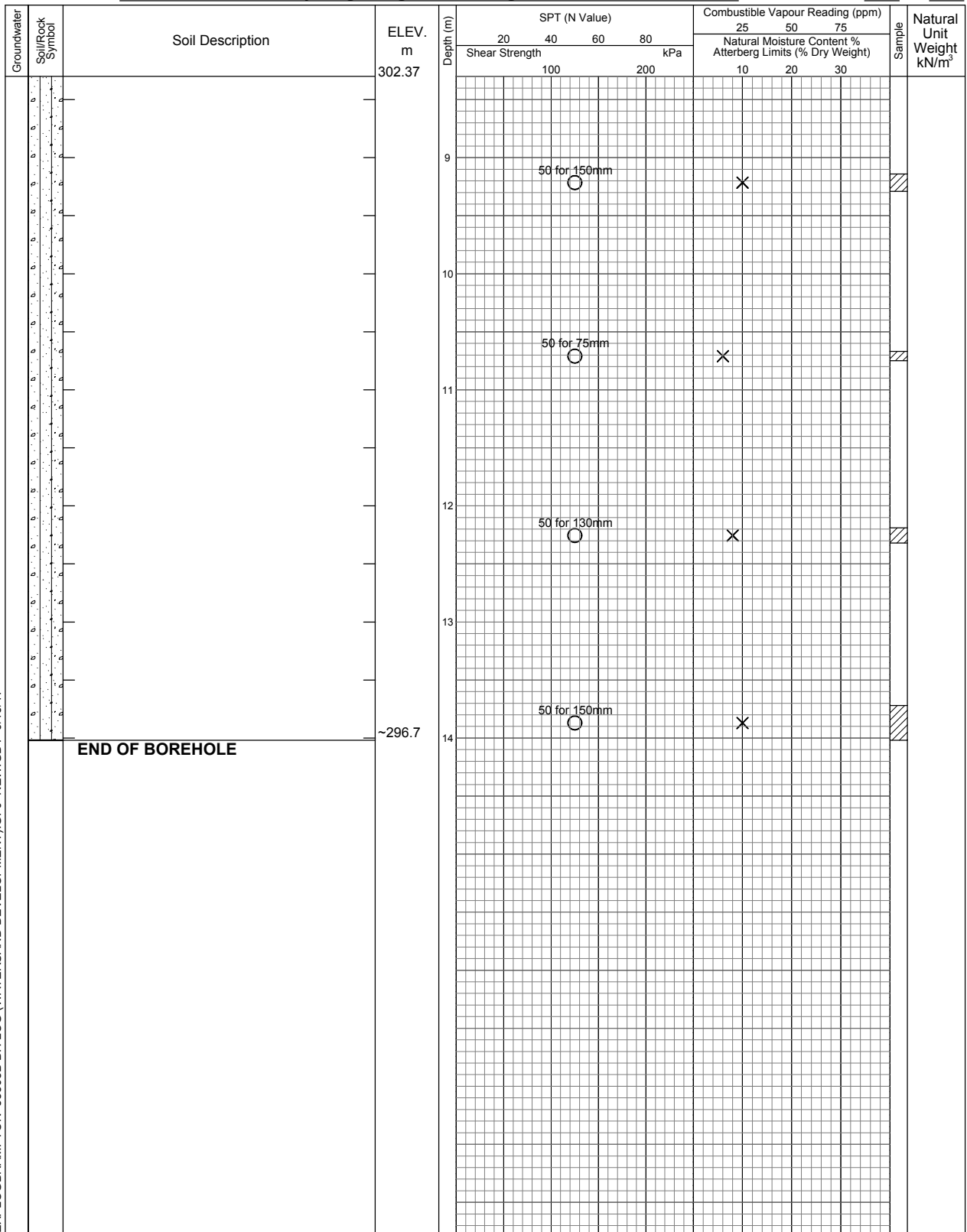
Project No. BRM-00038305-B0

Drawing No. 89

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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

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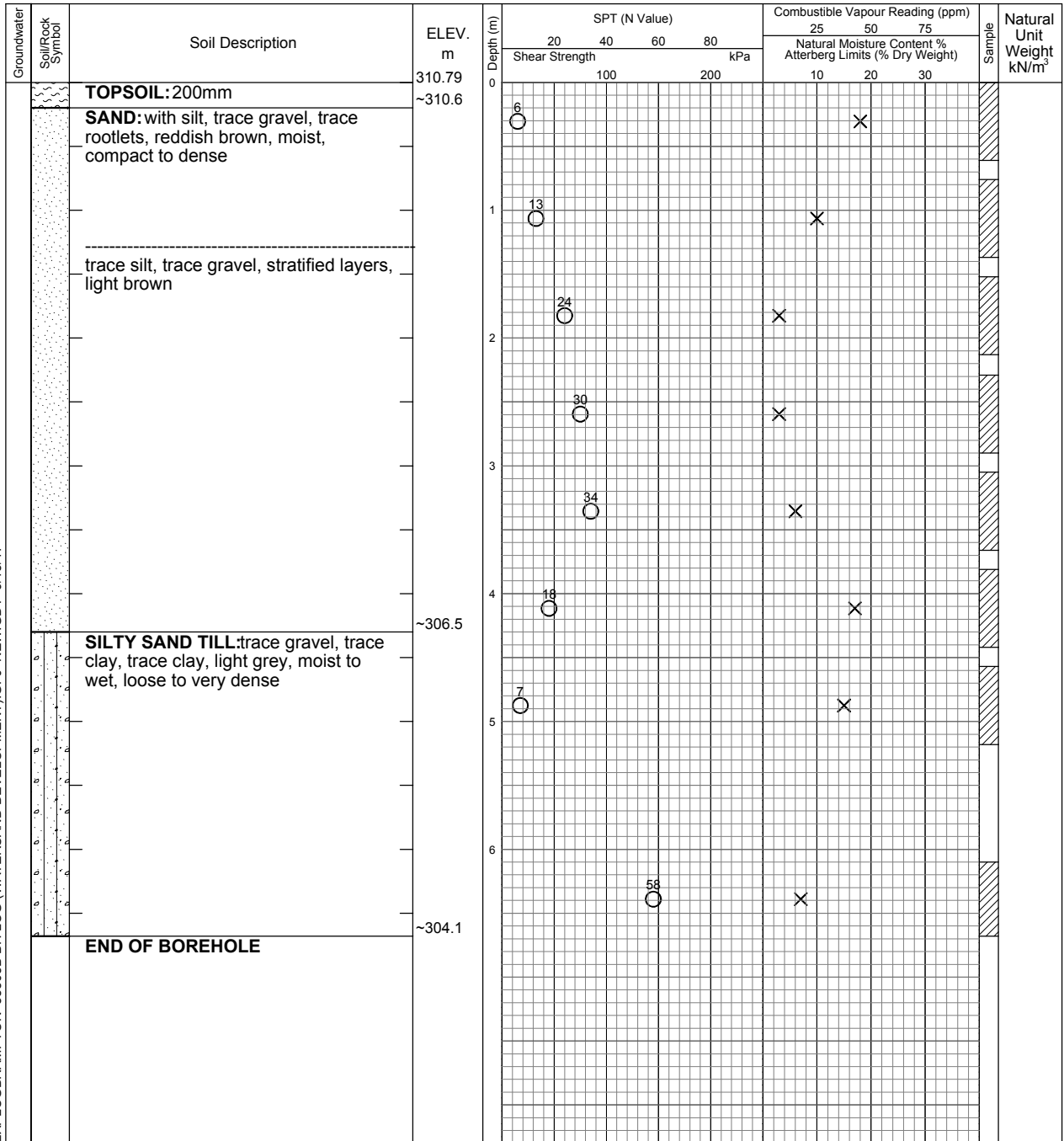
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

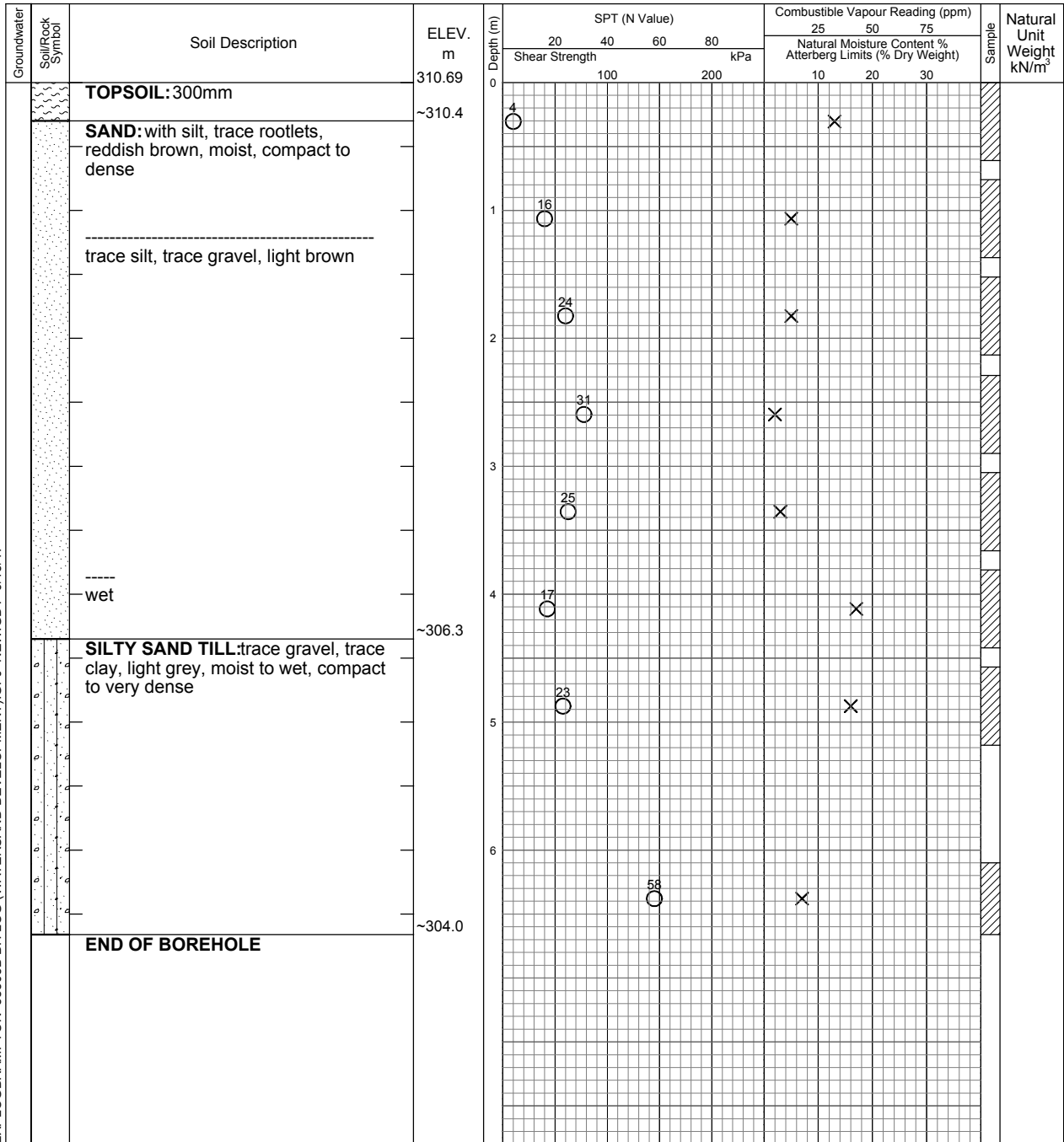


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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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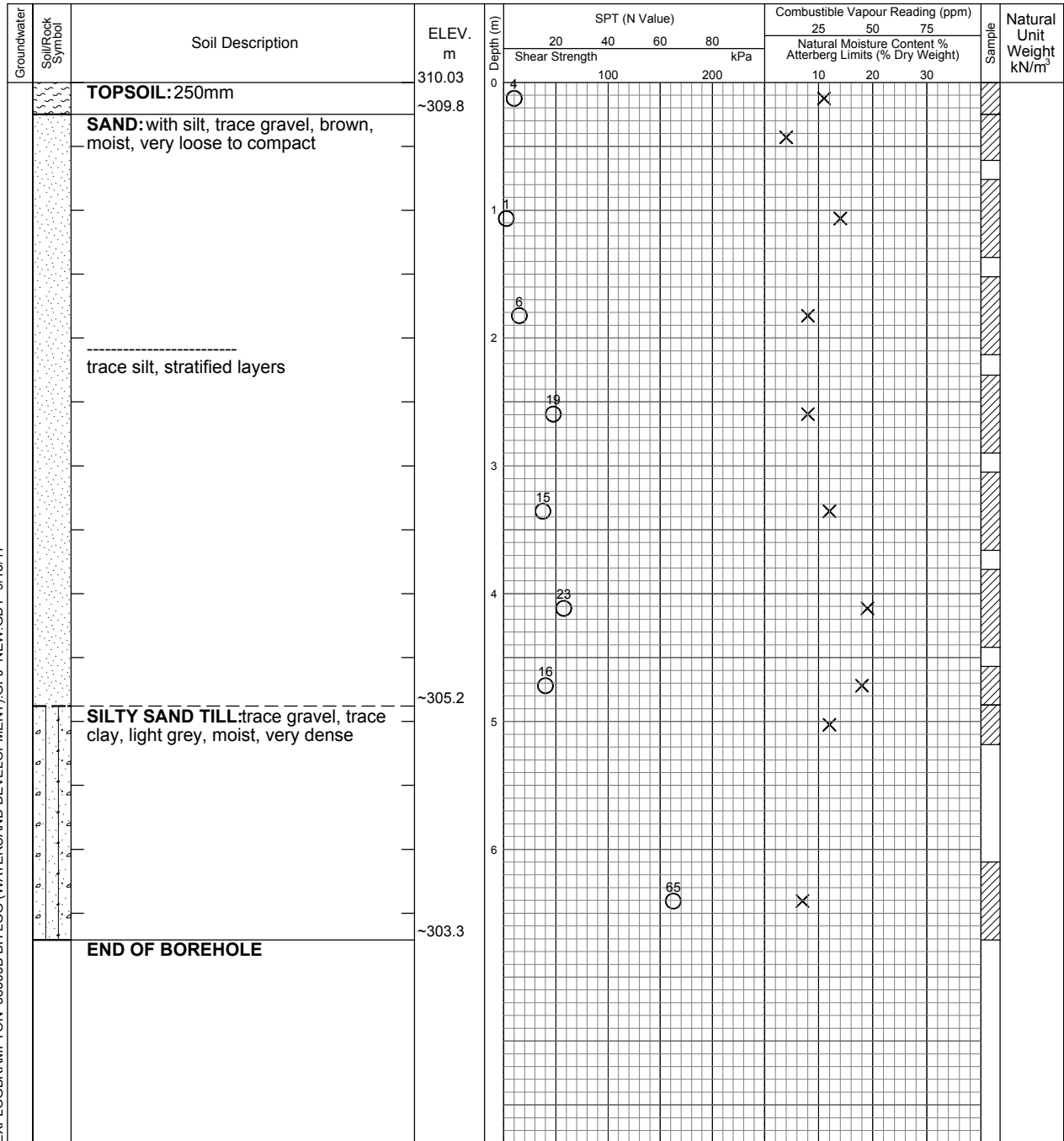
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPJ NEW GDT 9/13/17



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

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



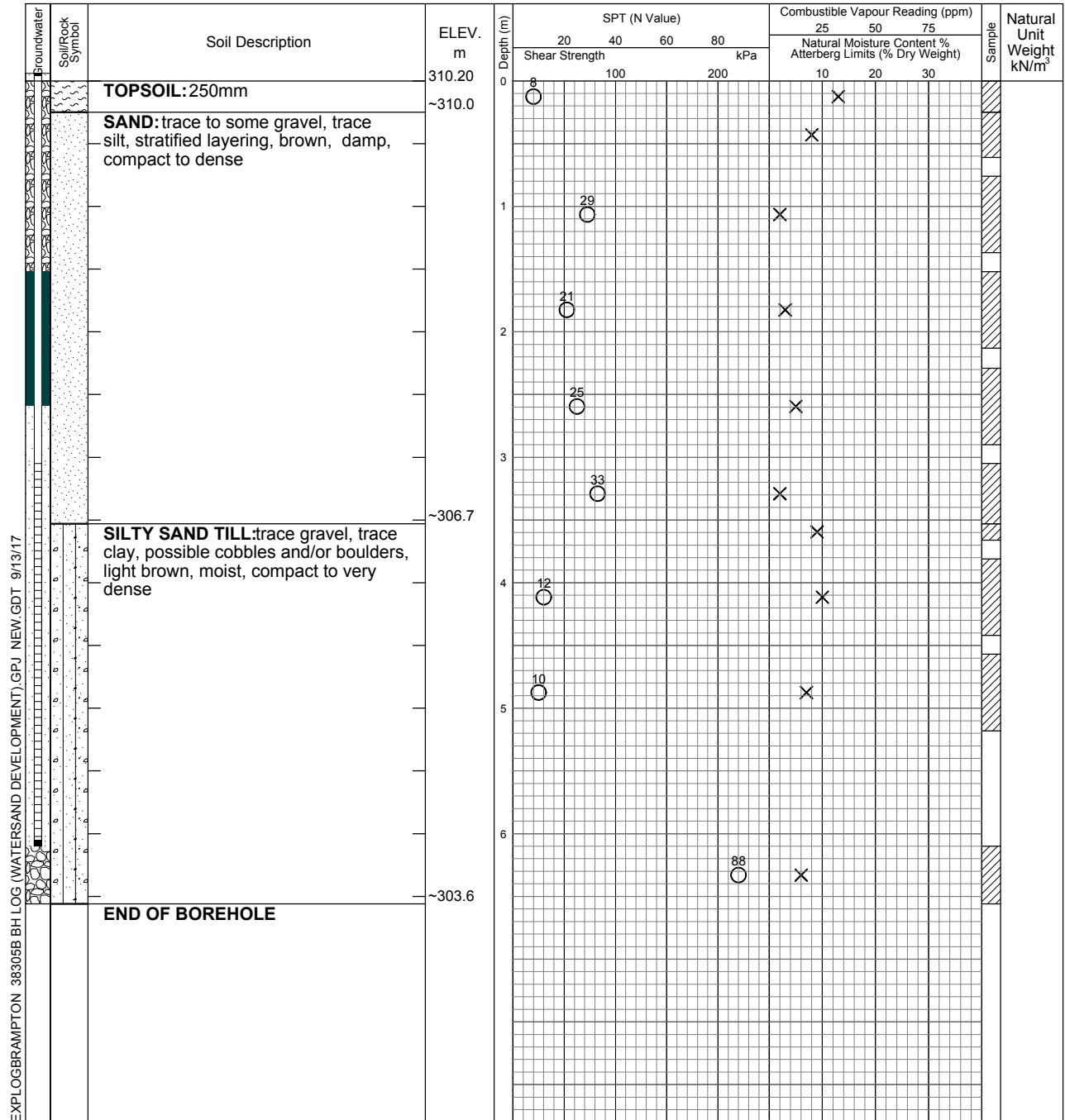
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion August 10, 2017	Dry 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

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

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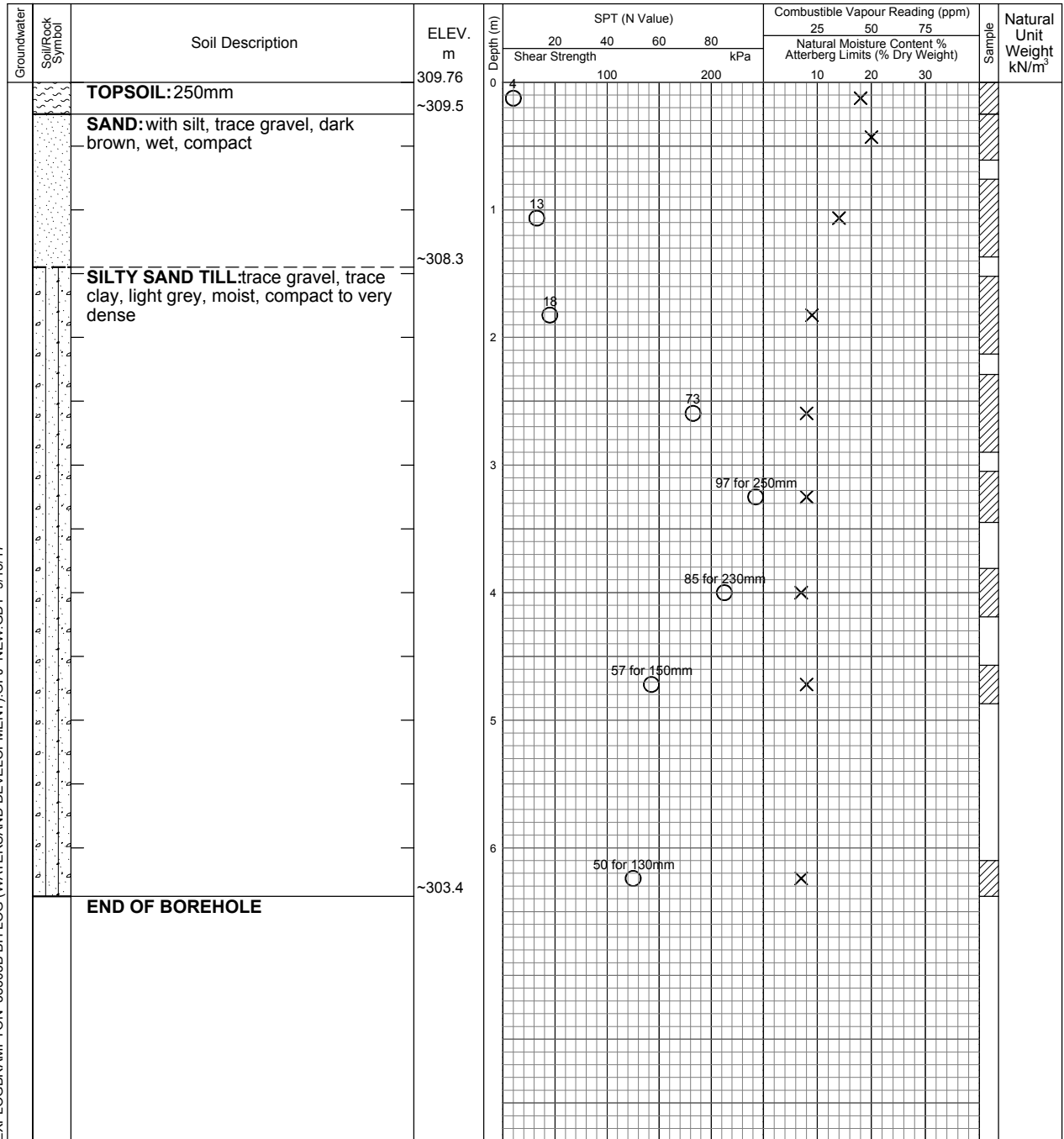
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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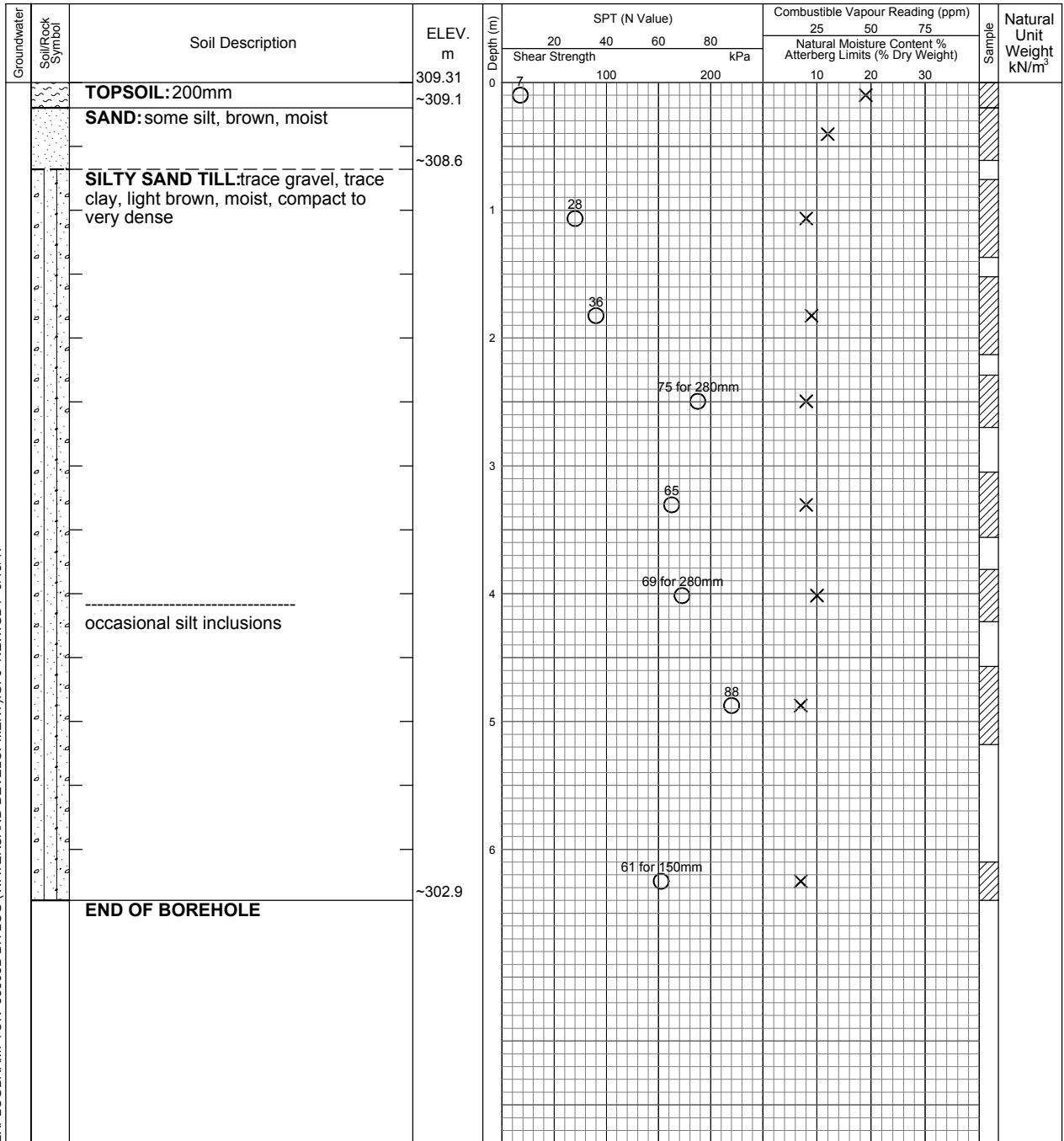
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	5.49	5.64

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

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

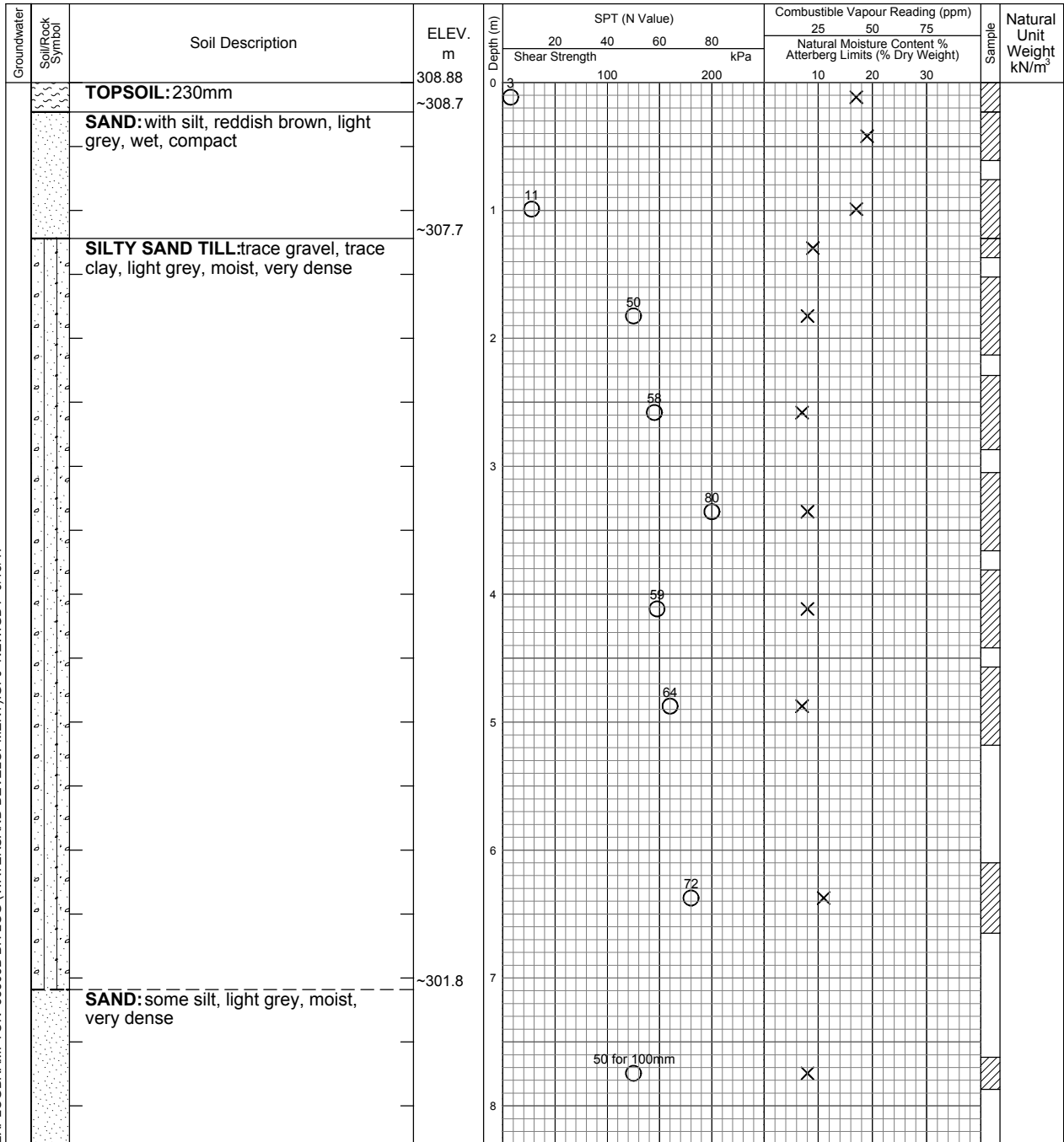


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.99	9.14



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
					Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
					100	200	10	20	30				
			300.58										
				9									
			~299.6										
		END OF BOREHOLE											

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.99	9.14



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

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

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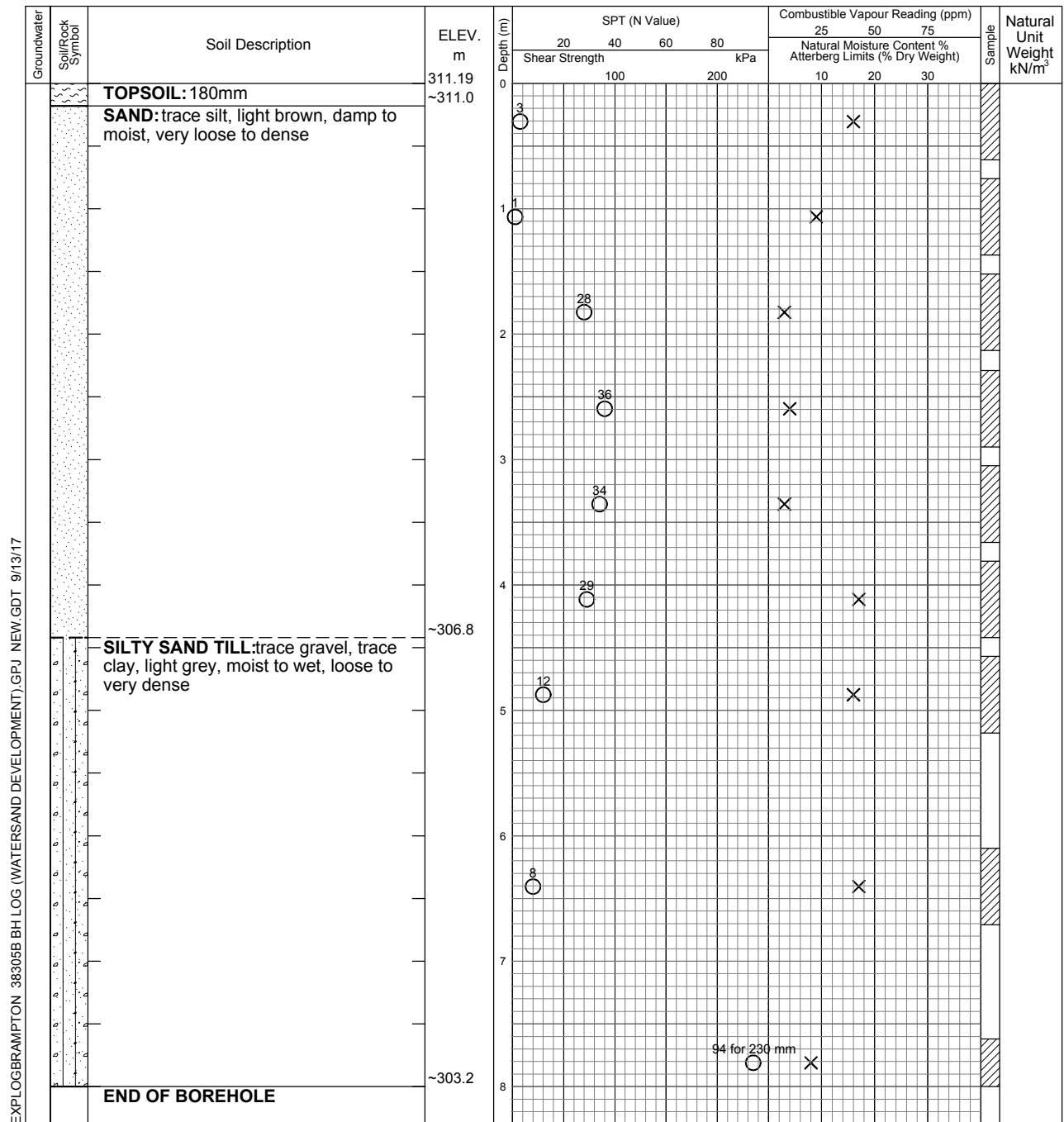
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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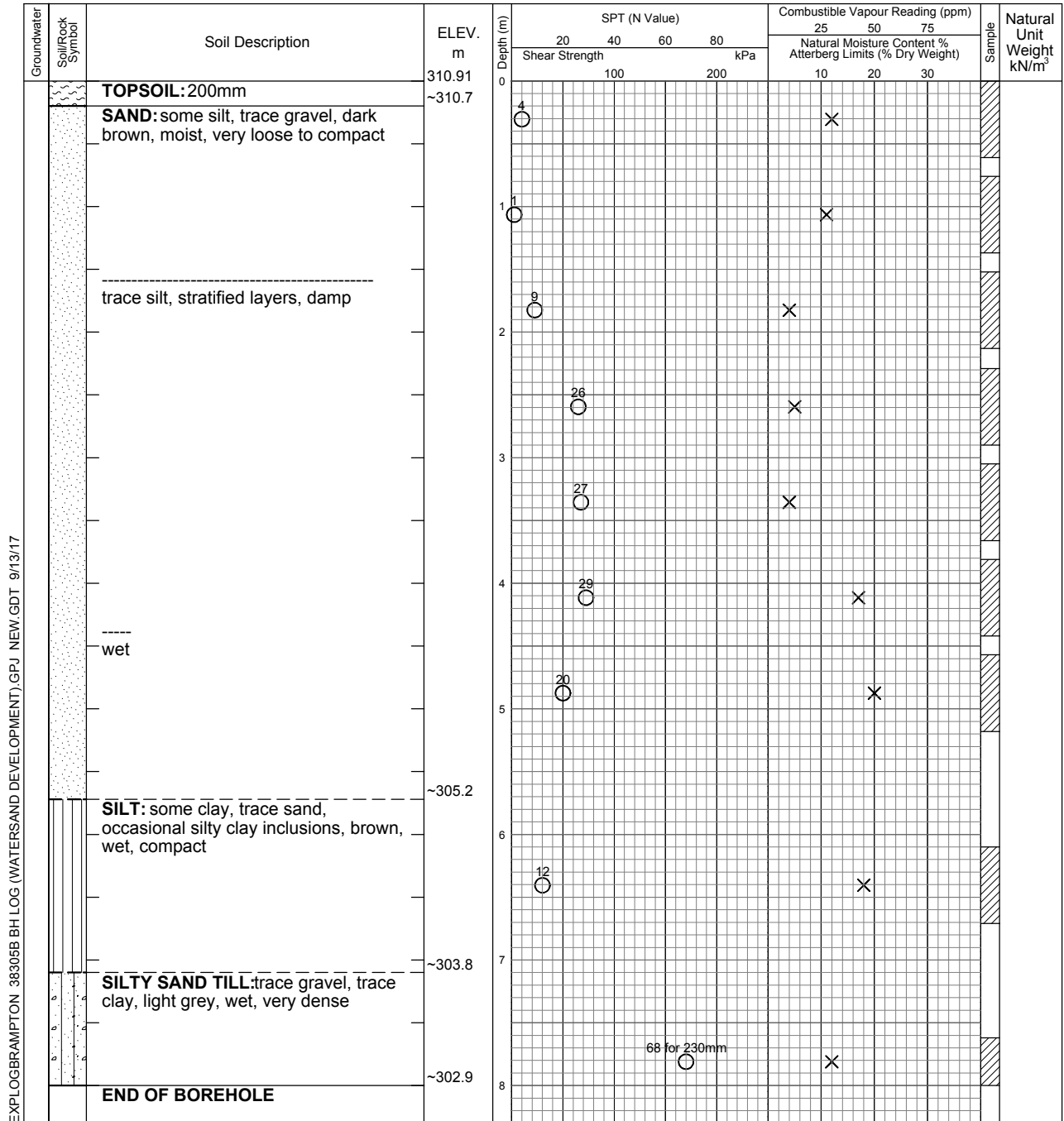
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Datum: Geodetic



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

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

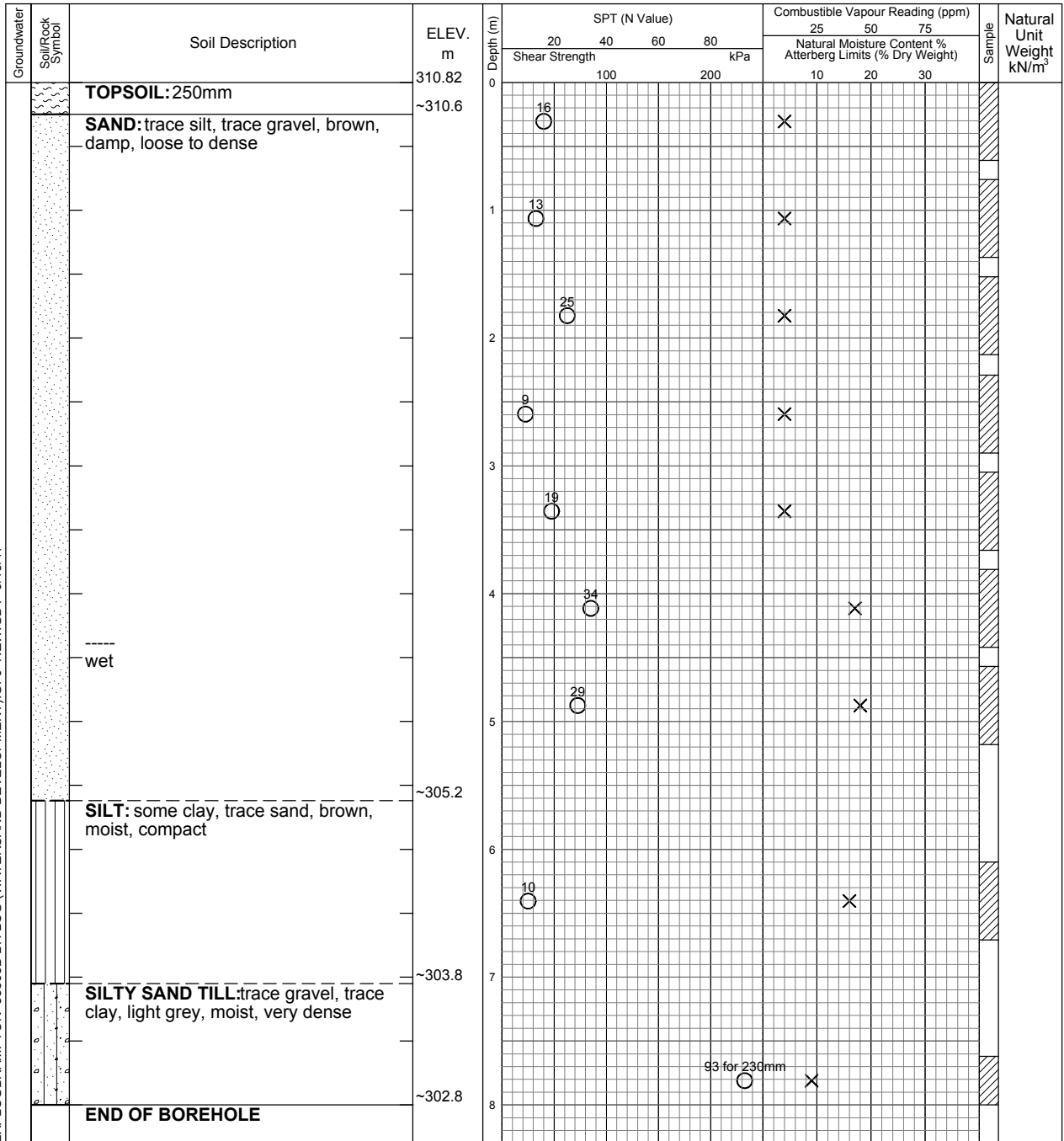


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



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

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

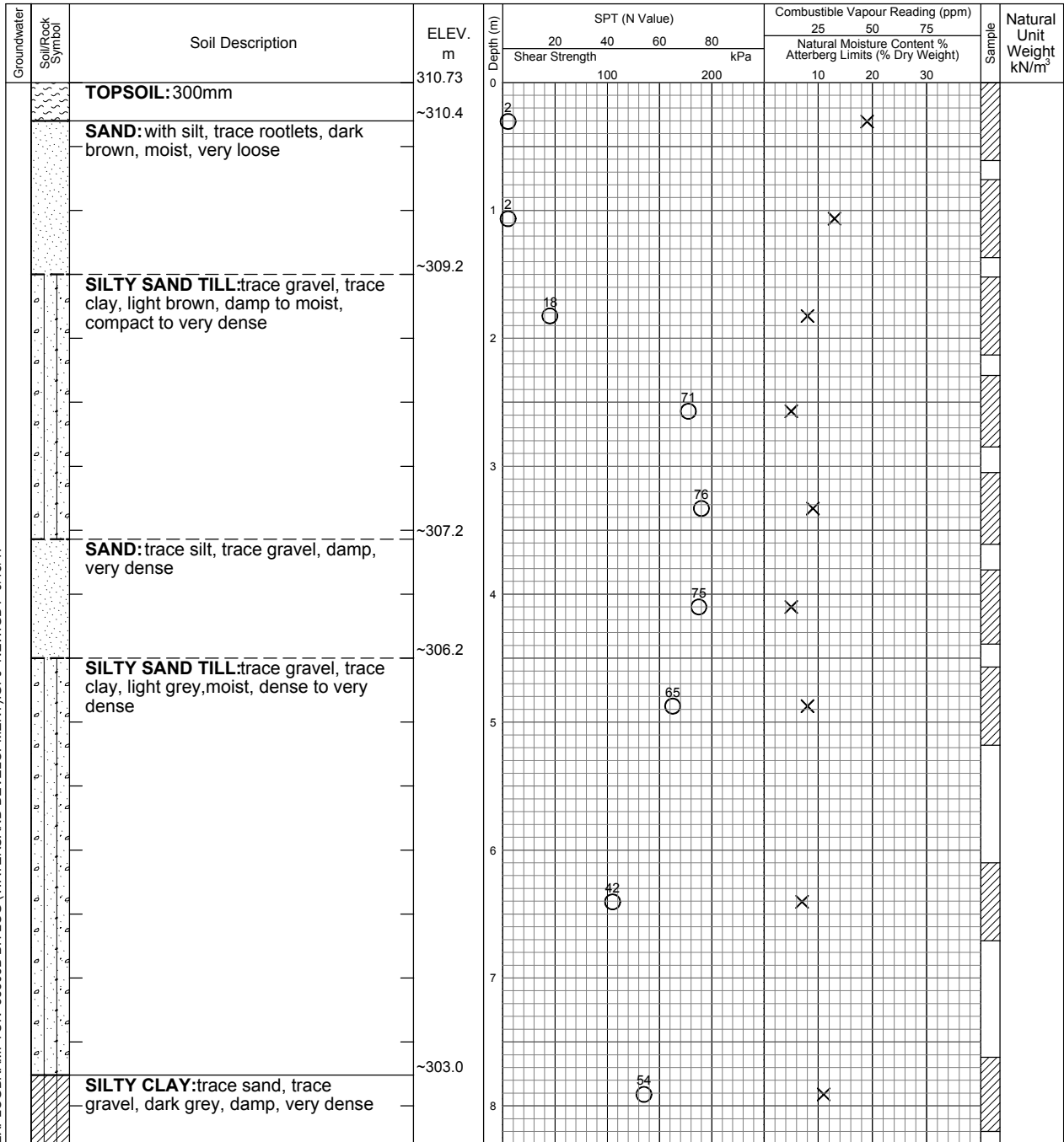


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.38	8.84



Log of Borehole 91

Project No. BRM-00038305-B0

Drawing No. 100

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.38	8.84



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

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

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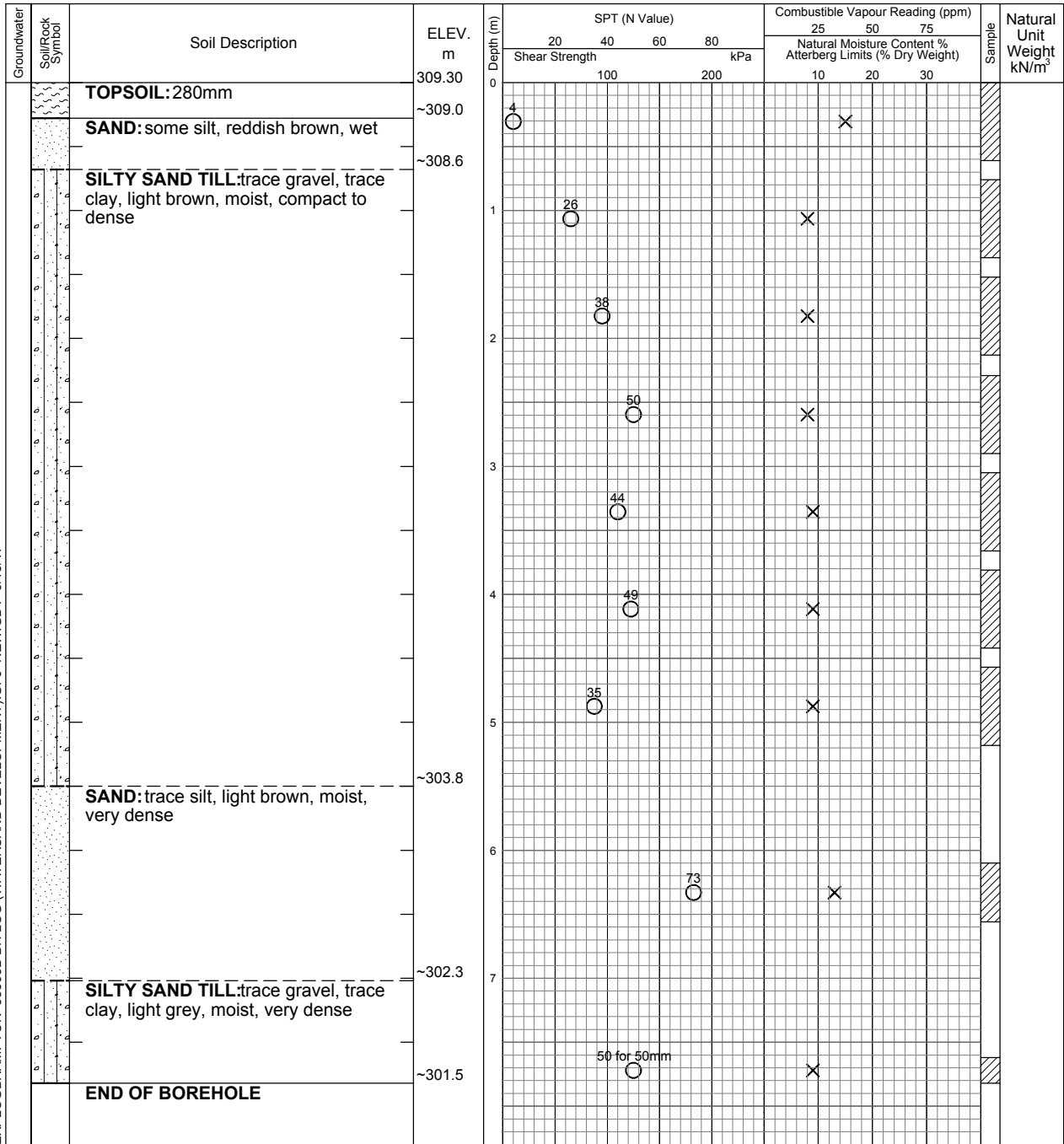
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	7.01	7.32



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

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

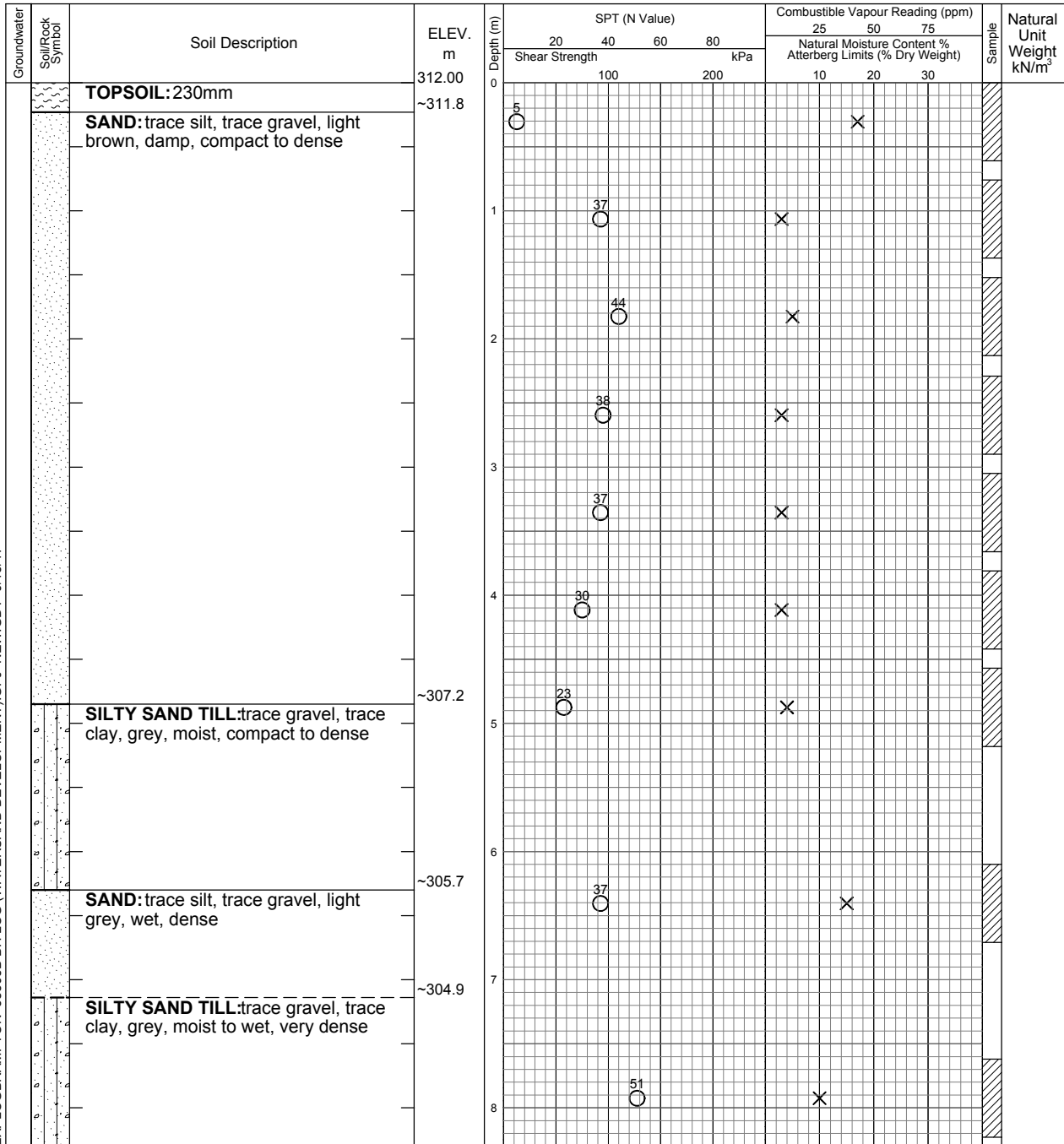


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.08	8.08



Log of Borehole 94

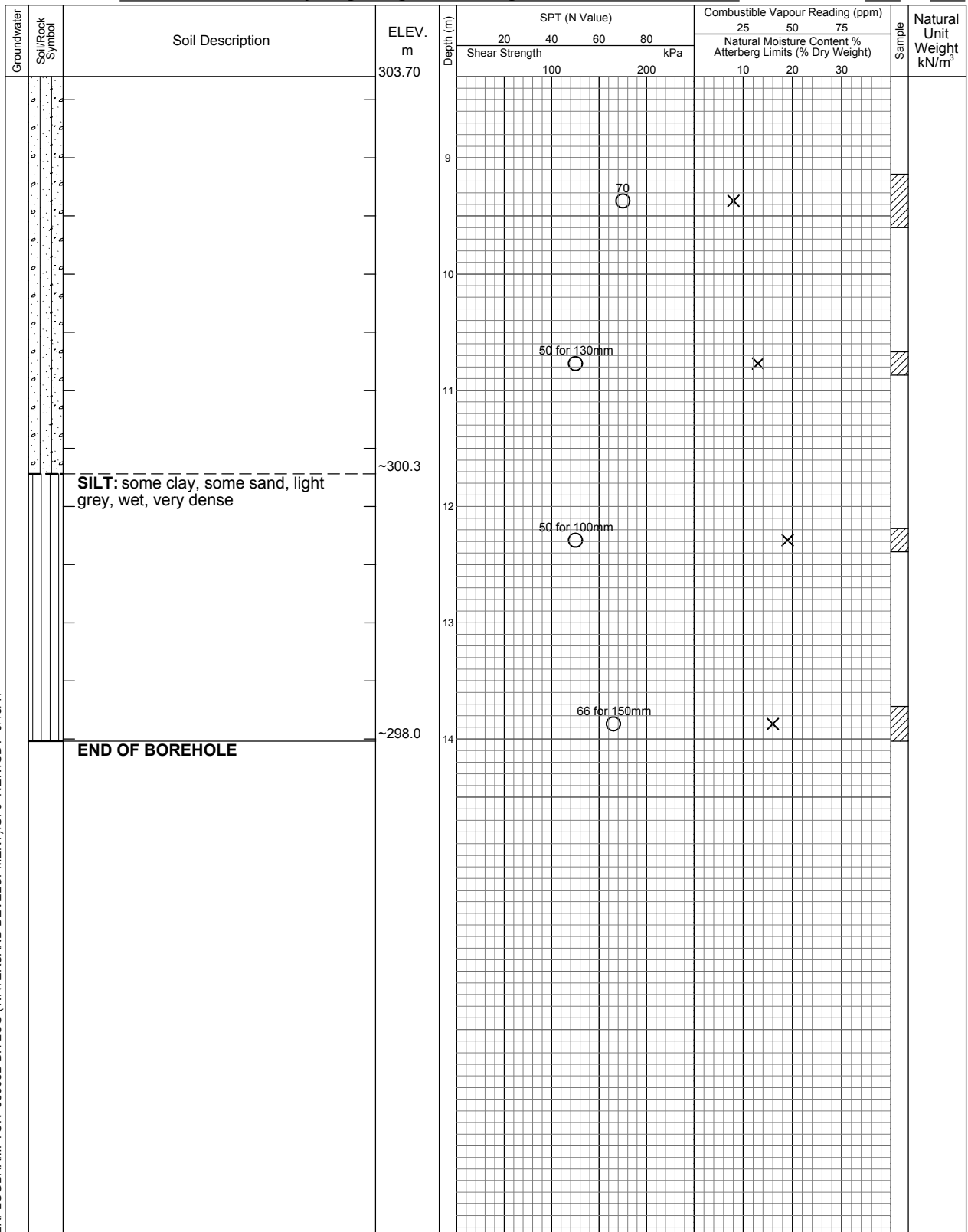
Project No. BRM-00038305-B0

Drawing No. 102

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	8.08	8.08

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

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

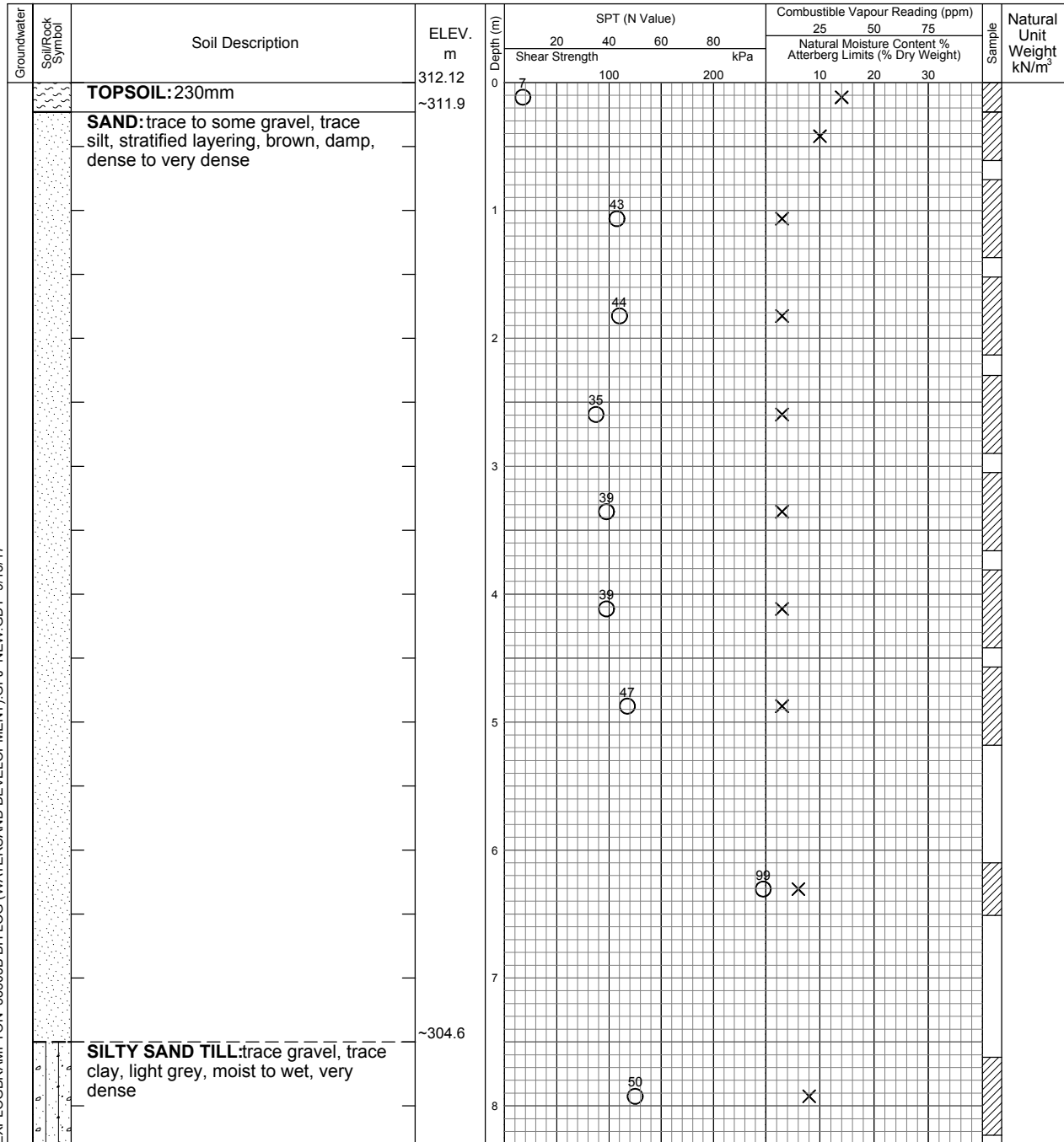


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	10.97	11.43



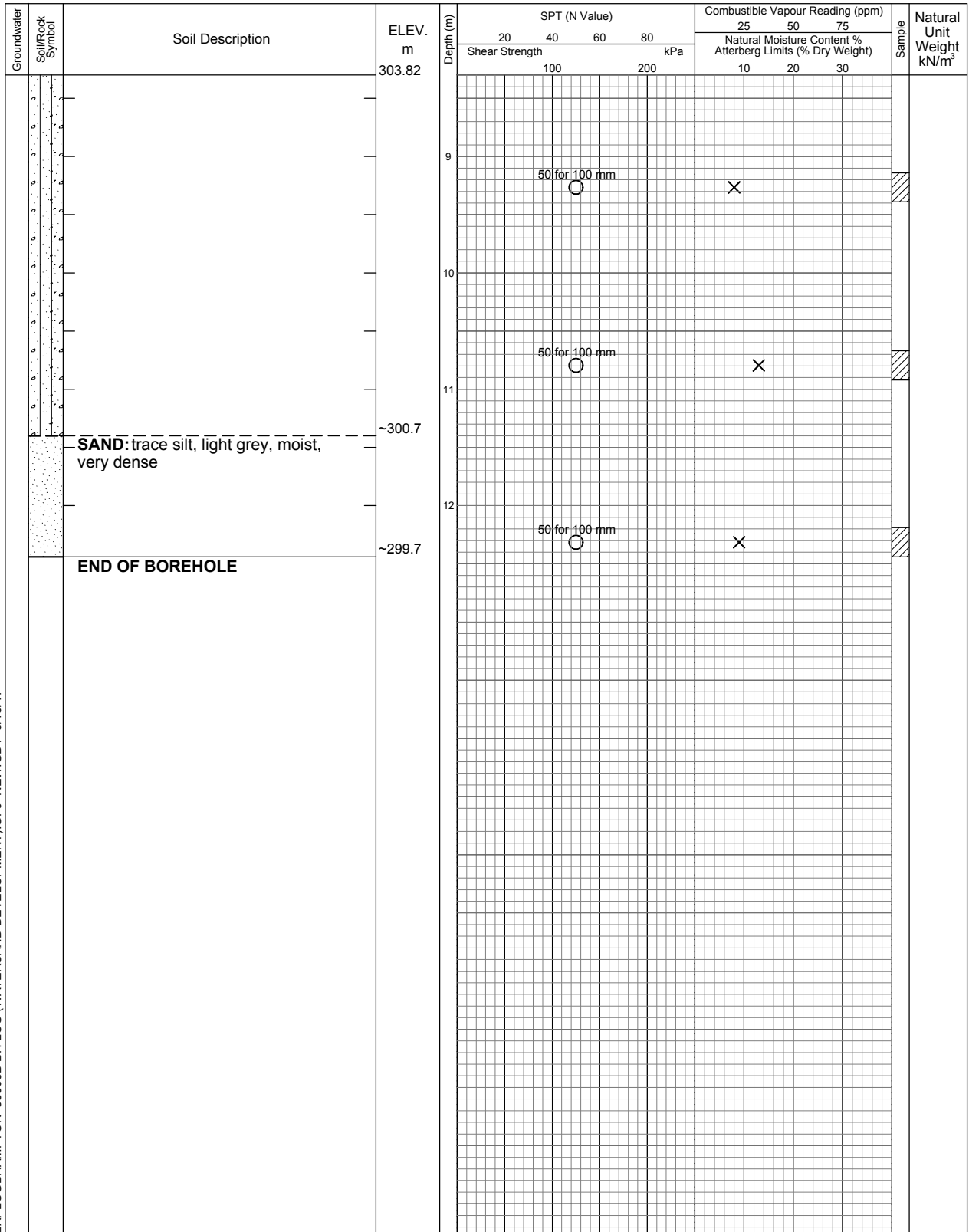
Log of Borehole 95

Project No. BRM-00038305-B0

Drawing No. 103

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	10.97	11.43

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

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

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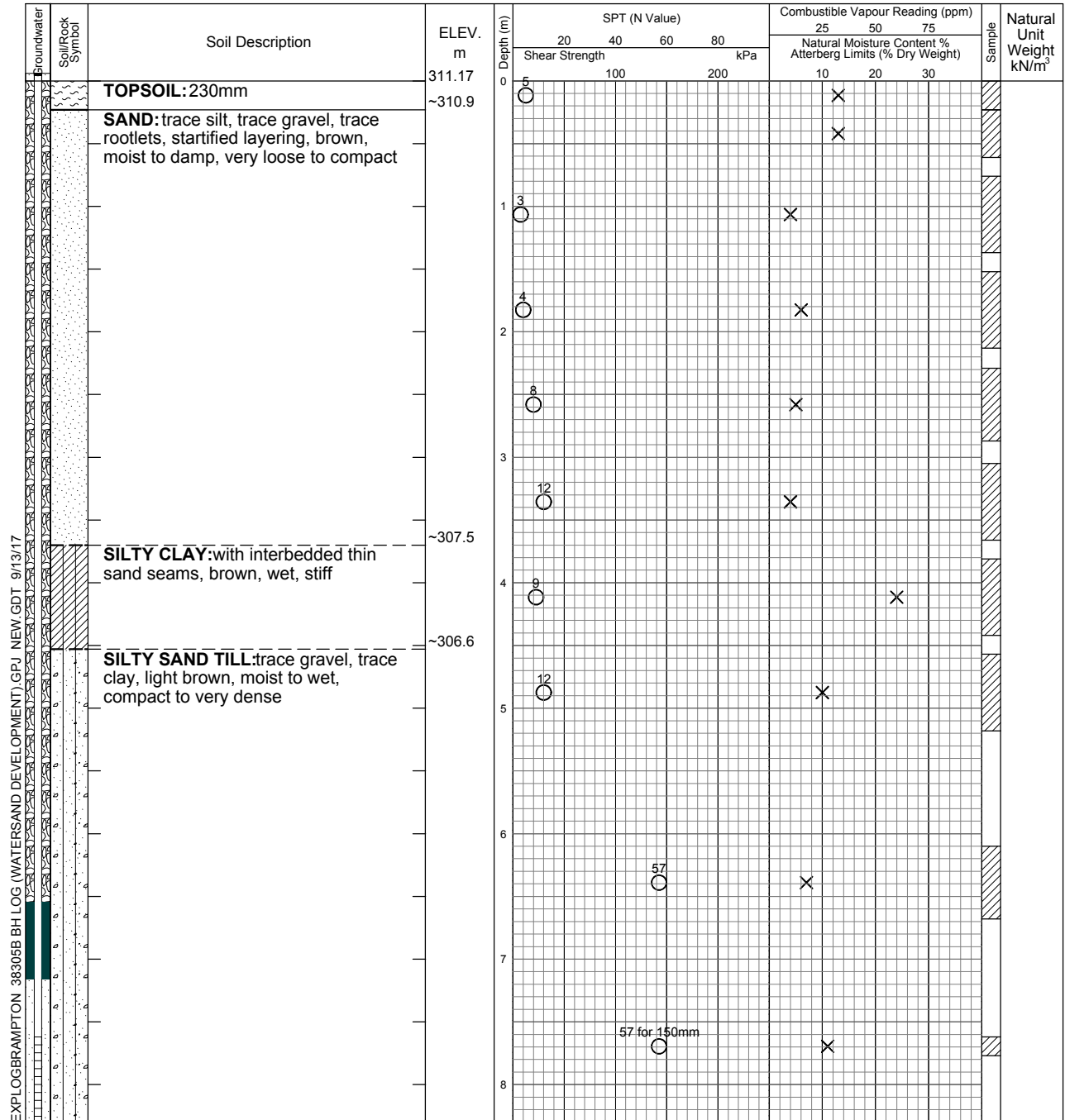
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
August 2, 2017	Dry	-
August 10, 2017	Dry	-

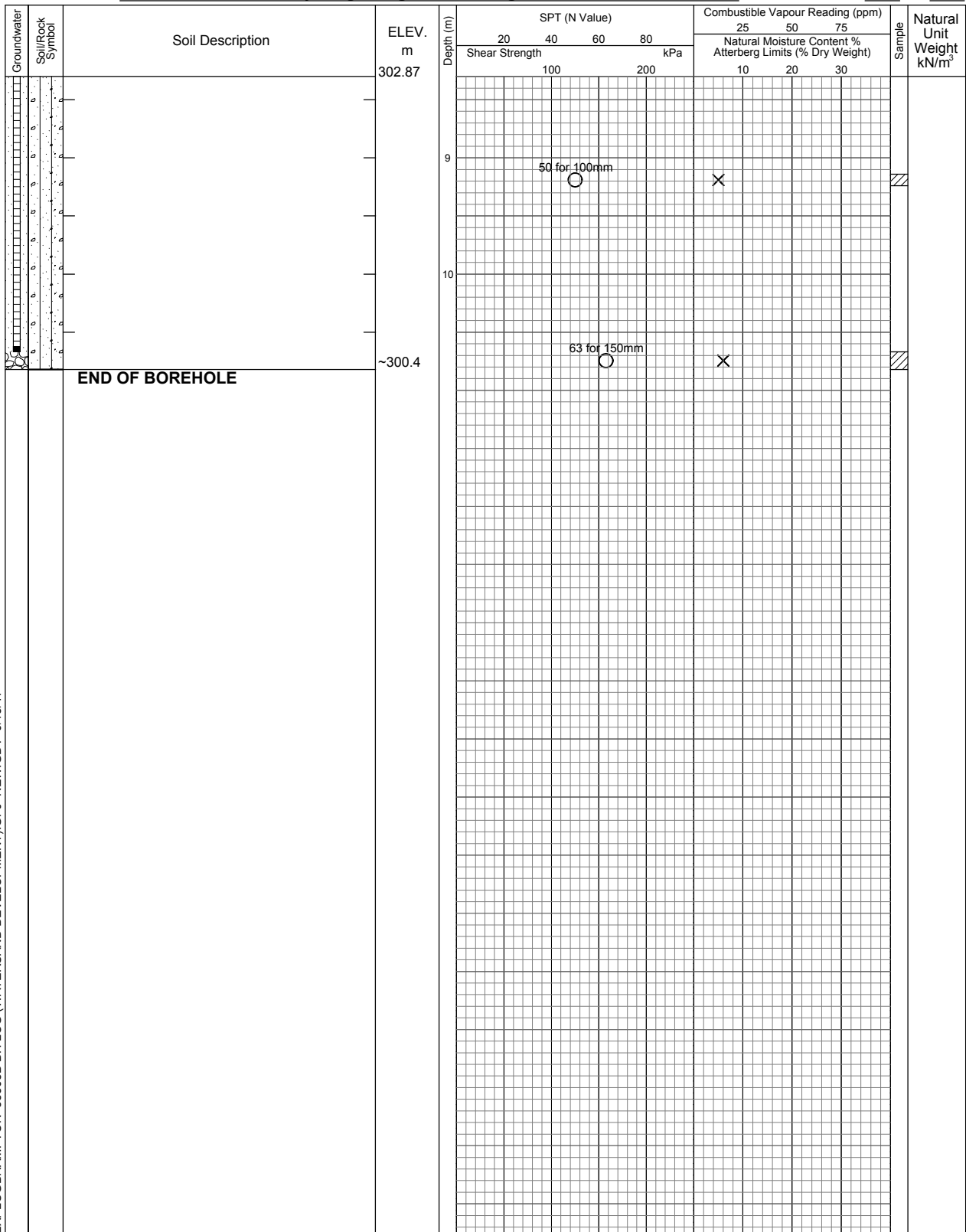
Log of Borehole 96

Project No. BRM-00038305-B0

Drawing No. 104

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
August 2, 2017	Dry	-
August 10, 2017	Dry	-

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

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

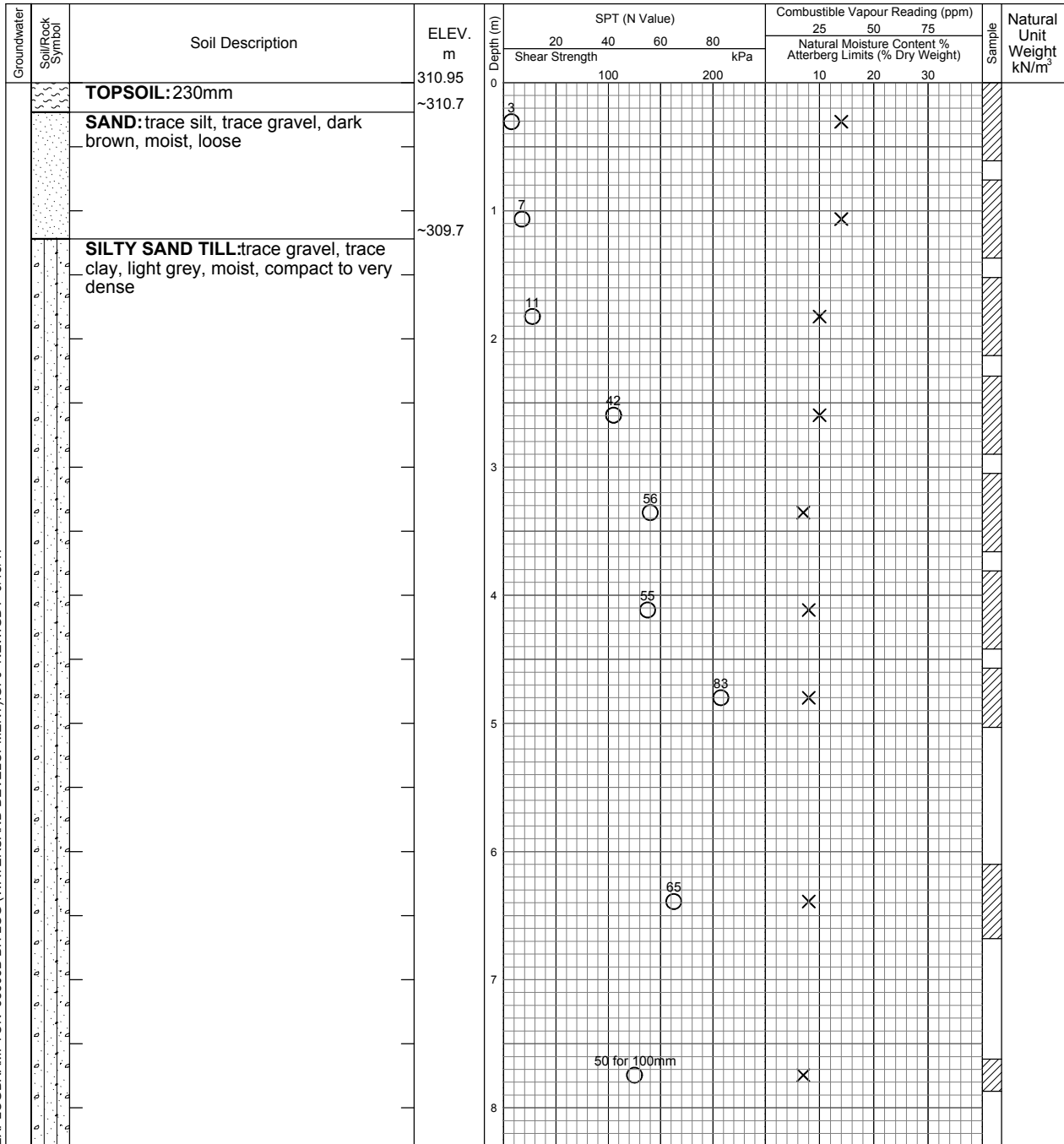


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
			302.65		Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
					100		200		10	20	30		
				9									
			~301.5										
		END OF BOREHOLE											

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	8.99

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

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

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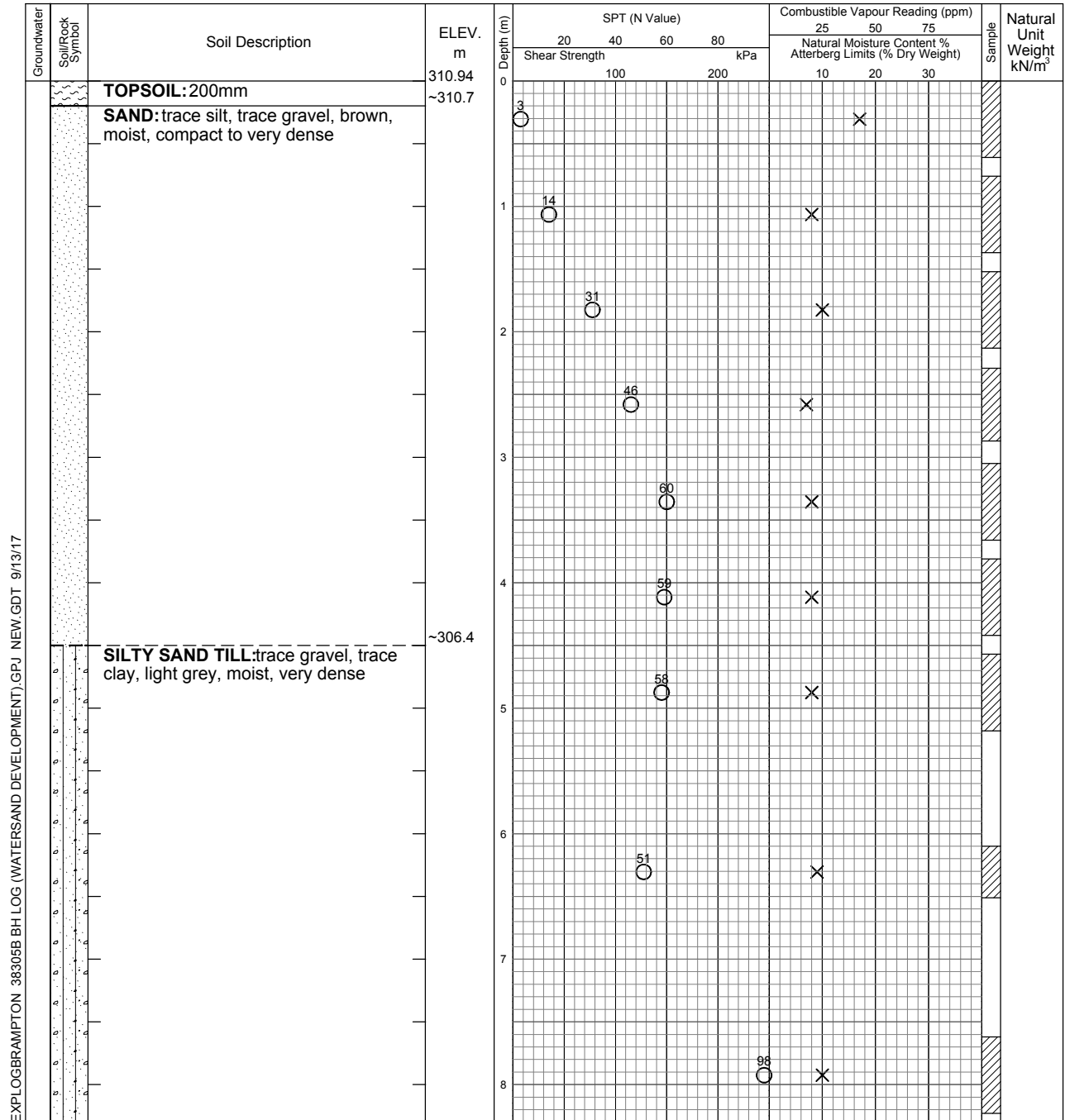
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.86



Log of Borehole 98

Project No. BRM-00038305-B0

Drawing No. 106

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

[illegible]

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.86



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

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

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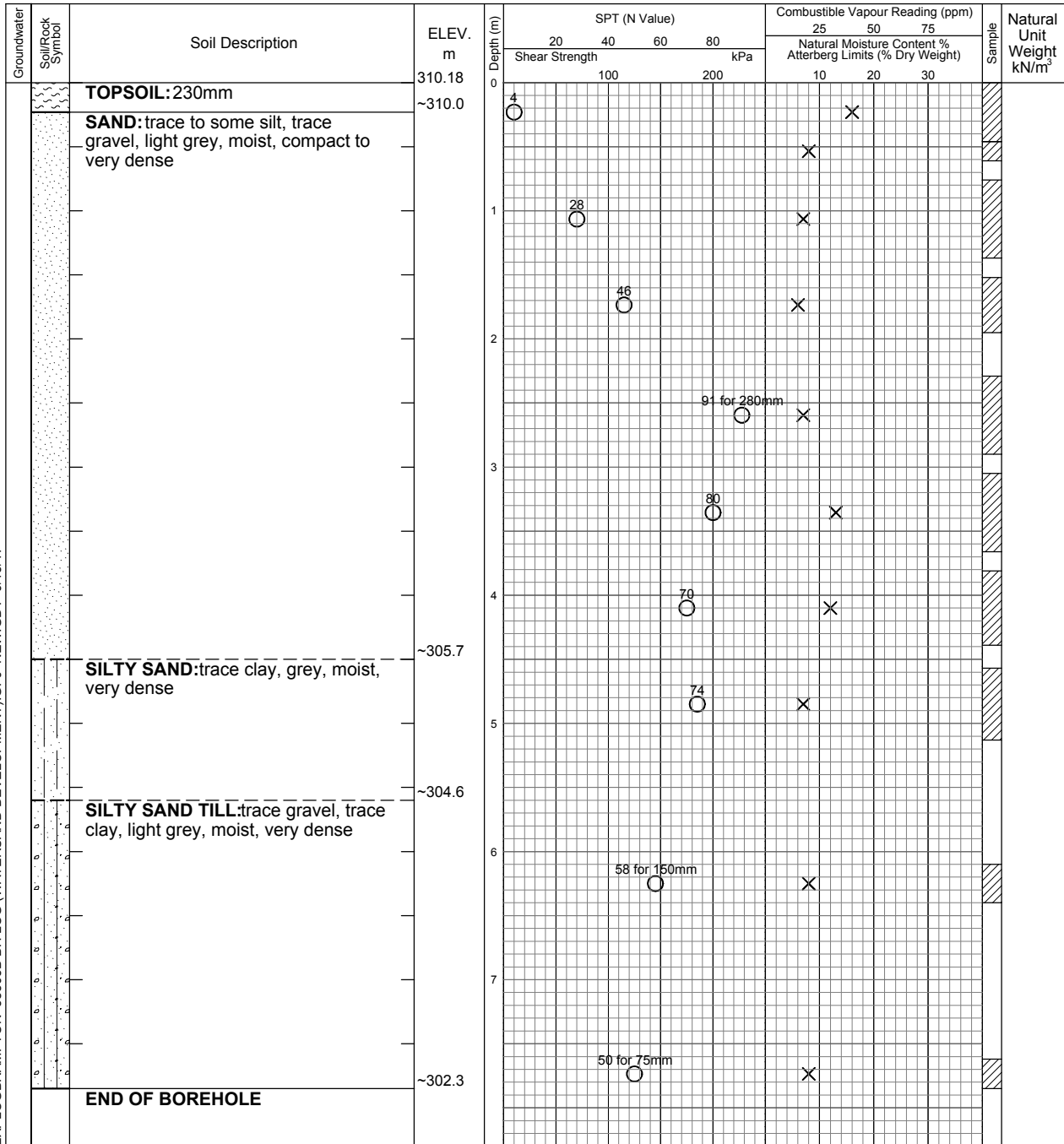
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Datum: Geodetic



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

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

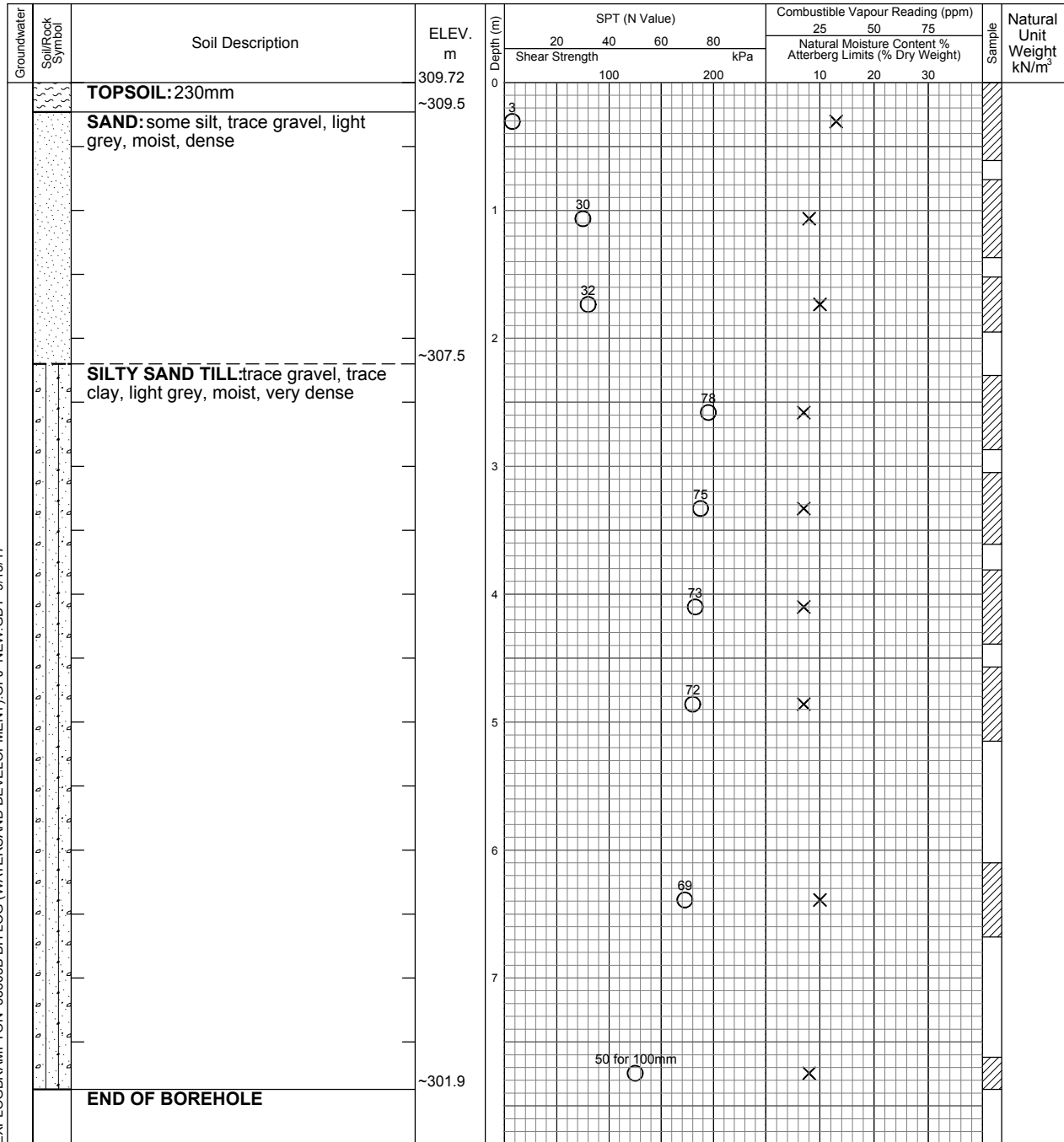


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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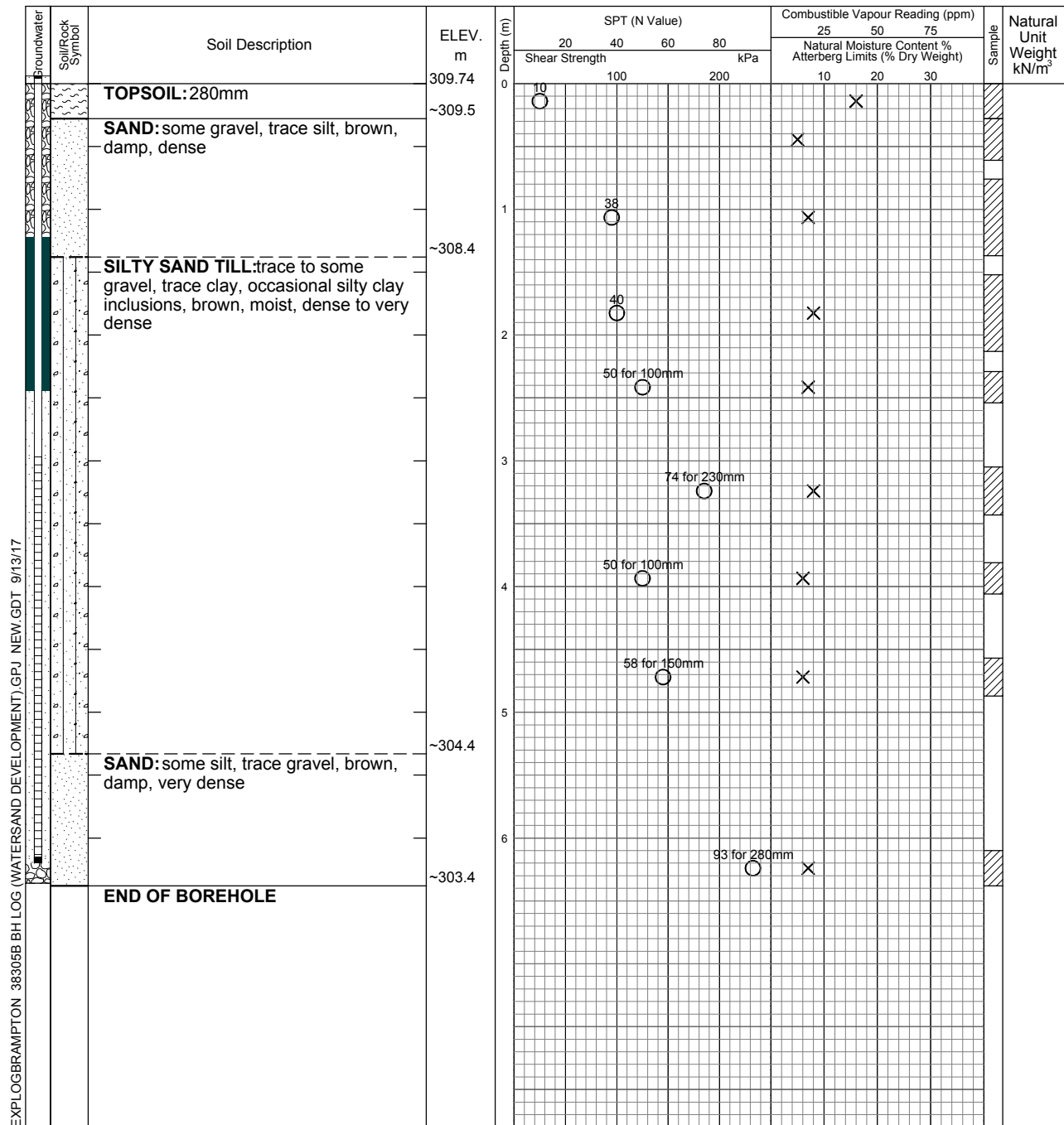
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.02
August 2, 2017	Dry	-
August 10, 2017	Dry	-

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

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

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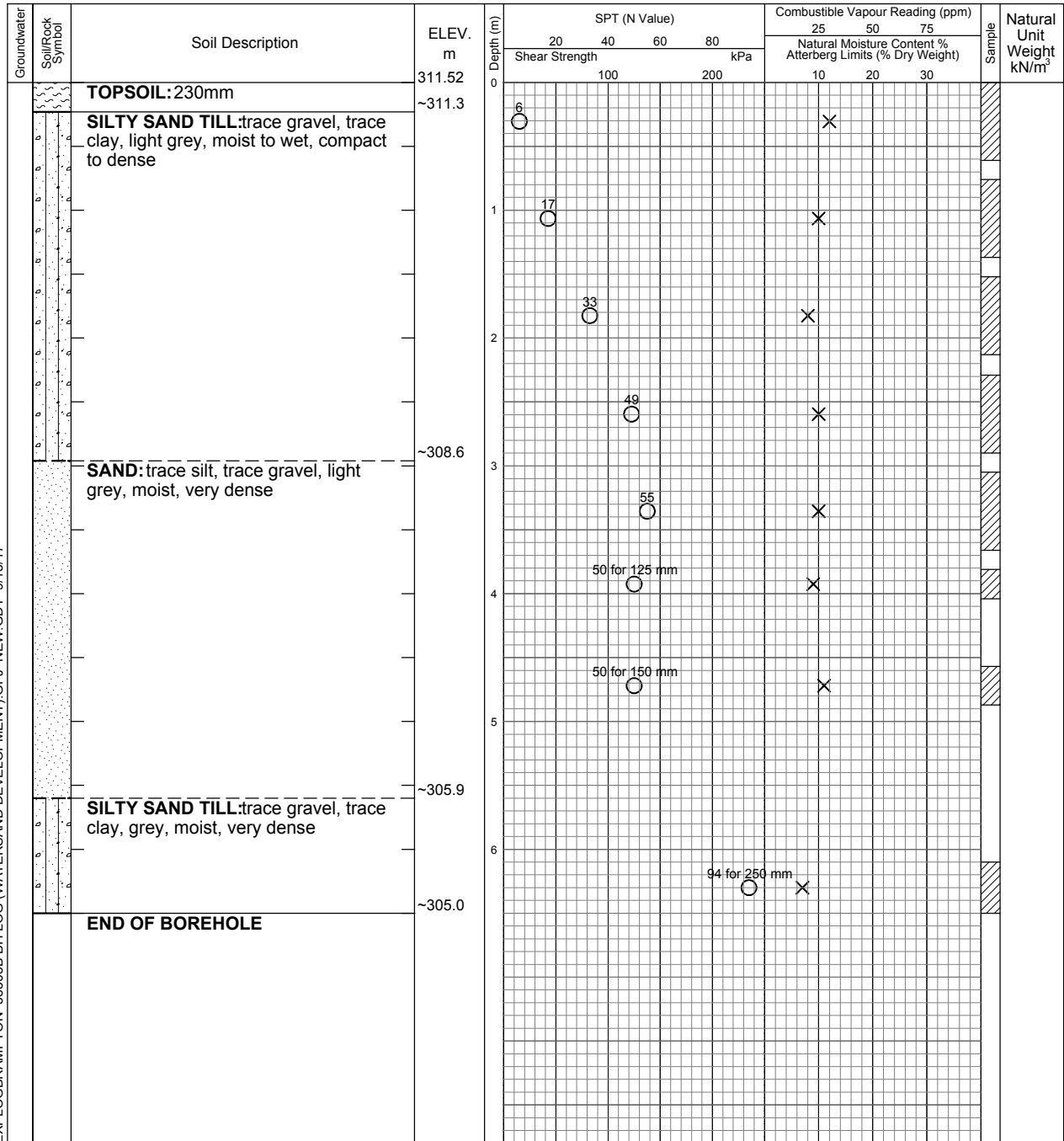
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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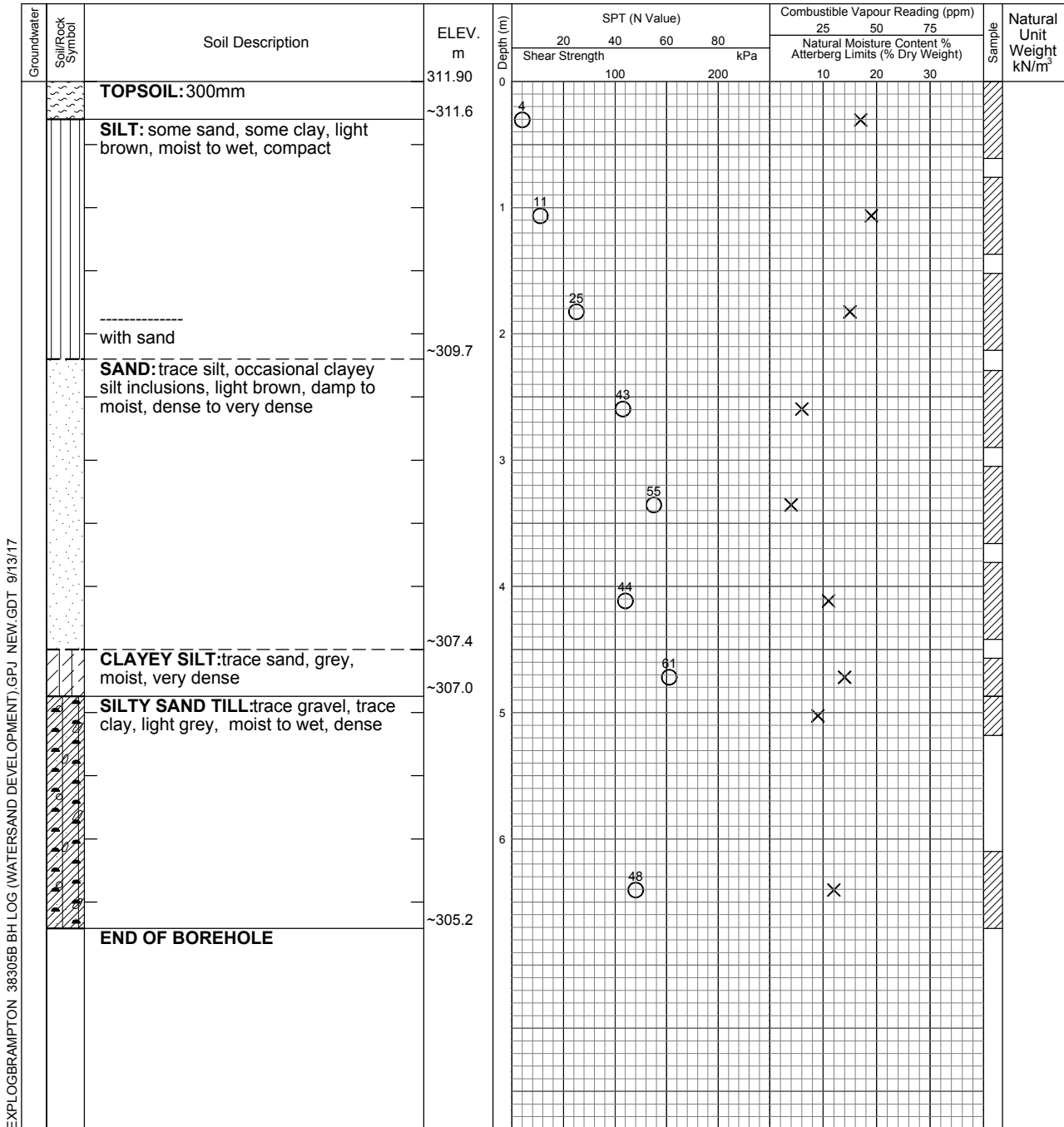
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

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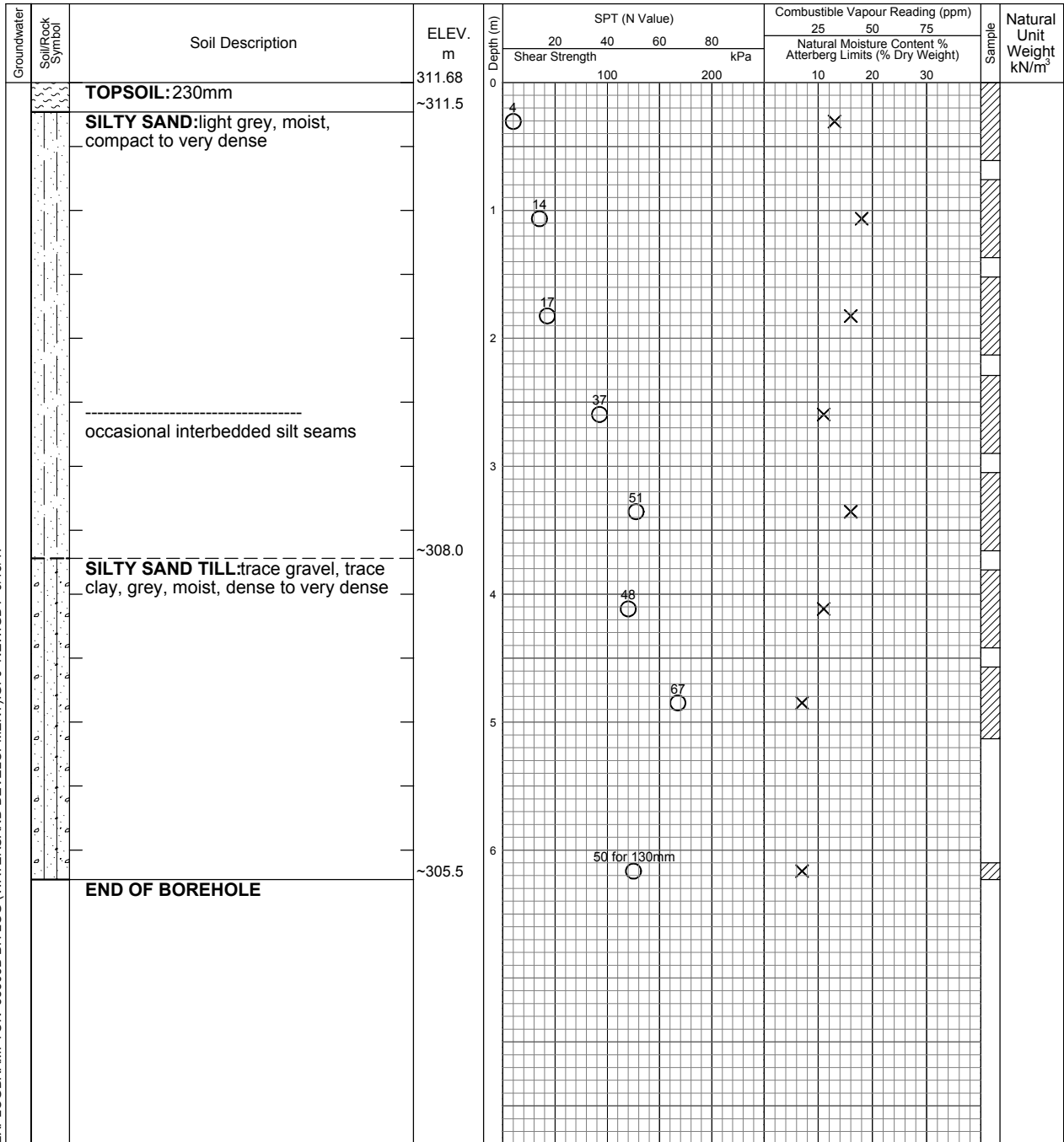
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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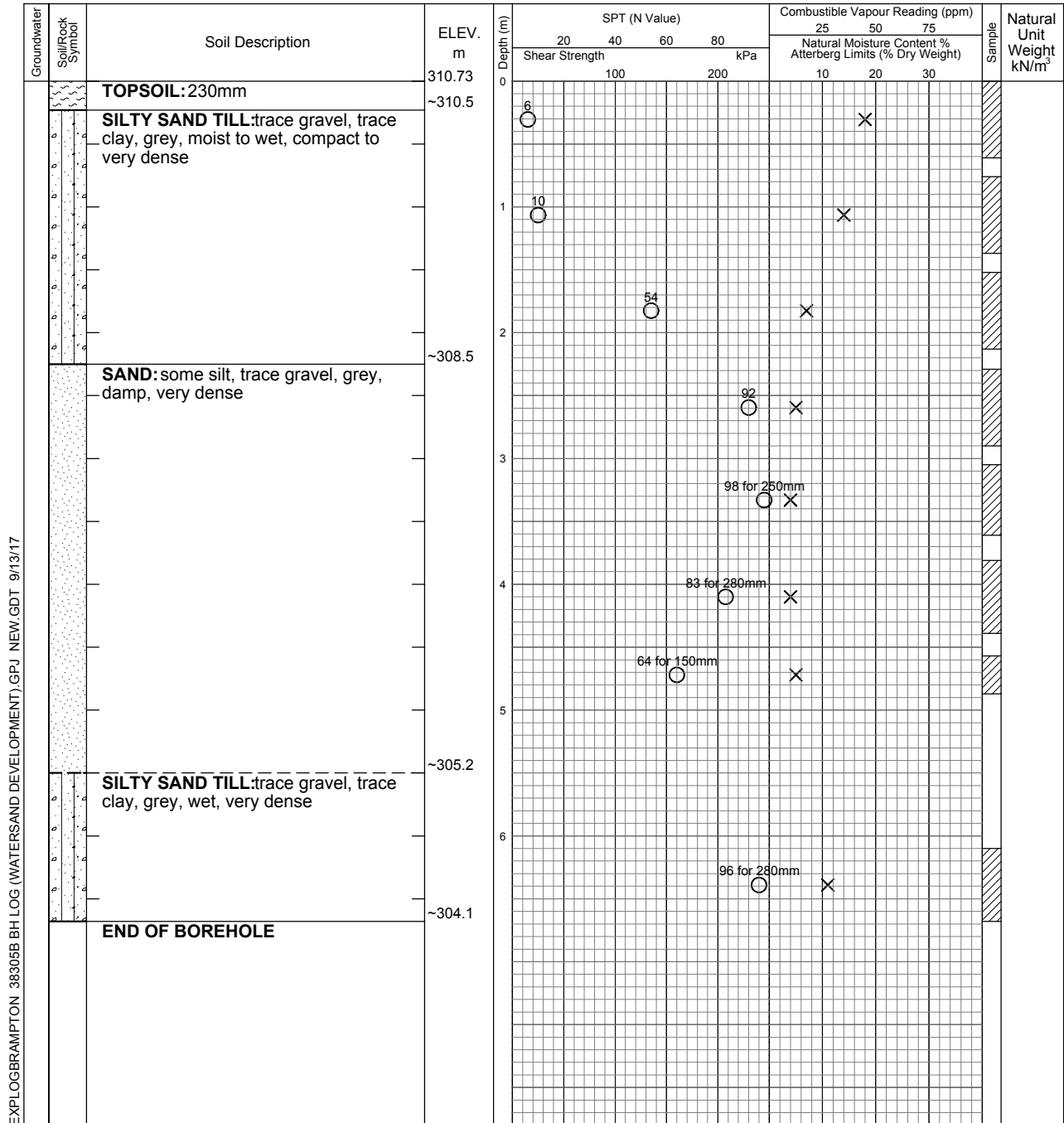
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	5.94

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

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

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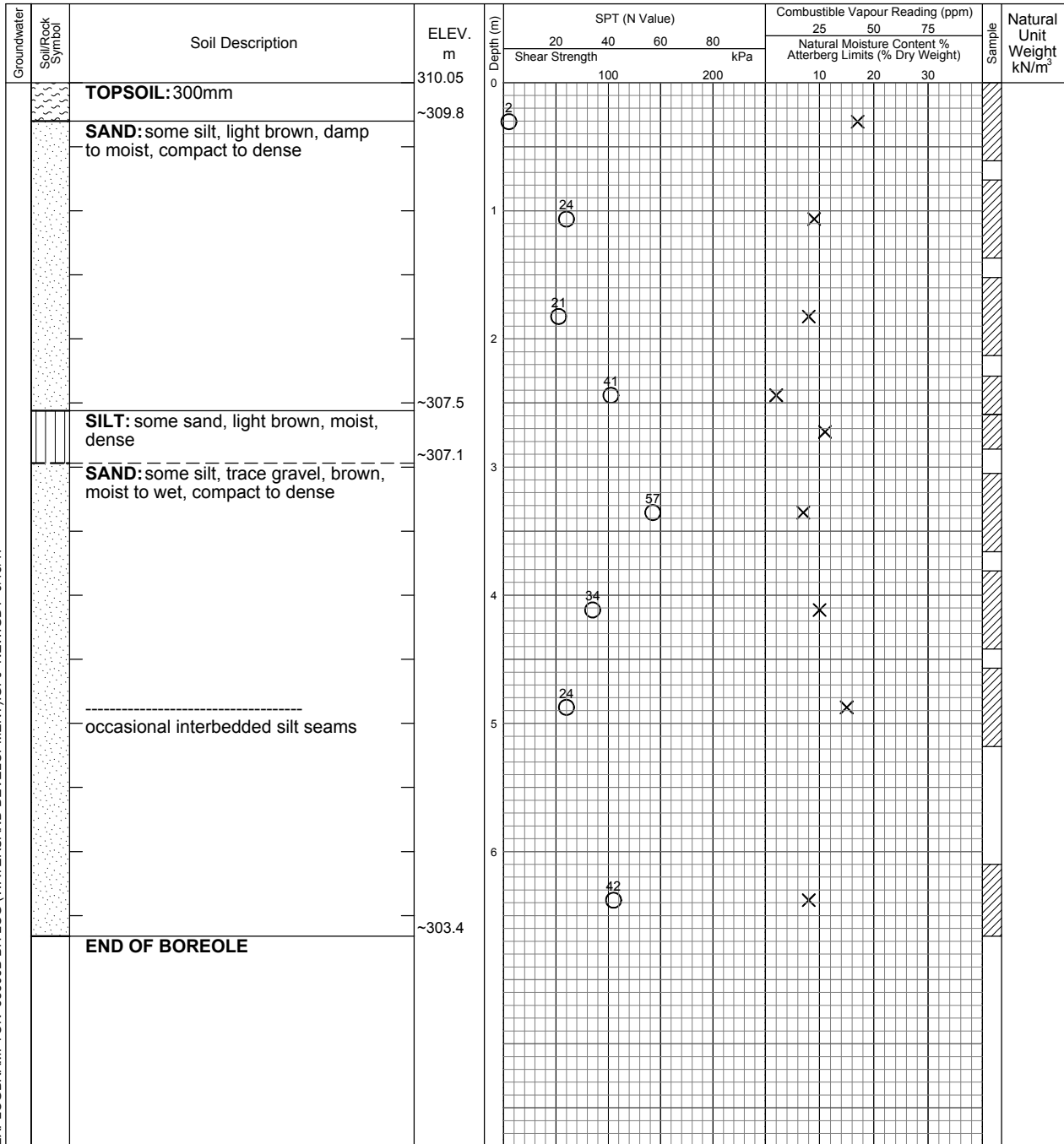
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	5.64	5.64

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

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

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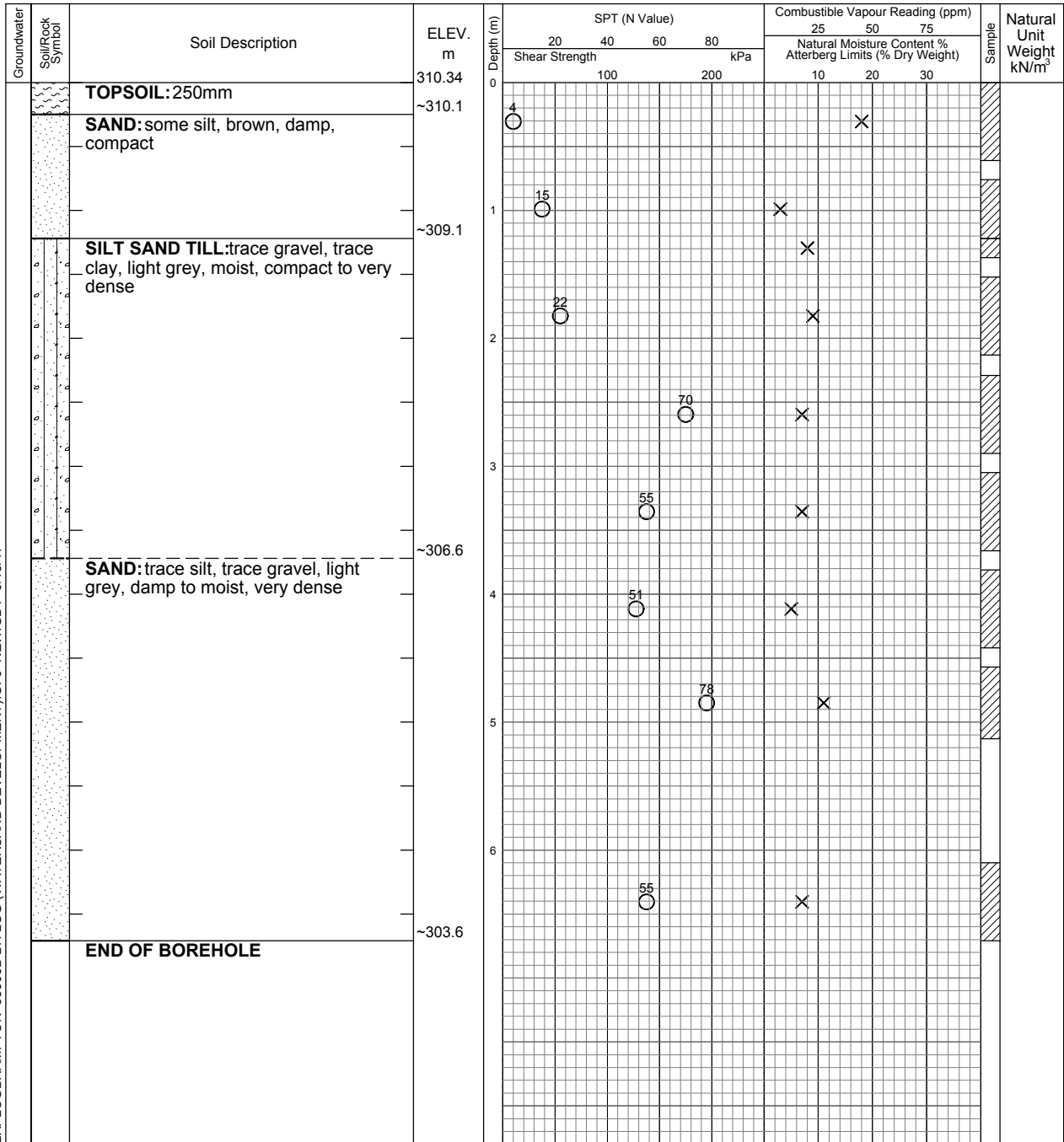
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

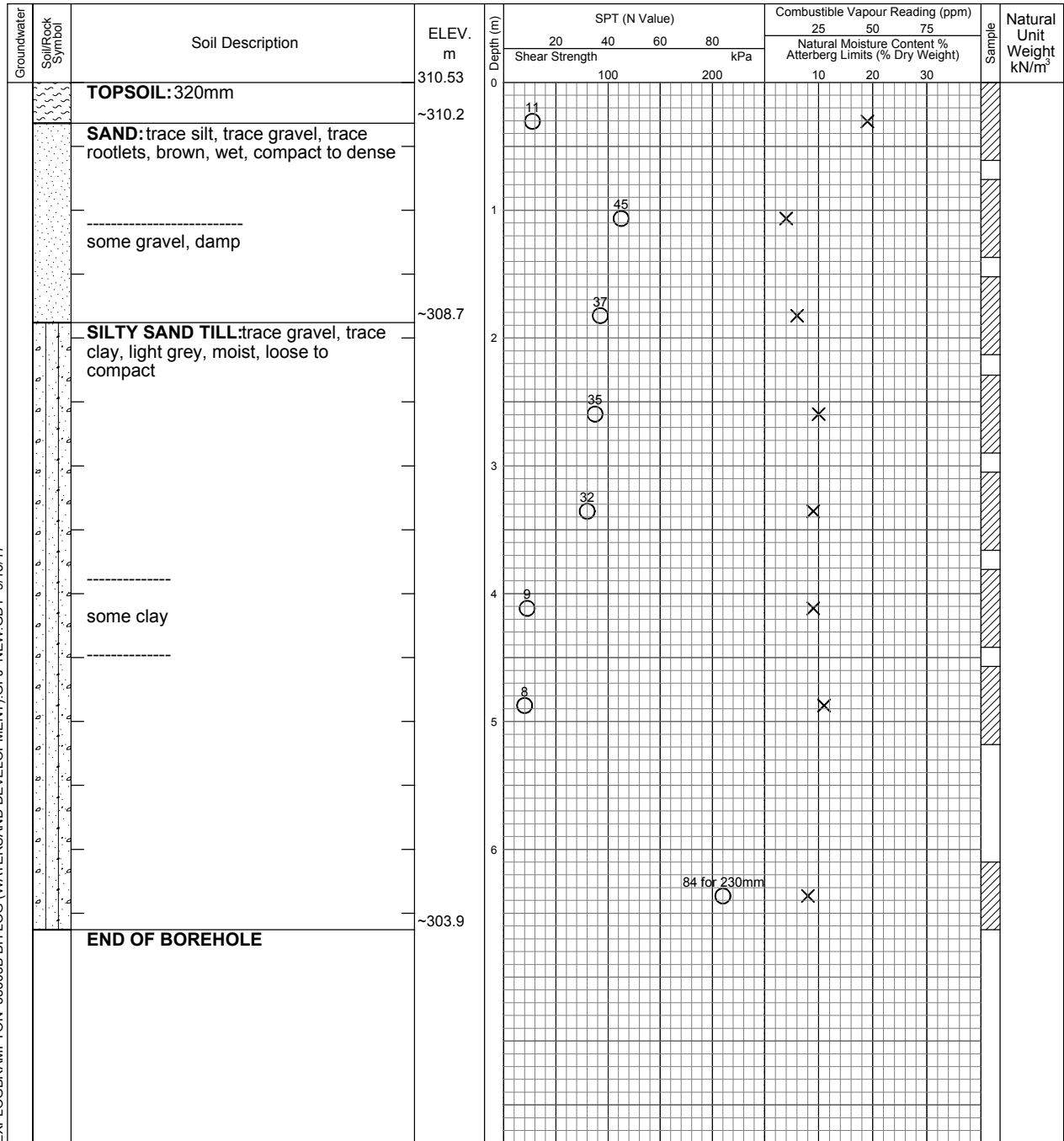


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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	5.64	6.10



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

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

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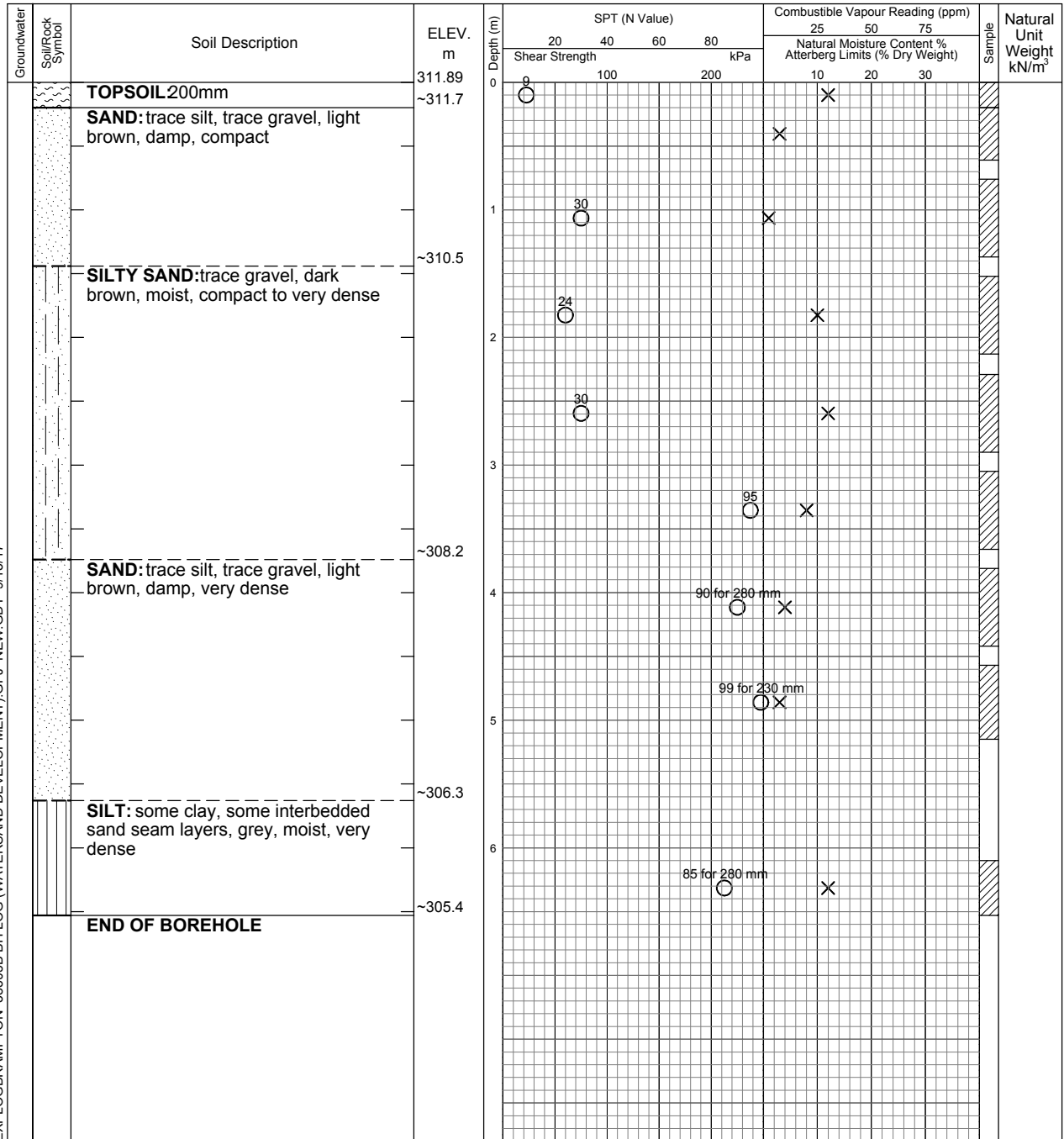
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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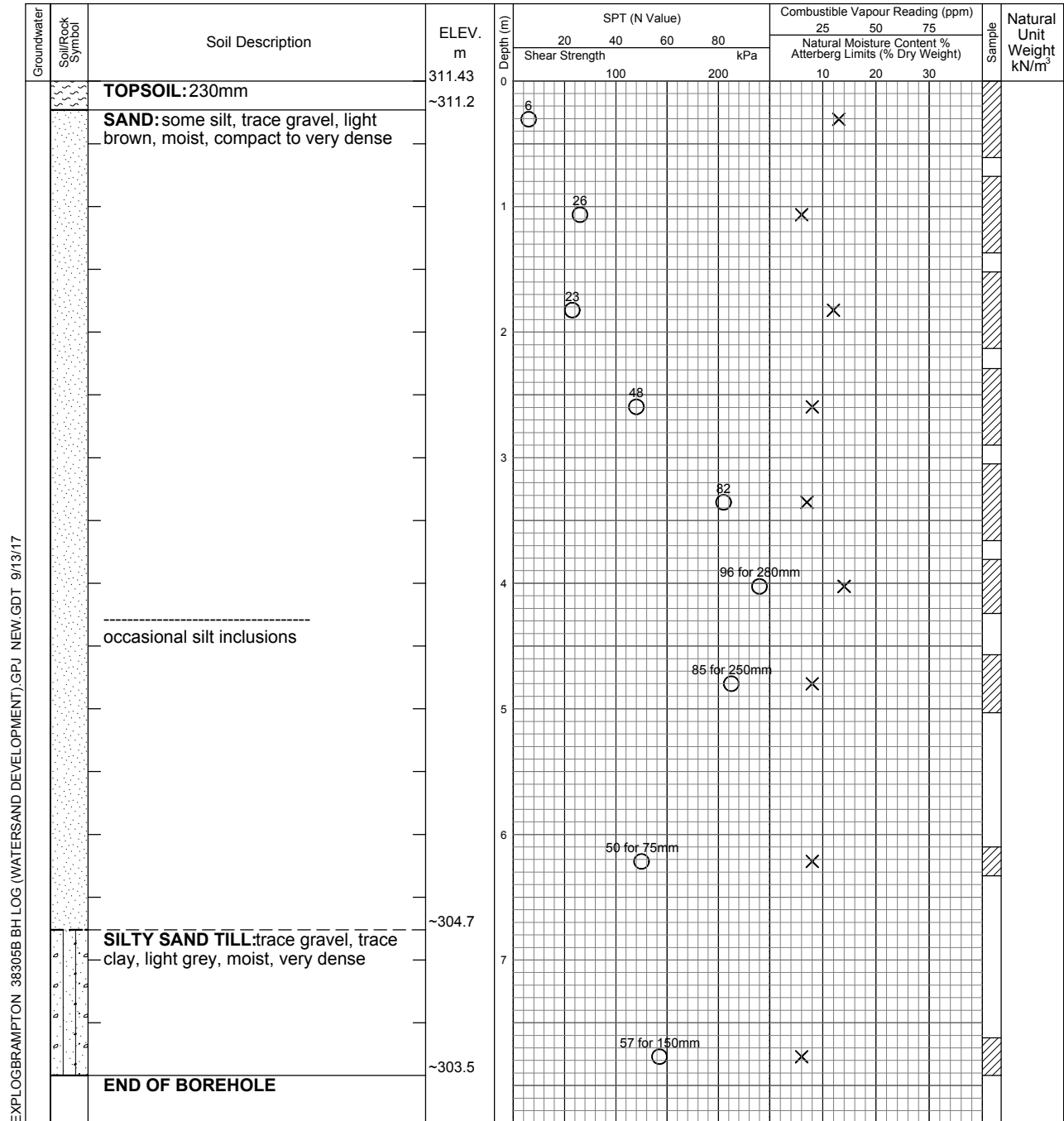
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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

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

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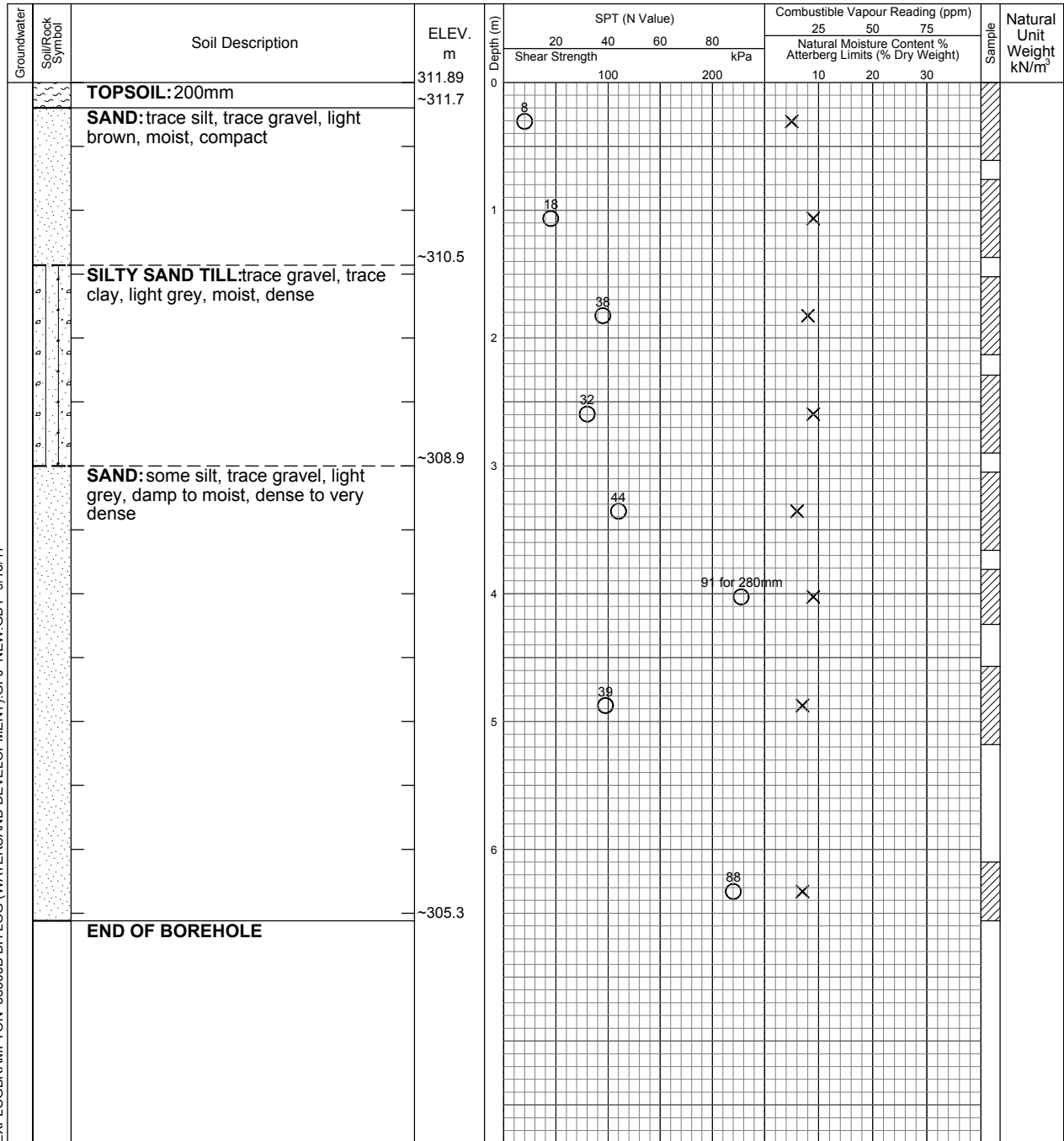
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

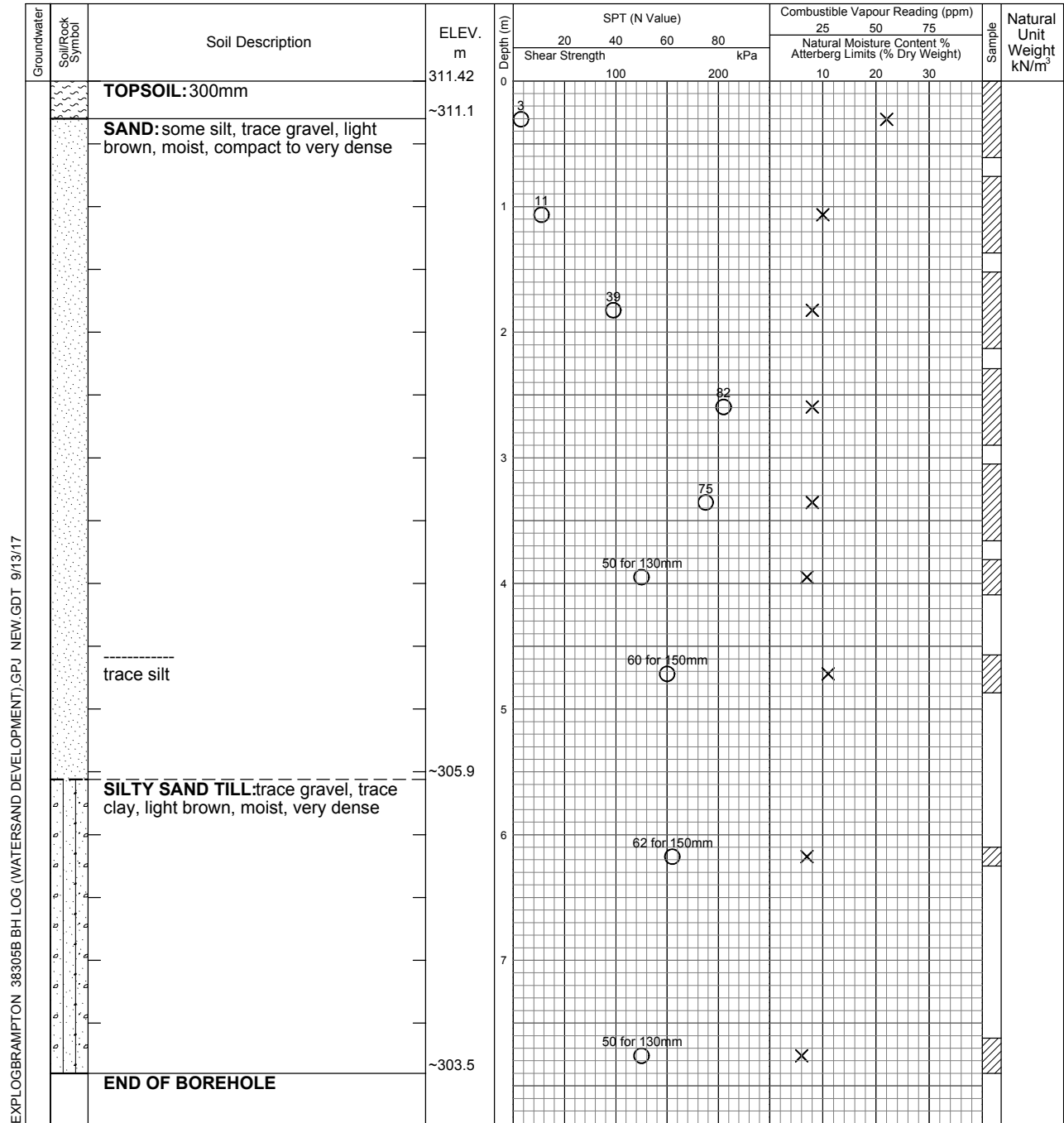
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.32



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

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

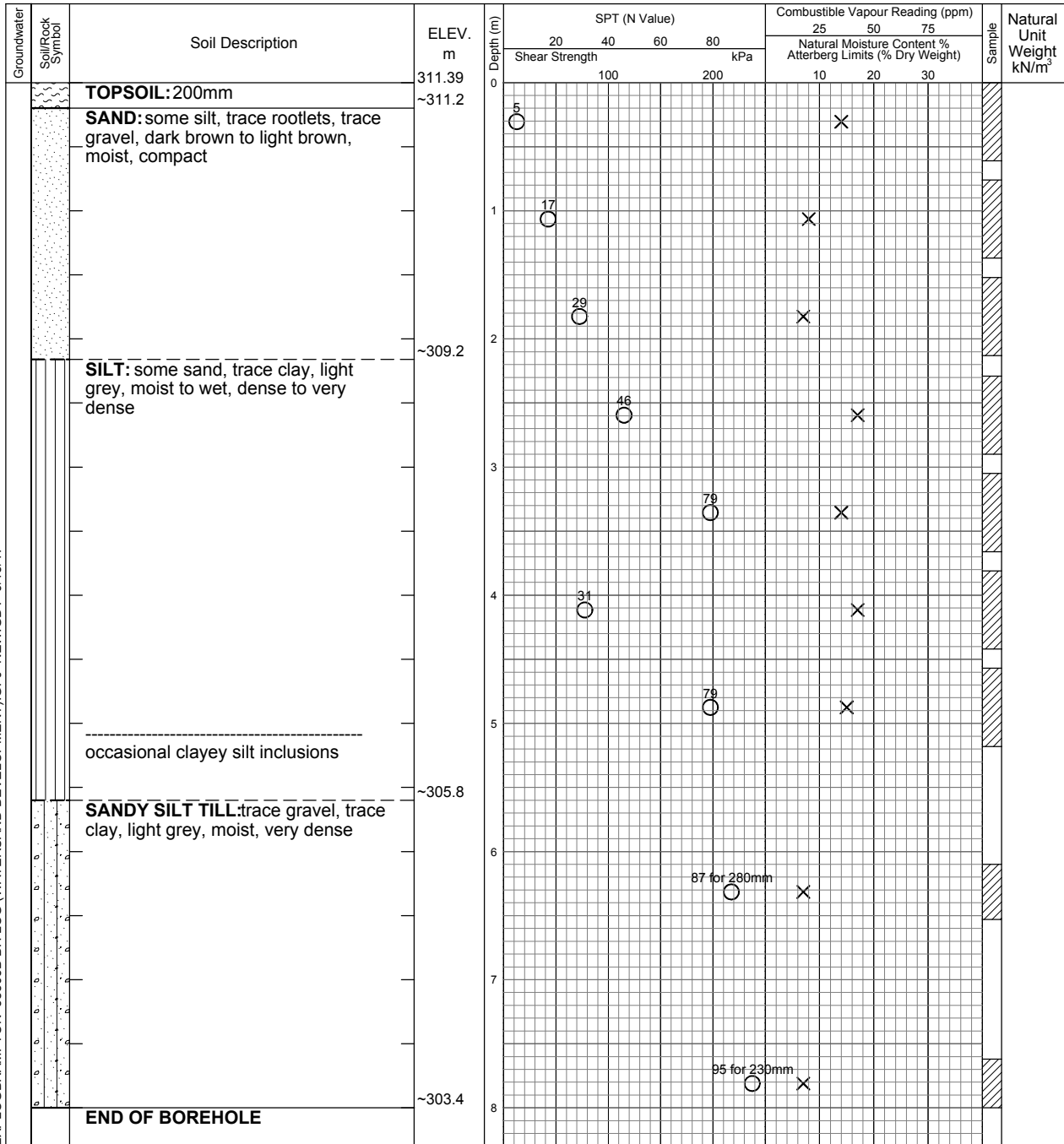


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.62



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

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

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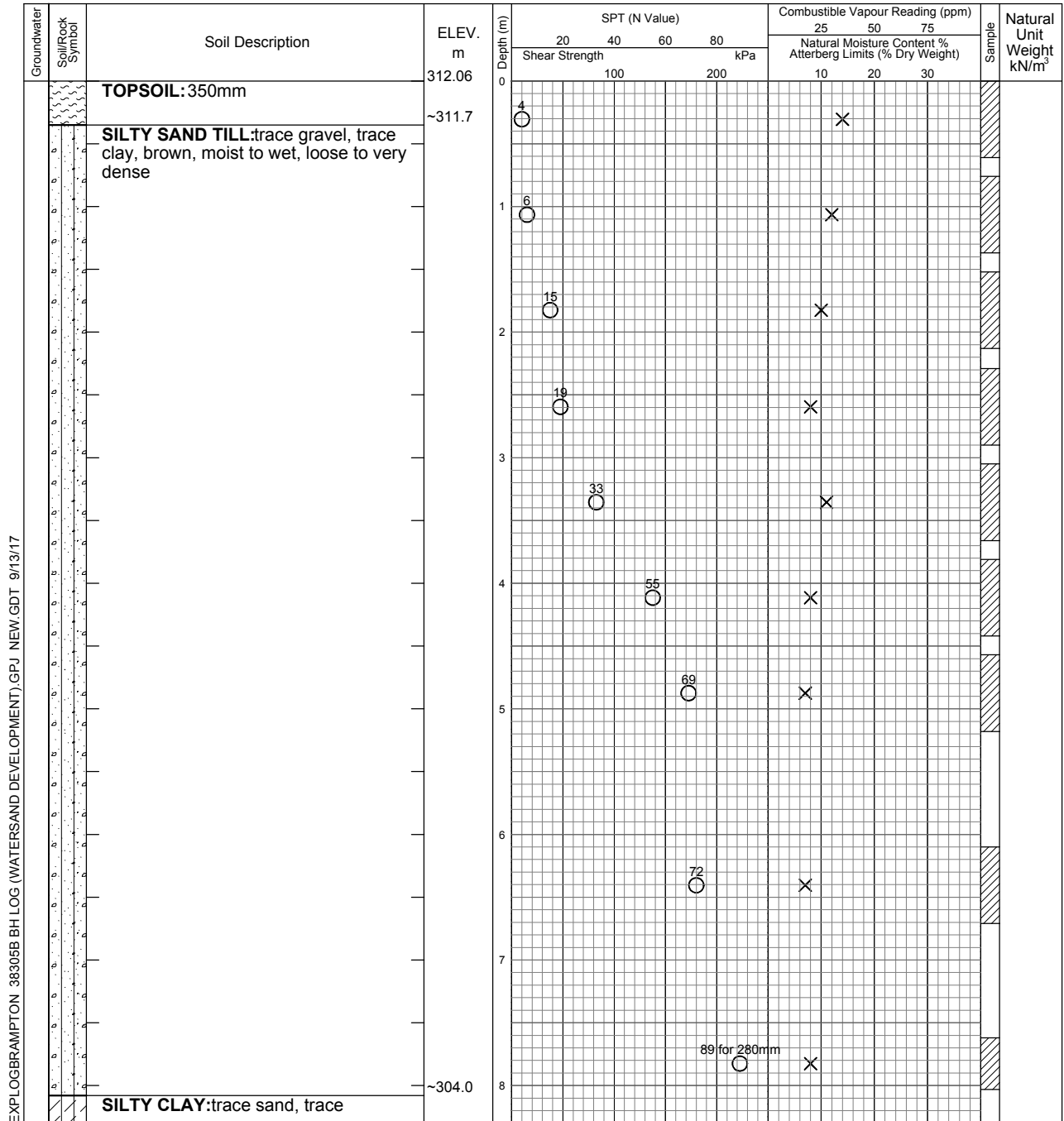
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	13.72



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17

Log of Borehole 118

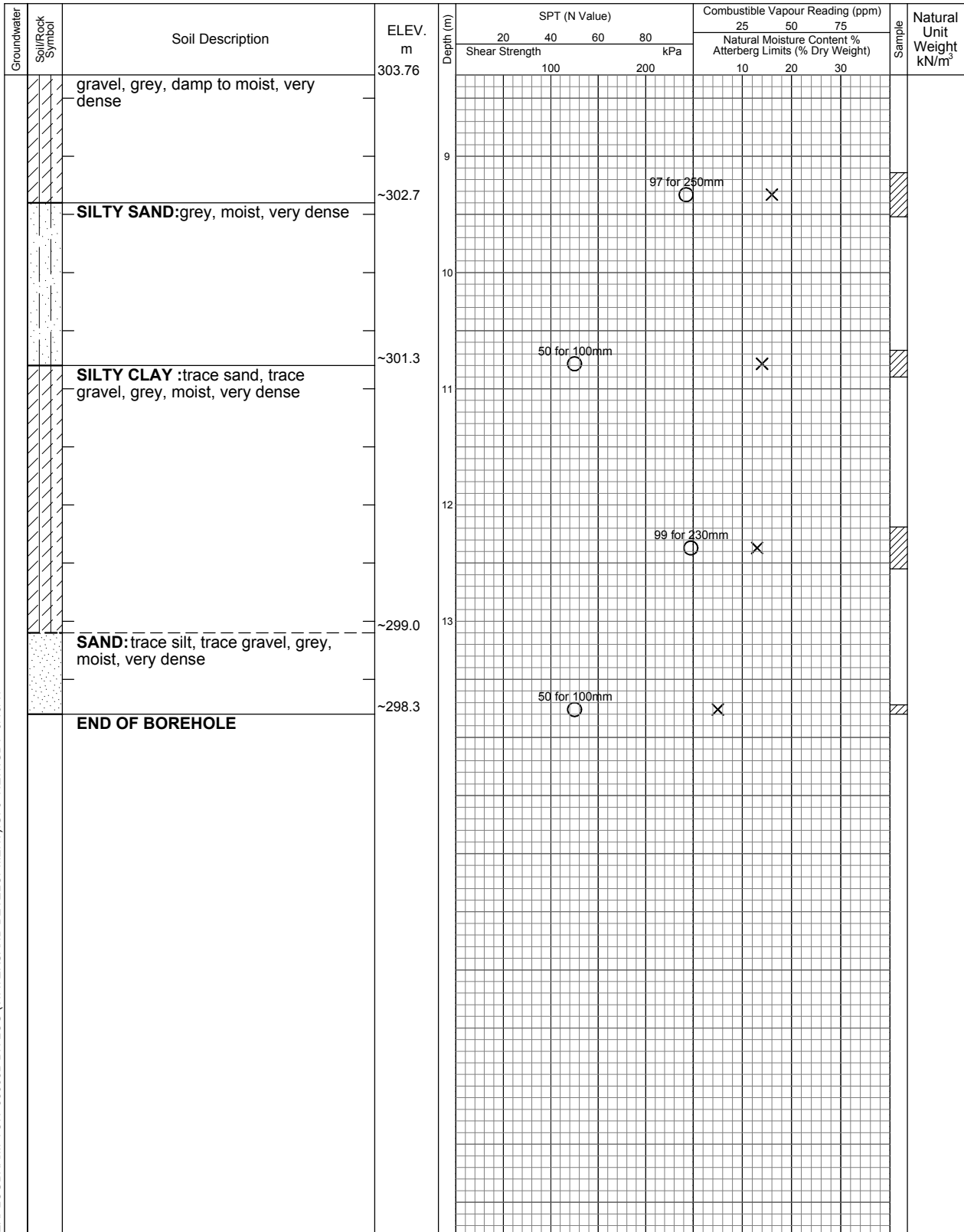
Project No. BRM-00038305-B0

Drawing No. 122

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	13.72



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

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

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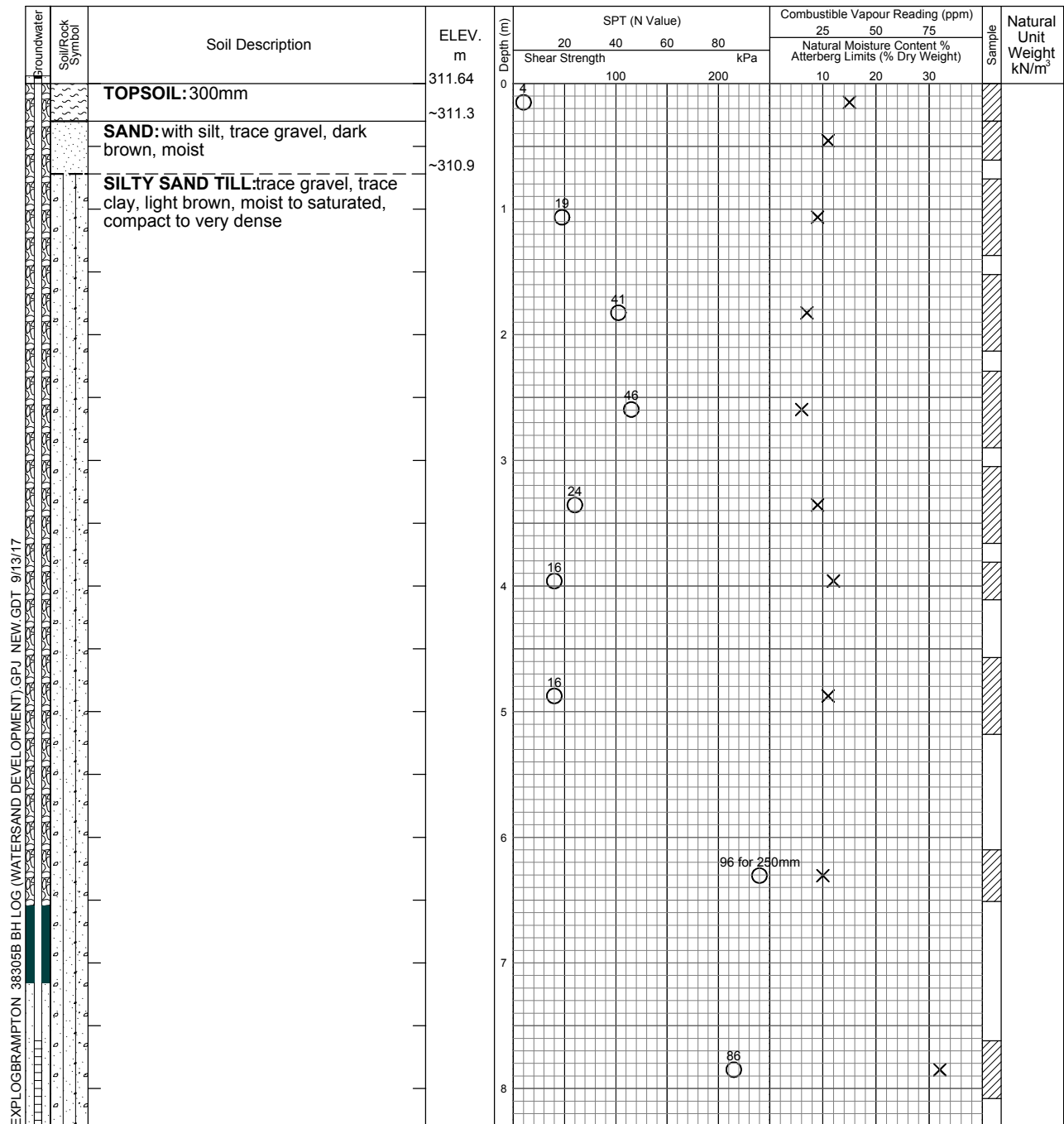
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Datum: Geodetic



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

Groundwater Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)		Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
				20 40 60 80		25 50 75				
				Shear Strength		Natural Moisture Content % Atterberg Limits (% Dry Weight)				
		303.34								
			9							
					77			X		
			10							
		~300.7			50 for 130mm			X		
	END OF BOREHOLE									

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

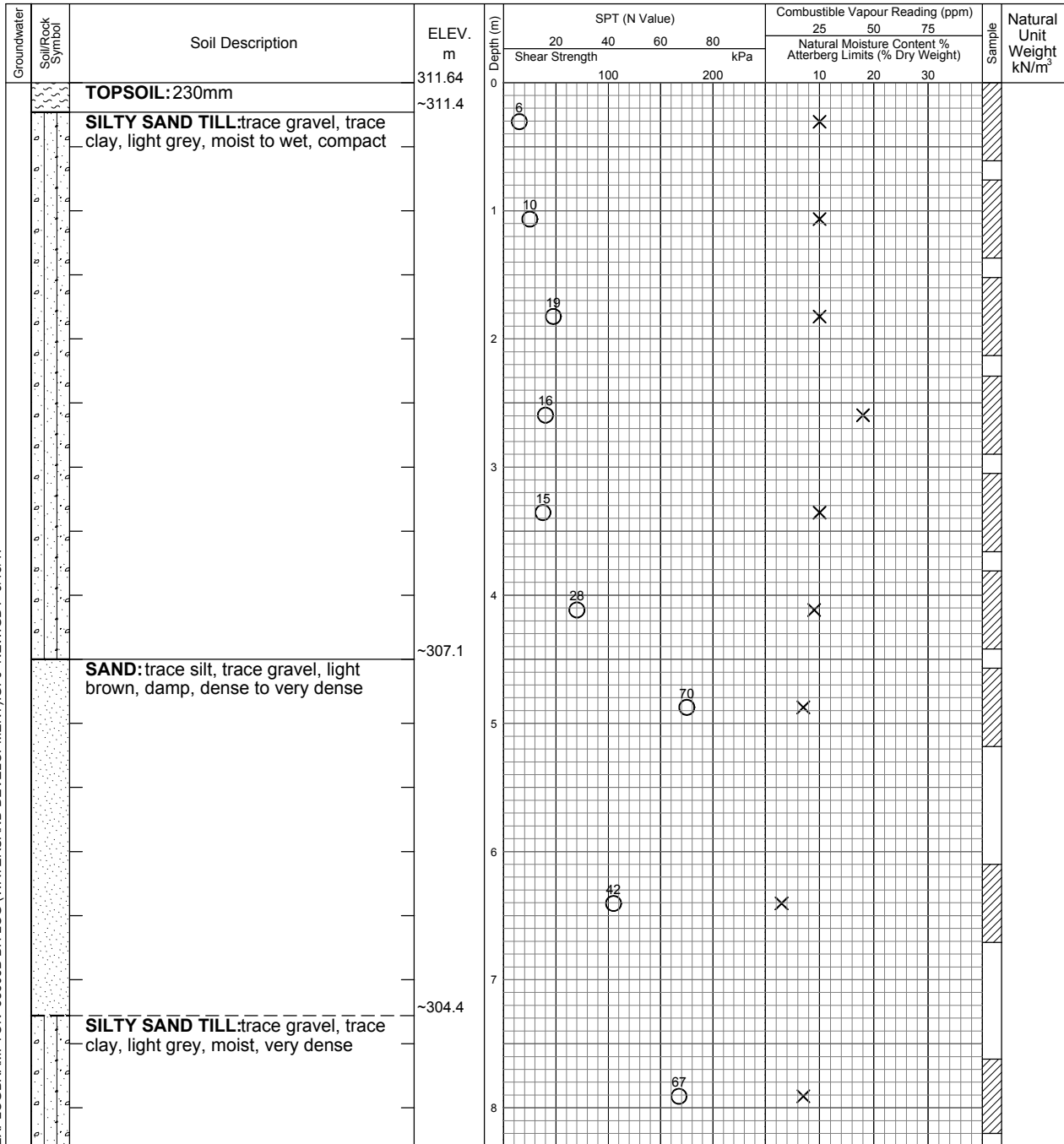


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	10.36



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
			303.34 ~303.1		20	40	60	80	25	50	75		
		SAND: trace silt, trace gravel, grey, moist, very dense											
				9									
			~301.8										
		SILTY SAND TILL: trace gravel, trace clay, light grey, moist, very dense		10									

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	10.36

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

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

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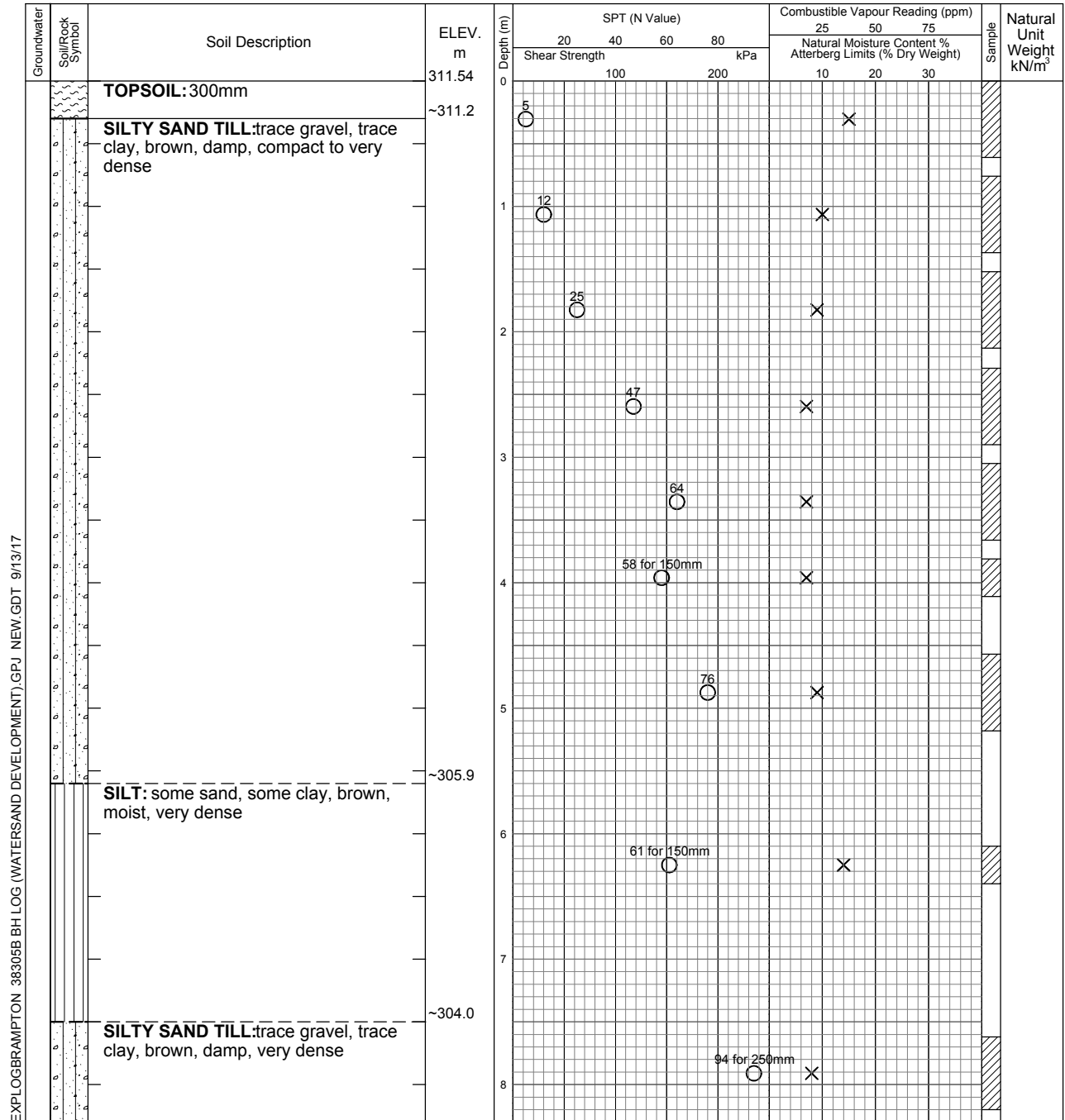
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Datum: Geodetic



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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

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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	10.67



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

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

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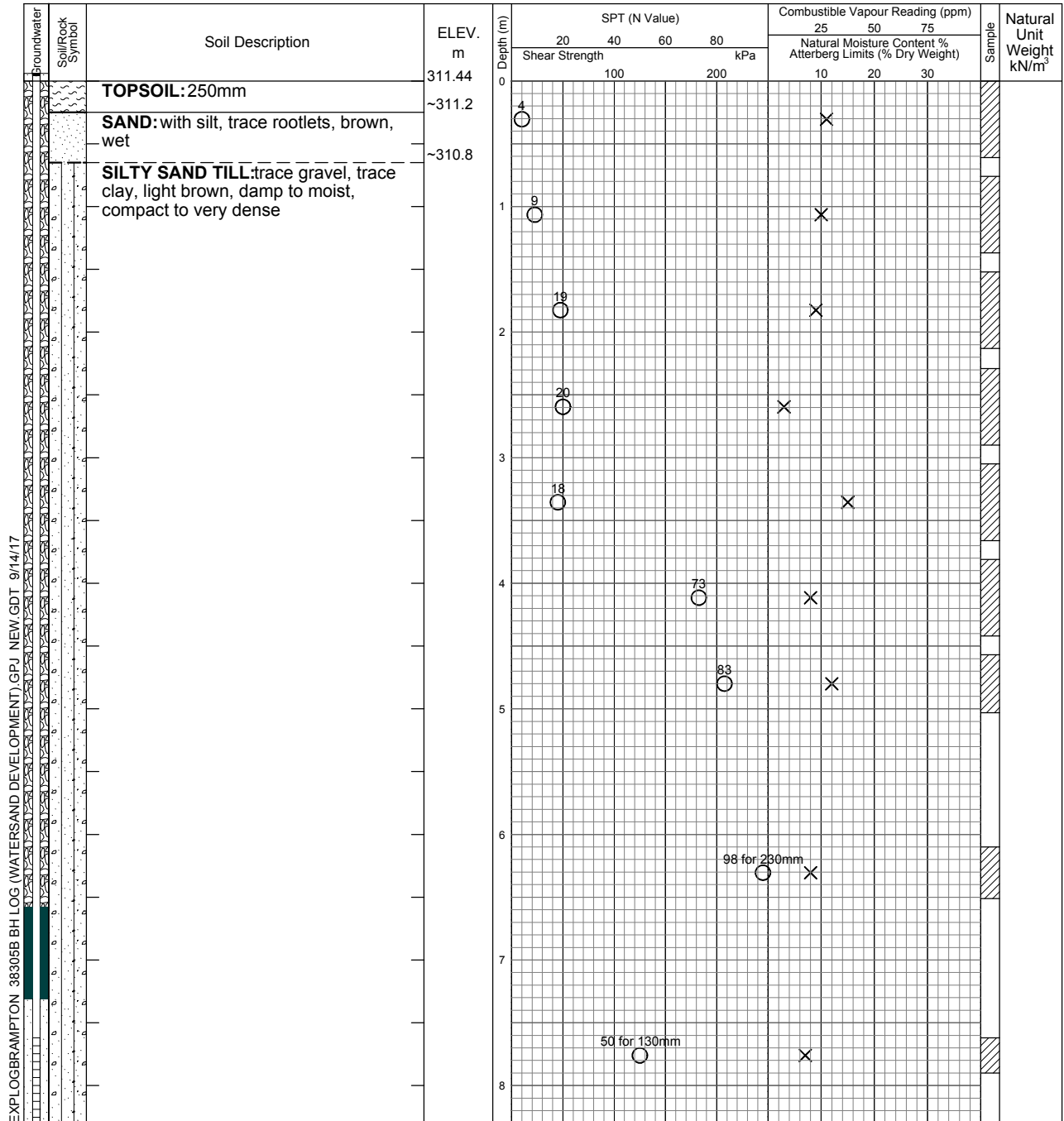
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Datum: Geodetic



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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 10, 2017	Dry	-

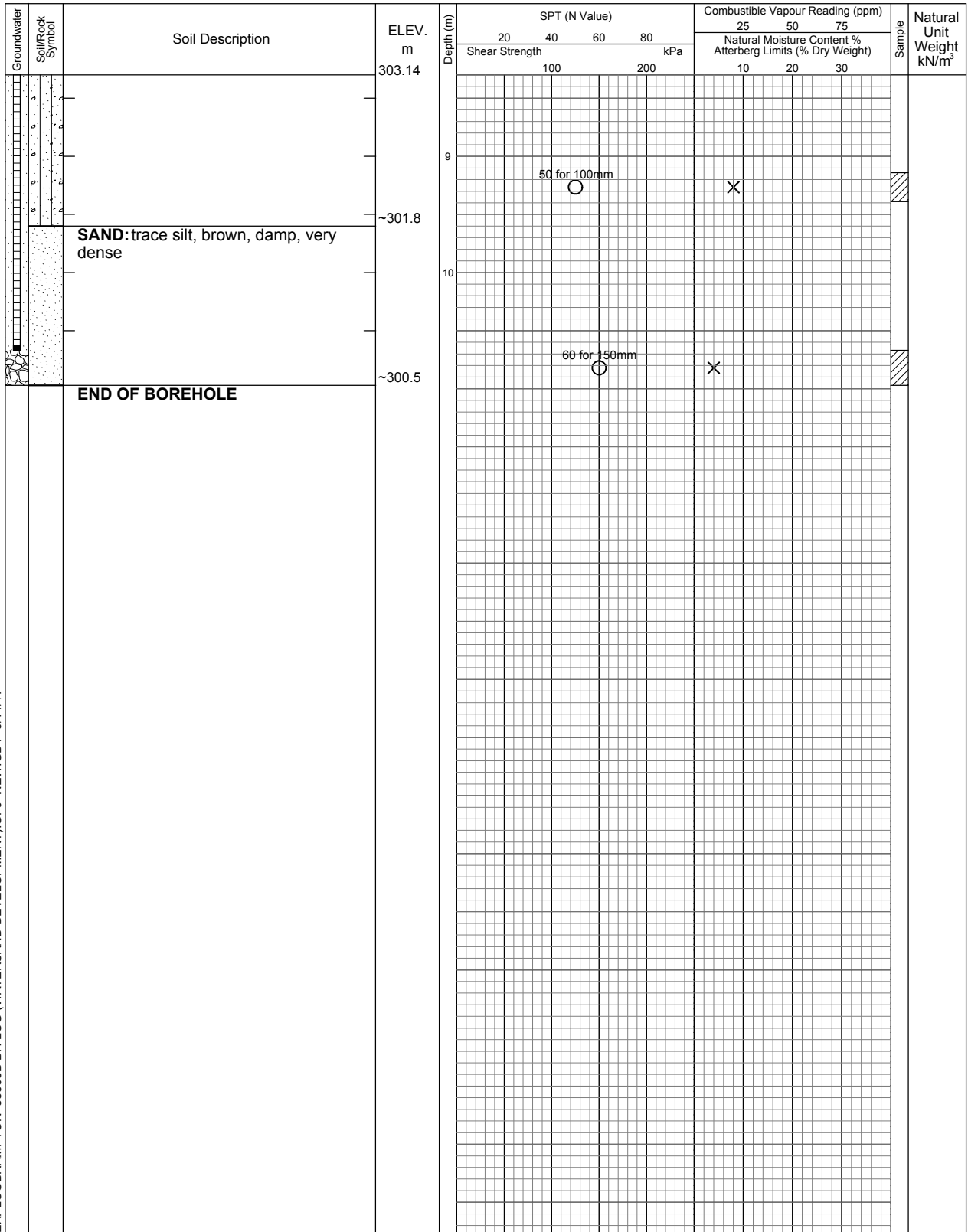
Log of Borehole 122

Project No. BRM-00038305-B0

Drawing No. 126

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
July 24, 2017	Dry	-
August 10, 2017	Dry	-



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

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

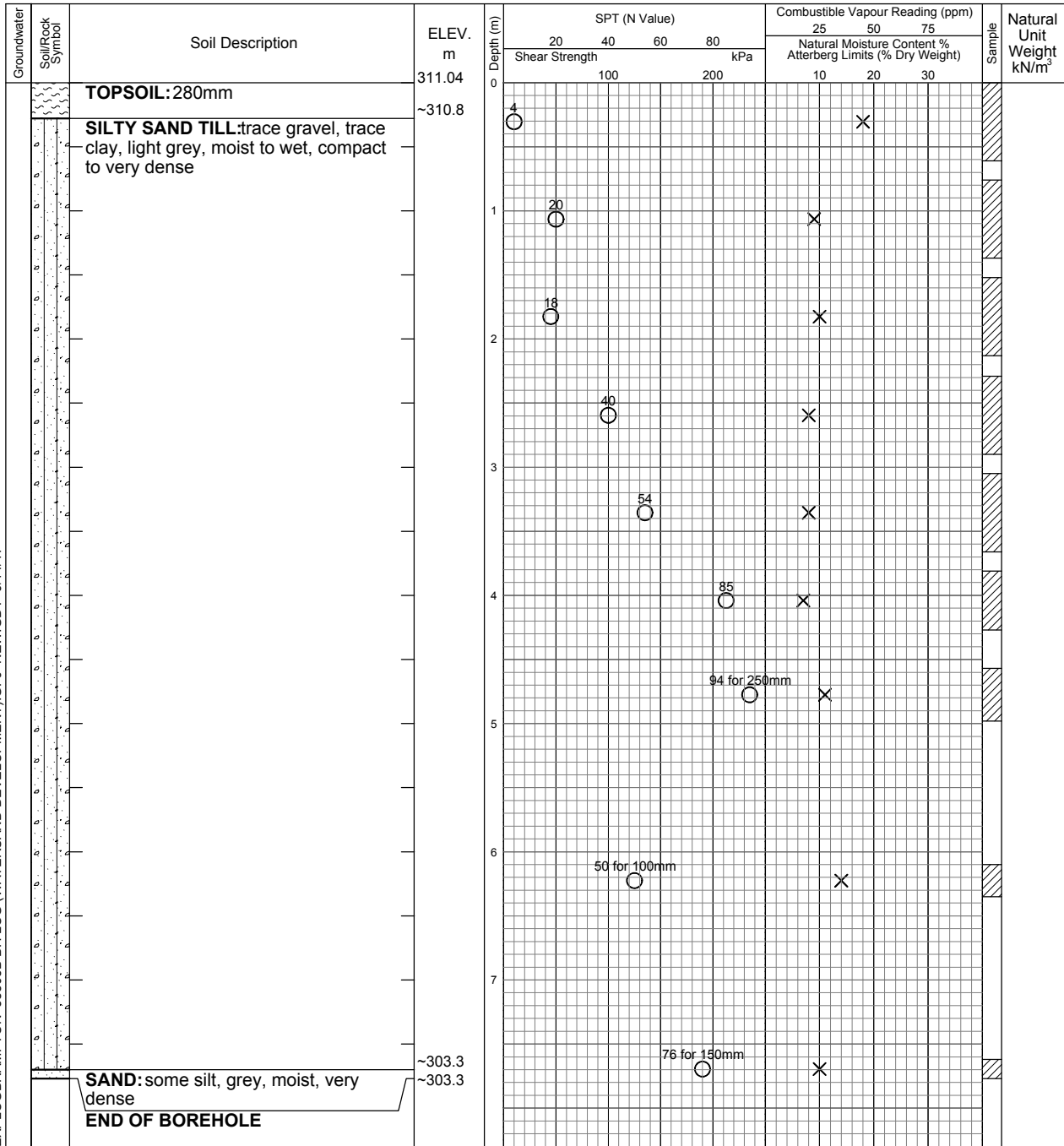


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/14/17



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

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

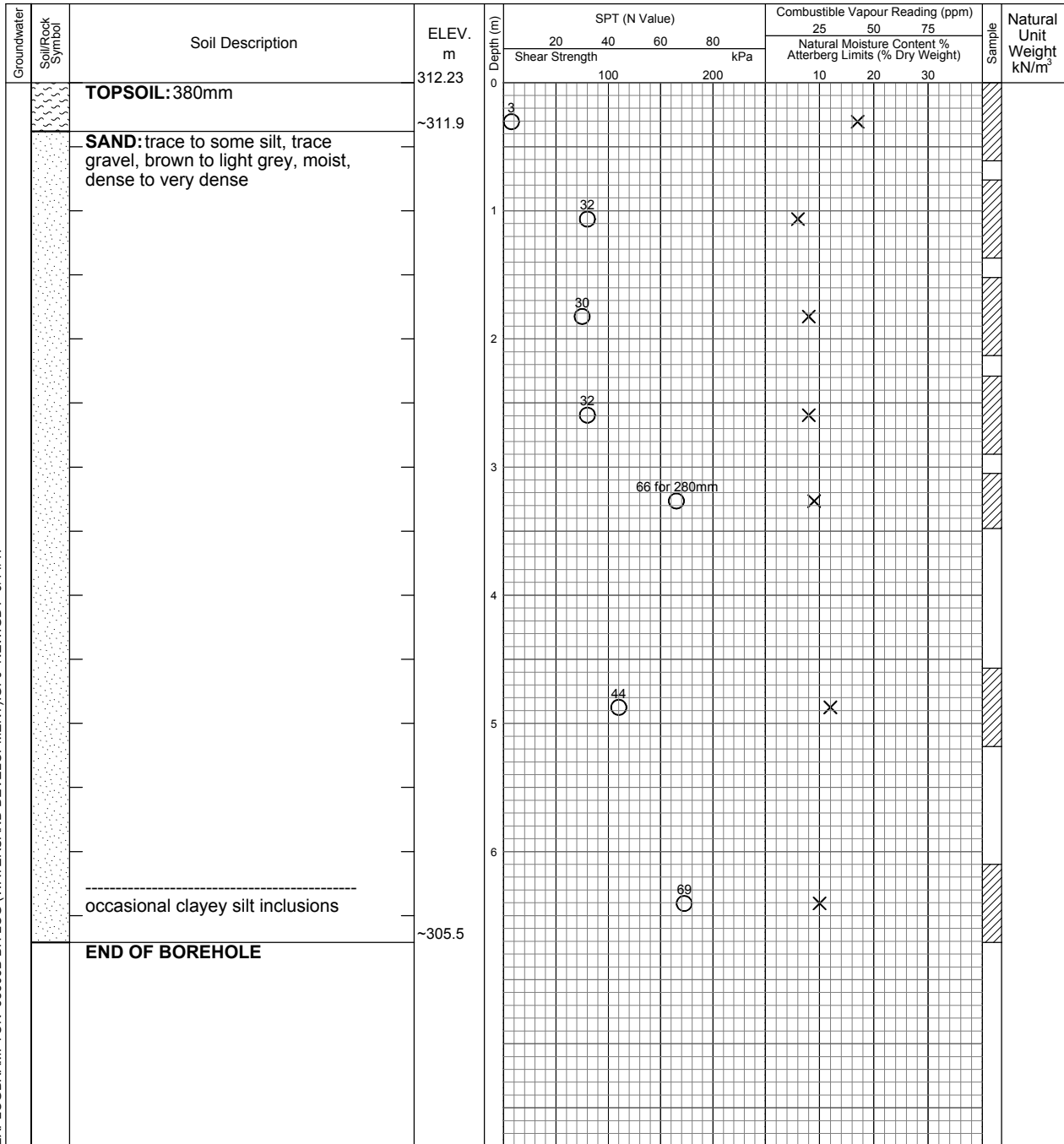


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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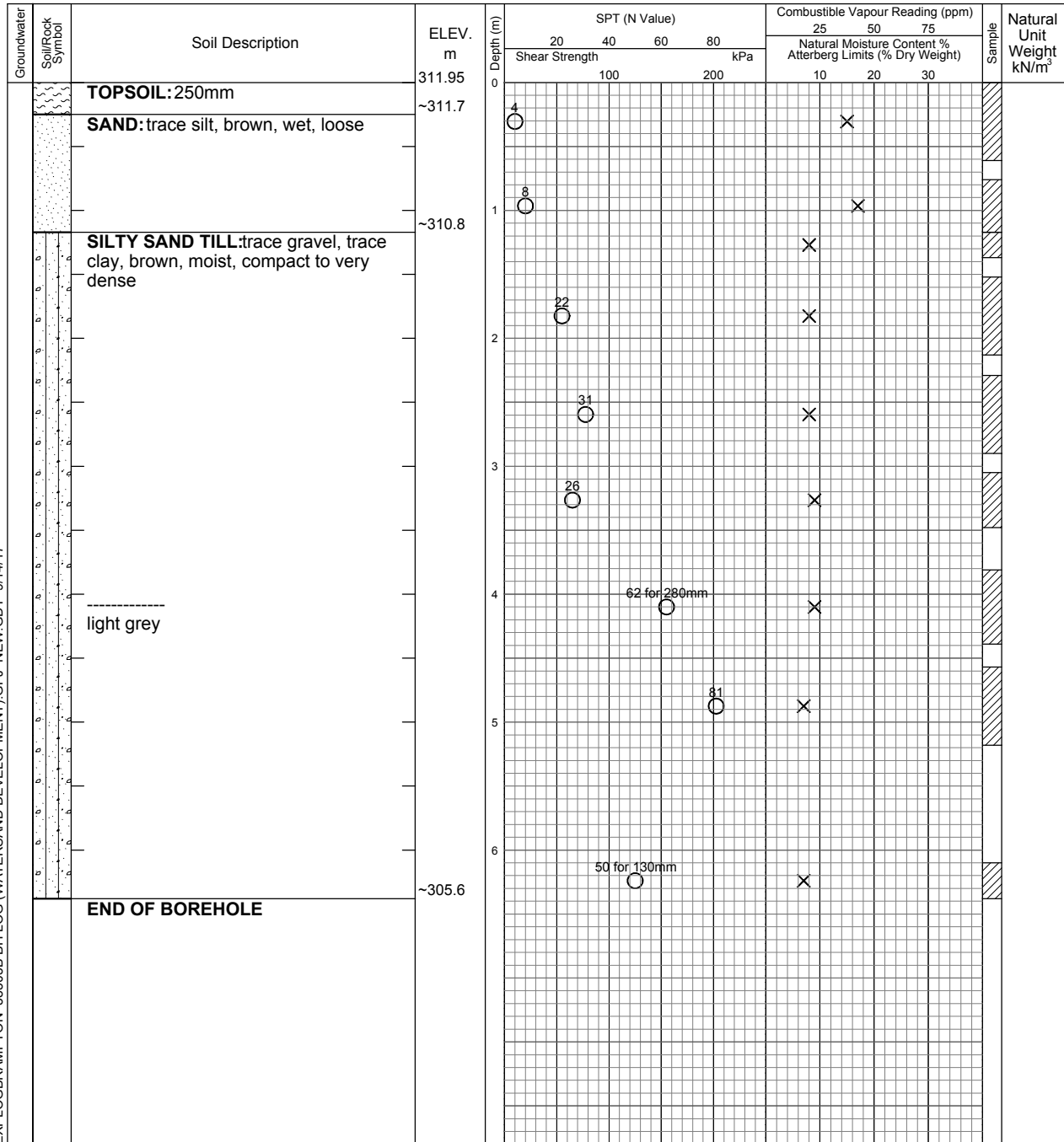
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

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

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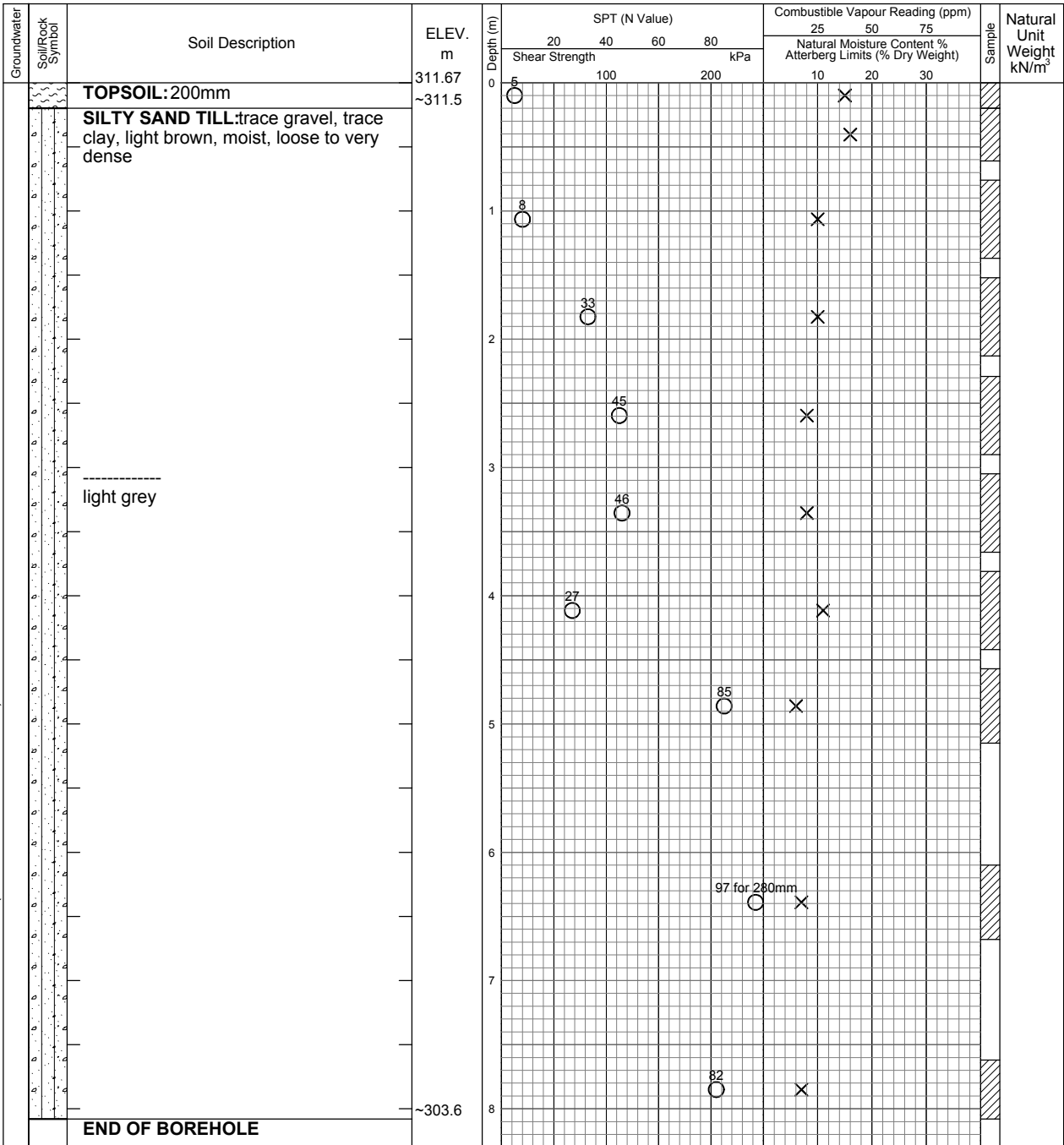
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Drill Type: D52 - Track Mount

Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.32

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

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

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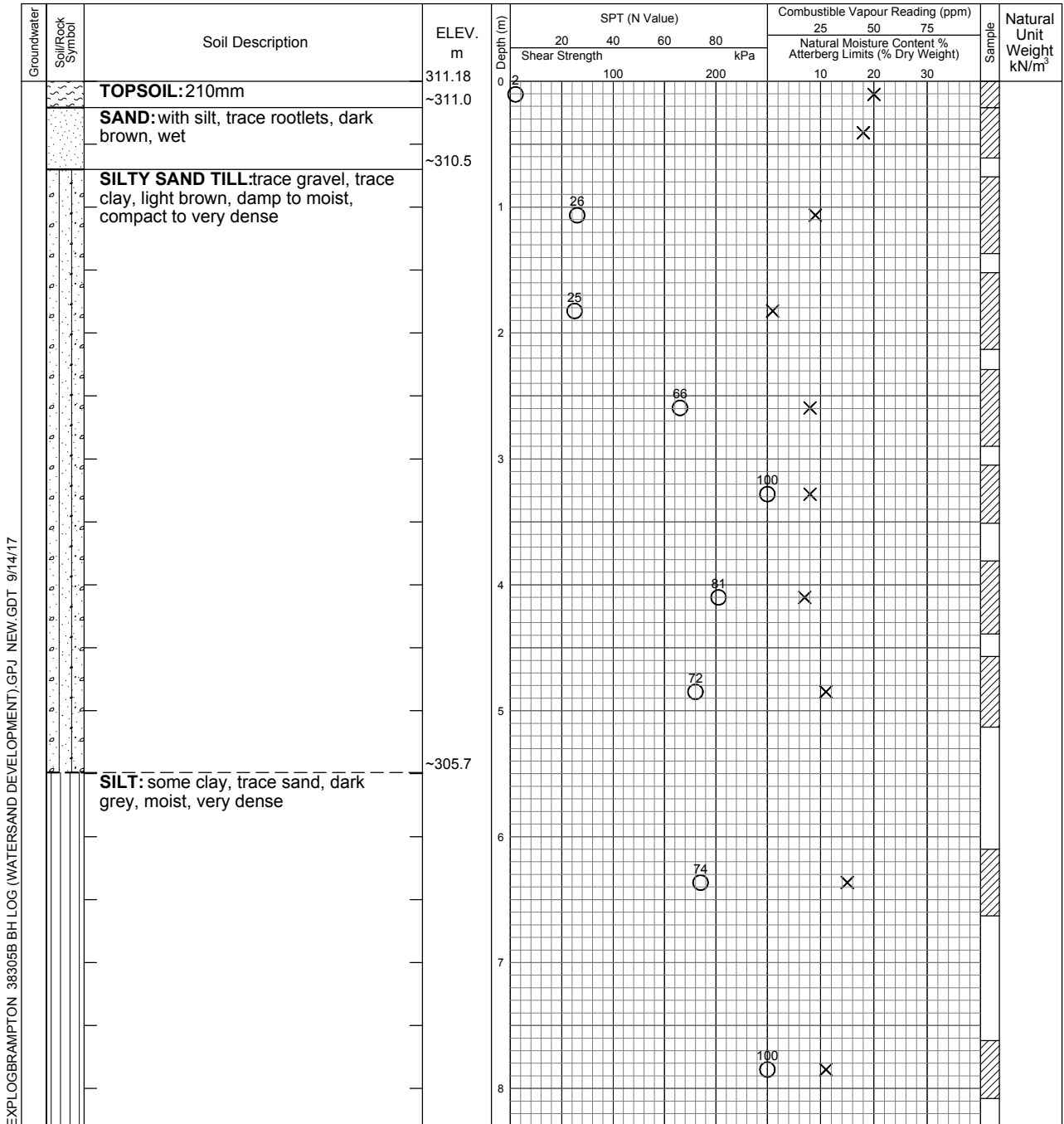
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	13.11	13.56



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)		Combustible Vapour Reading (ppm)		Sample	Natural Unit Weight kN/m ³			
					20	40	60	80			25	50	75
					Shear Strength kPa						Natural Moisture Content % Atterberg Limits (% Dry Weight)		
			302.88										
				9									
				10									
		SILTY SAND TILL: trace gravel, trace clay, light grey, moist to wet, very dense	~301.0										
				11									
				12									
				13									
		END OF BOREHOLE	~297.3										

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	13.11	13.56



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

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

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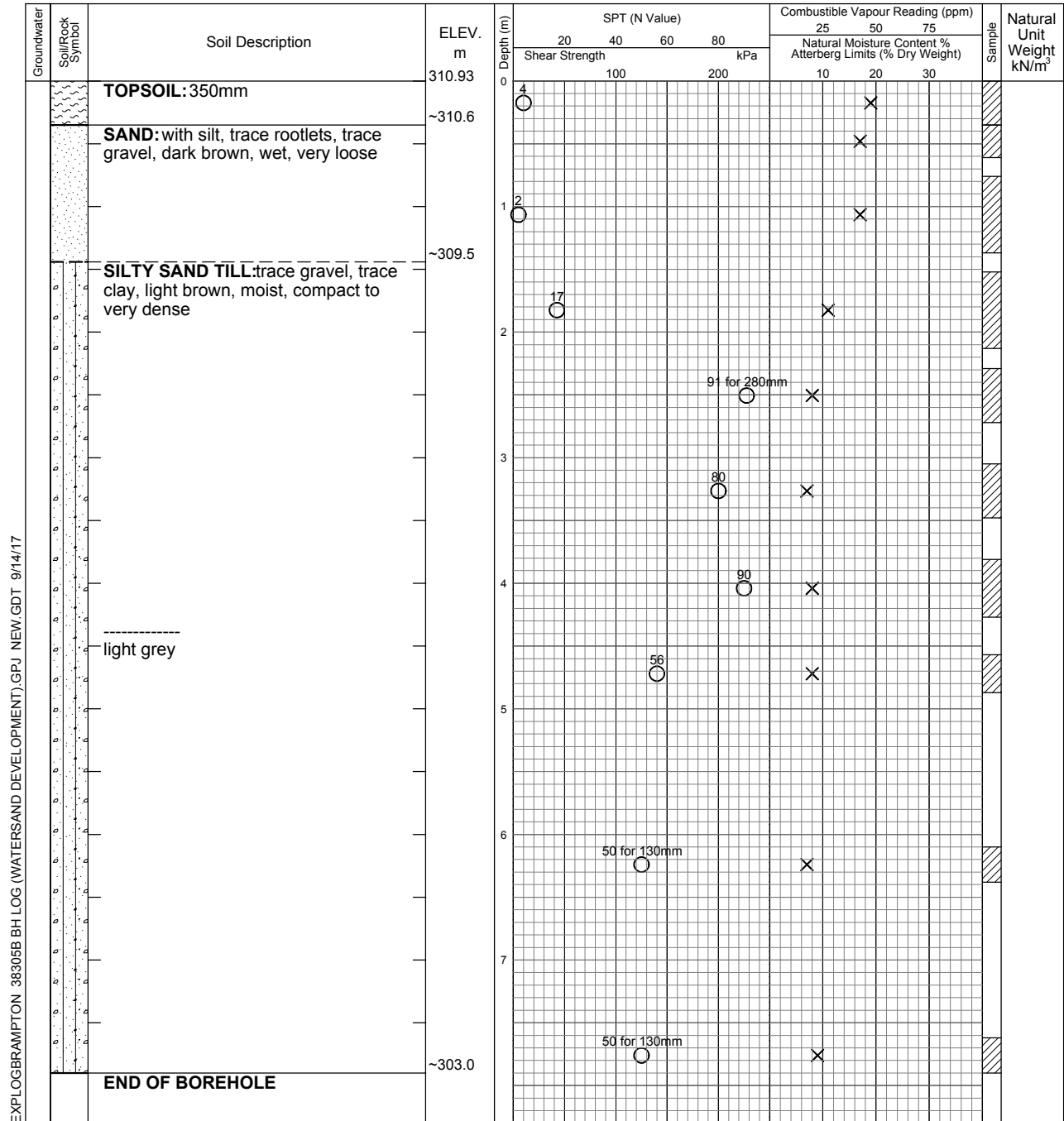
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Datum: Geodetic



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

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

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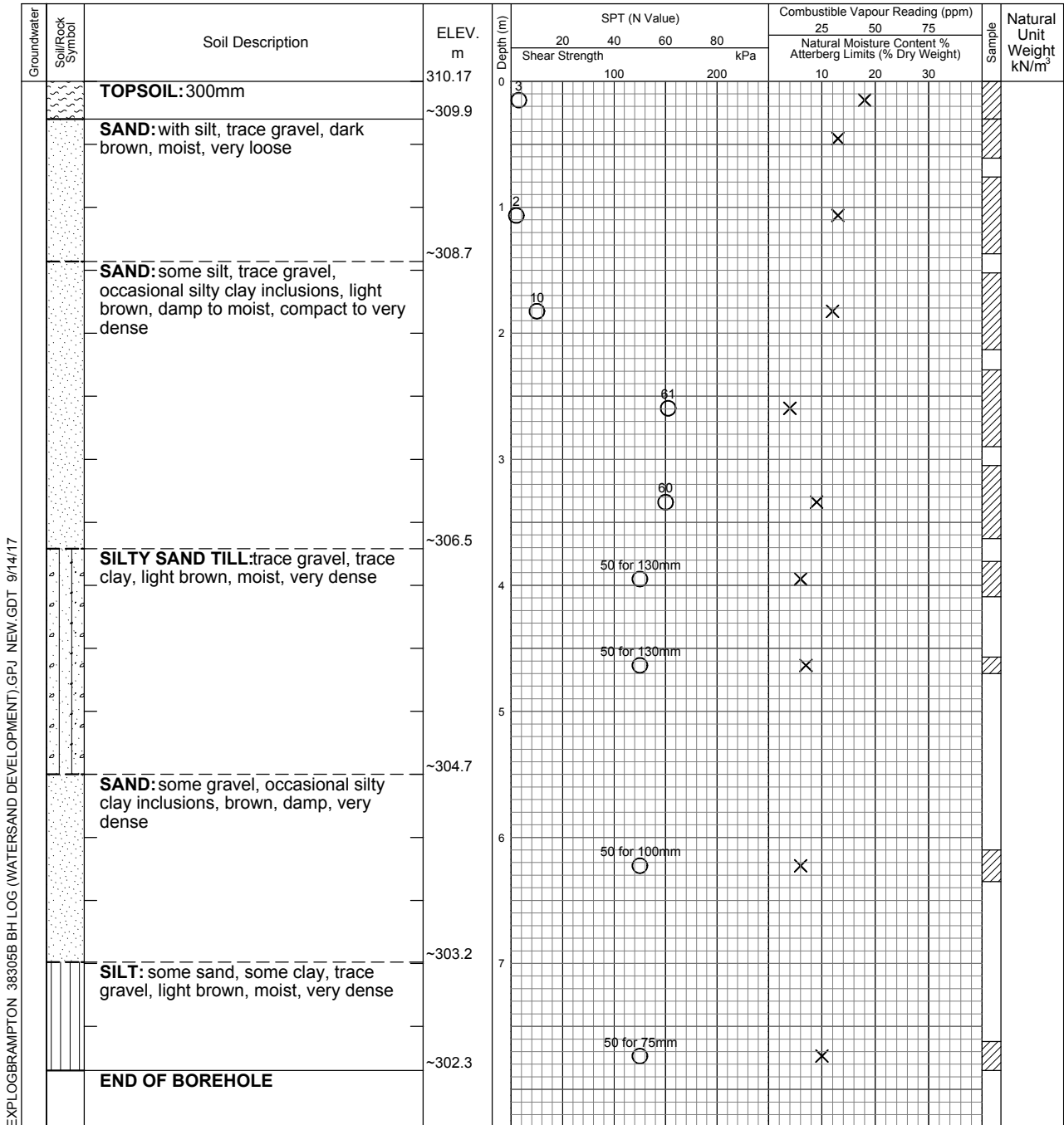
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.47



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

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

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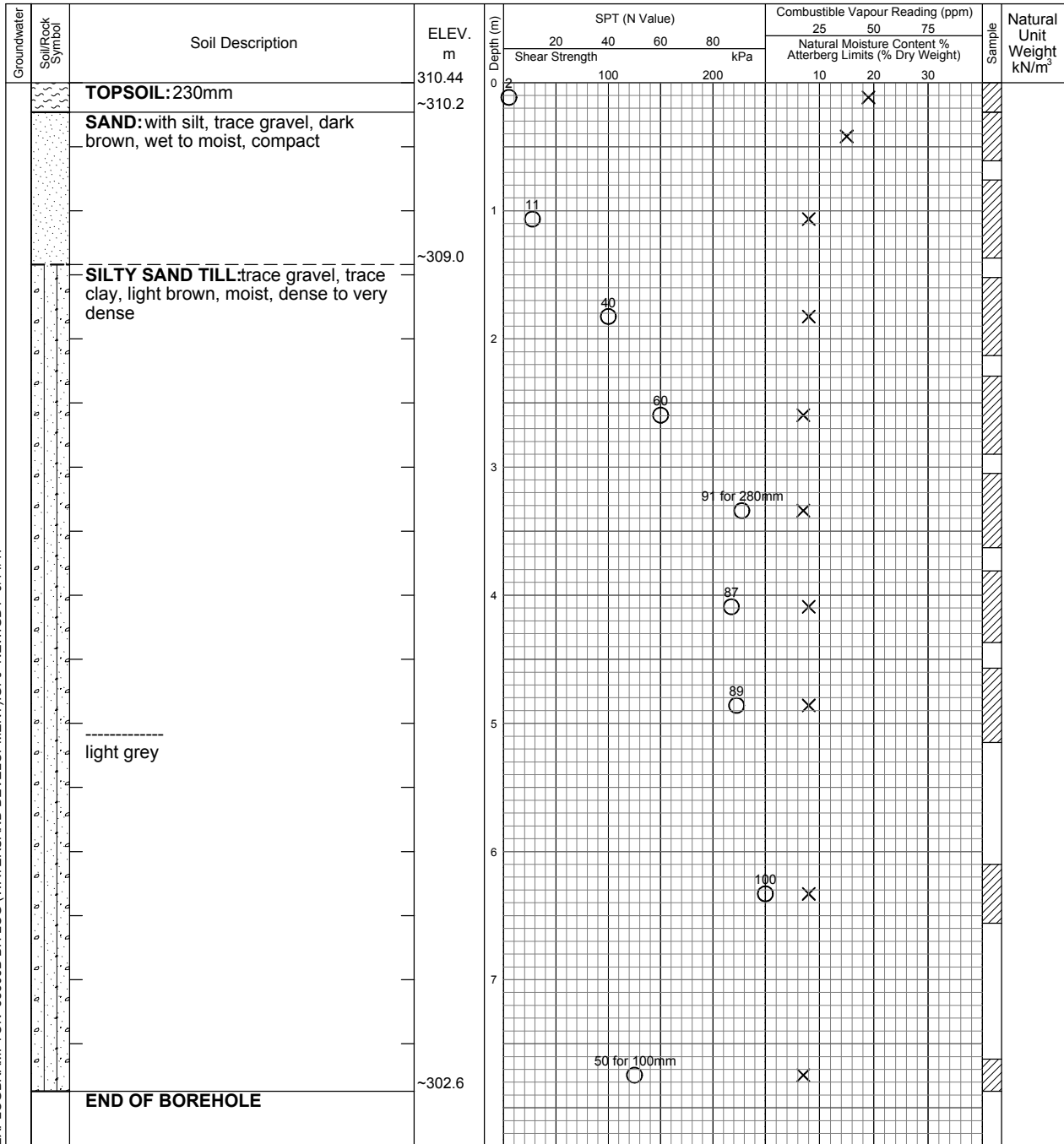
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

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

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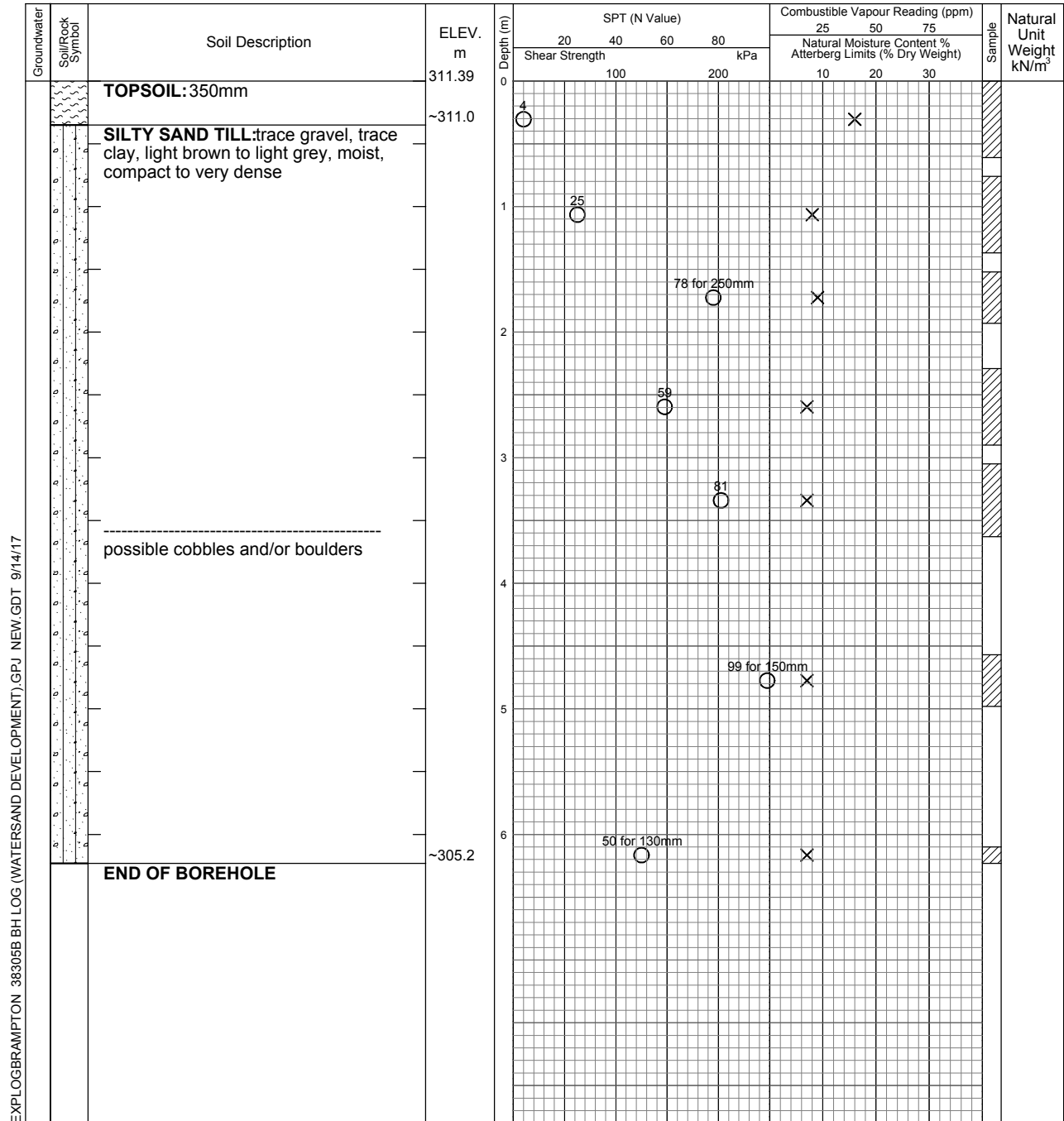
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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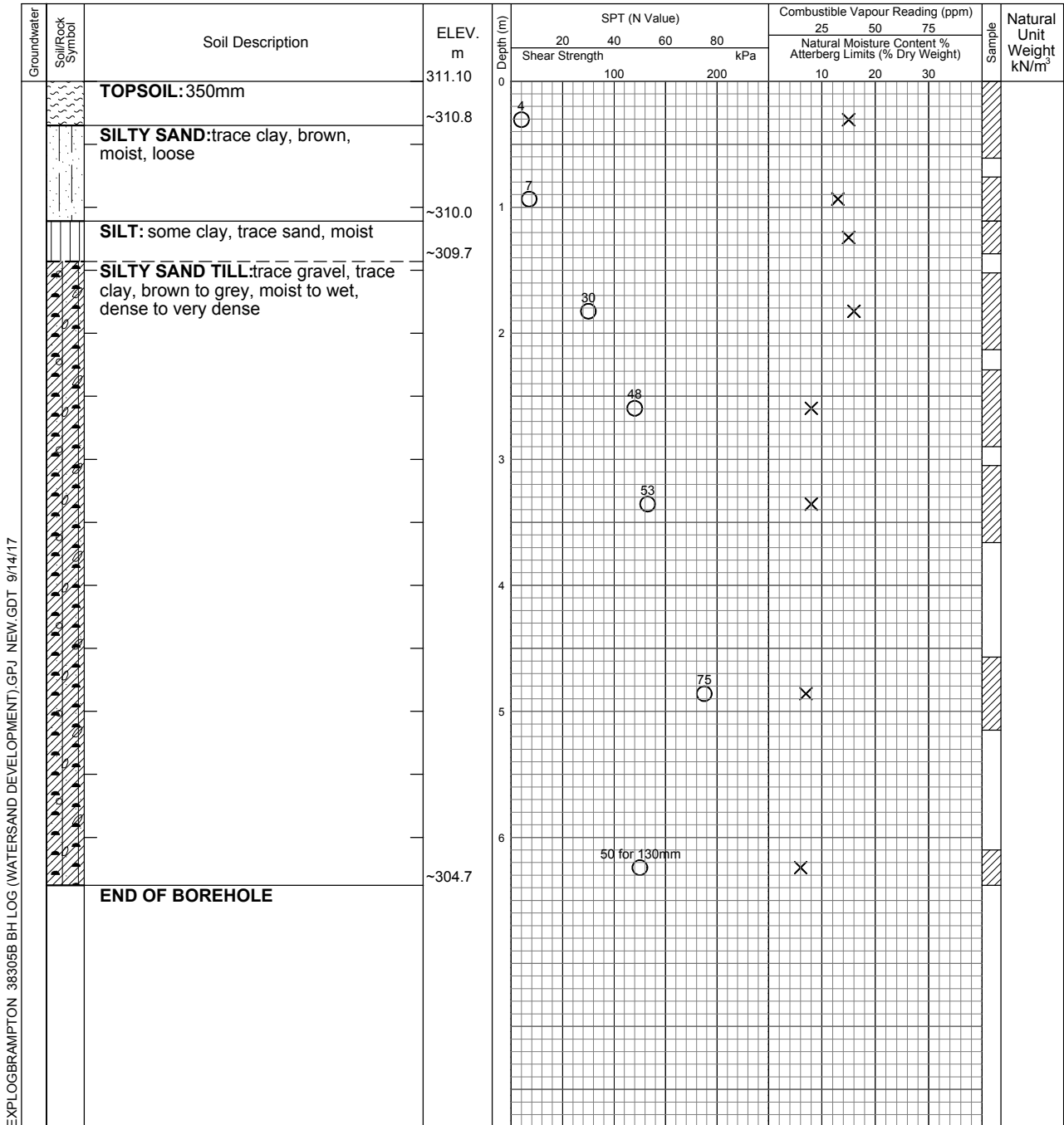
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	5.97



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

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

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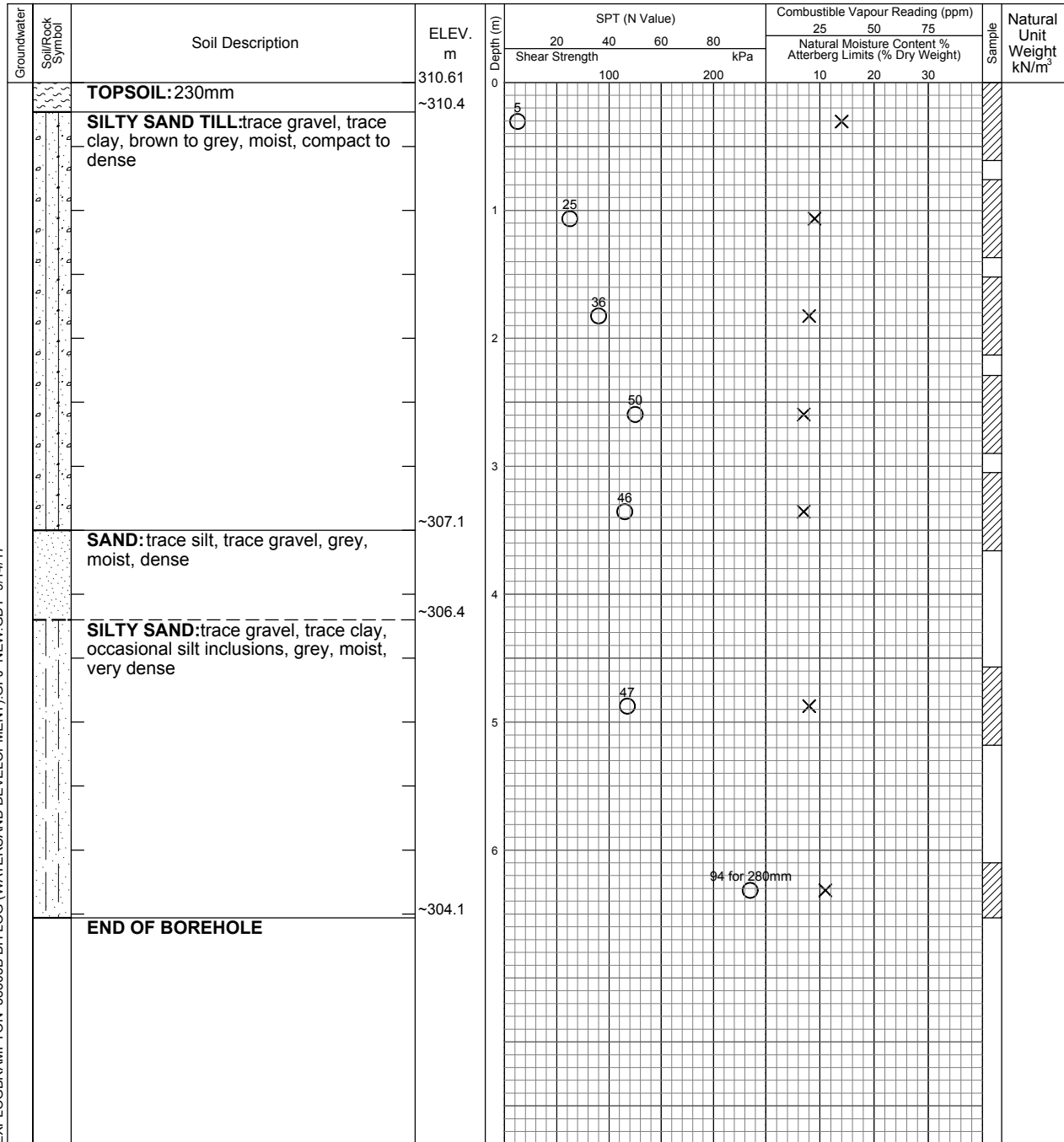
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

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

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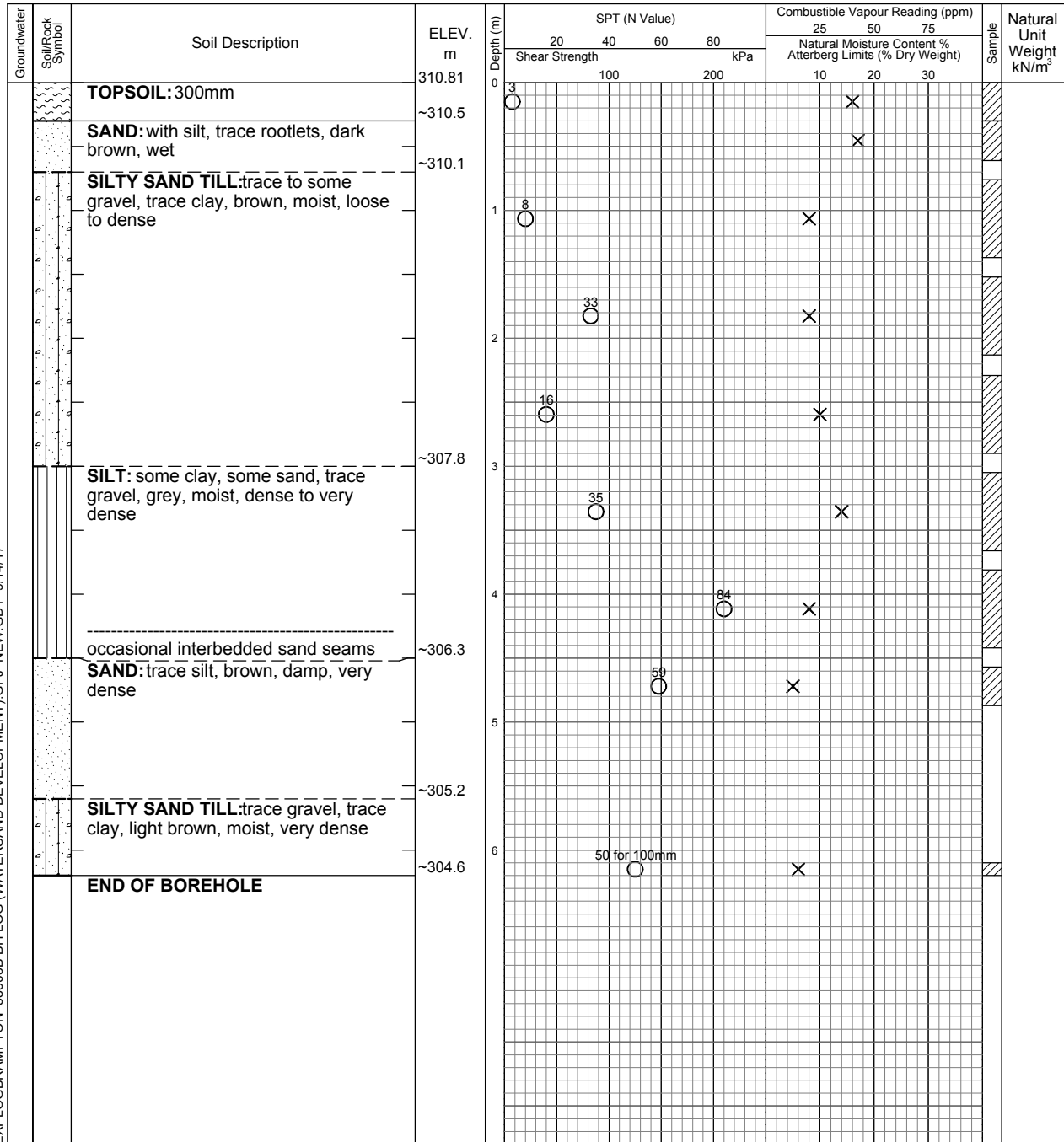
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



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

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

Drill Type: D52 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

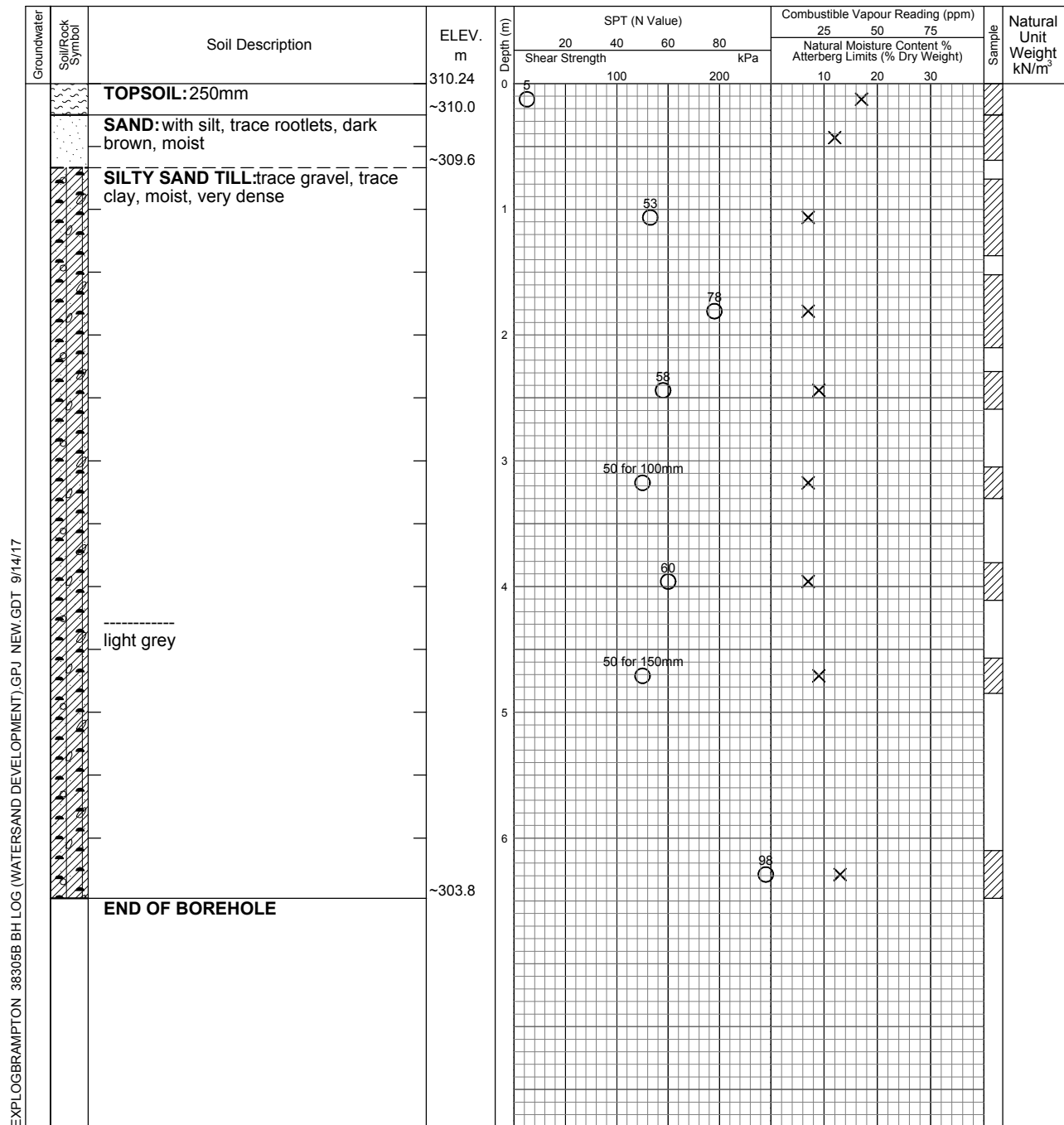
Datum: Geodetic

Shelby Tube

Undrained Triaxial at
% Strain at Failure

Field Vane Test

Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	5.10	5.33



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

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

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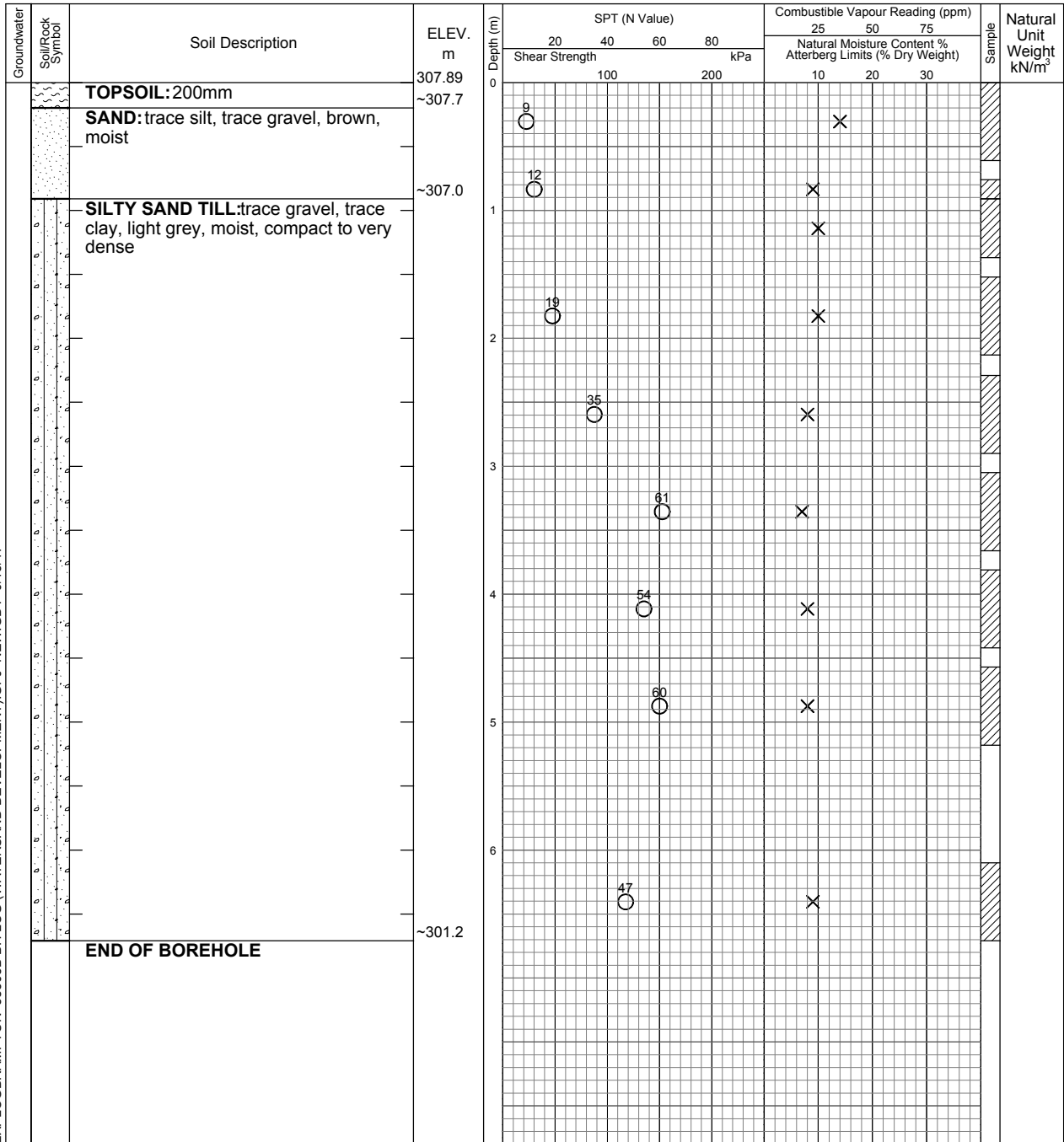
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Drill Type: D52 - Track Mount

Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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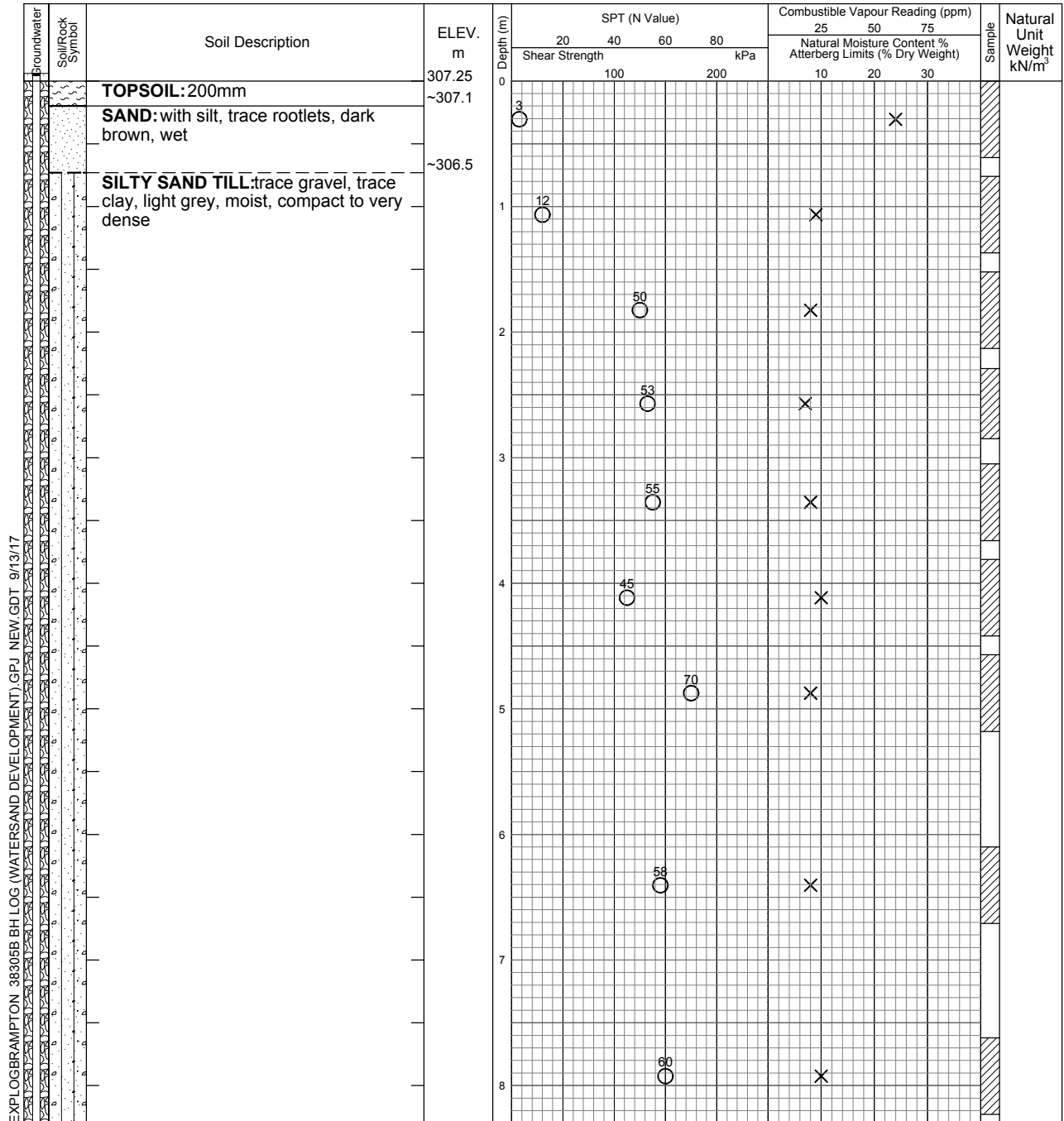
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Datum: Geodetic



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Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	12.01	-
August 9, 2017	14.04	-
August 17, 2017	13.97	-



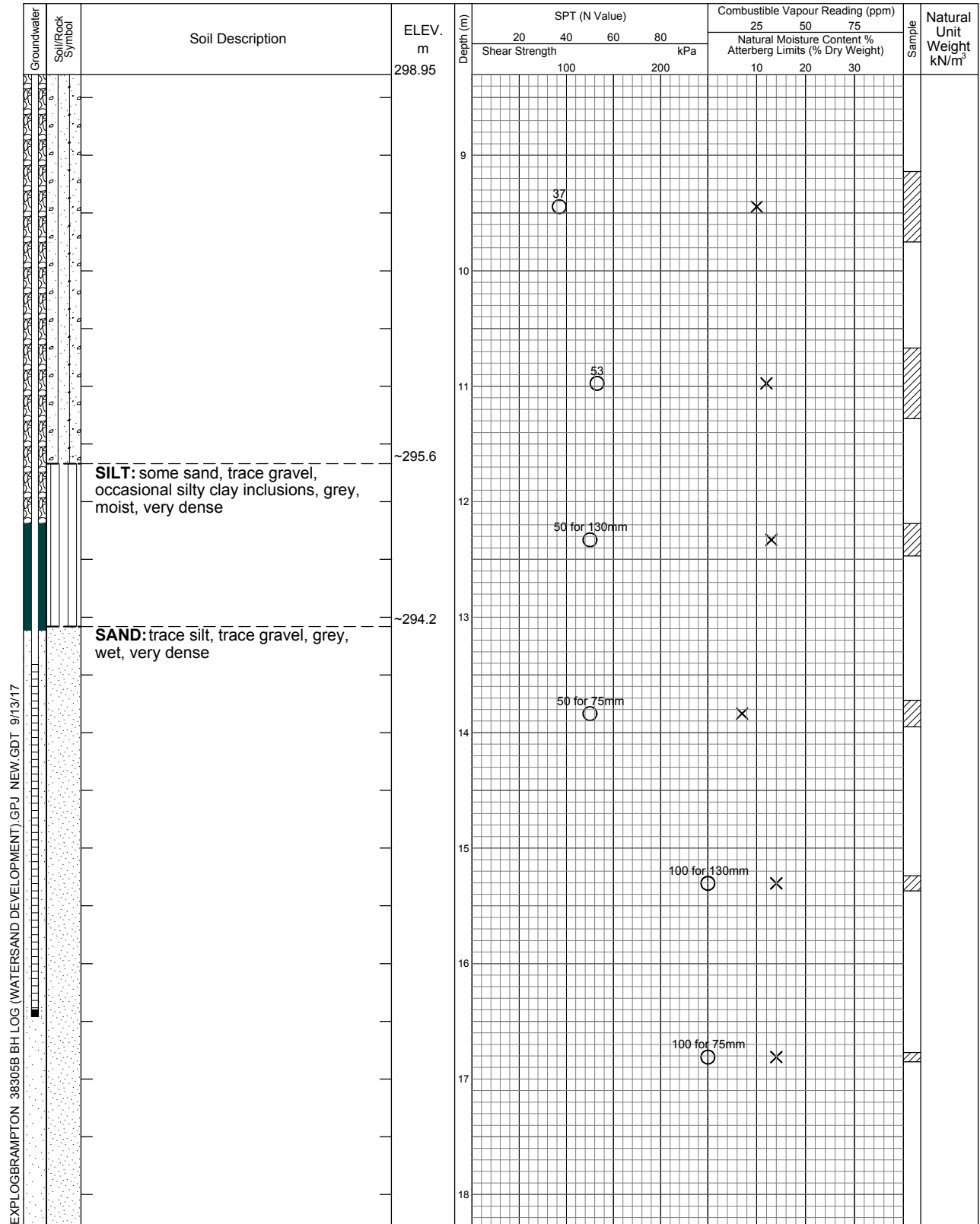
Log of Borehole A2-D

Project No. BRM-00038305-B0

Drawing No. 141

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 3



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-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

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



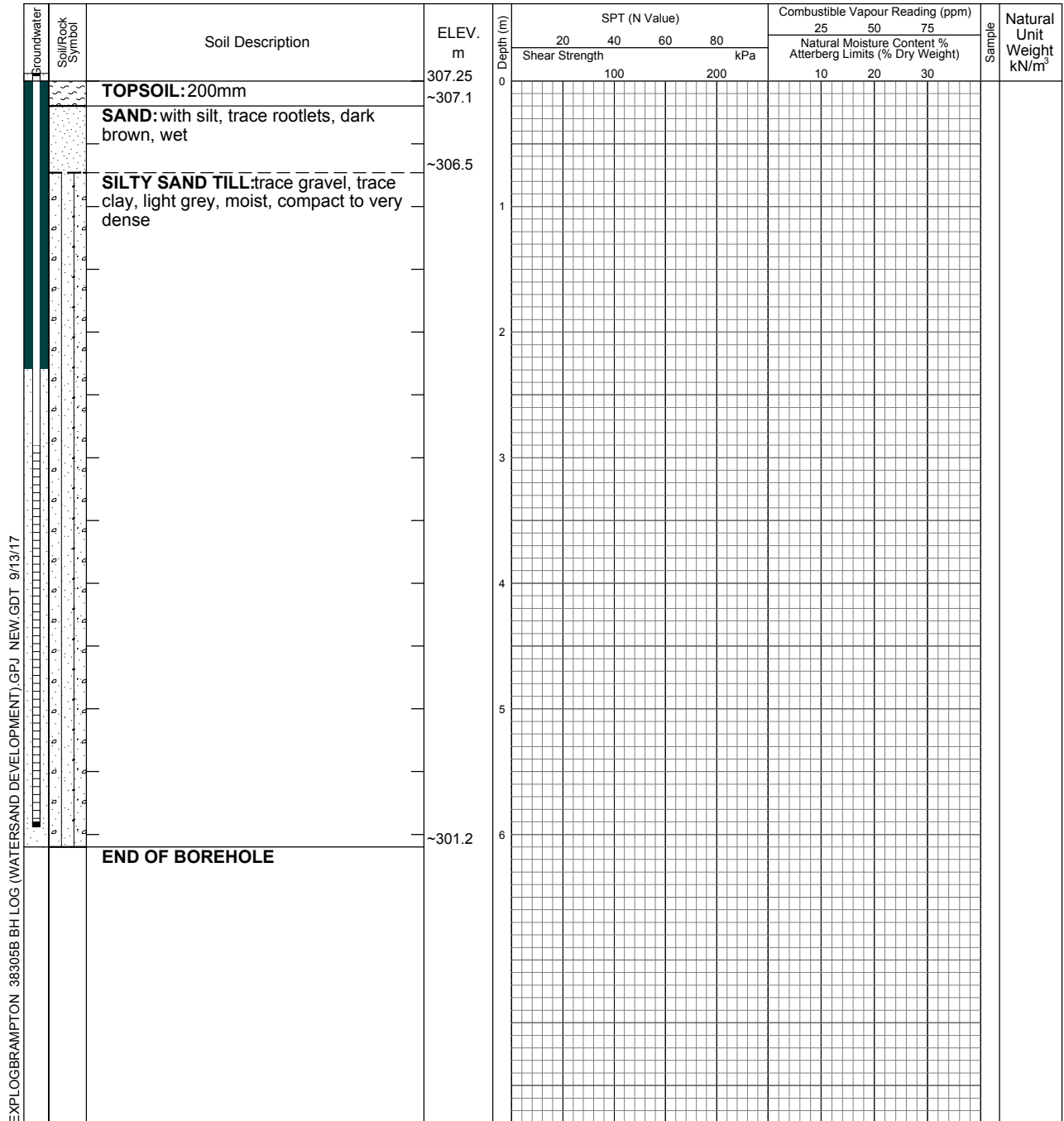
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	1.95	-
August 9, 2017	2.38	-
August 17, 2017	2.54	-

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

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

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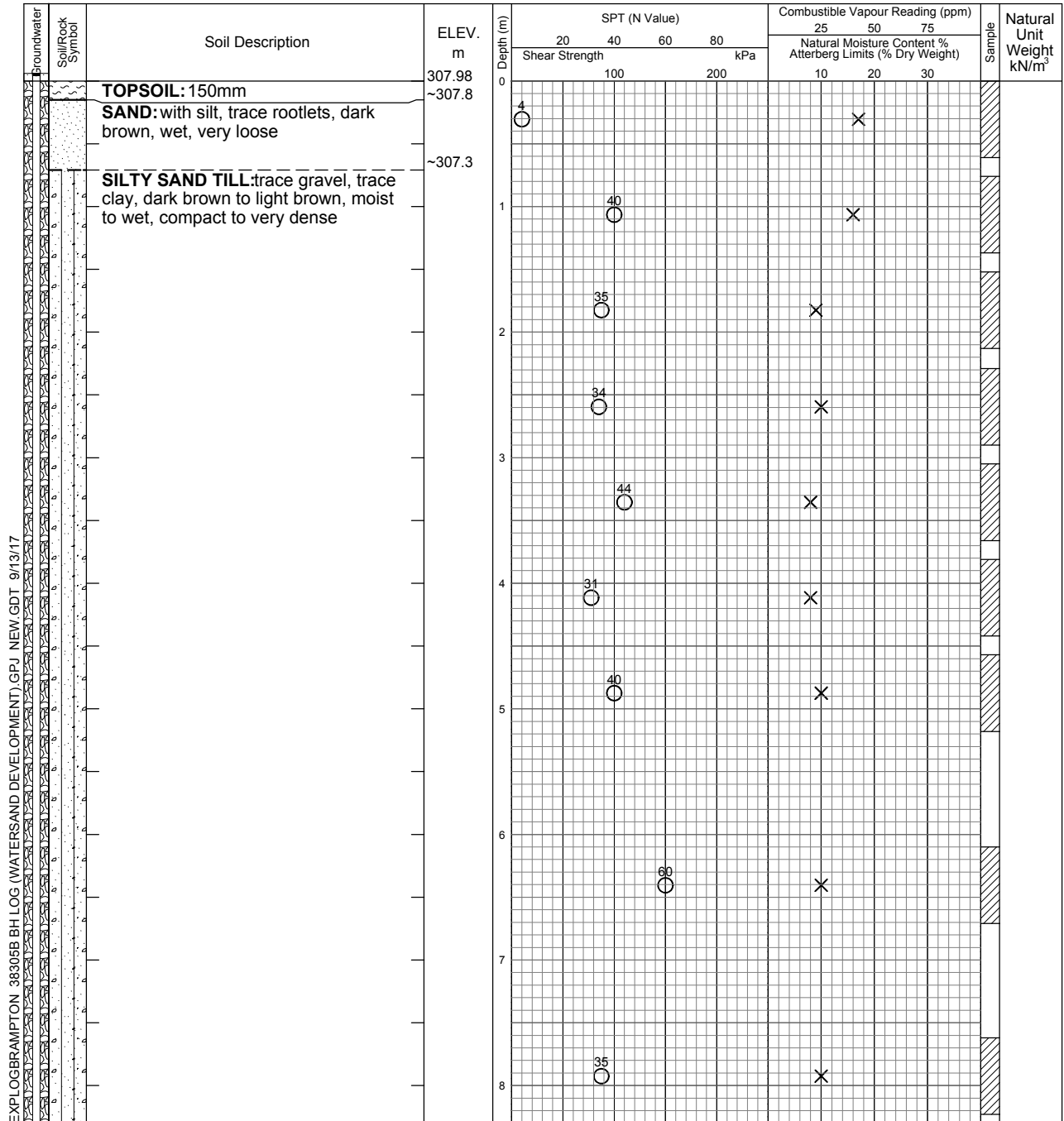
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Datum: Geodetic



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Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	12.86	-
August 9, 2017	13.36	-



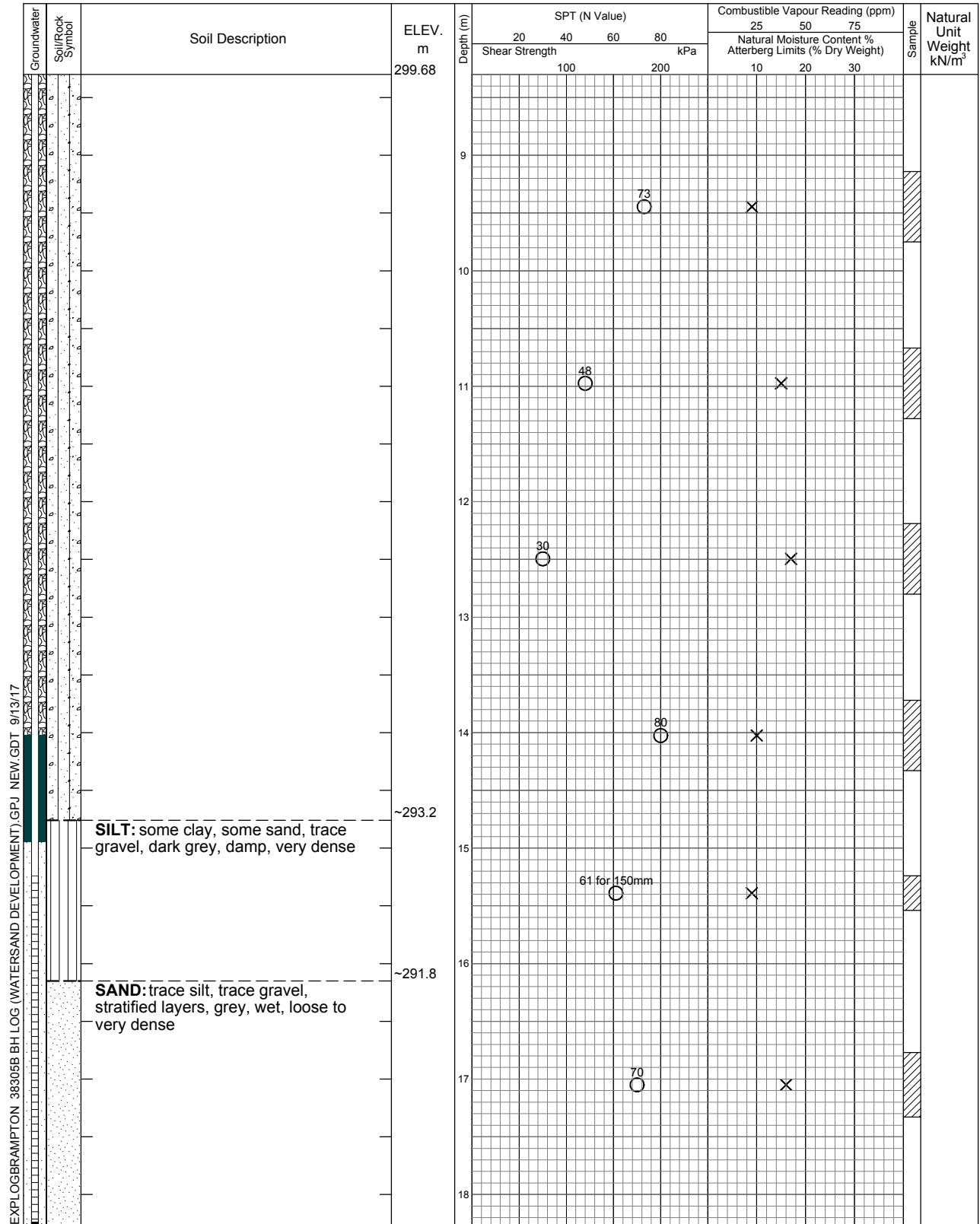
Log of Borehole A3-D

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	-

Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	12.86	-
August 9, 2017	13.36	-

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

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



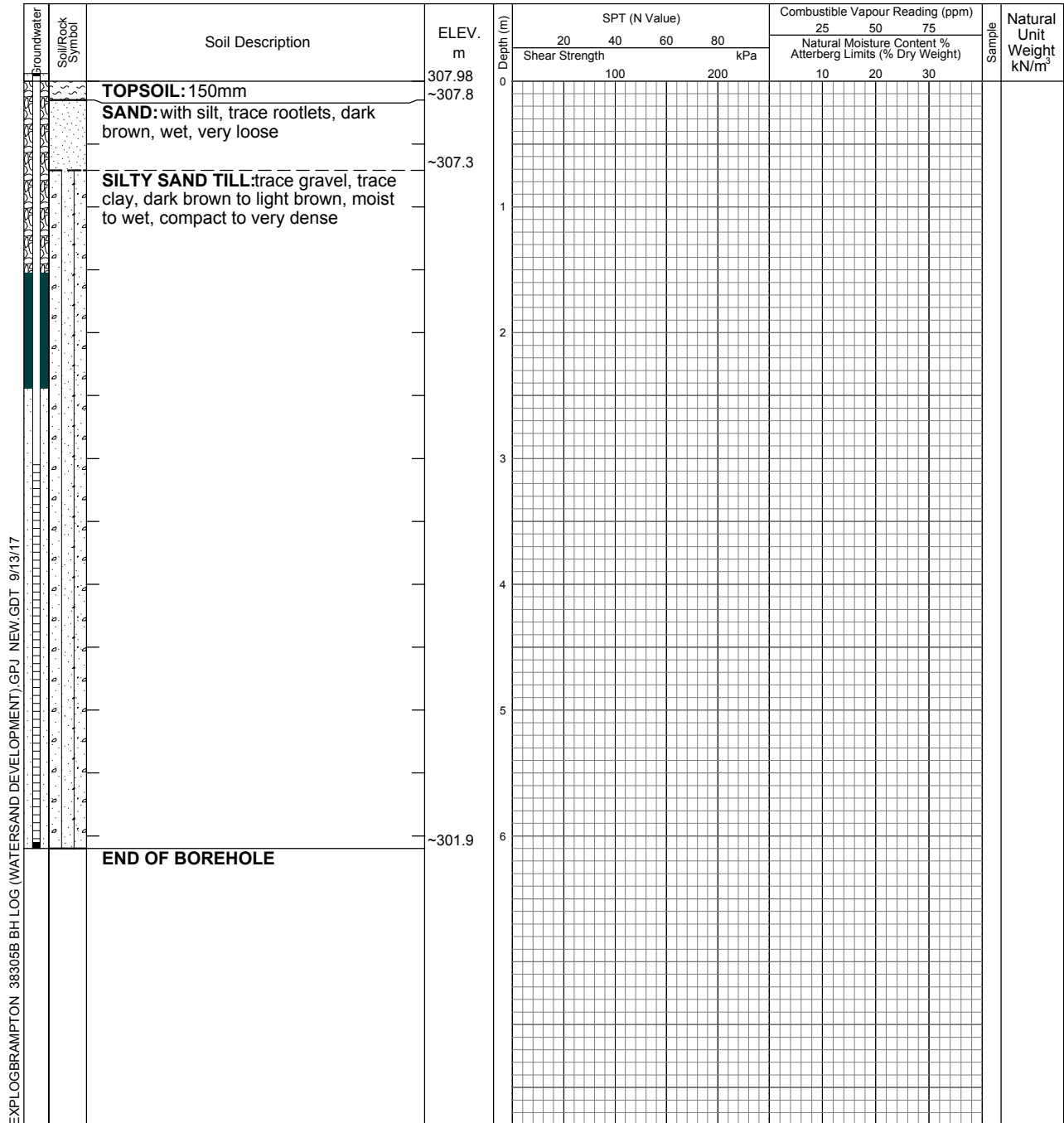
% Strain at Failure



Penetrometer



Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
July 24, 2017	2.54	-
August 9, 2017	3.15	-

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

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

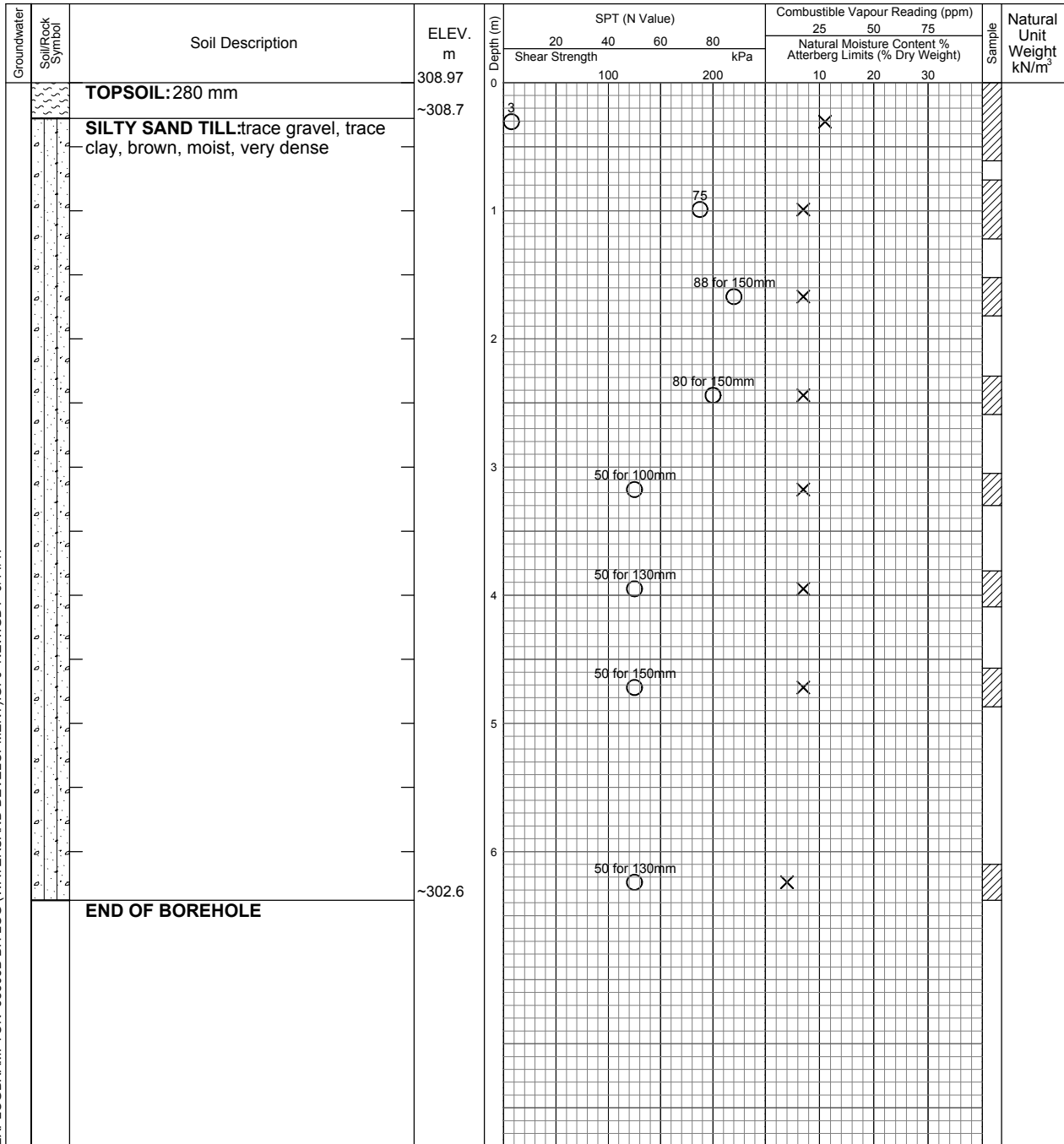


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.38



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

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

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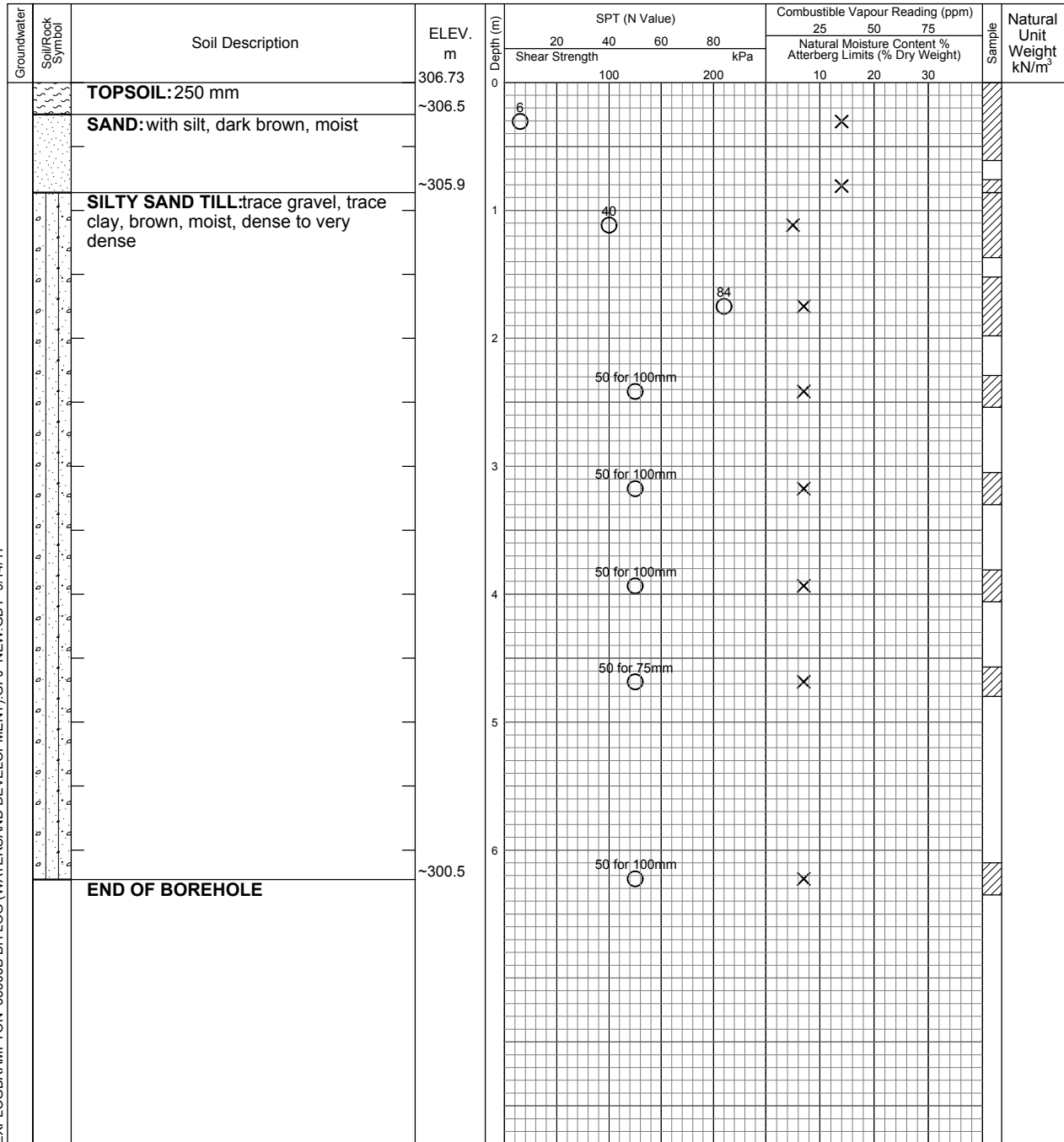
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.35



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

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

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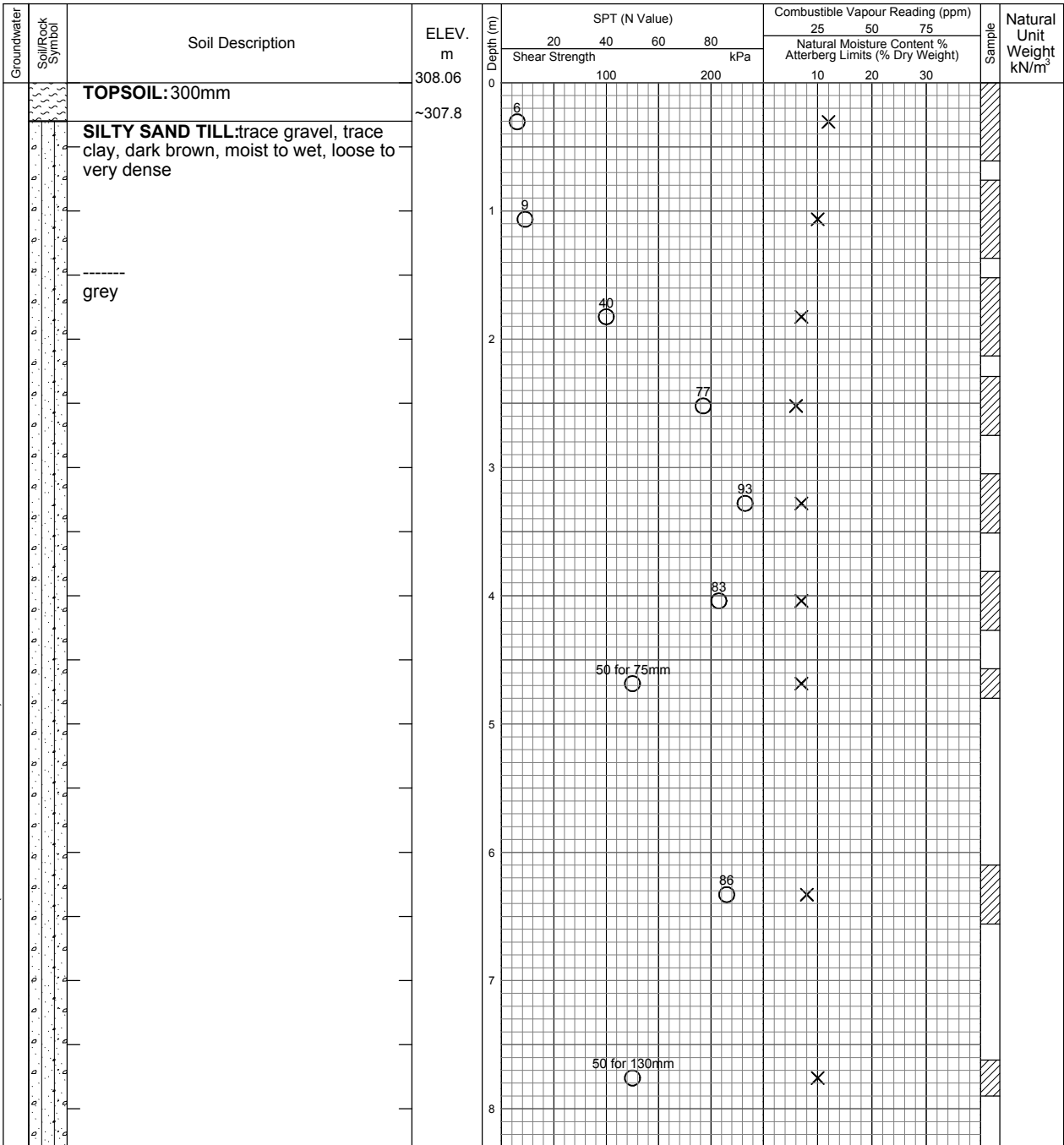
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.29



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)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
			299.76		Shear Strength kPa				Natural Moisture Content % Atterberg Limits (% Dry Weight)				
					100 200				10 20 30				
				9	50 for 150mm				X				
		END OF BOREHOLE	~298.8										

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.29

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

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

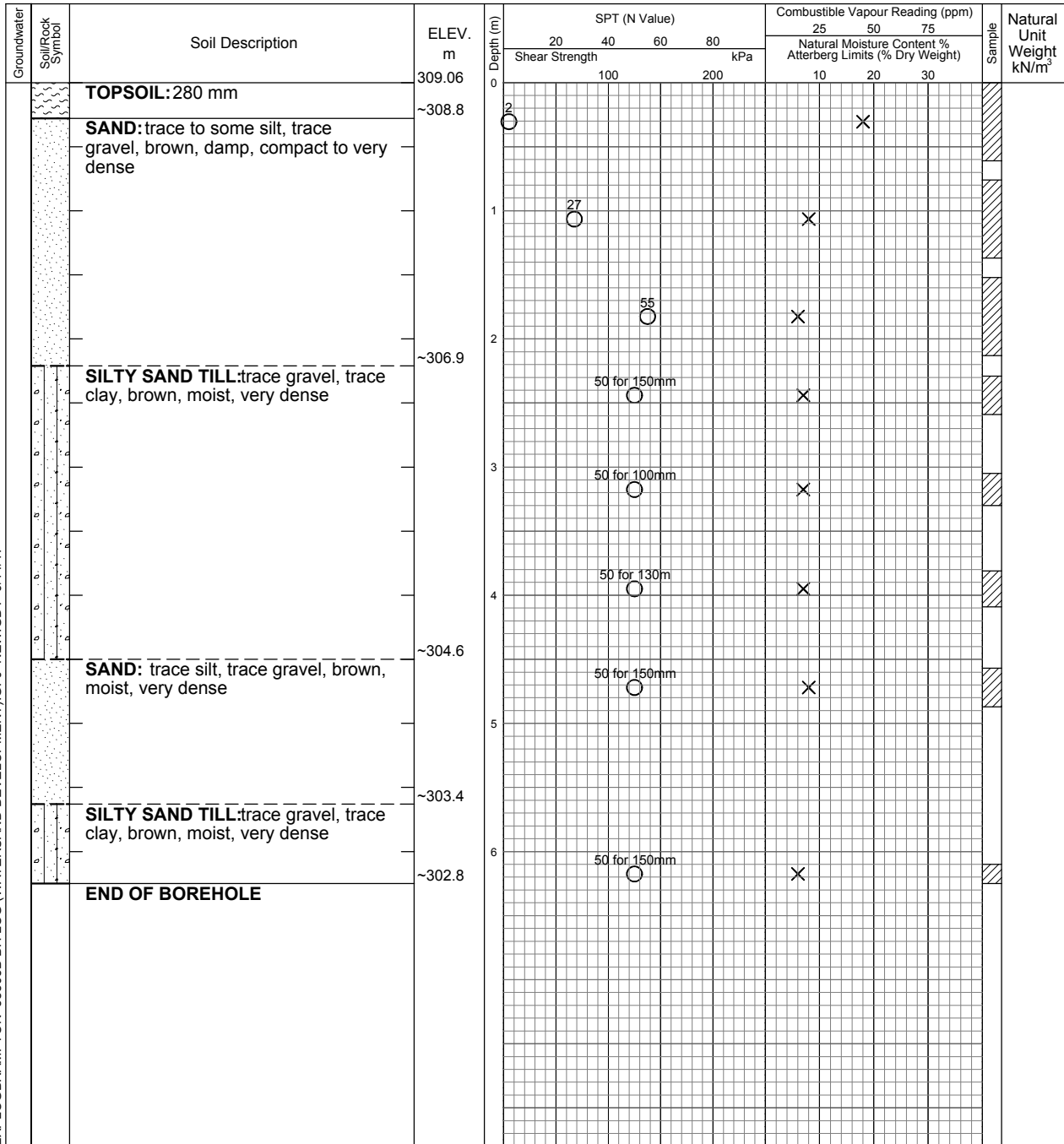


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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



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

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

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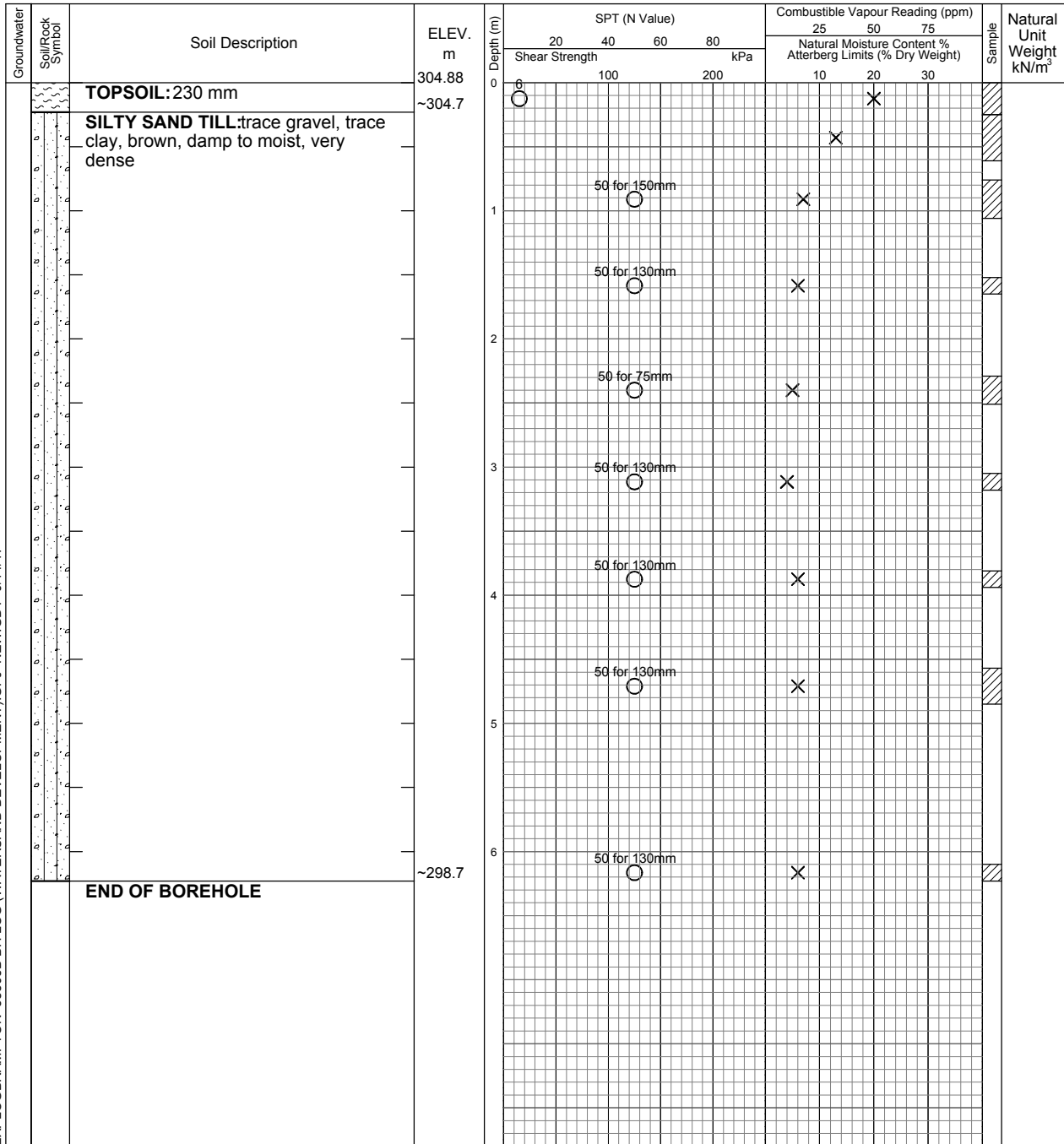
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

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

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

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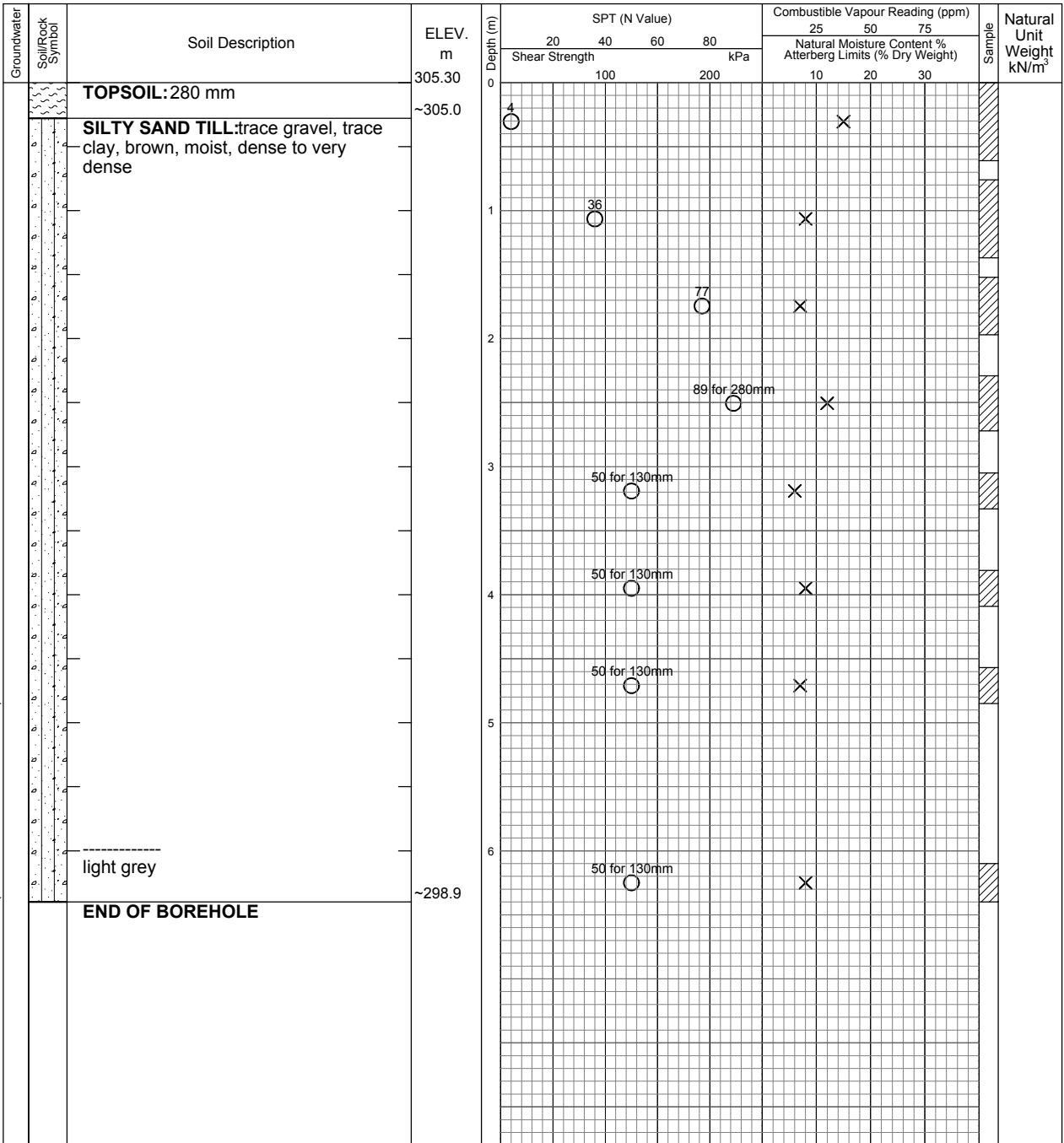
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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

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

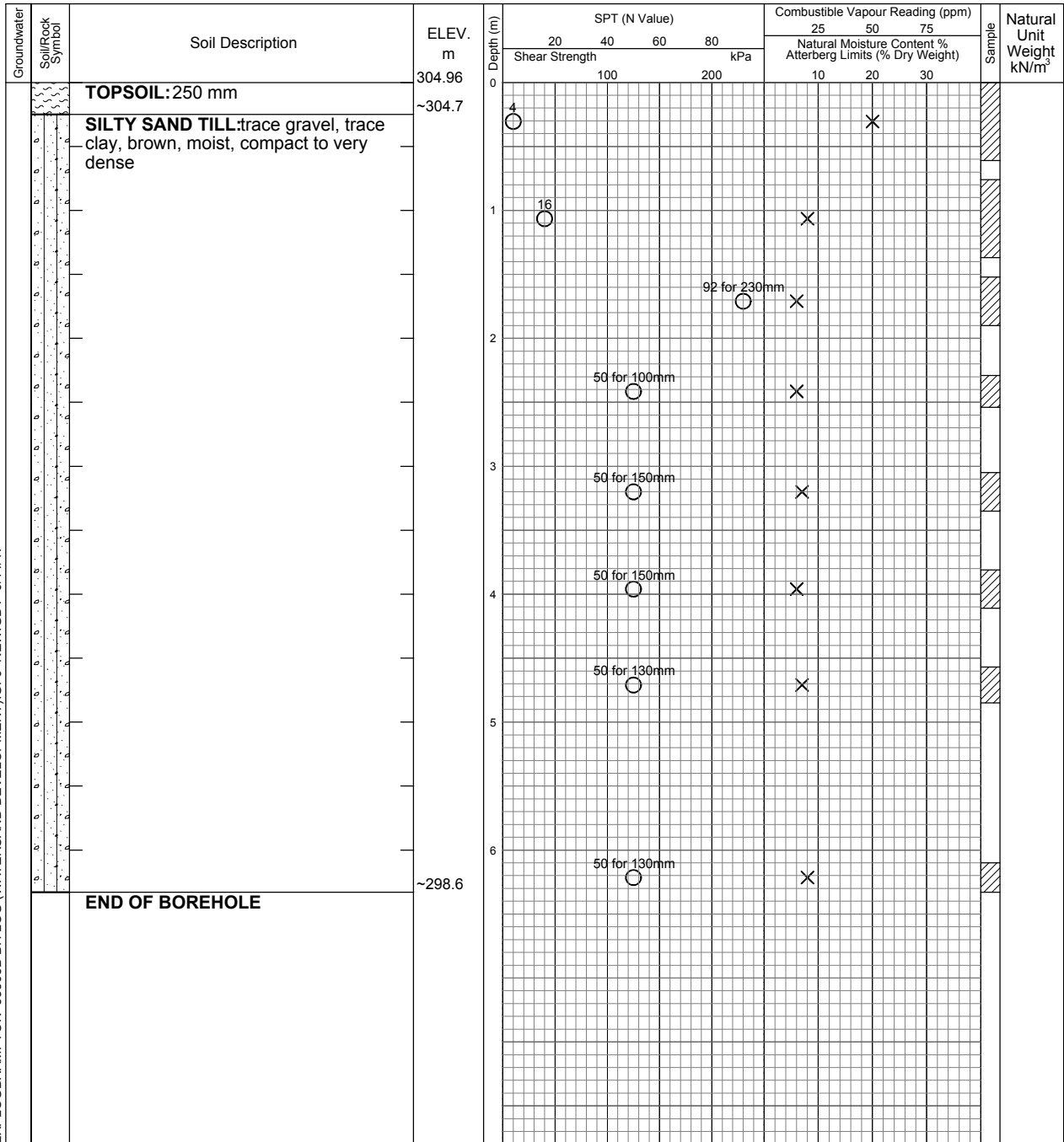


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33



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

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

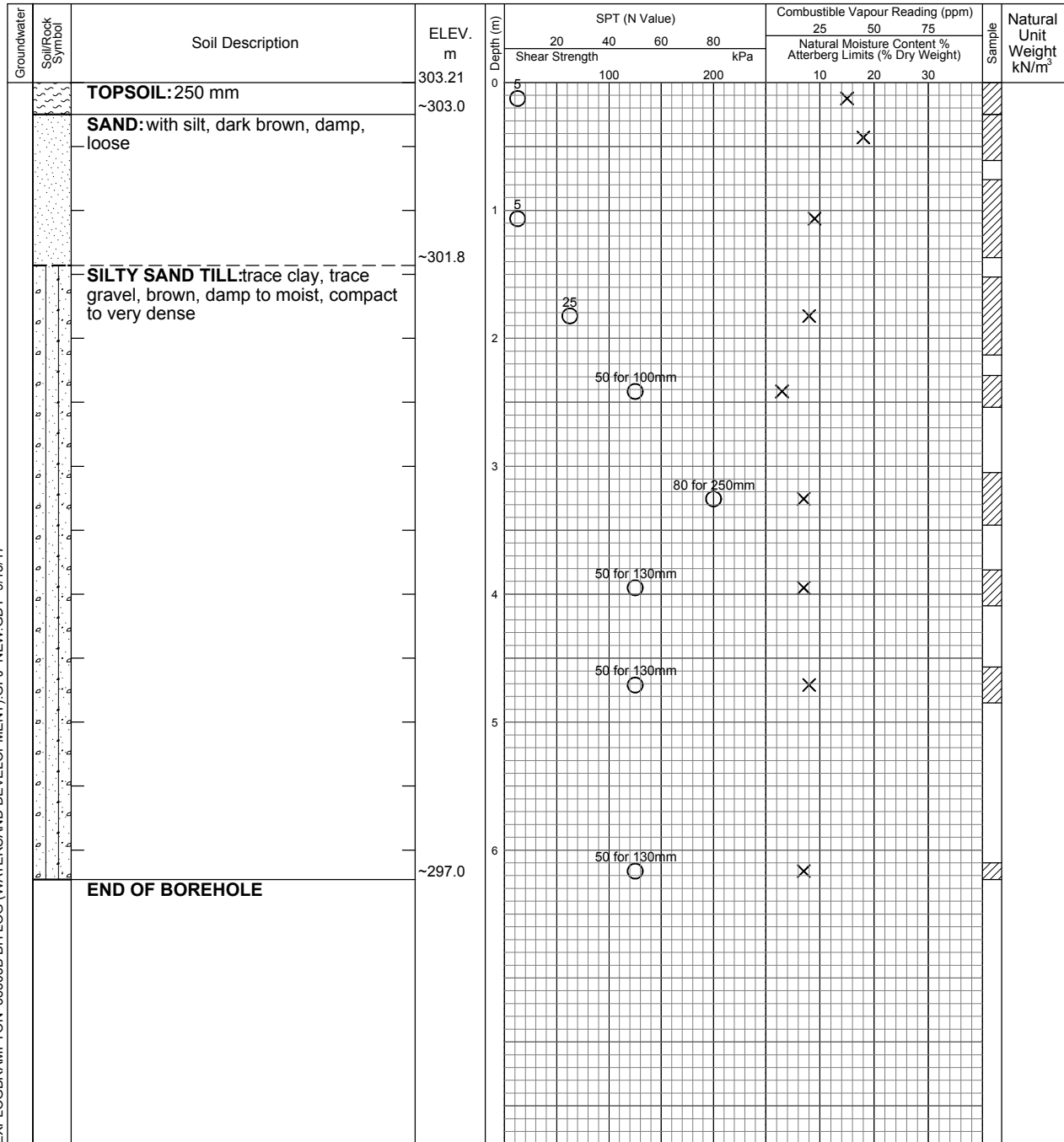


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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

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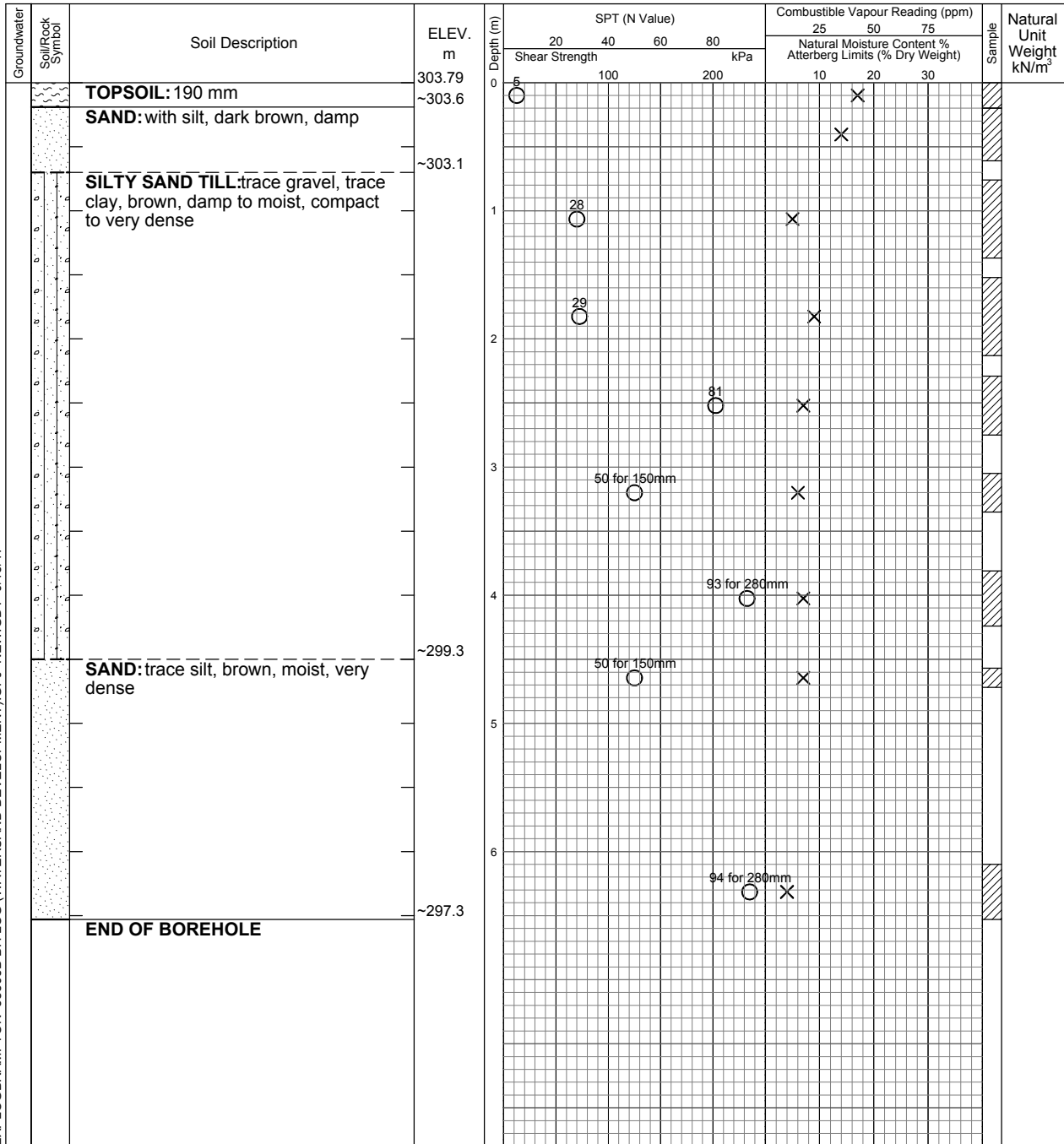
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.53



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

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

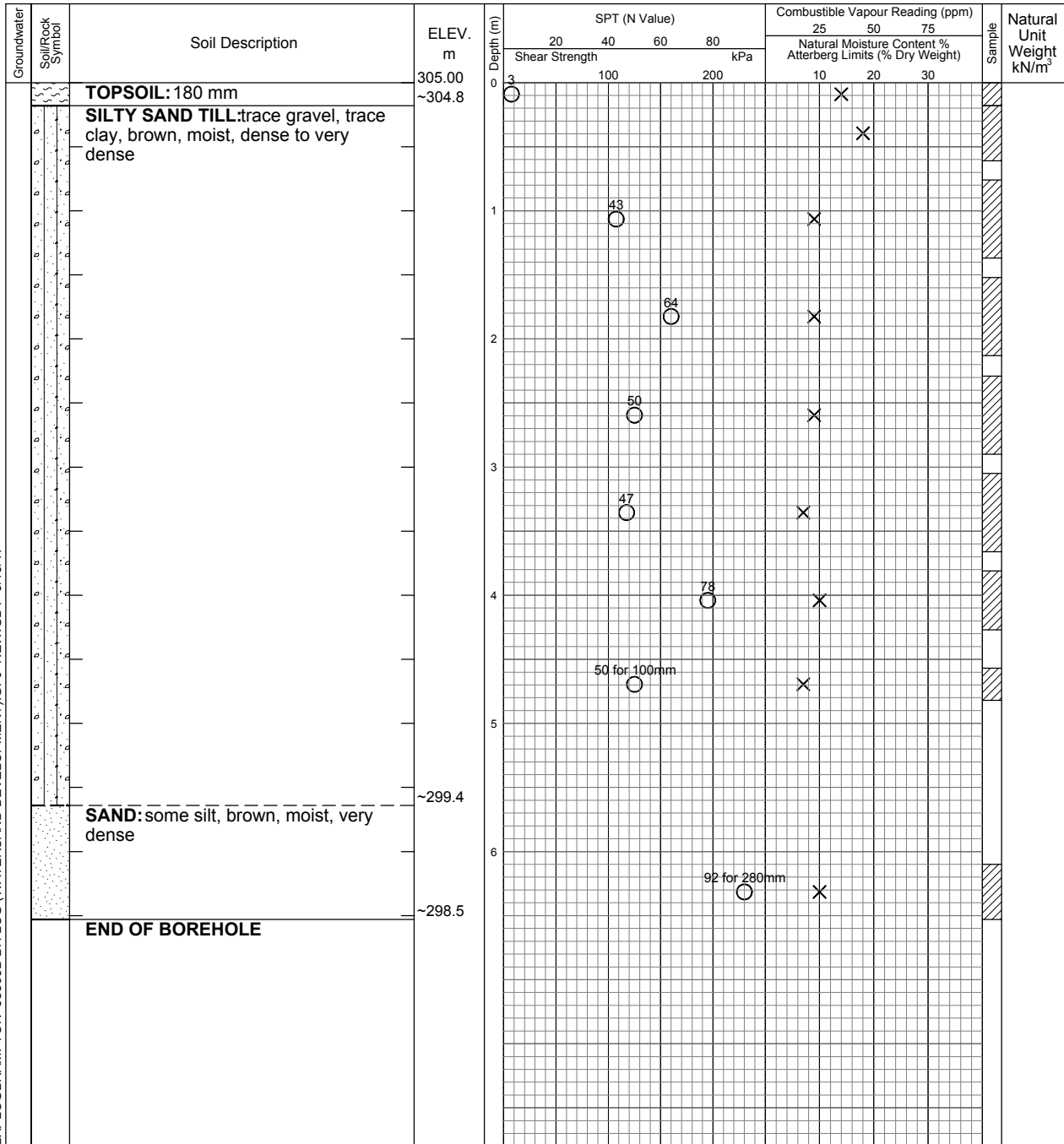


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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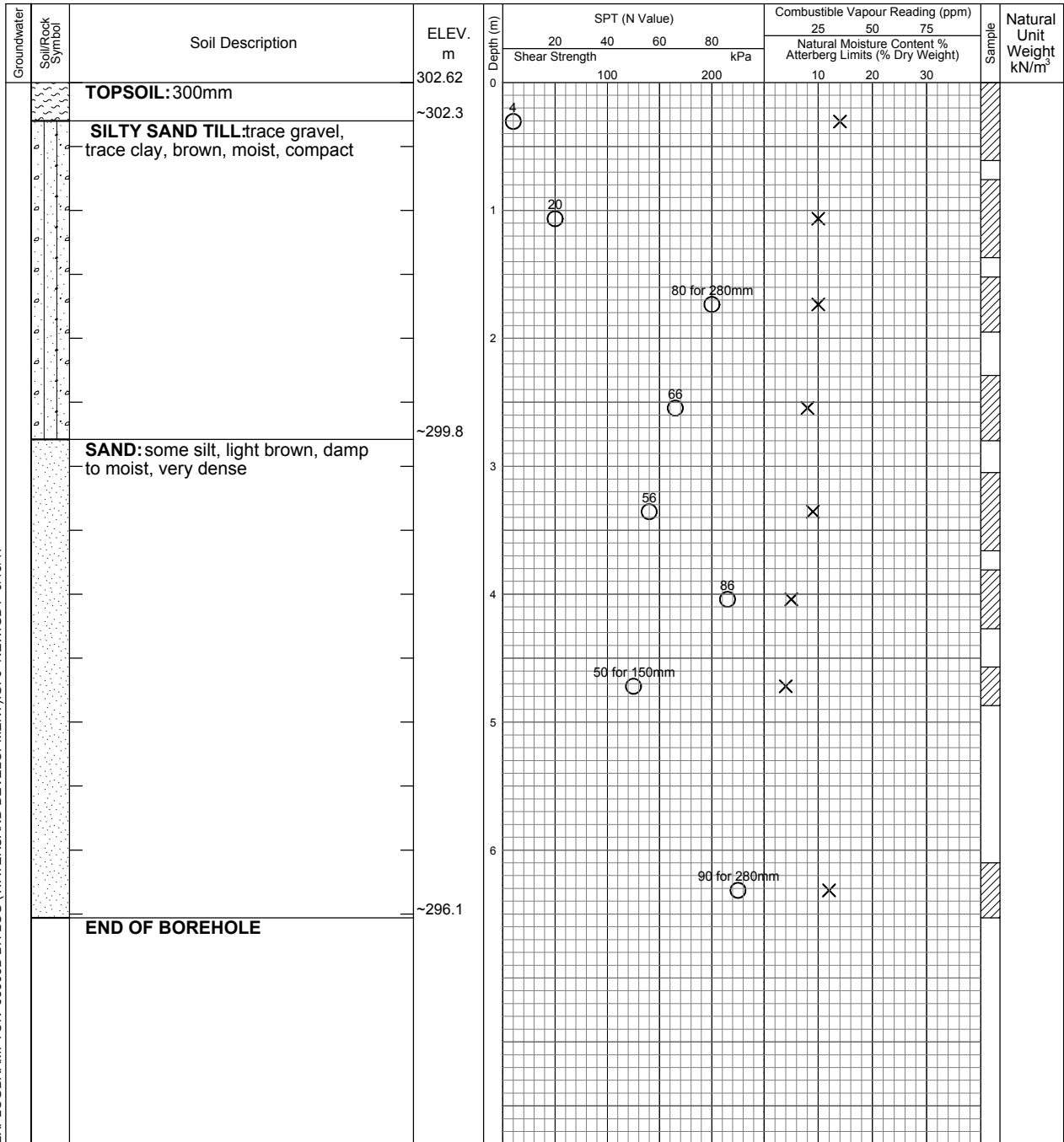
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.53



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

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

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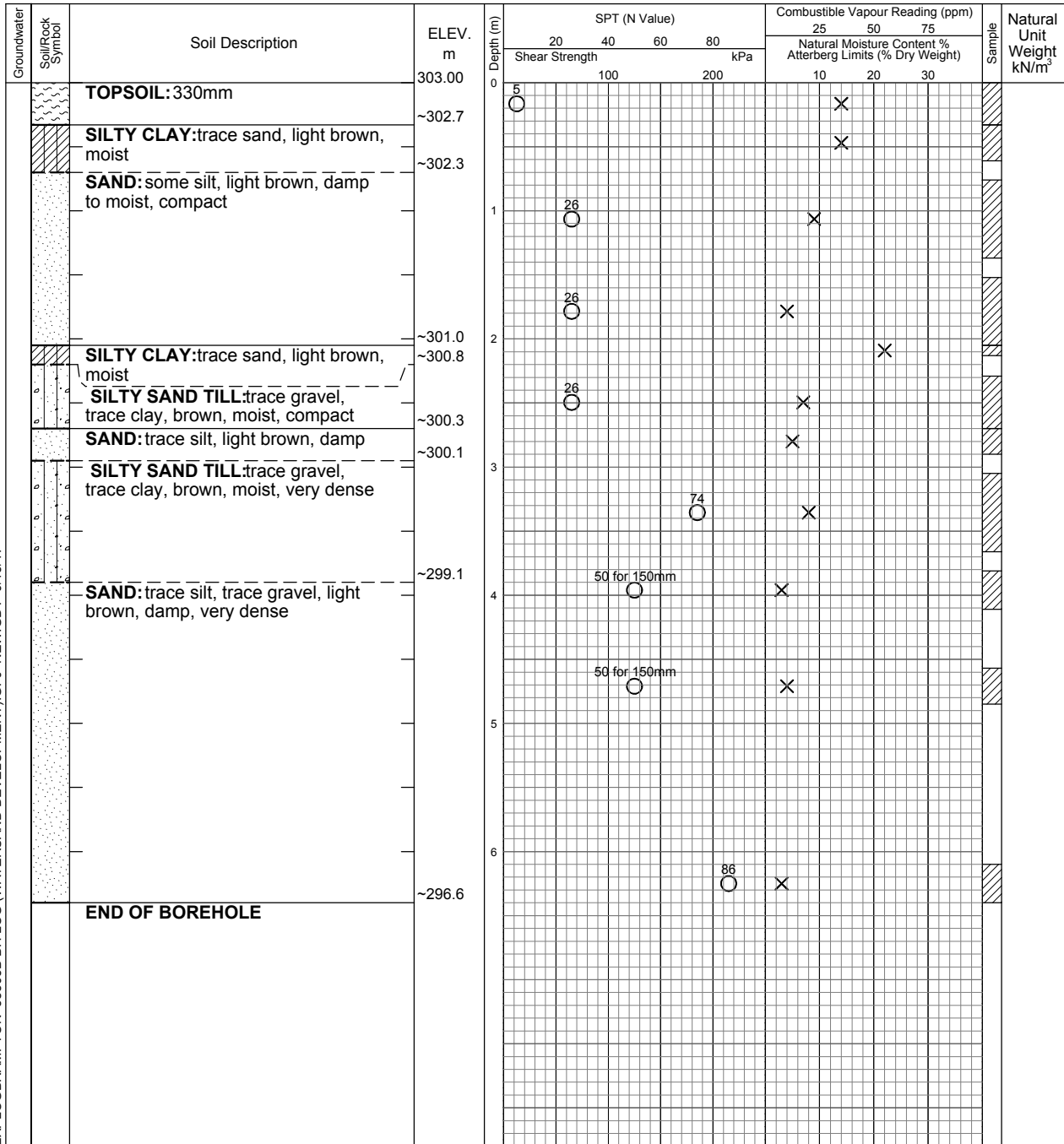
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40

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

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

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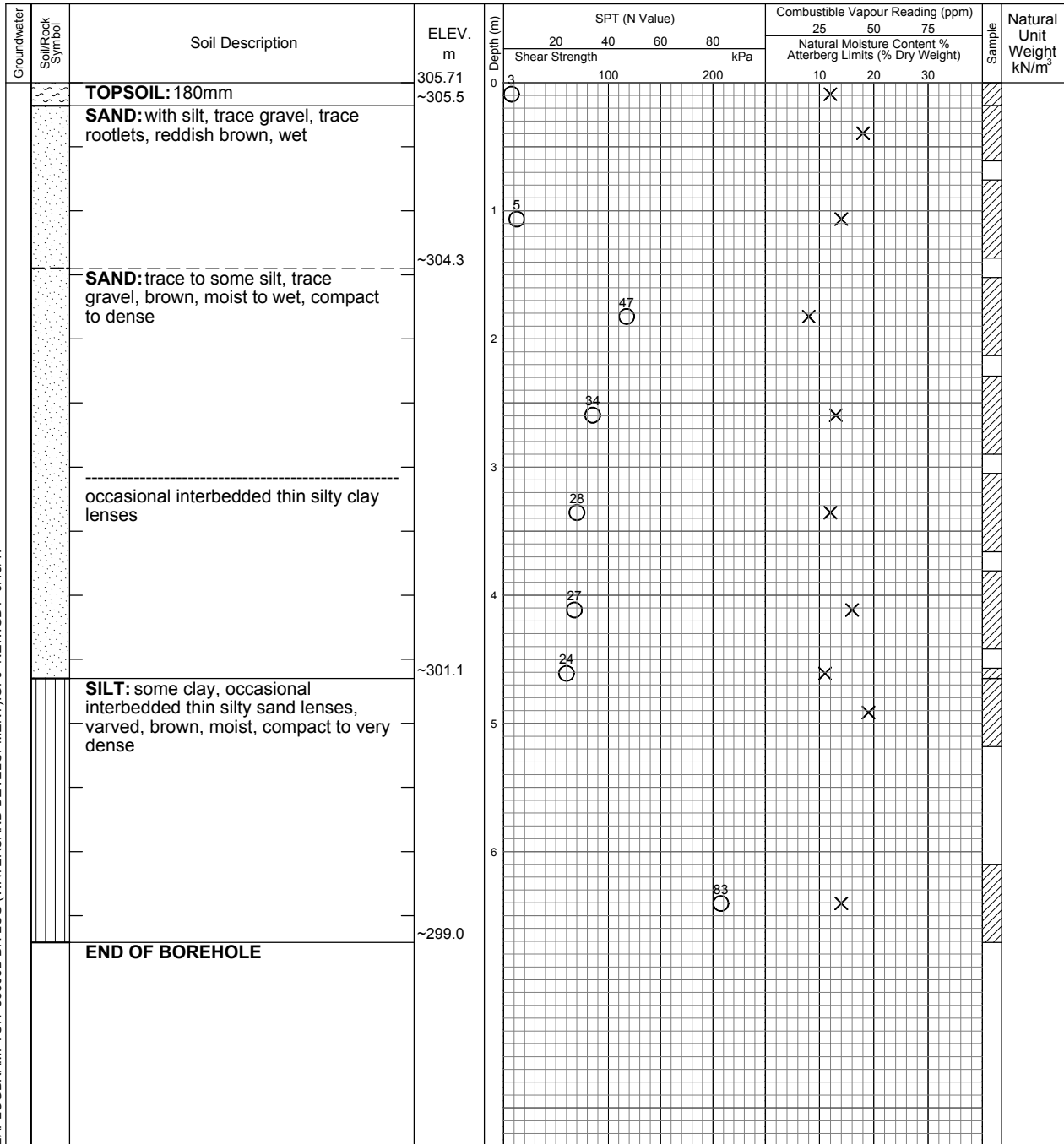
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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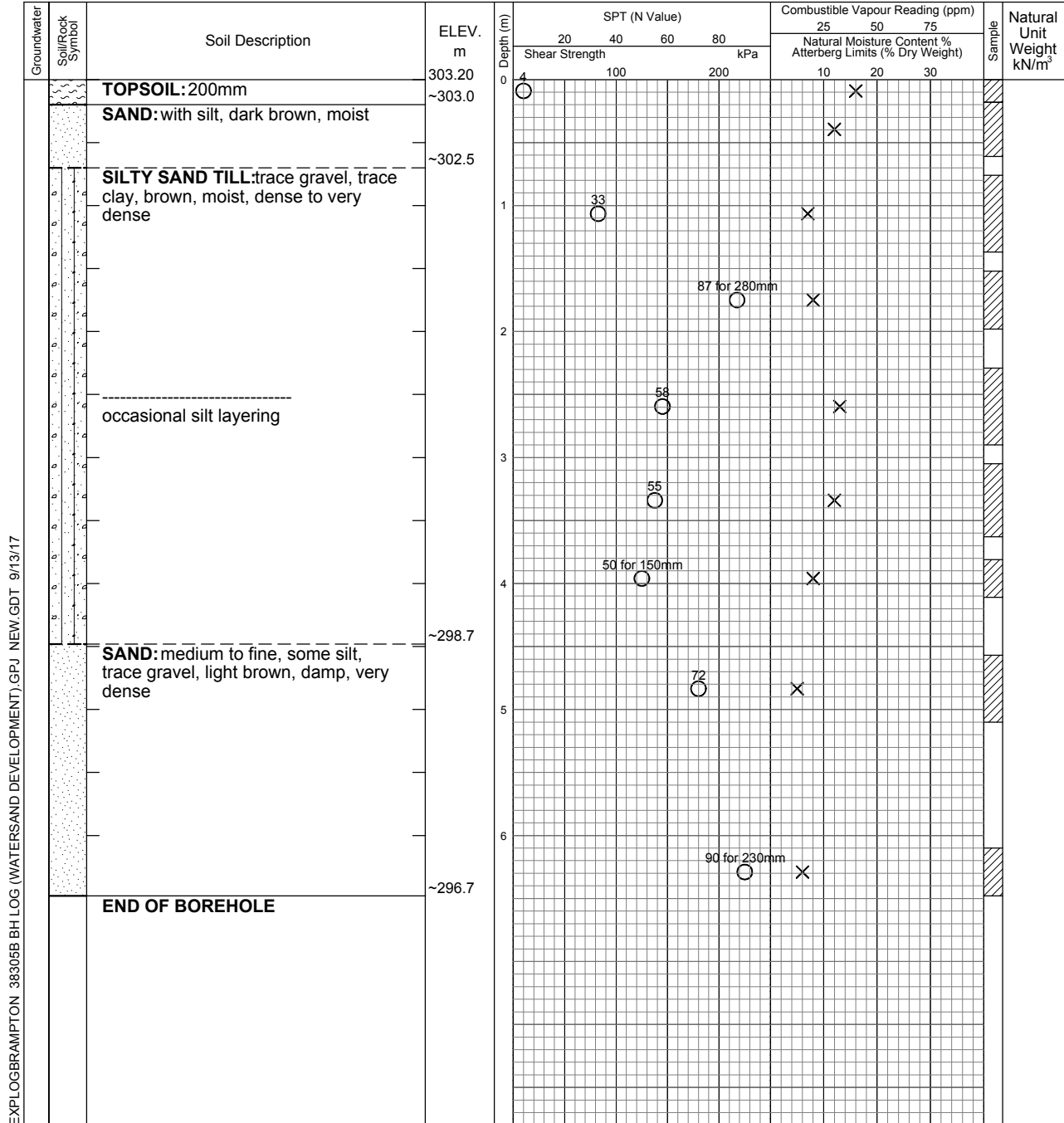
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.48

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

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

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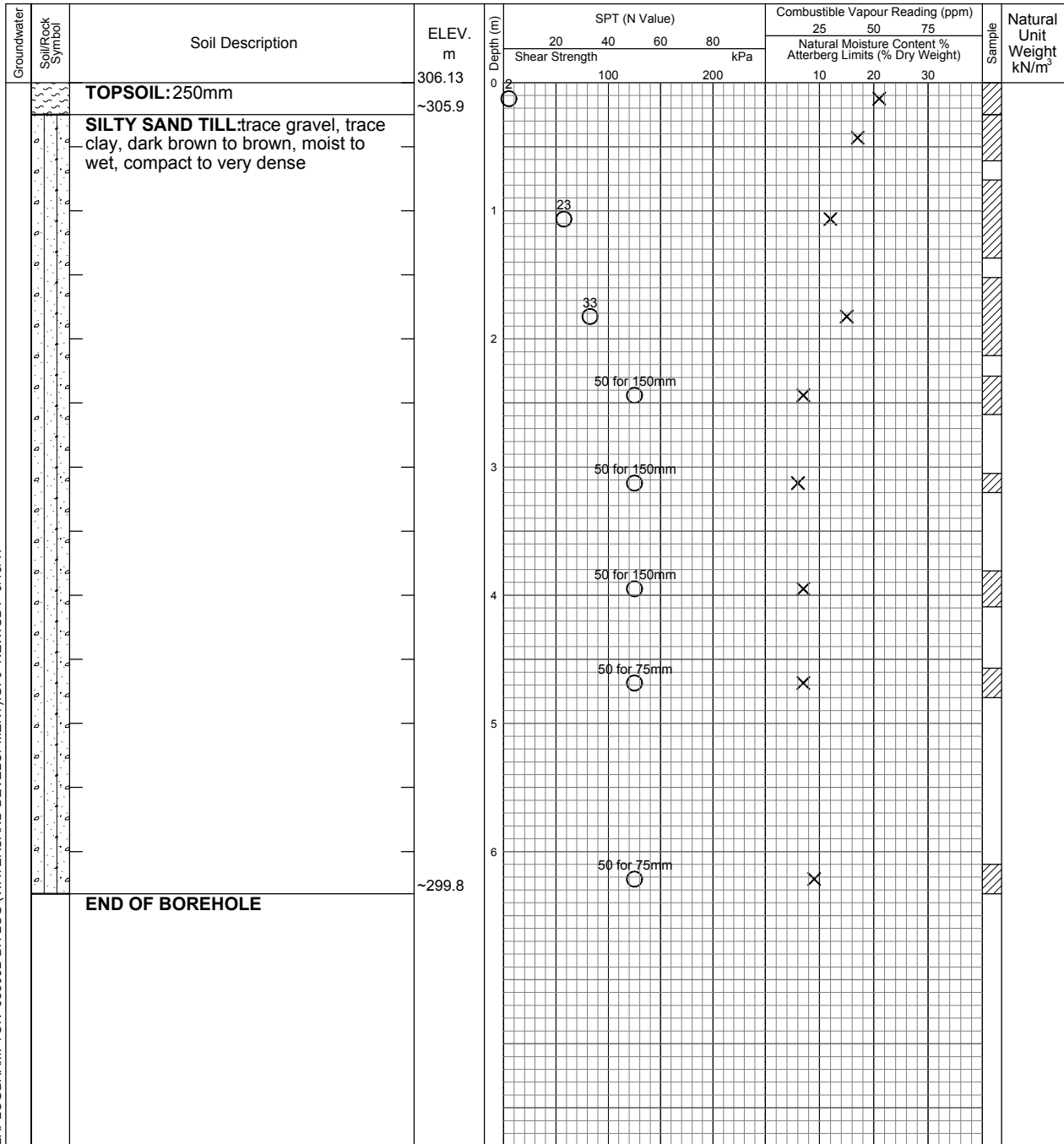
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33

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

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

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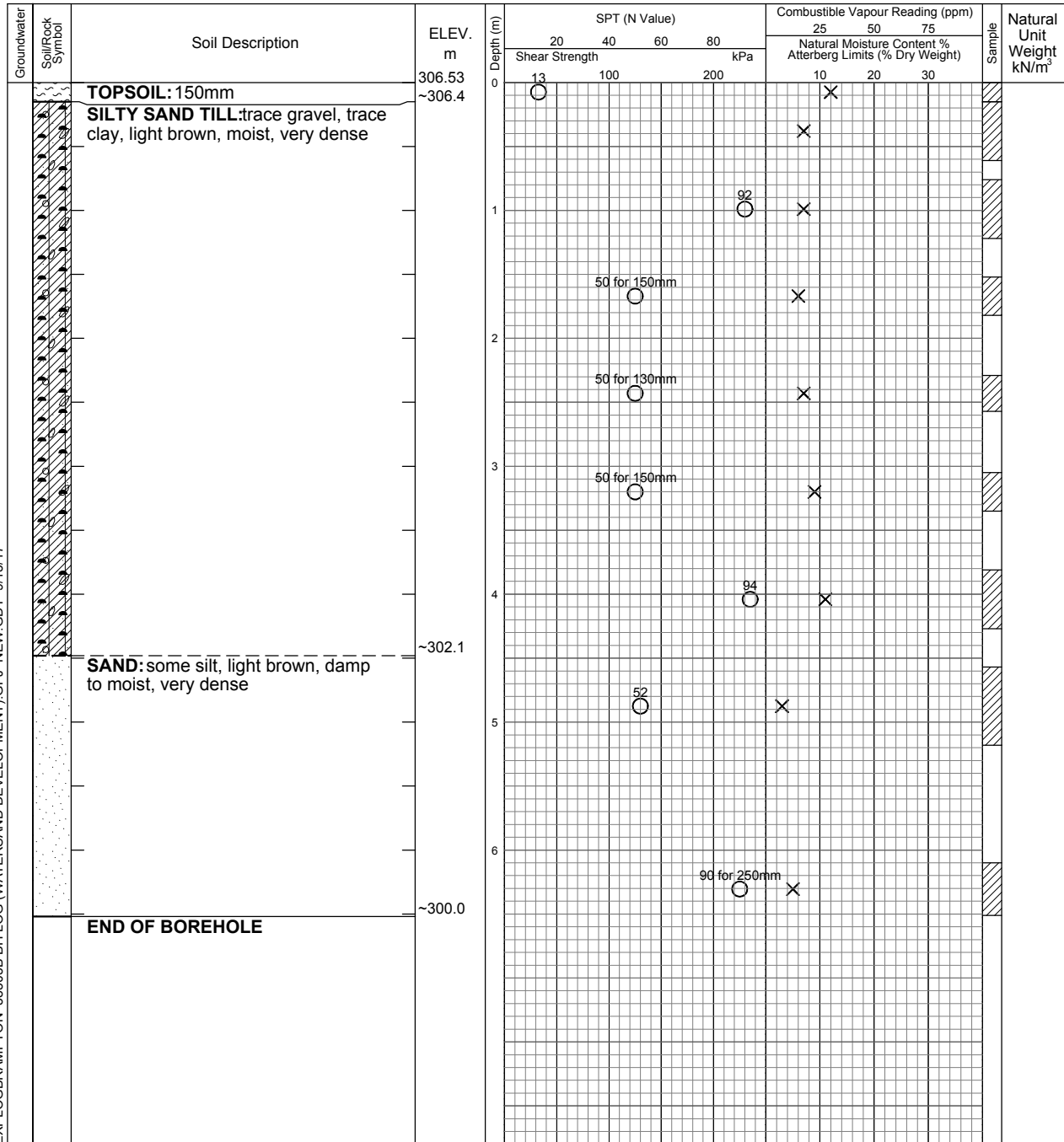
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71



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

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

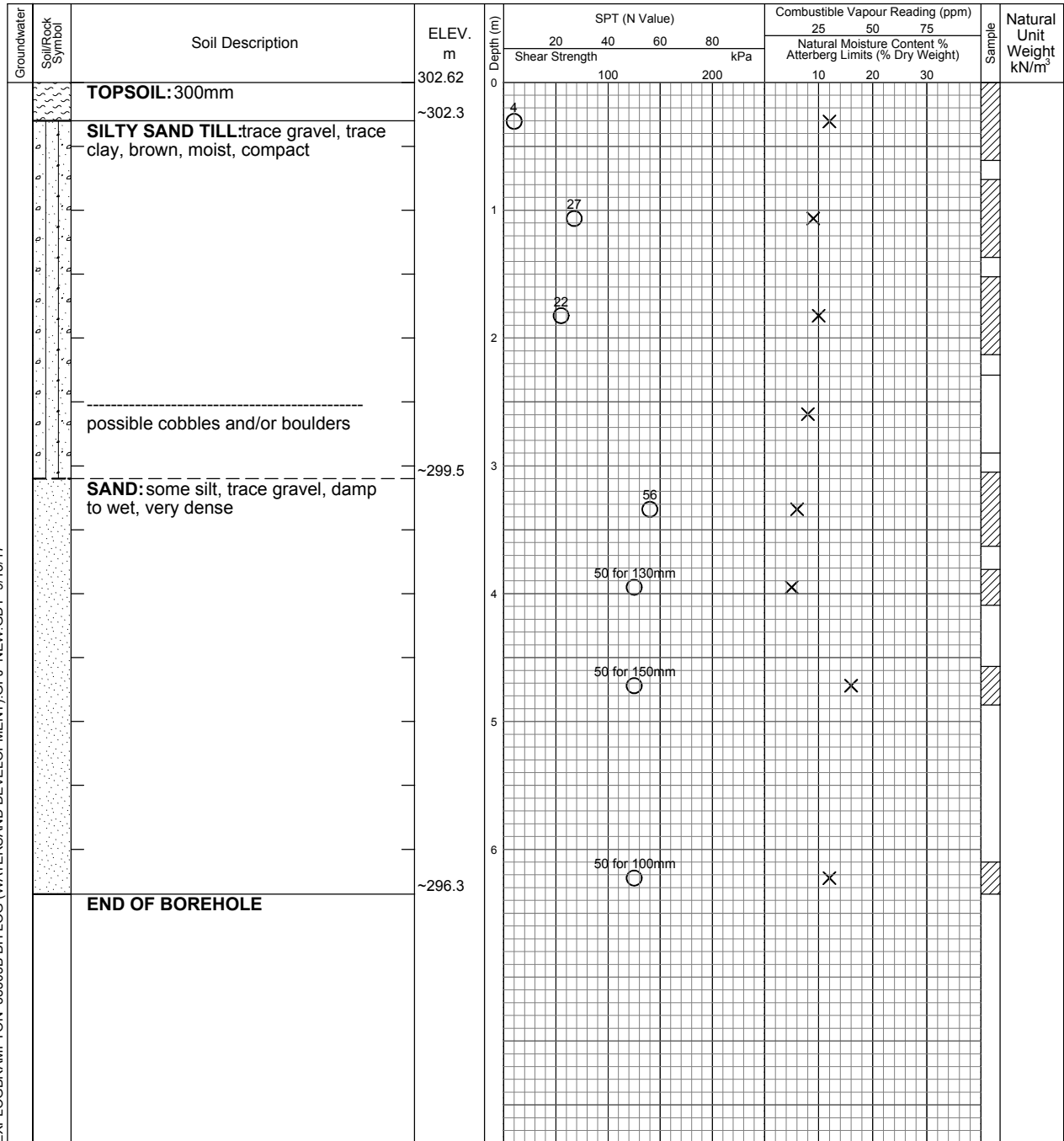


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.35



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

Auger Sample

SPT (N) Value

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Shelby Tube

Datum: Geodetic

Field Vane Test

Combustible Vapour Reading

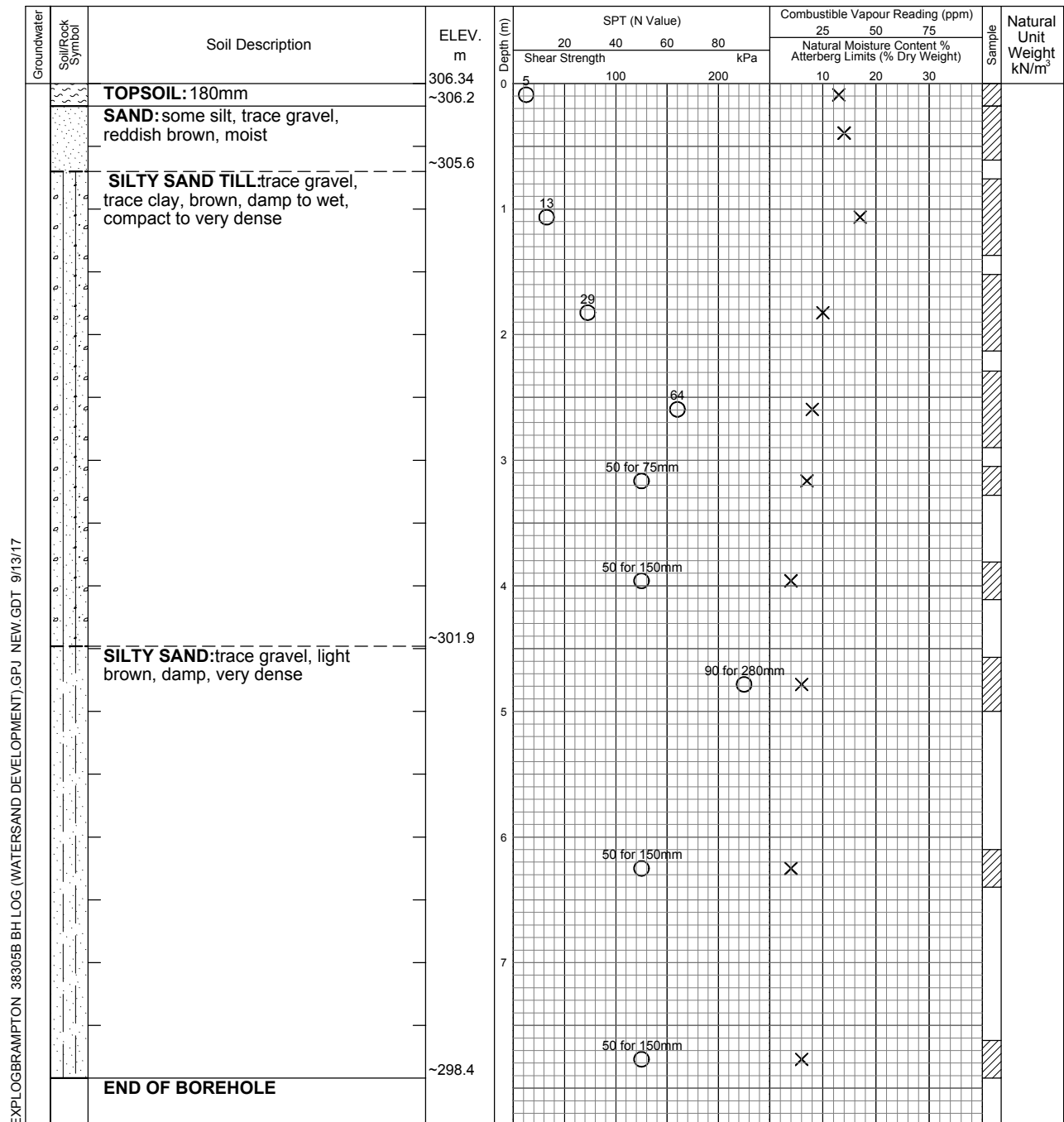
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.92



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

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

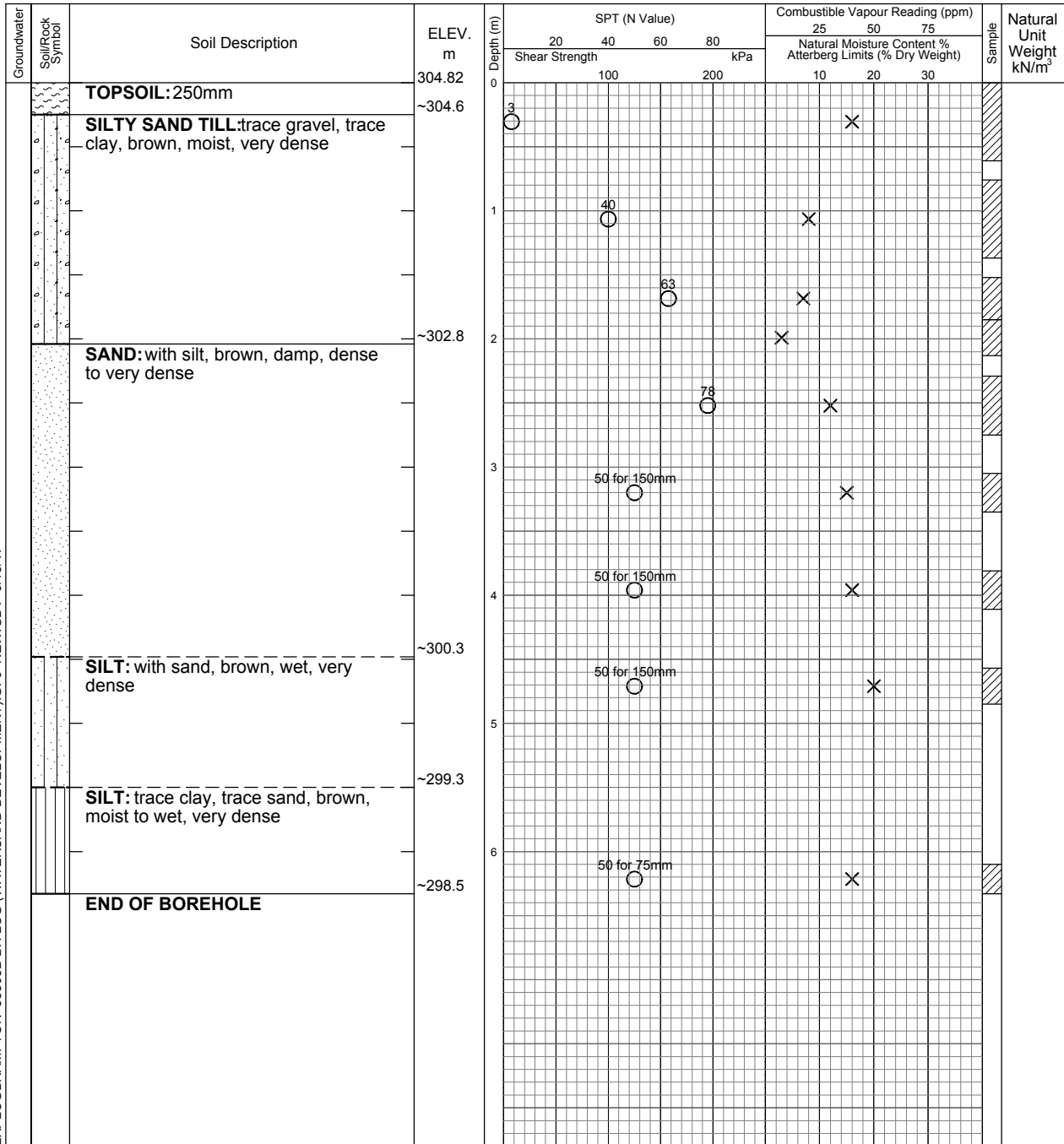


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33

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

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

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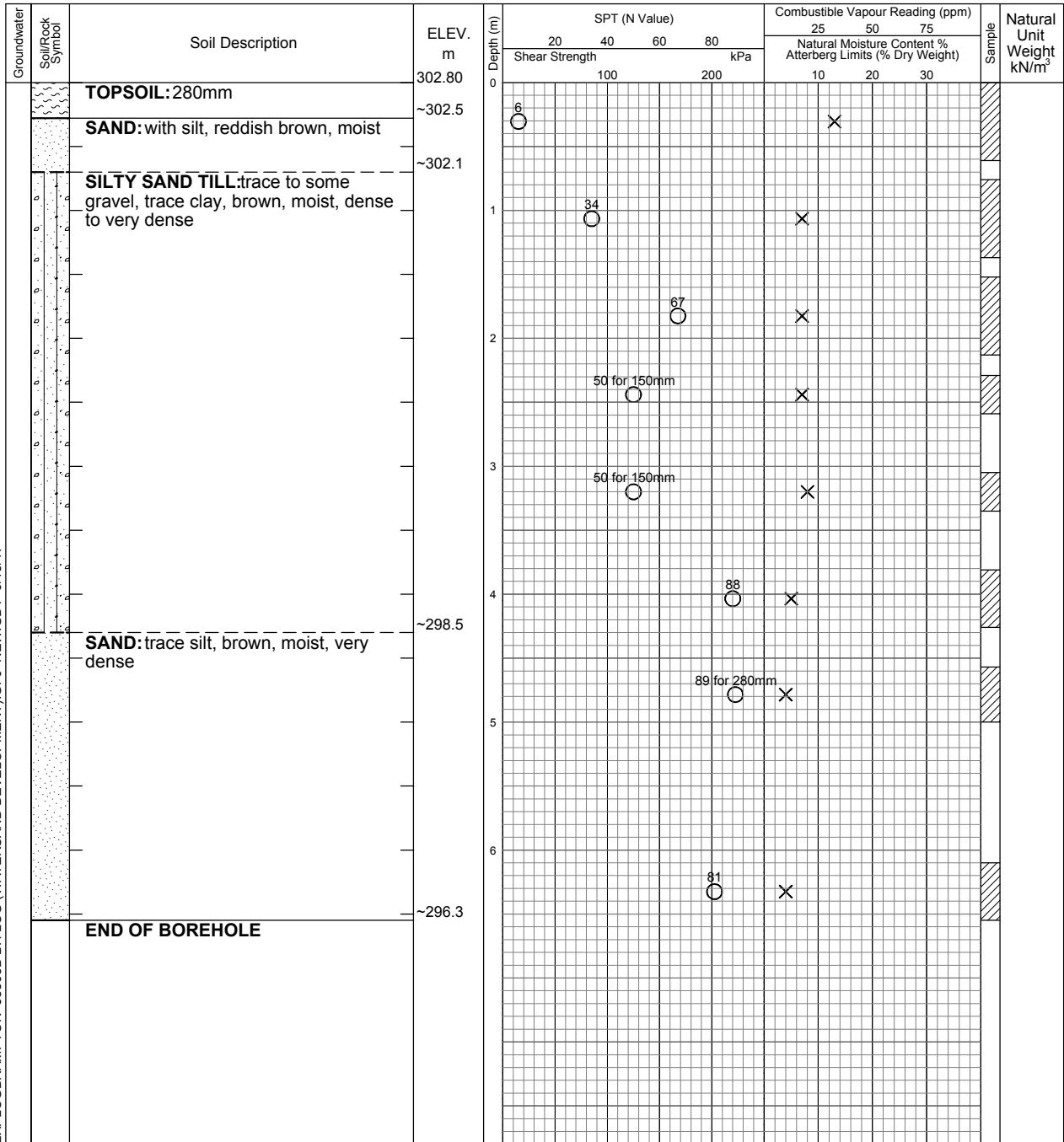
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.55



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

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

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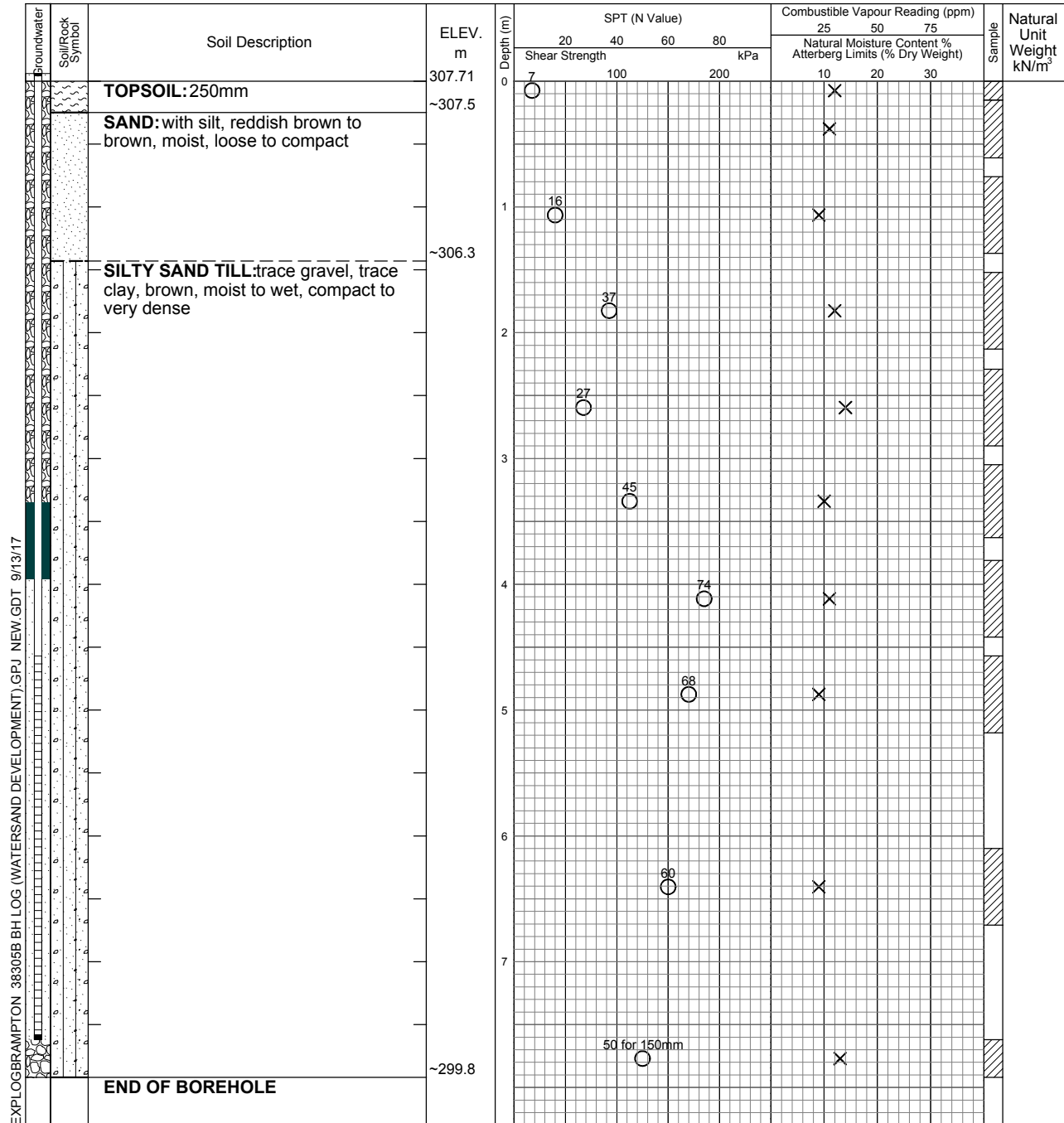
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
June 22, 2017	5.18	-
August 10, 2017	5.80	-

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

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

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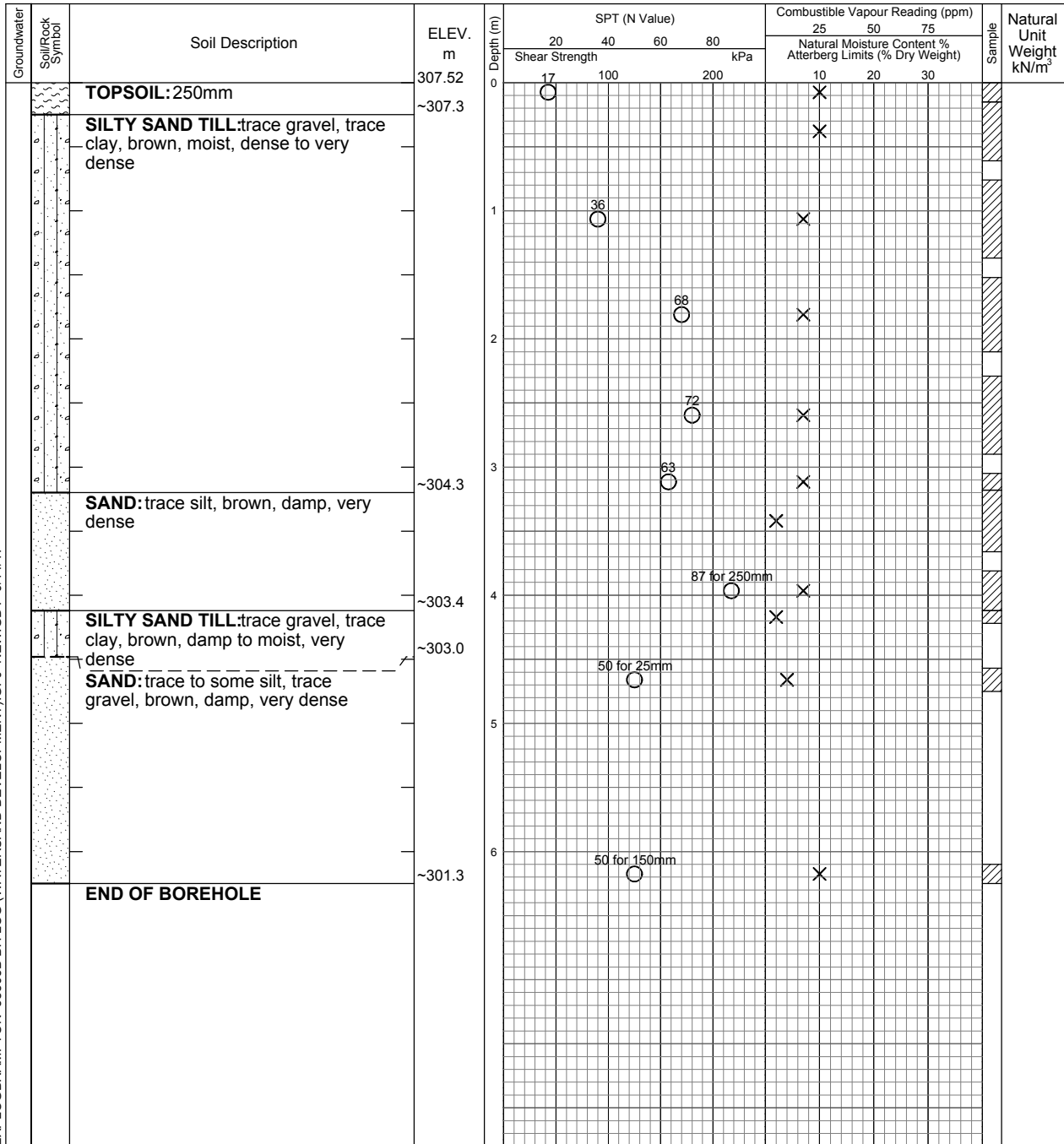
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



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



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

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

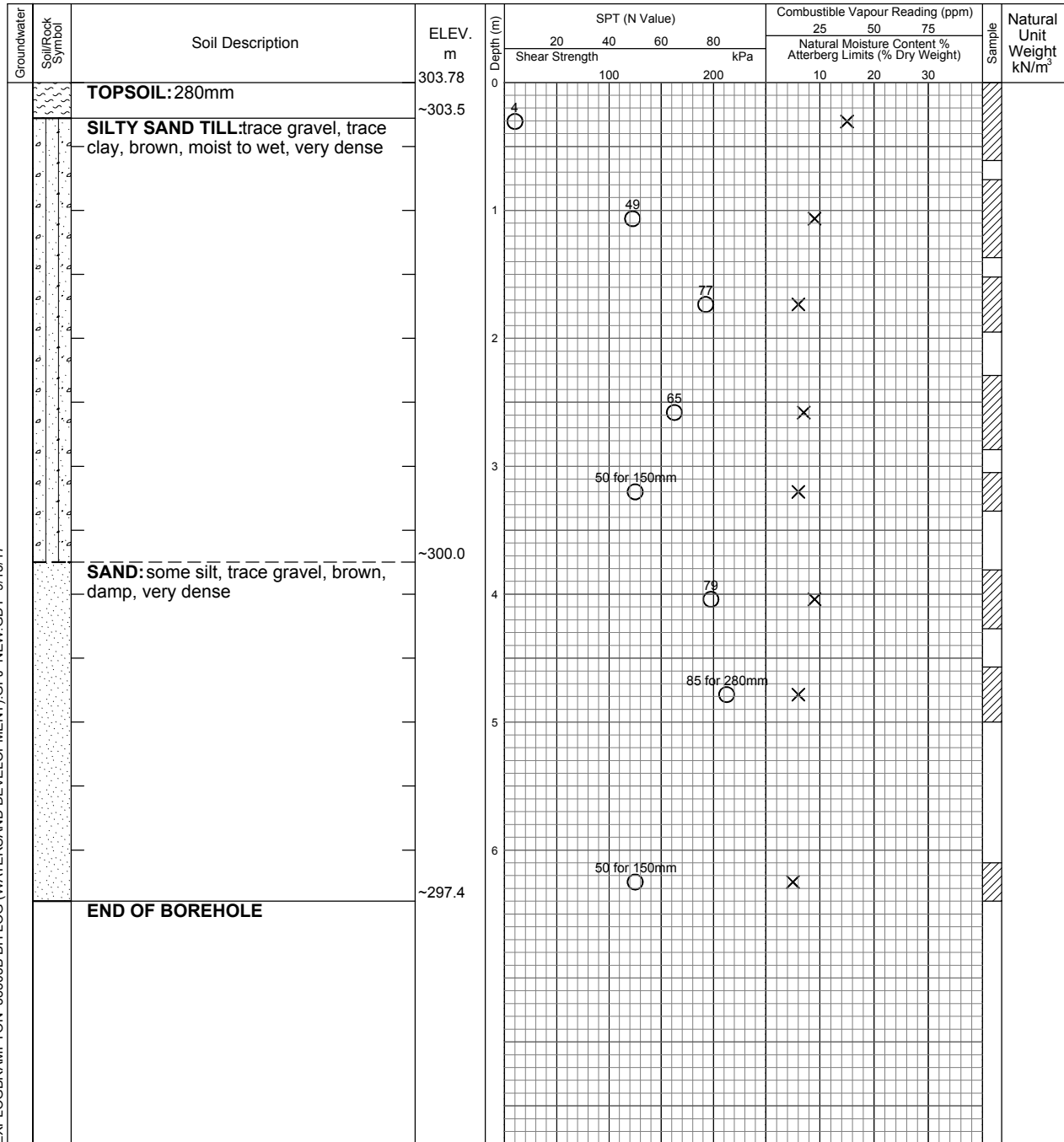


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



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

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

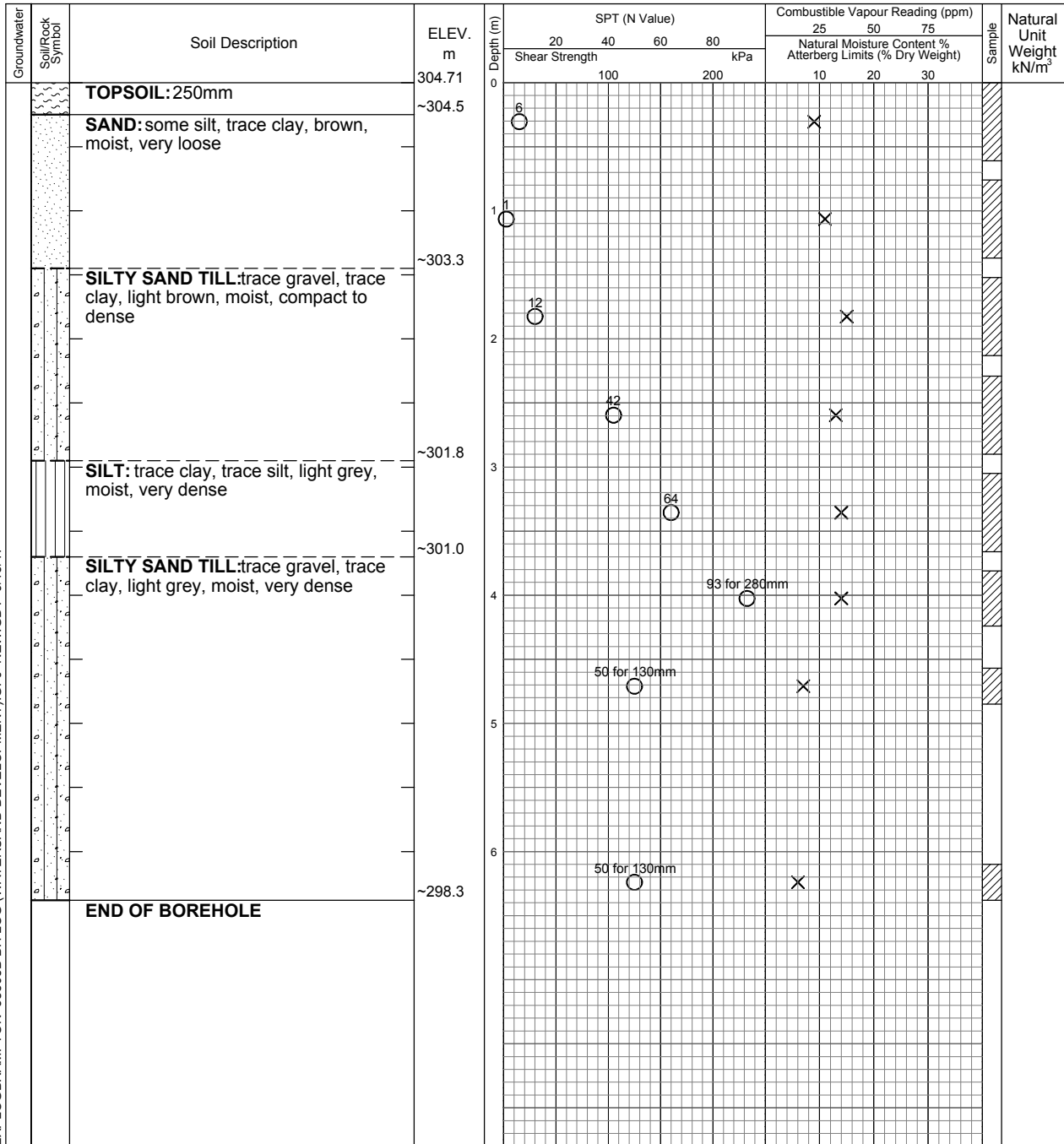


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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

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

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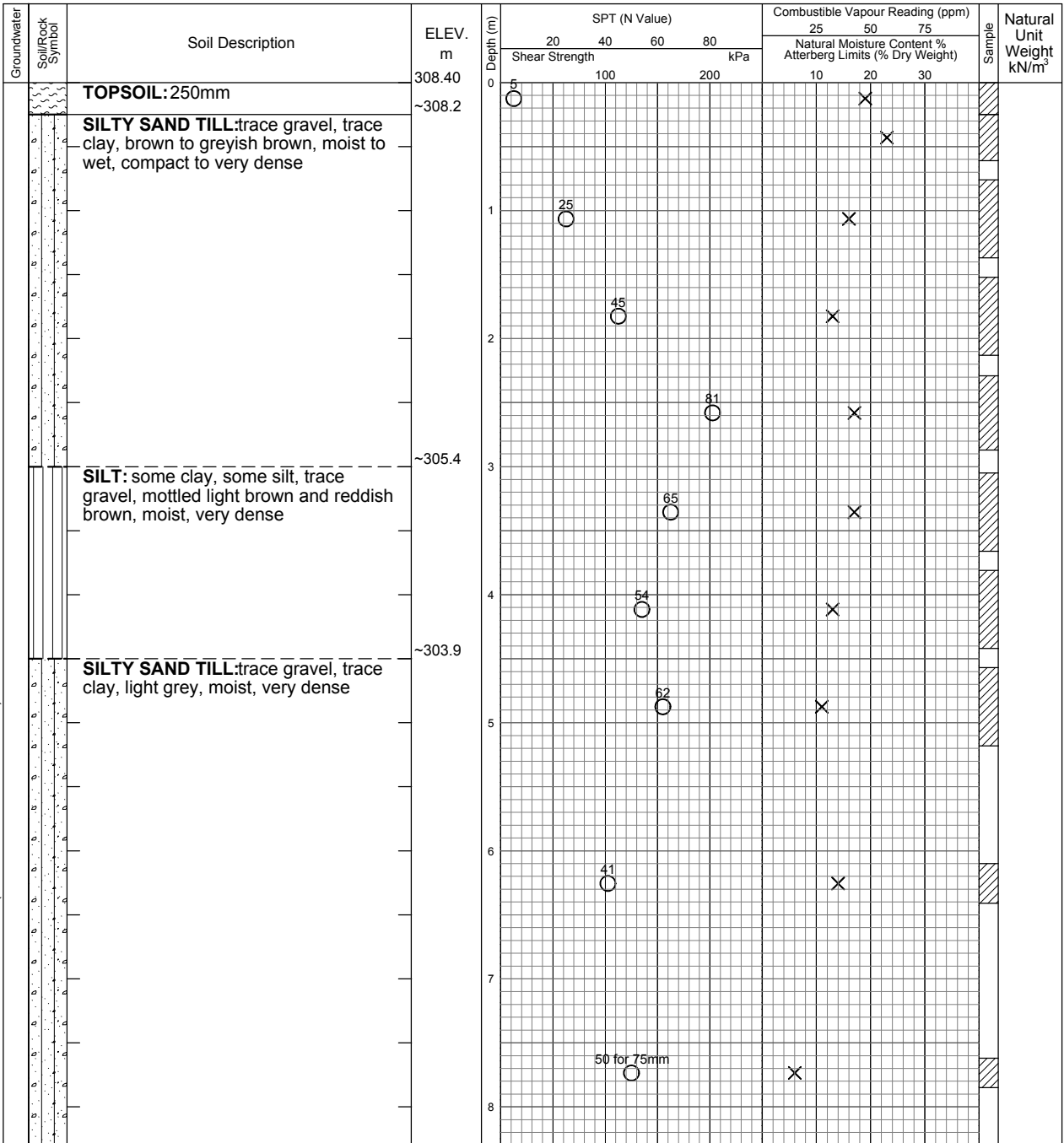
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.24



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.24

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

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

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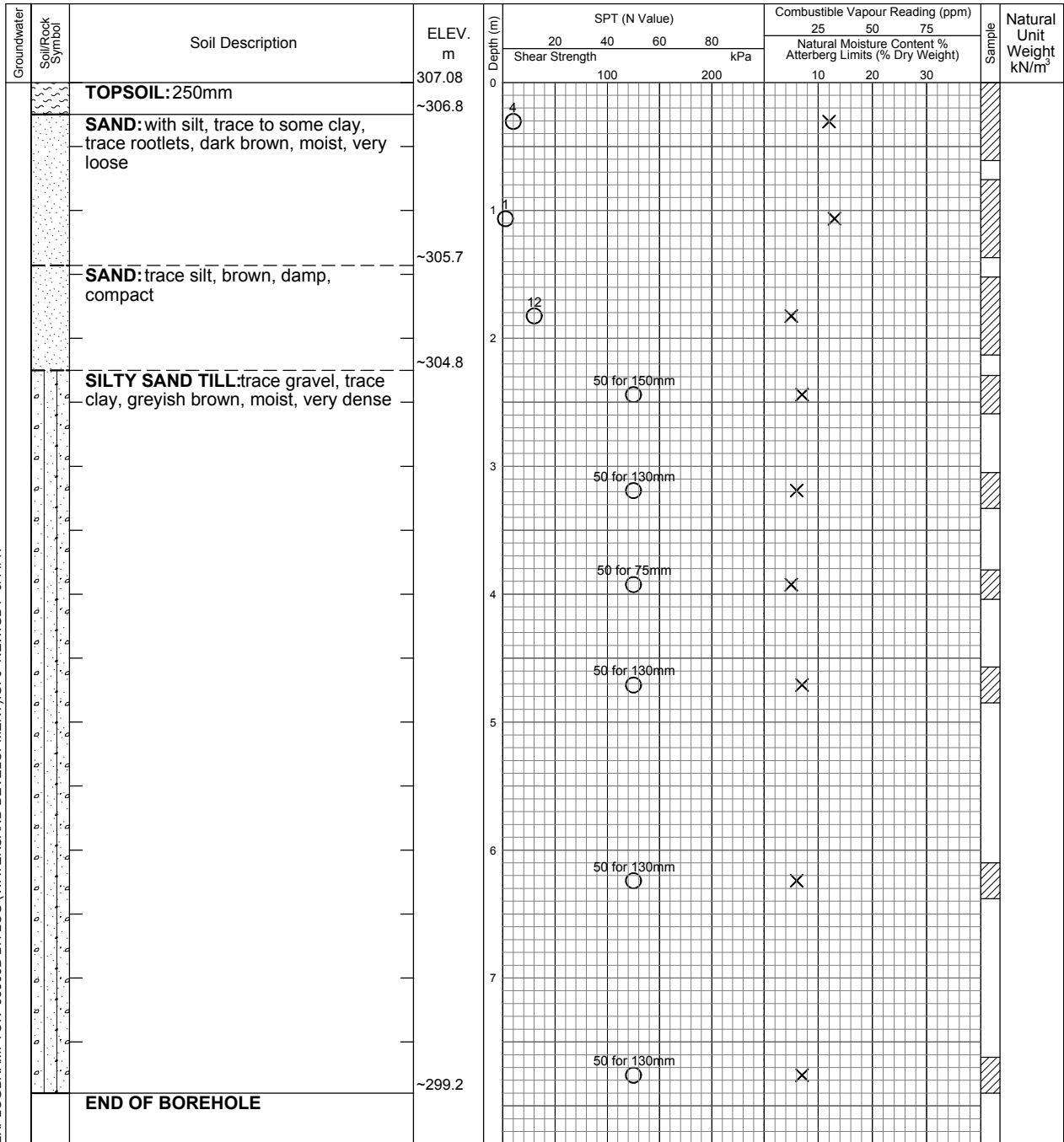
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.90



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

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

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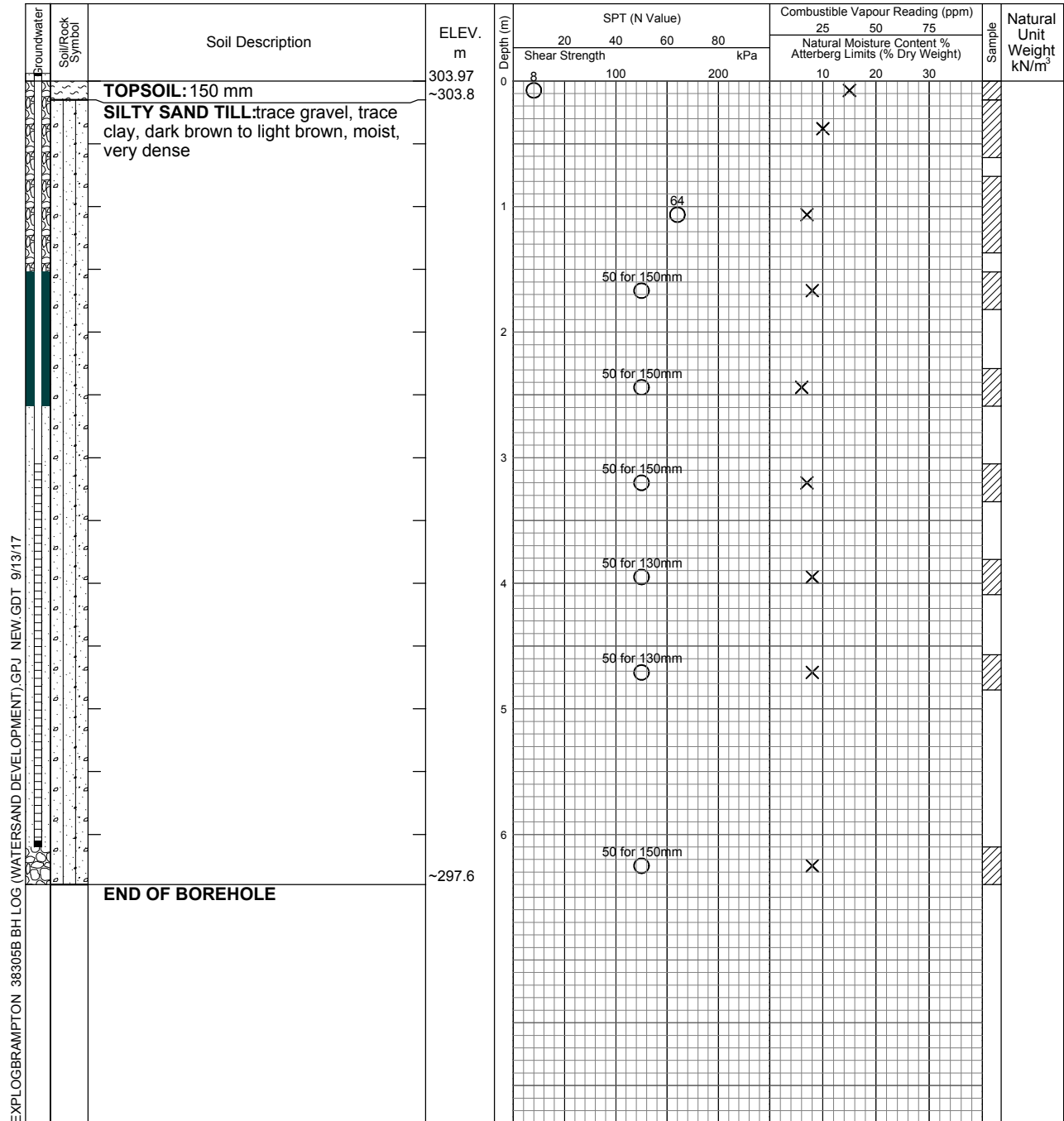
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40
June 22, 2017	Dry	-
August 18, 2017	Dry	-

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

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

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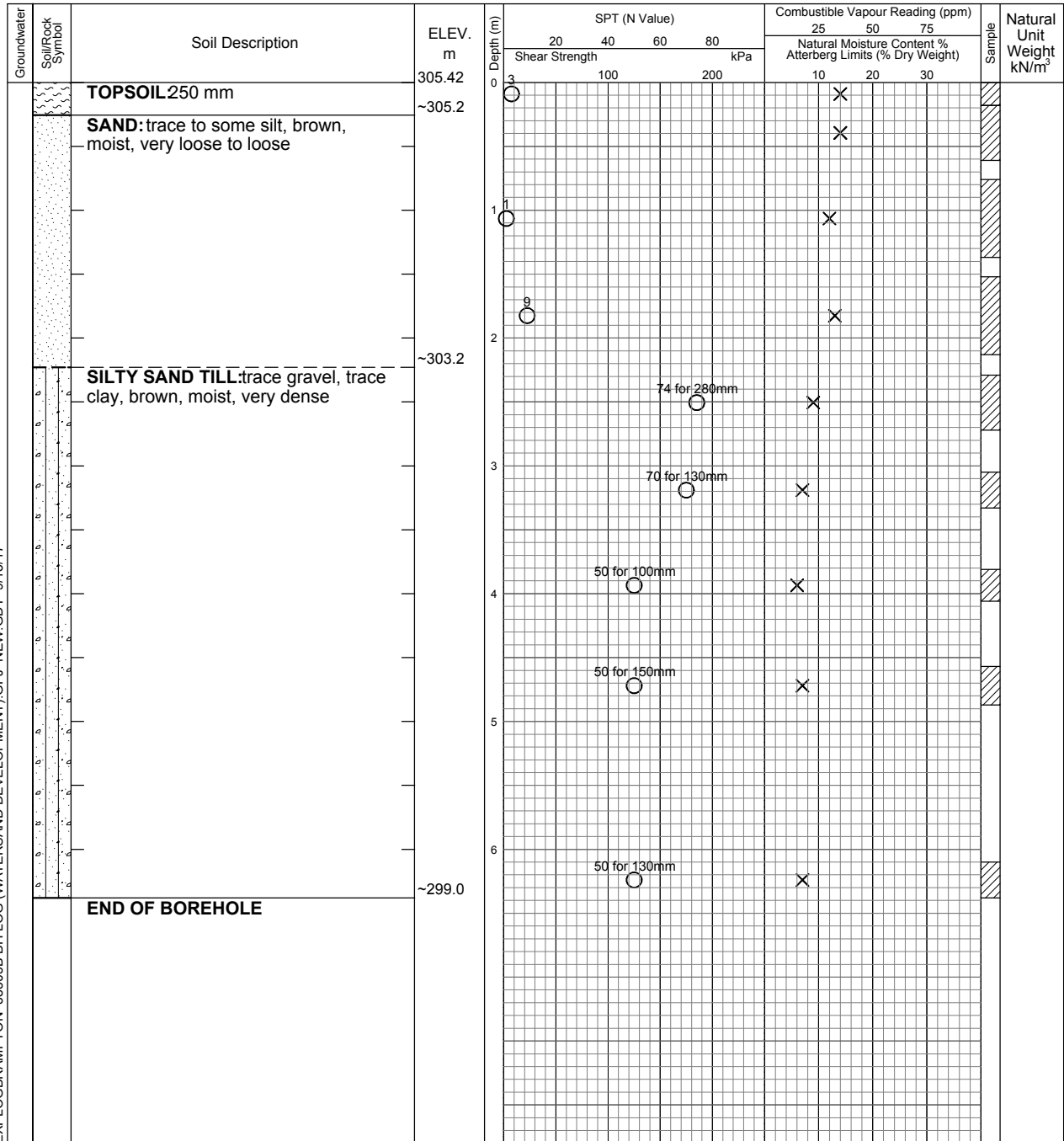
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

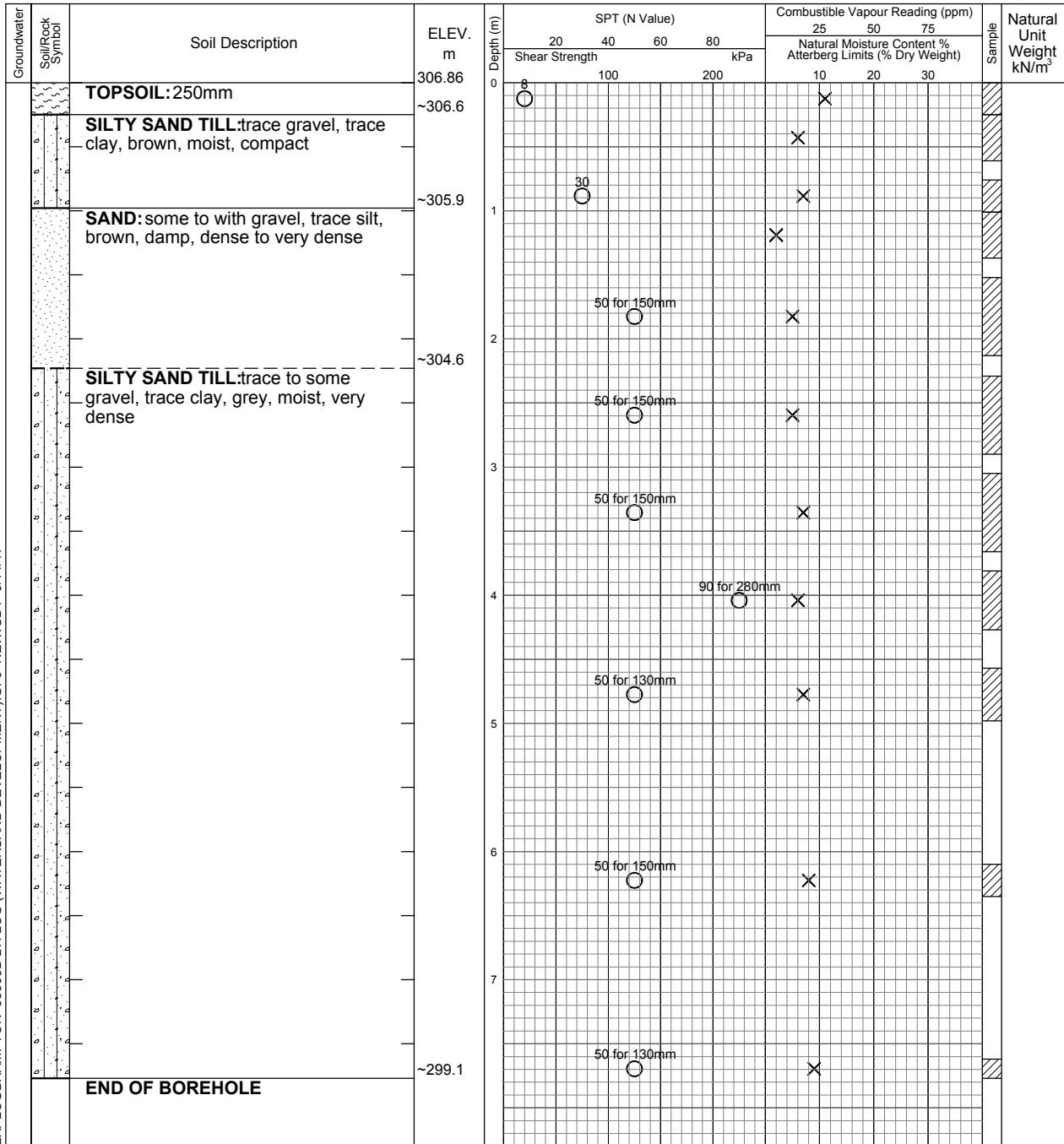


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/14/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	7.77



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

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

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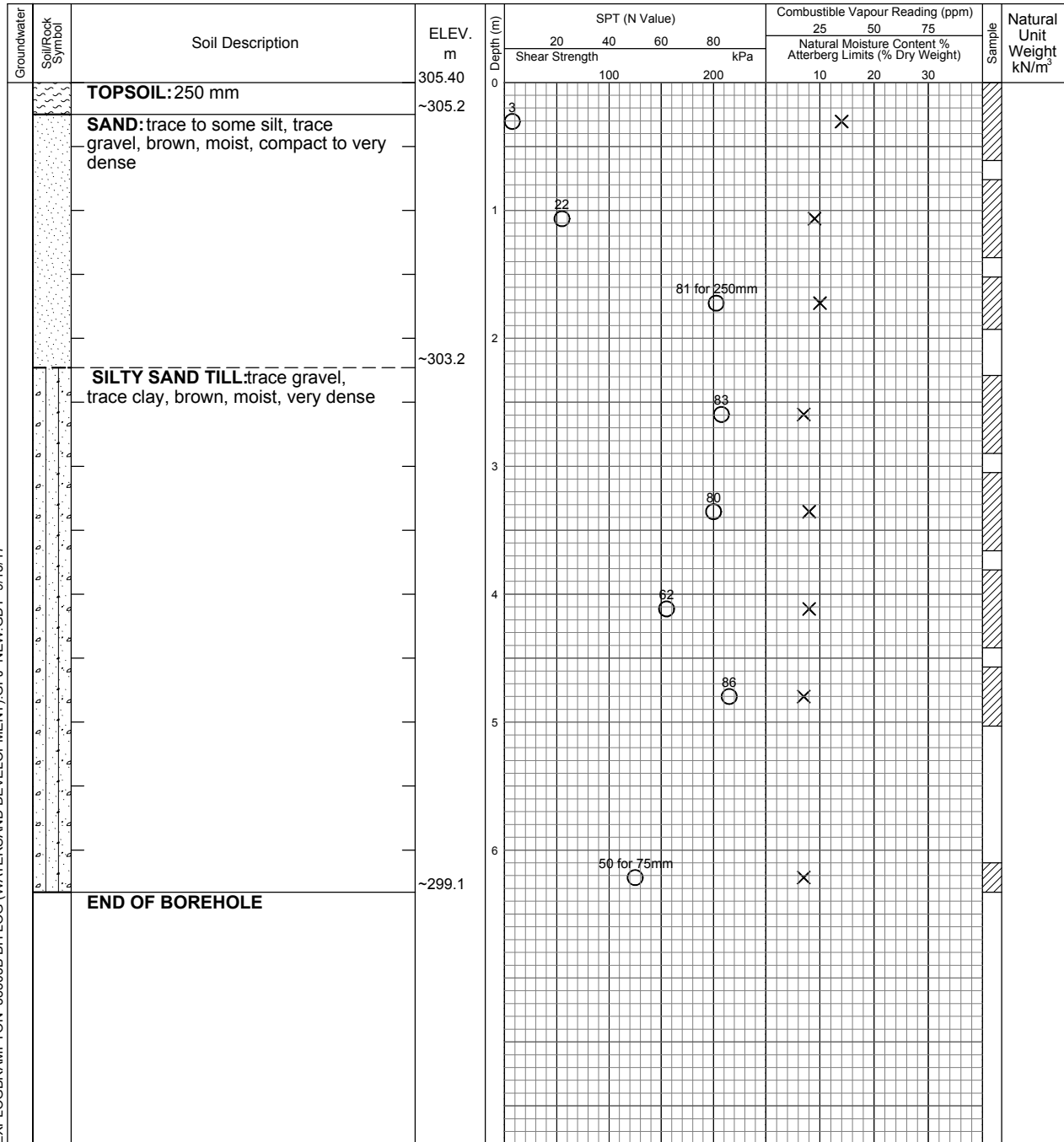
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

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

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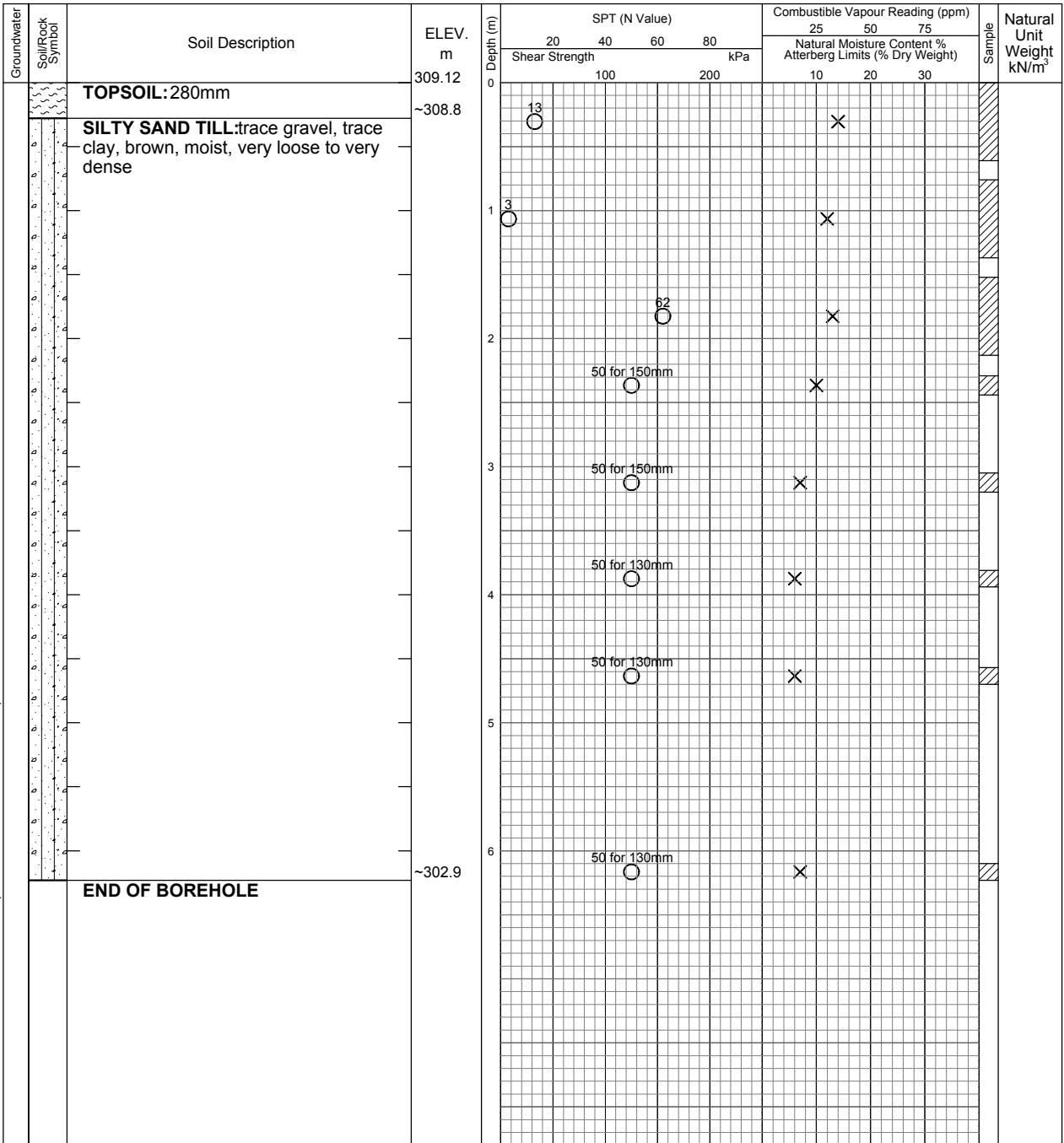
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.22

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

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

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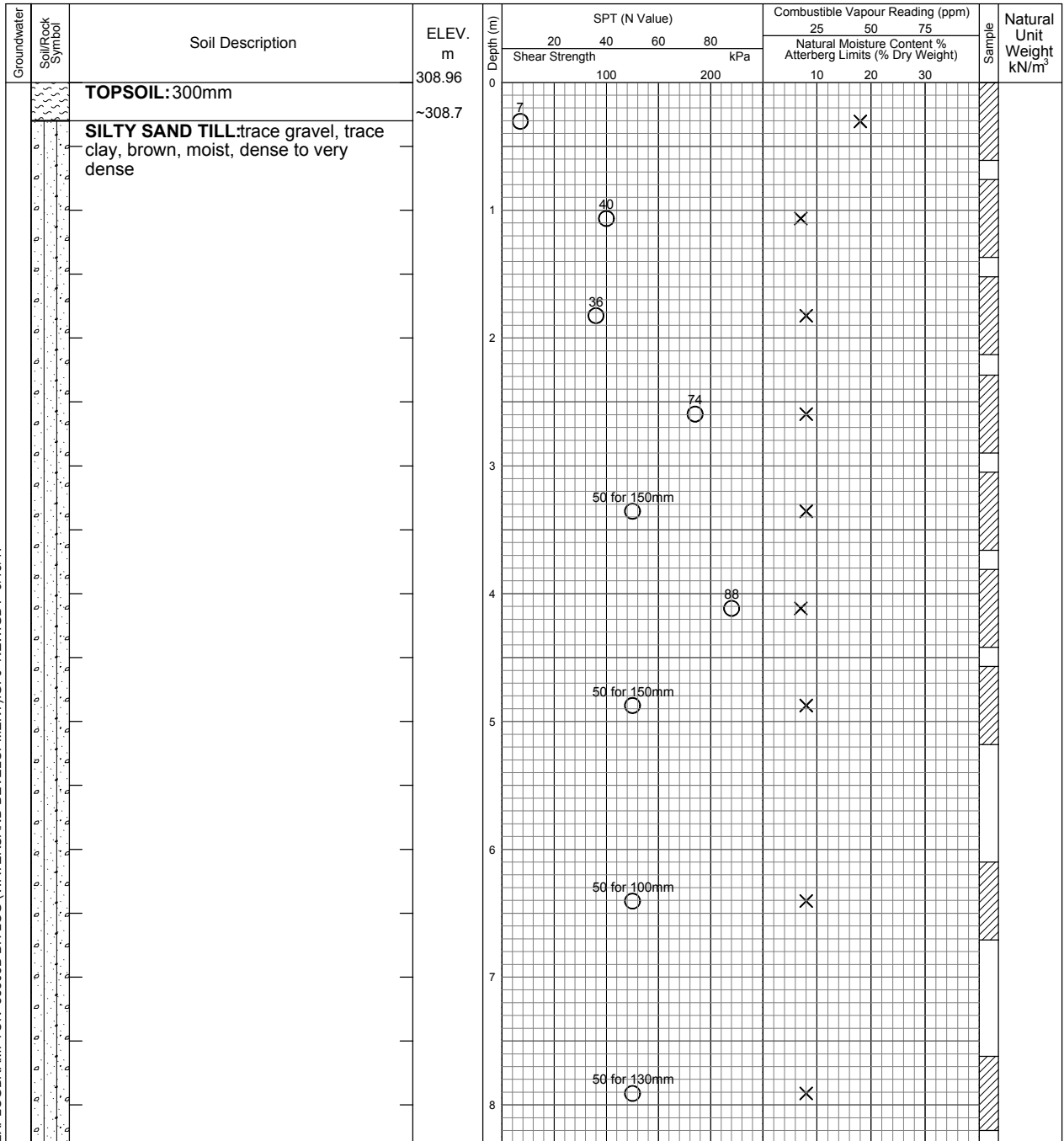
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	10.82



Log of Borehole 147C

Project No. BRM-00038305-B0

Drawing No. 177

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	10.82



Log of Borehole 148A

Project No. BRM-00038305-B0

Drawing No. 178

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

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

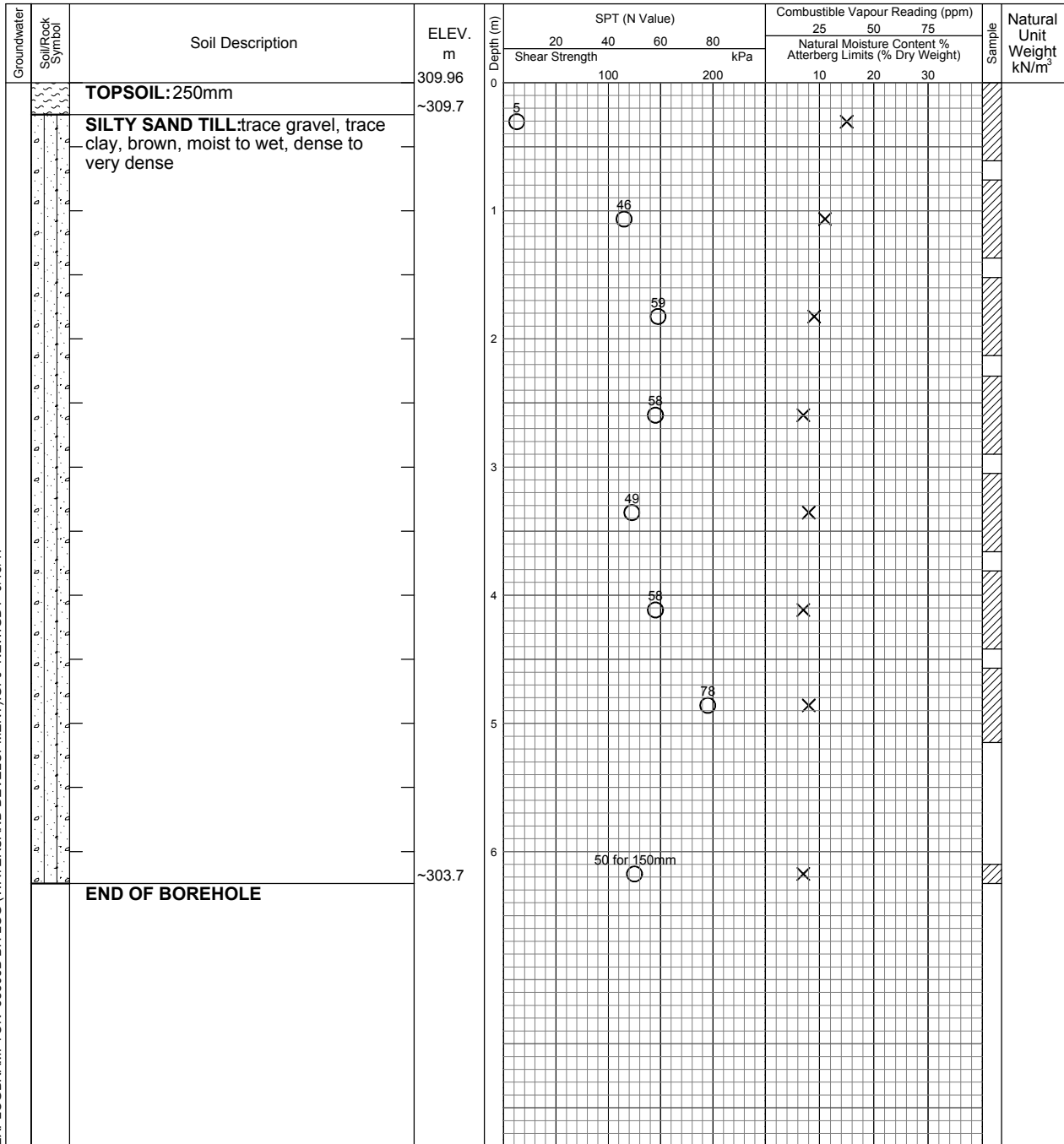


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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



Log of Borehole 148B

Project No. BRM-00038305-B0

Drawing No. 179

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: May 30, 2016

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

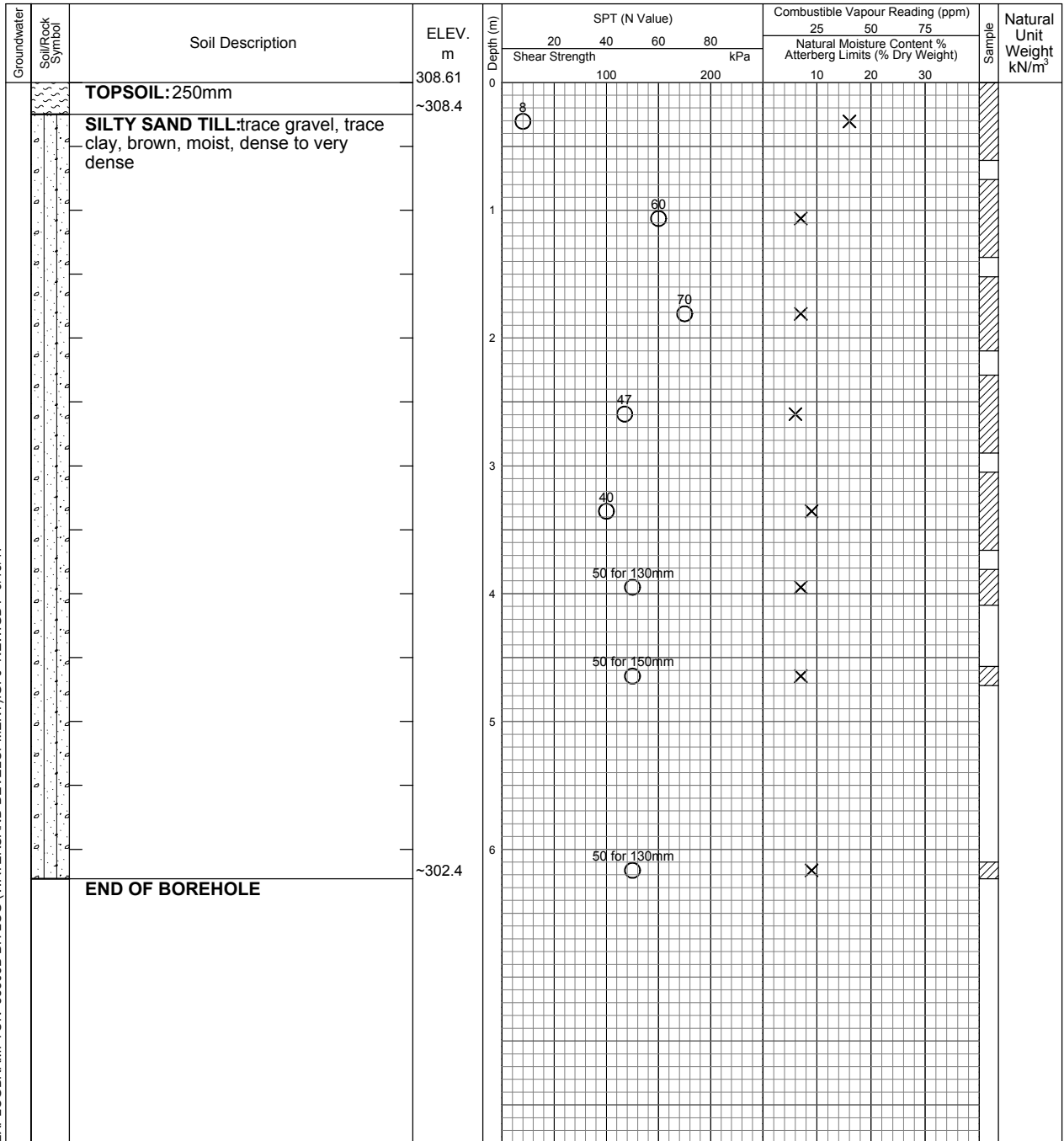


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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



Log of Borehole 148C

Project No. BRM-00038305-B0

Drawing No. 180

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

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

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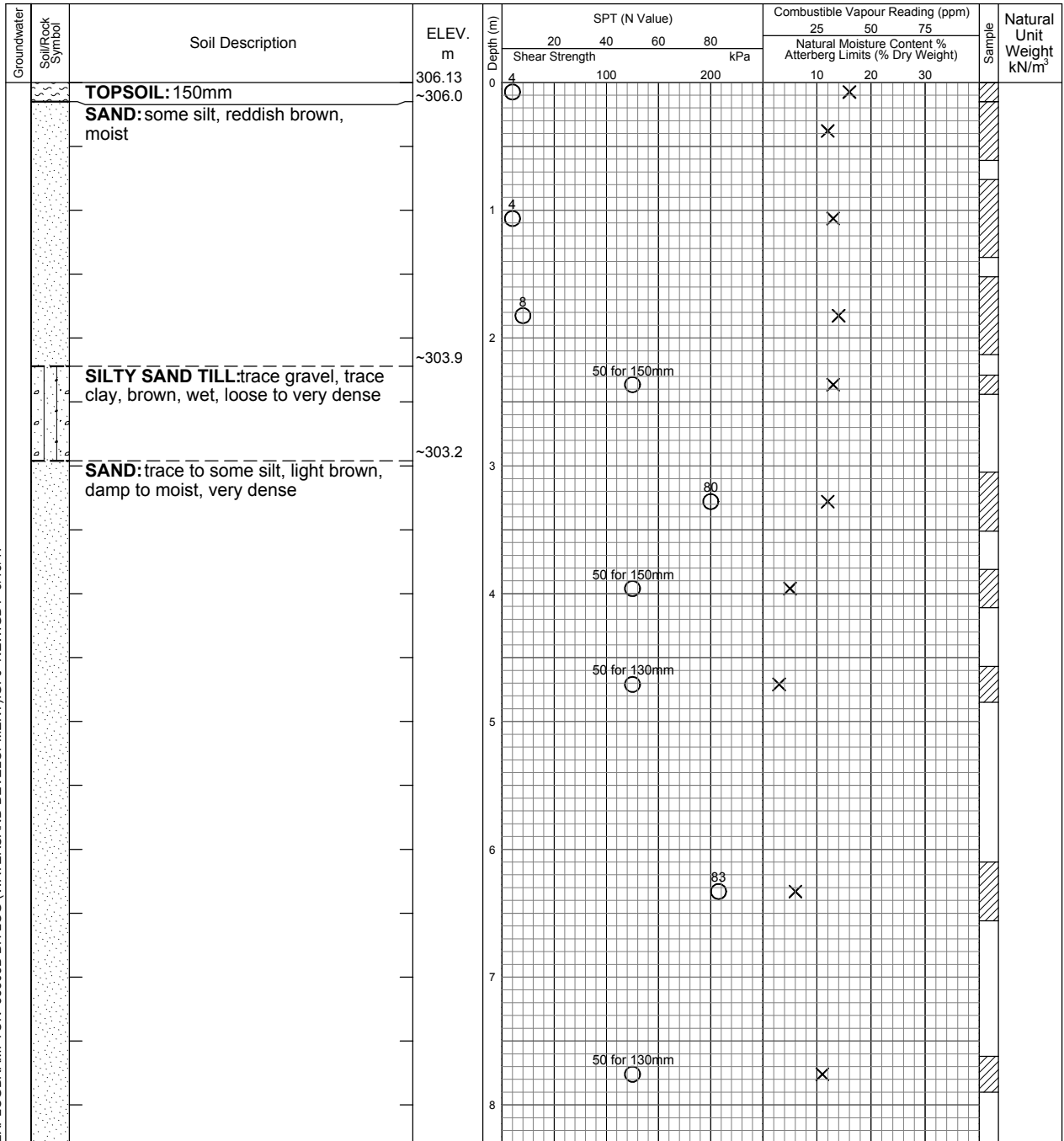
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Datum: Geodetic



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.60



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17

Log of Borehole 148C

Project No. BRM-00038305-B0

Drawing No. 180

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value)				Combustible Vapour Reading (ppm)			Sample	Natural Unit Weight kN/m ³
					20	40	60	80	25	50	75		
					Shear Strength				Natural Moisture Content %				
					kPa				Atterberg Limits (% Dry Weight)				
			297.83		100		200		10	20	30		
		light grey		9									
		END OF BOREHOLE	~296.5					93		X			
	</												

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	9.60

Log of Borehole 149B

Project No. BRM-00038305-B0

Drawing No. 181

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

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

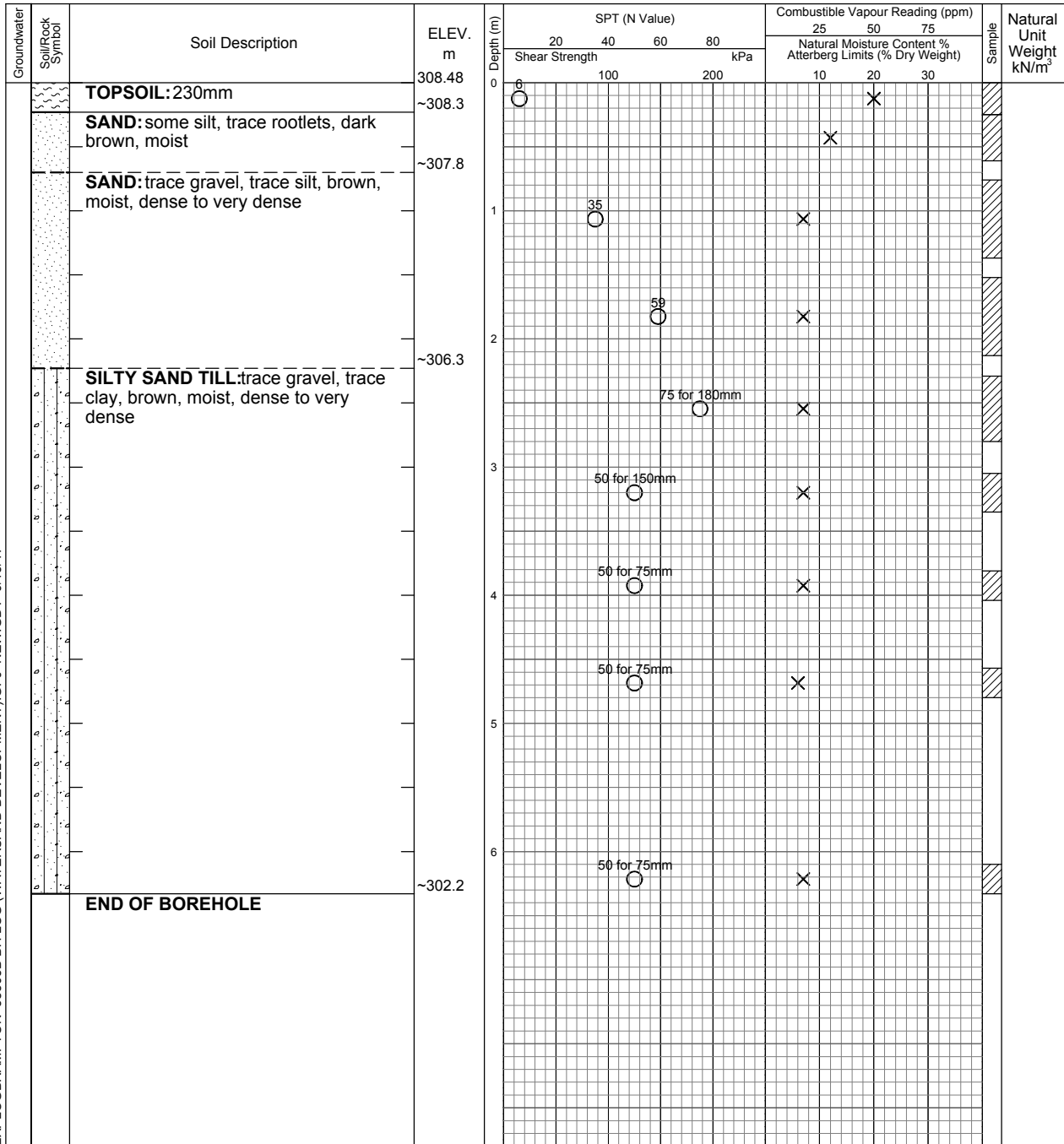


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33



Log of Borehole 149C

Project No. BRM-00038305-B0

Drawing No. 182

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

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

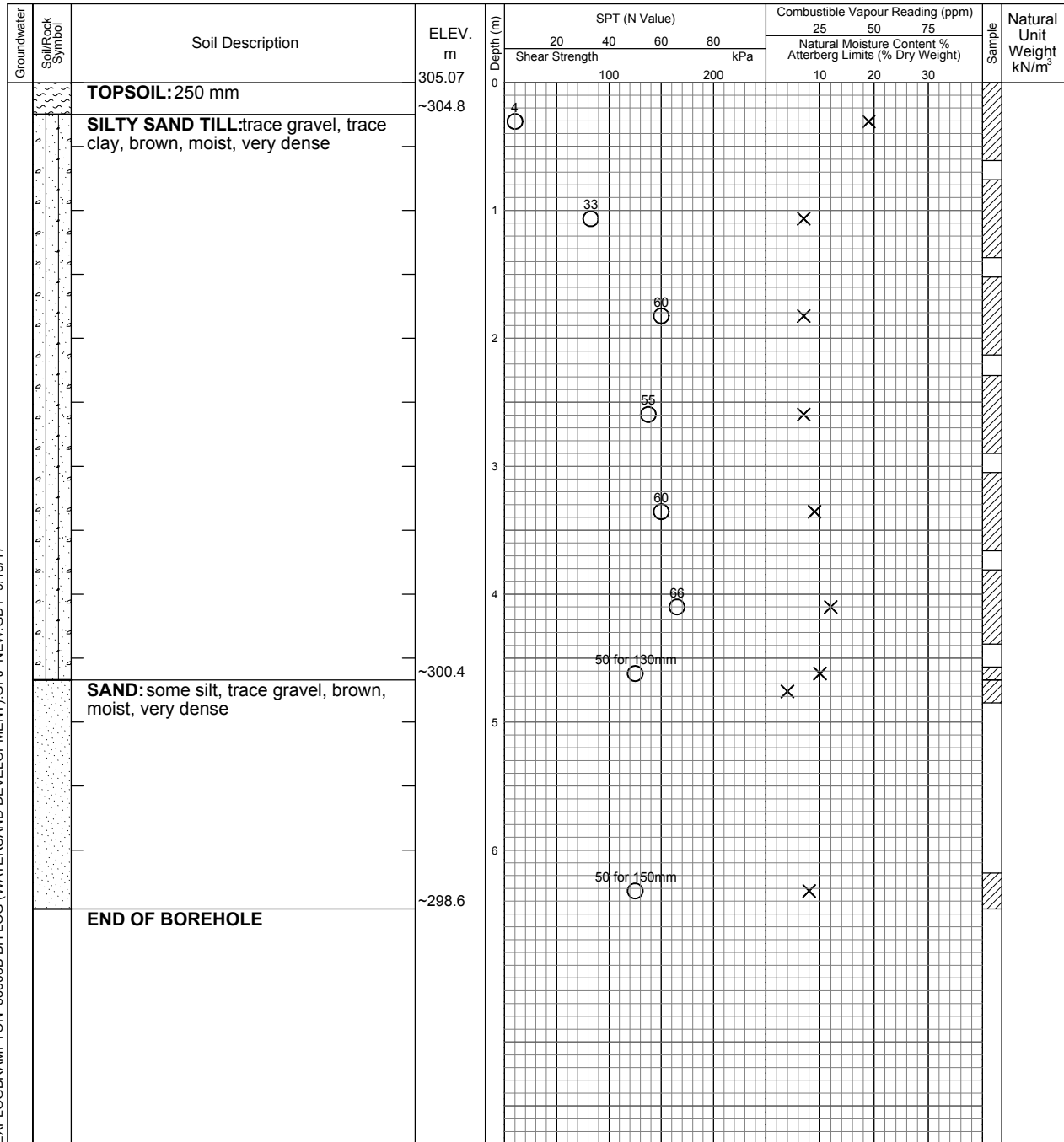


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.46



Log of Borehole E2

Project No. BRM-00038305-B0

Drawing No. 185

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

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

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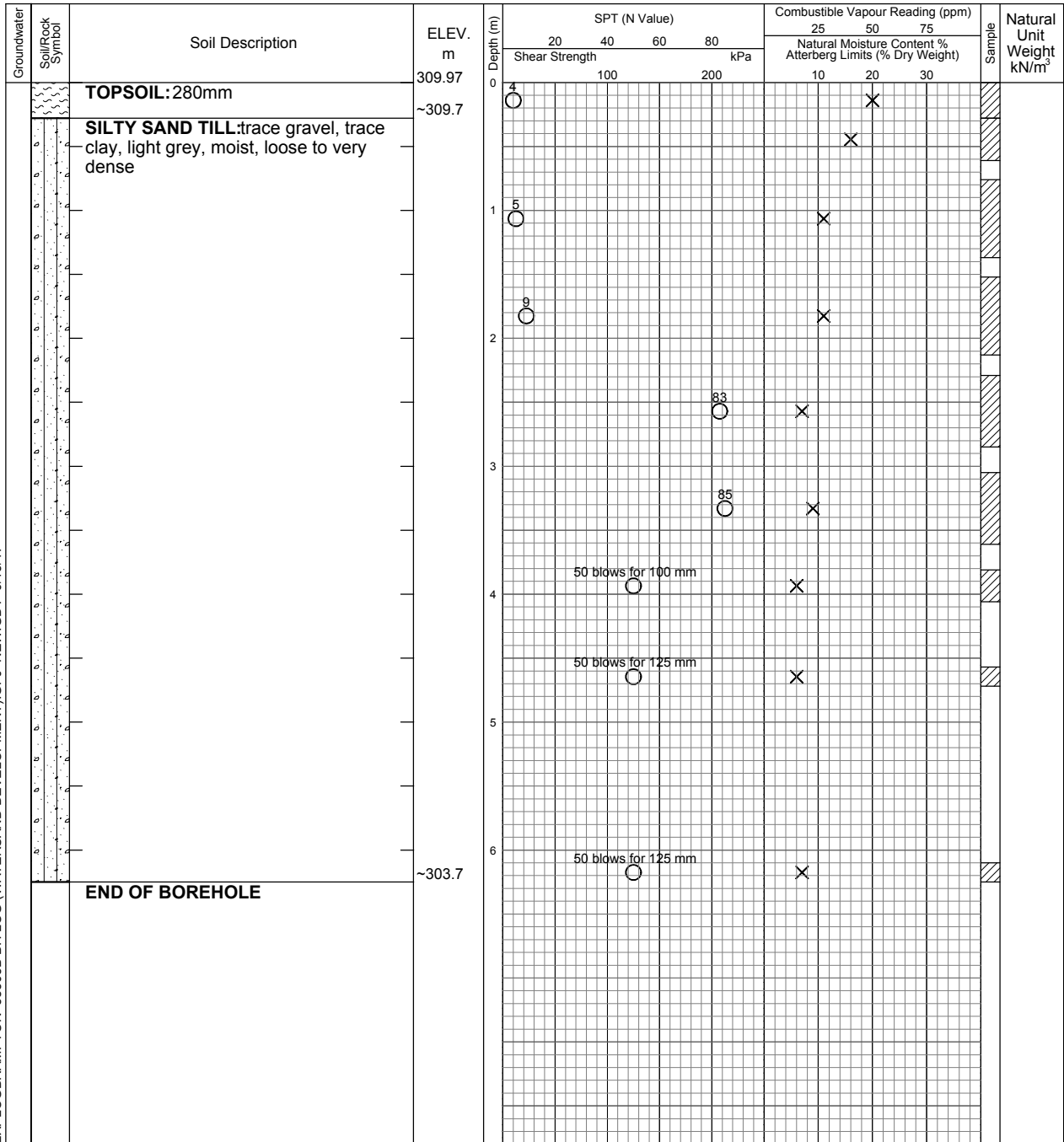
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



Log of Borehole E3

Project No. BRM-00038305-B0

Drawing No. 186

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

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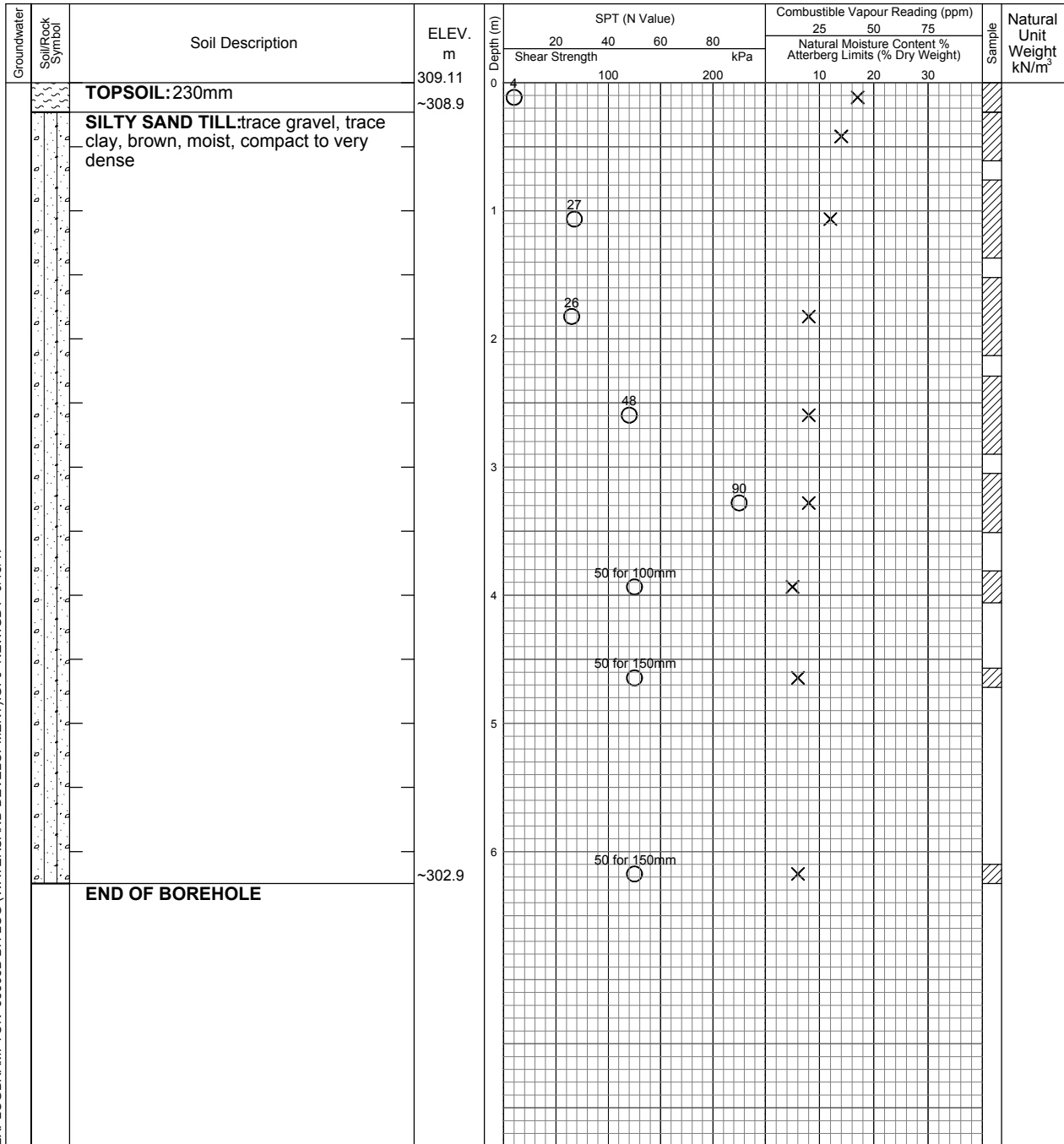
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E9

Project No. BRM-00038305-B0

Drawing No. 187

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

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

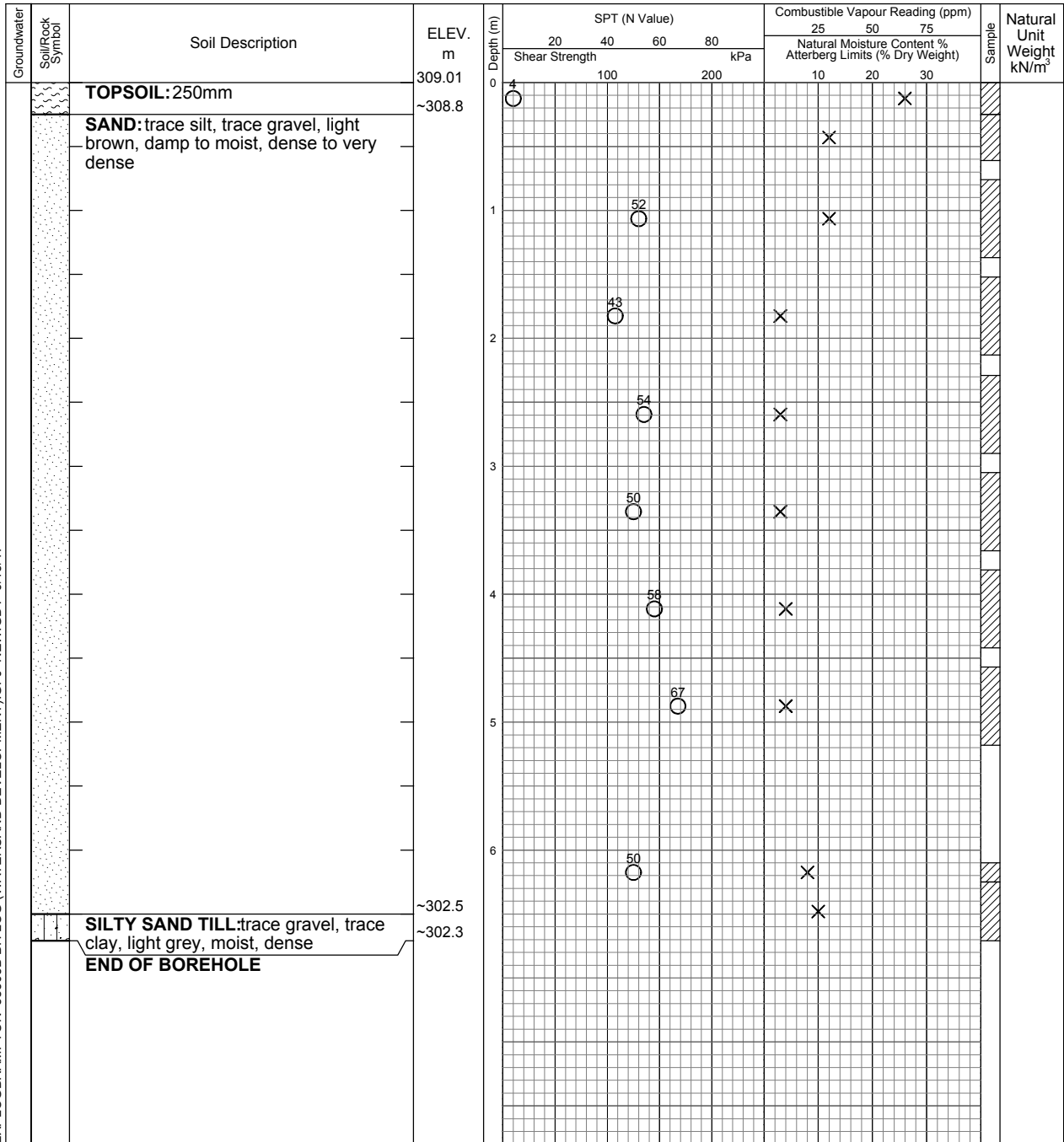


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Log of Borehole E10

Project No. BRM-00038305-B0

Drawing No. 188

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

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

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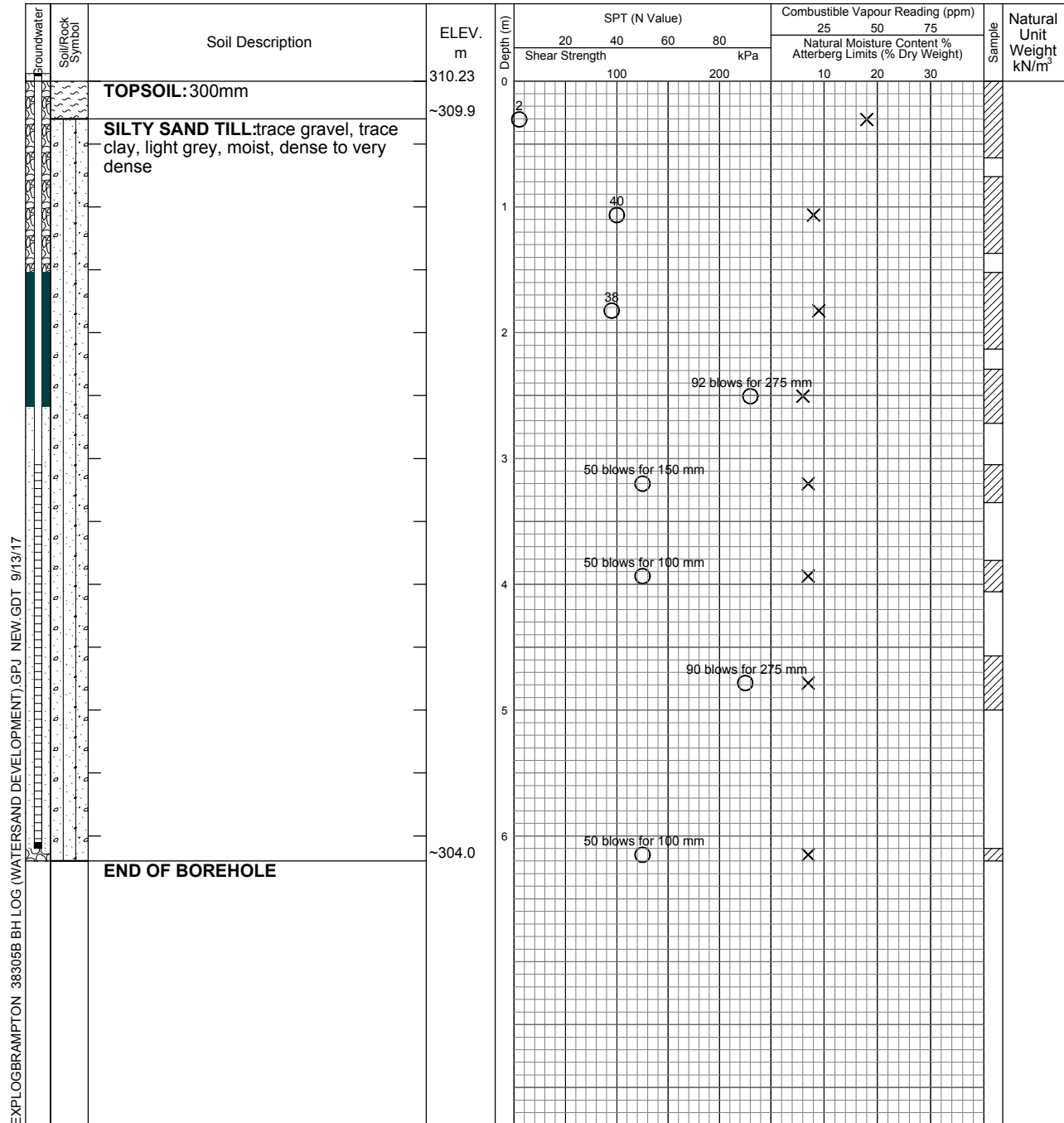
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
June 22, 2017	Dry	-
July 24, 2017	Dry	-
August 17, 2017	Dry	-



Log of Borehole E11

Project No. BRM-00038305-B0

Drawing No. 189

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 9, 2017

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

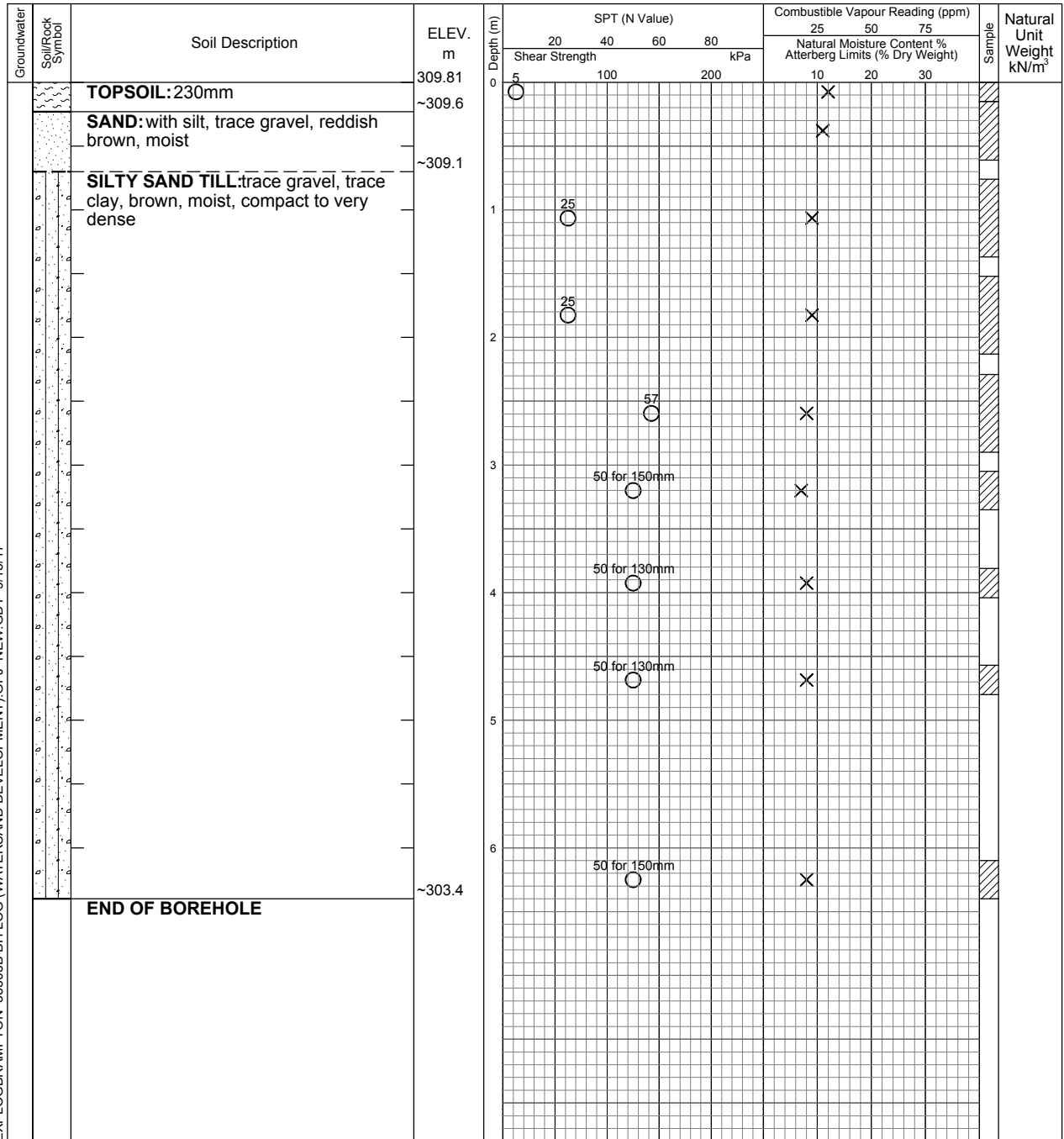


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40



Log of Borehole E12

Project No. BRM-00038305-B0

Drawing No. 190

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

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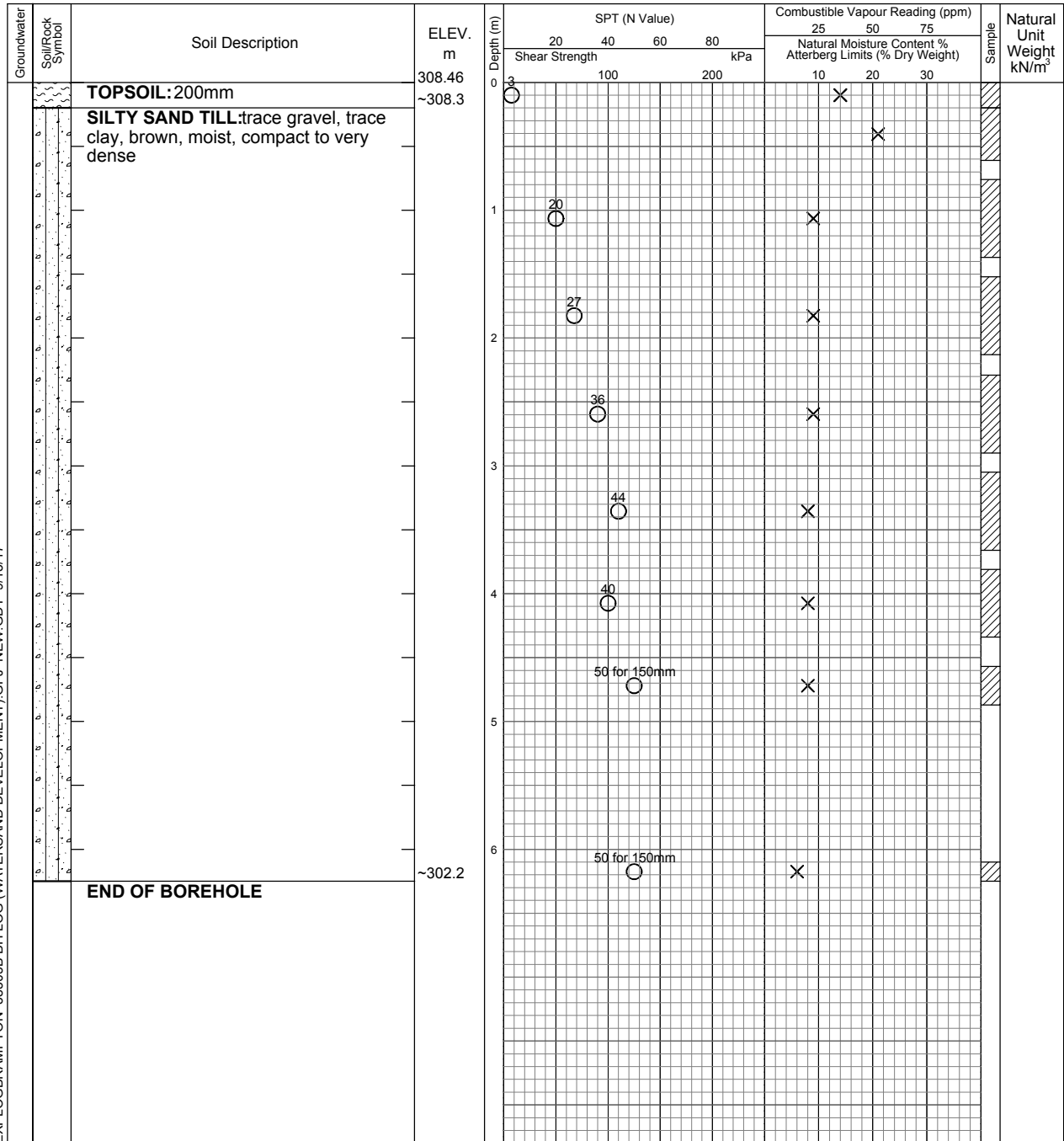
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



Log of Borehole E19

Project No. BRM-00038305-B0

Drawing No. 191

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

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

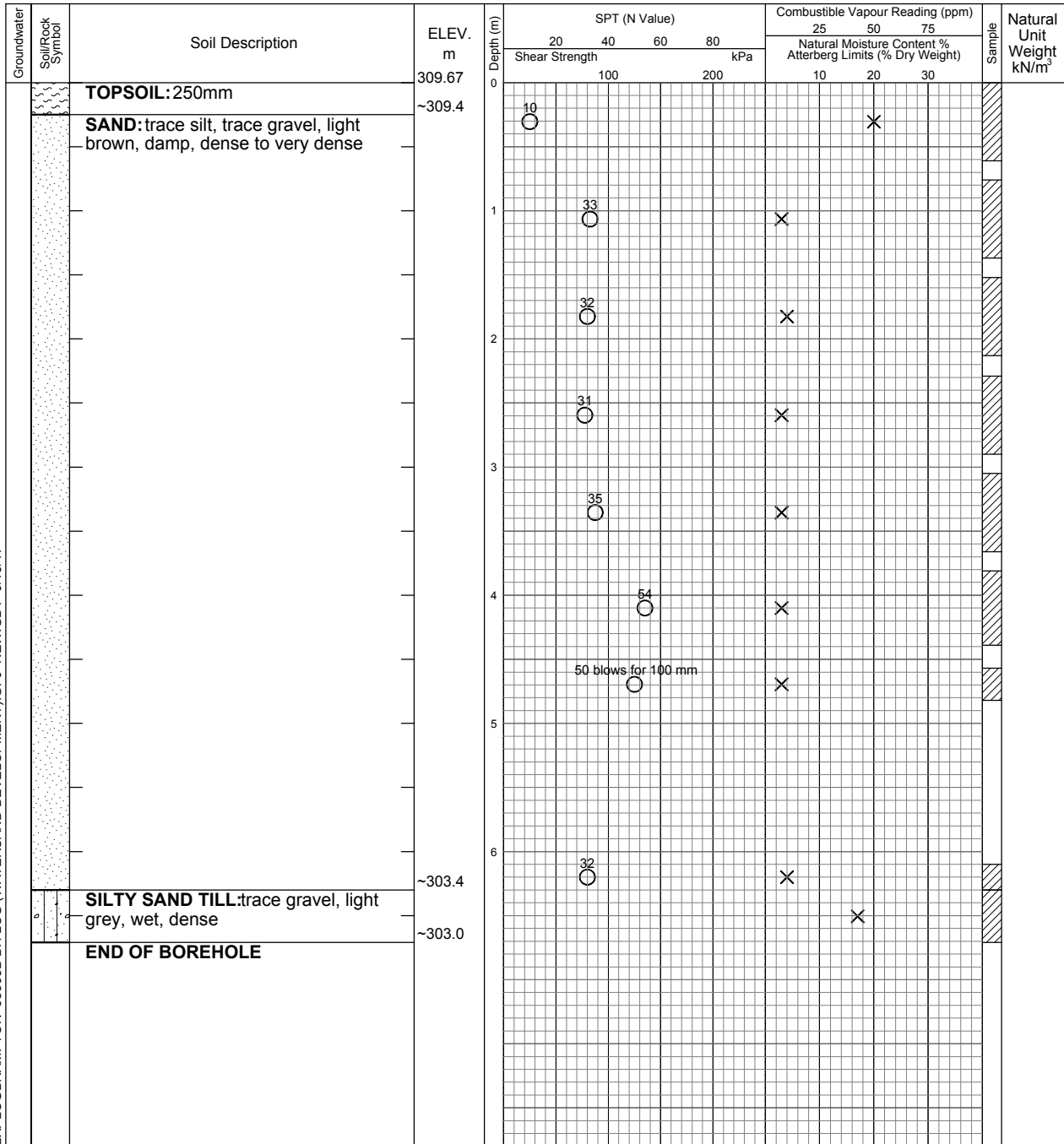


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	2.70



Log of Borehole E20

Project No. BRM-00038305-B0

Drawing No. 192

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

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

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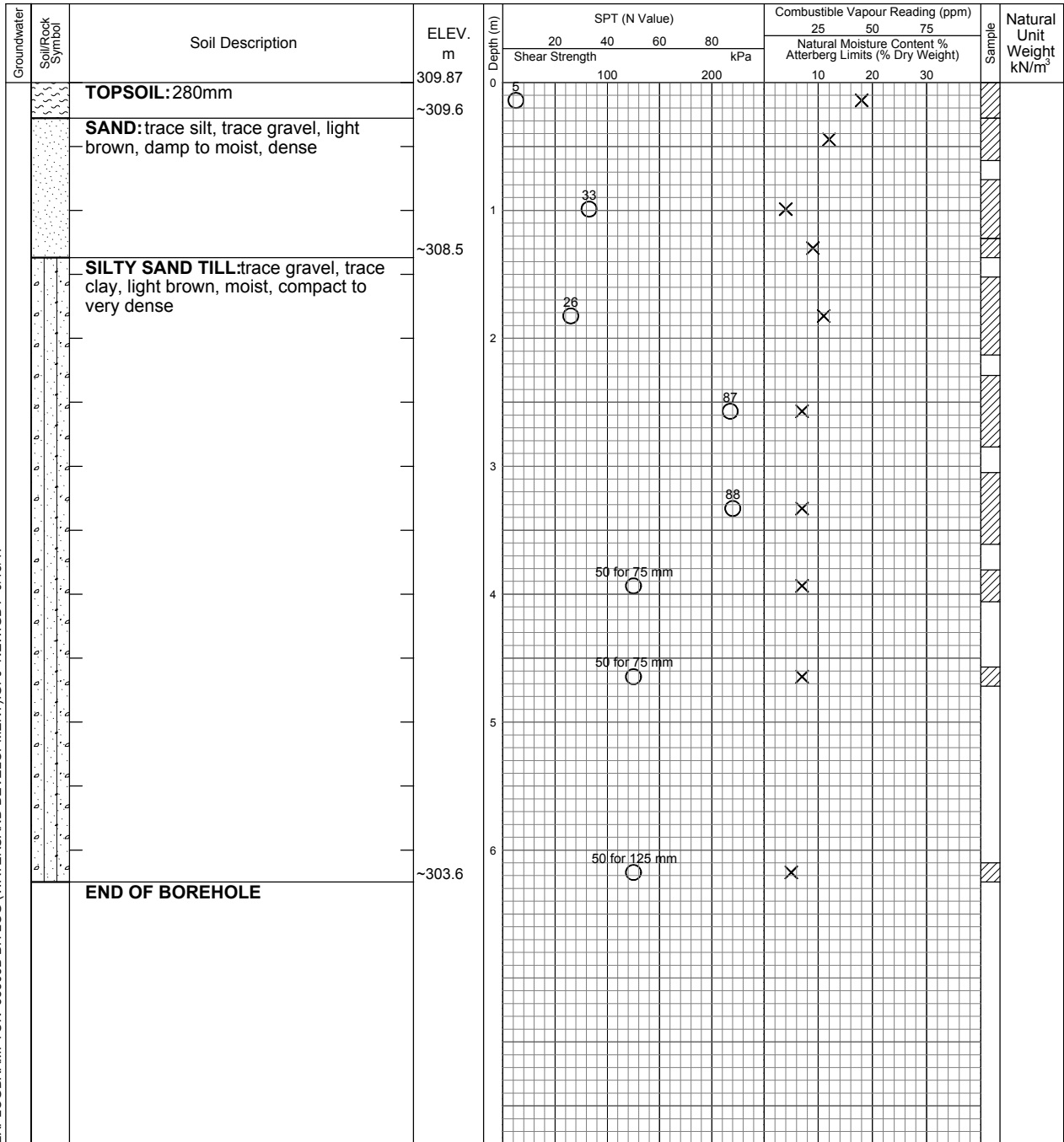
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10

Log of Borehole E21

Project No. BRM-00038305-B0

Drawing No. 193

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 9, 2017

Auger Sample

Combustible Vapour Reading

SPT (N) Value

Natural Moisture

X

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Plastic and Liquid Limit

Datum: Geodetic

Shelby Tube

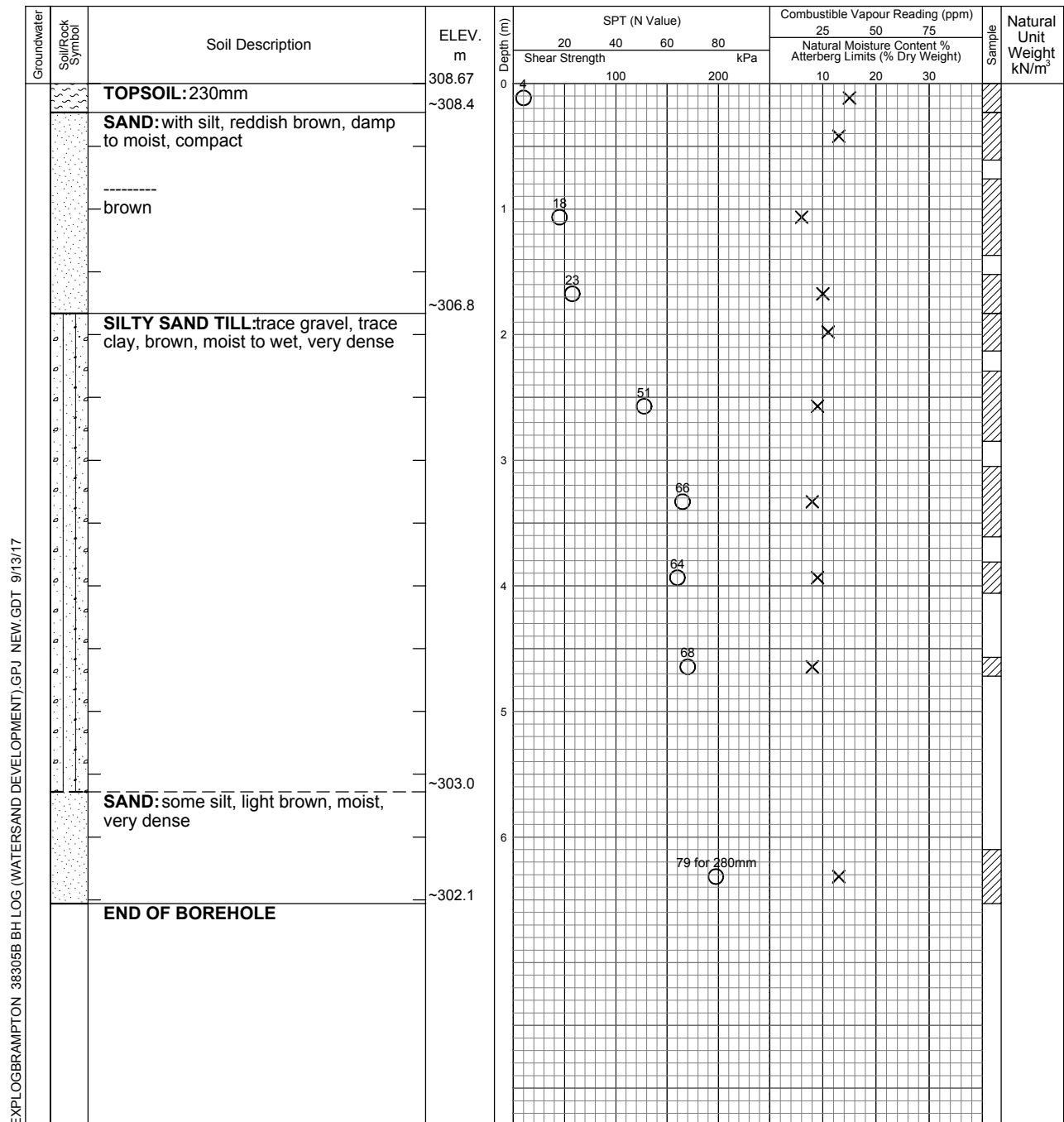
Undrained Triaxial at

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Field Vane Test

Penetrometer

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Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.53



Log of Borehole E22

Project No. BRM-00038305-B0

Drawing No. 194

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

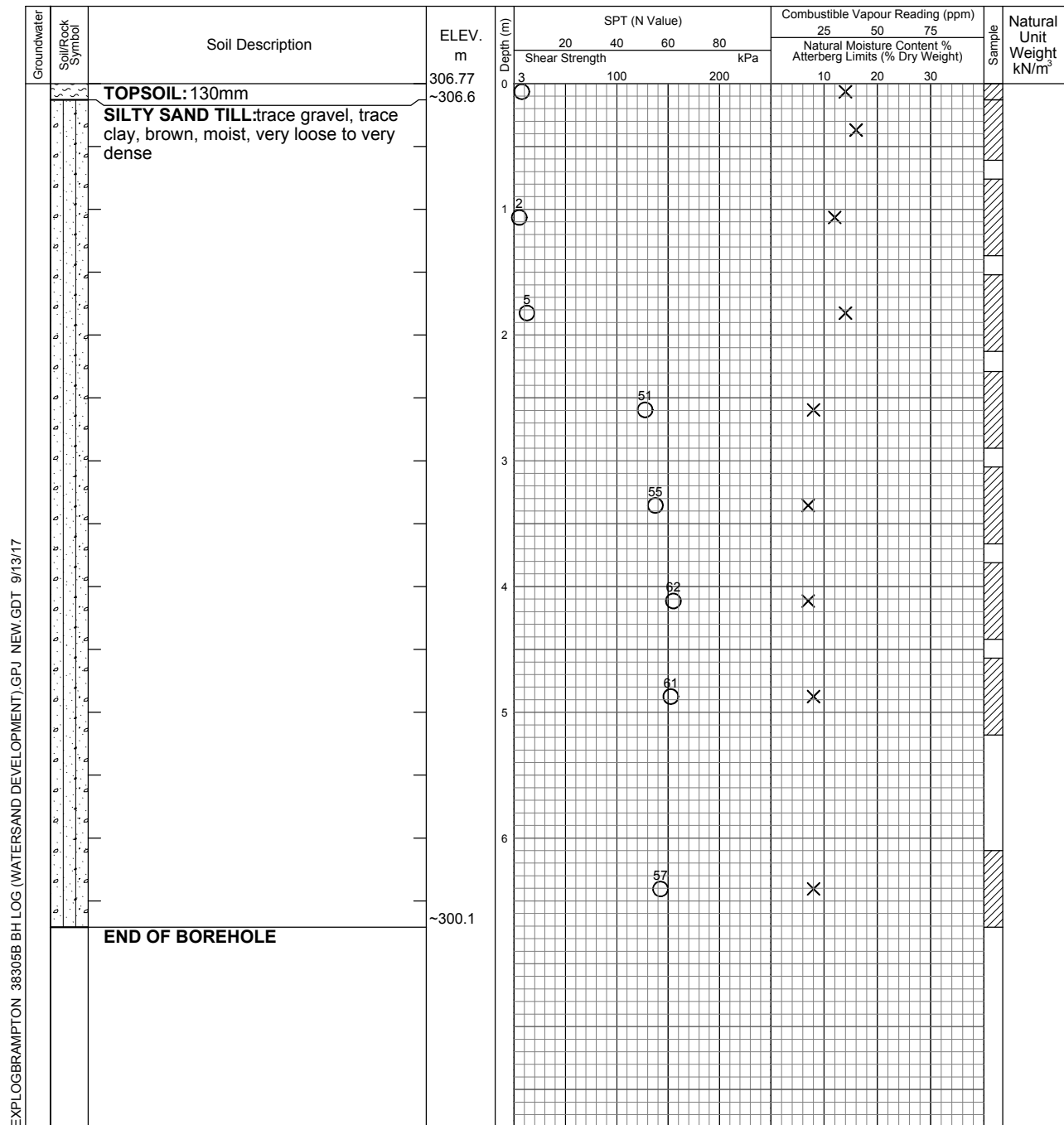
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71



Log of Borehole E27

Project No. BRM-00038305-B0

Drawing No. 195

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 13, 2017

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

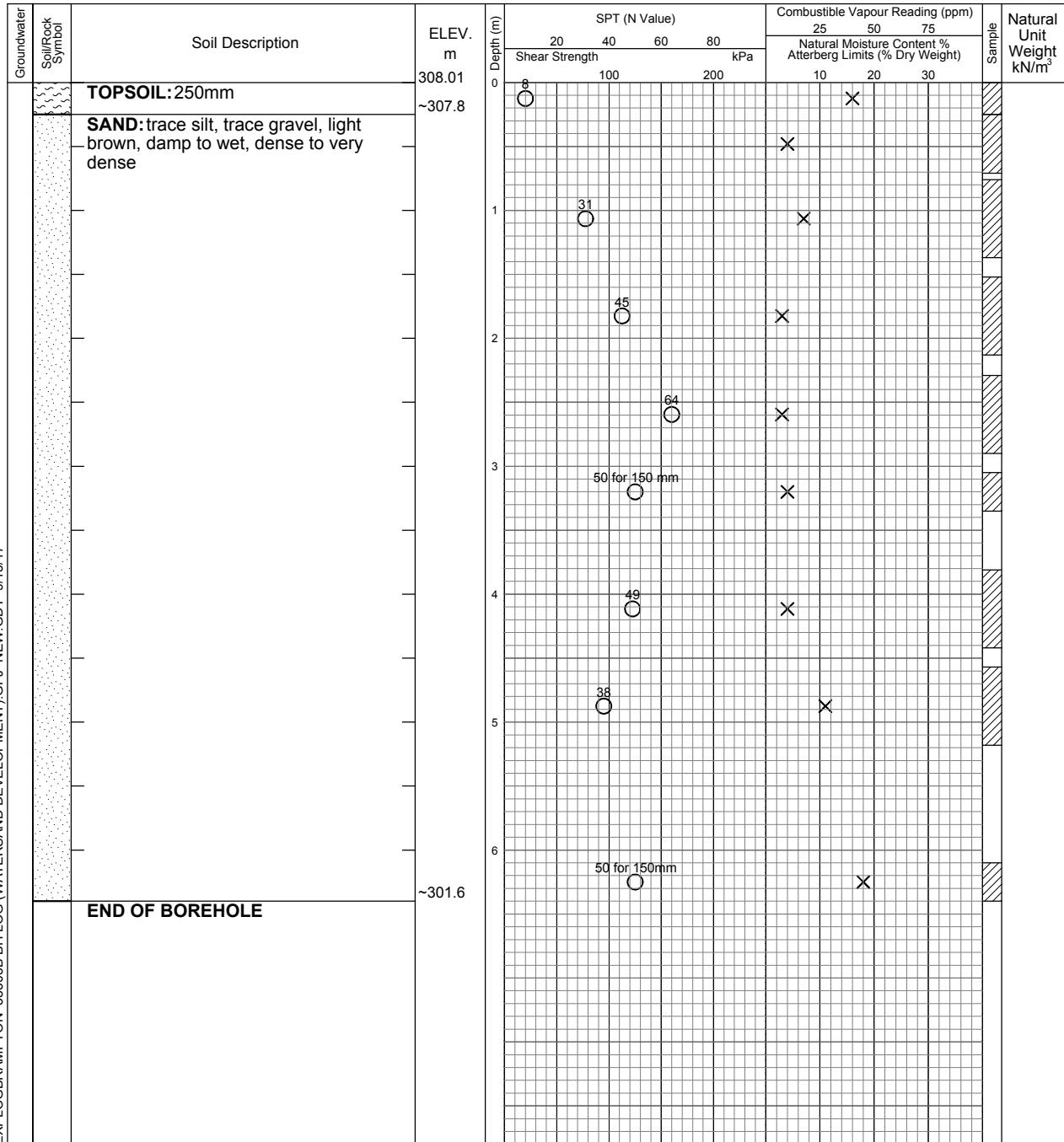


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	5.49

Log of Borehole E28

Project No. BRM-00038305-B0

Drawing No. 196

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

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

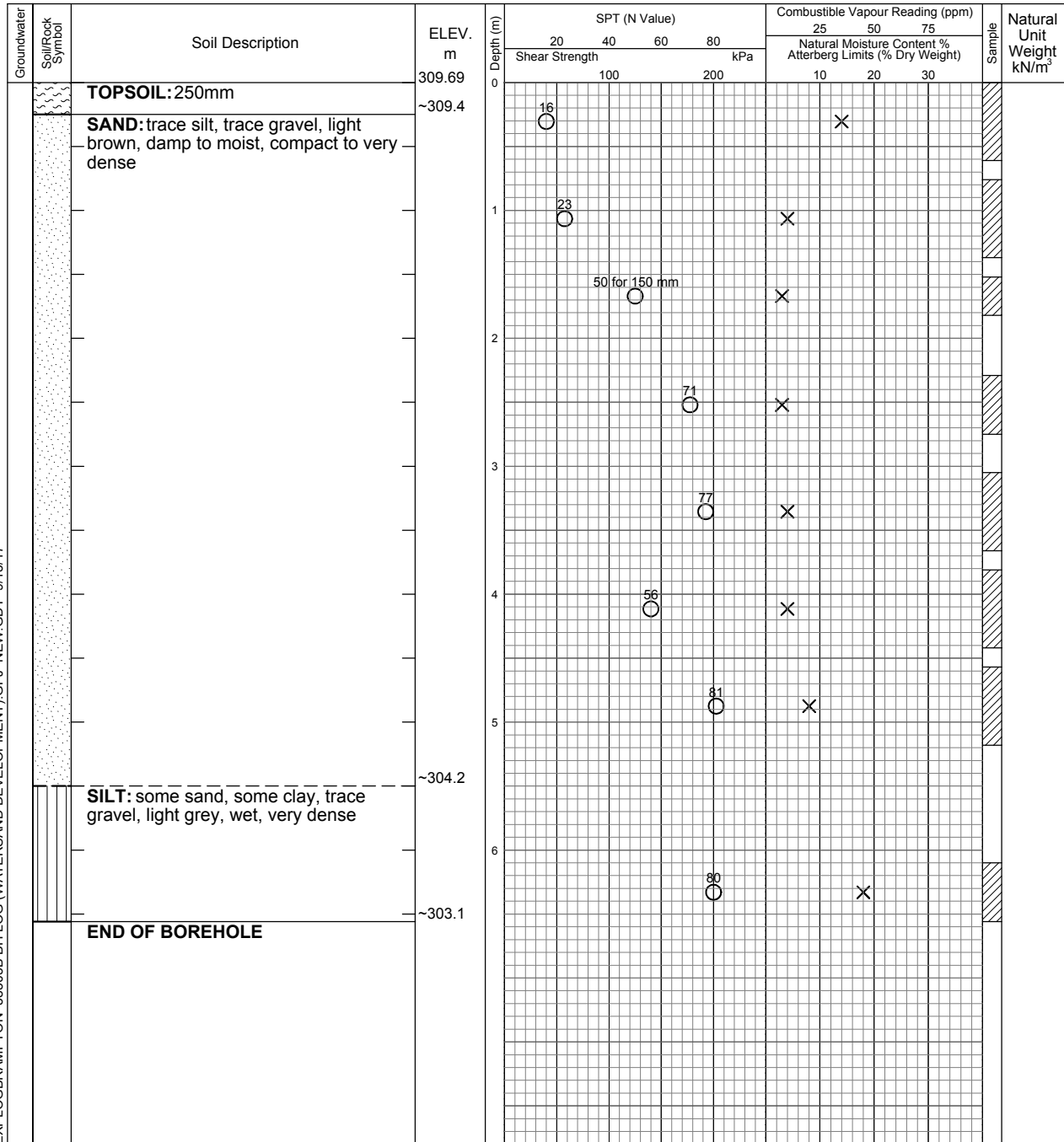


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.60



Log of Borehole E29

Project No. BRM-00038305-B0

Drawing No. 197

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

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

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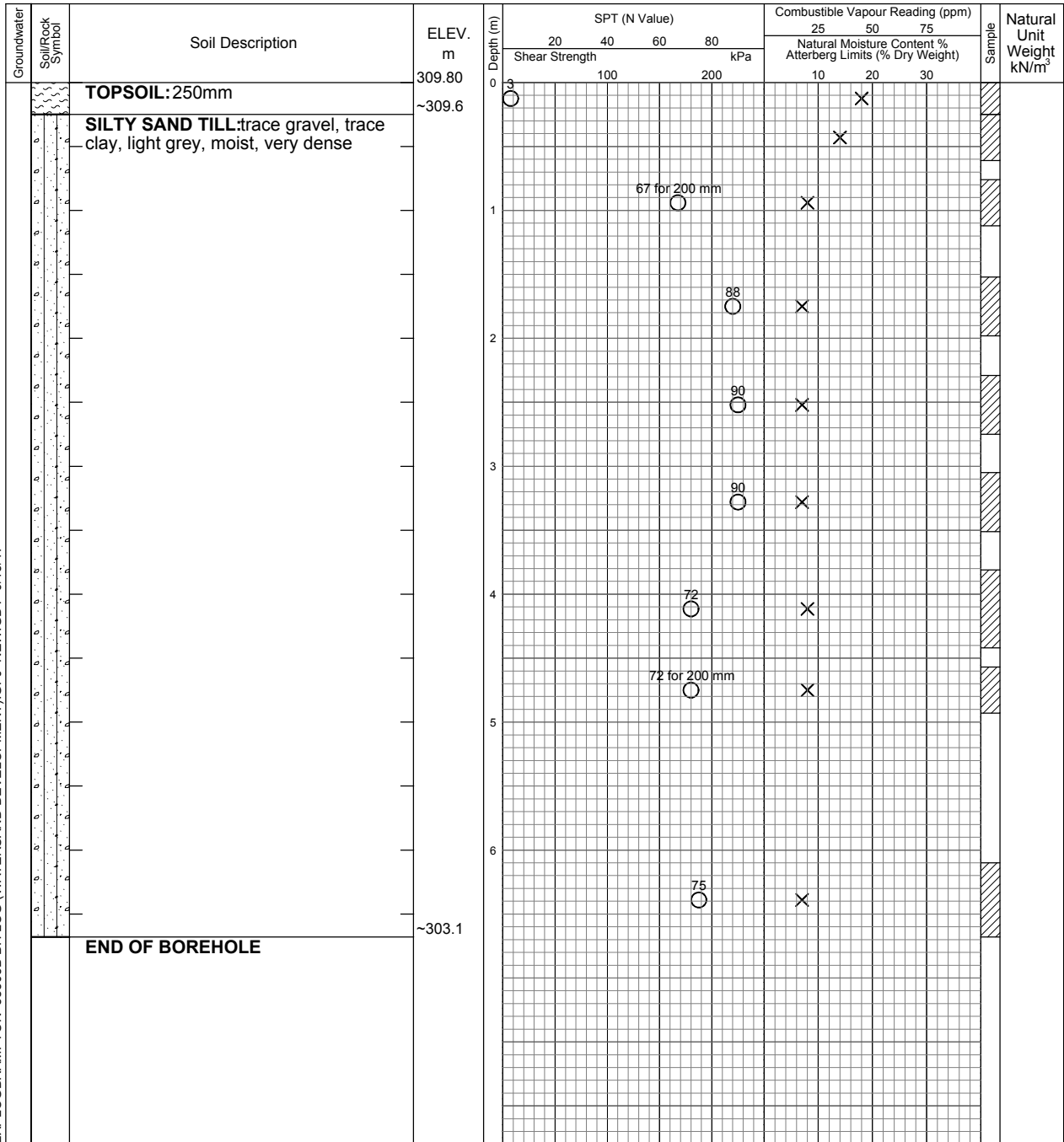
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.70



Log of Borehole E30

Project No. BRM-00038305-B0

Drawing No. 198

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

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

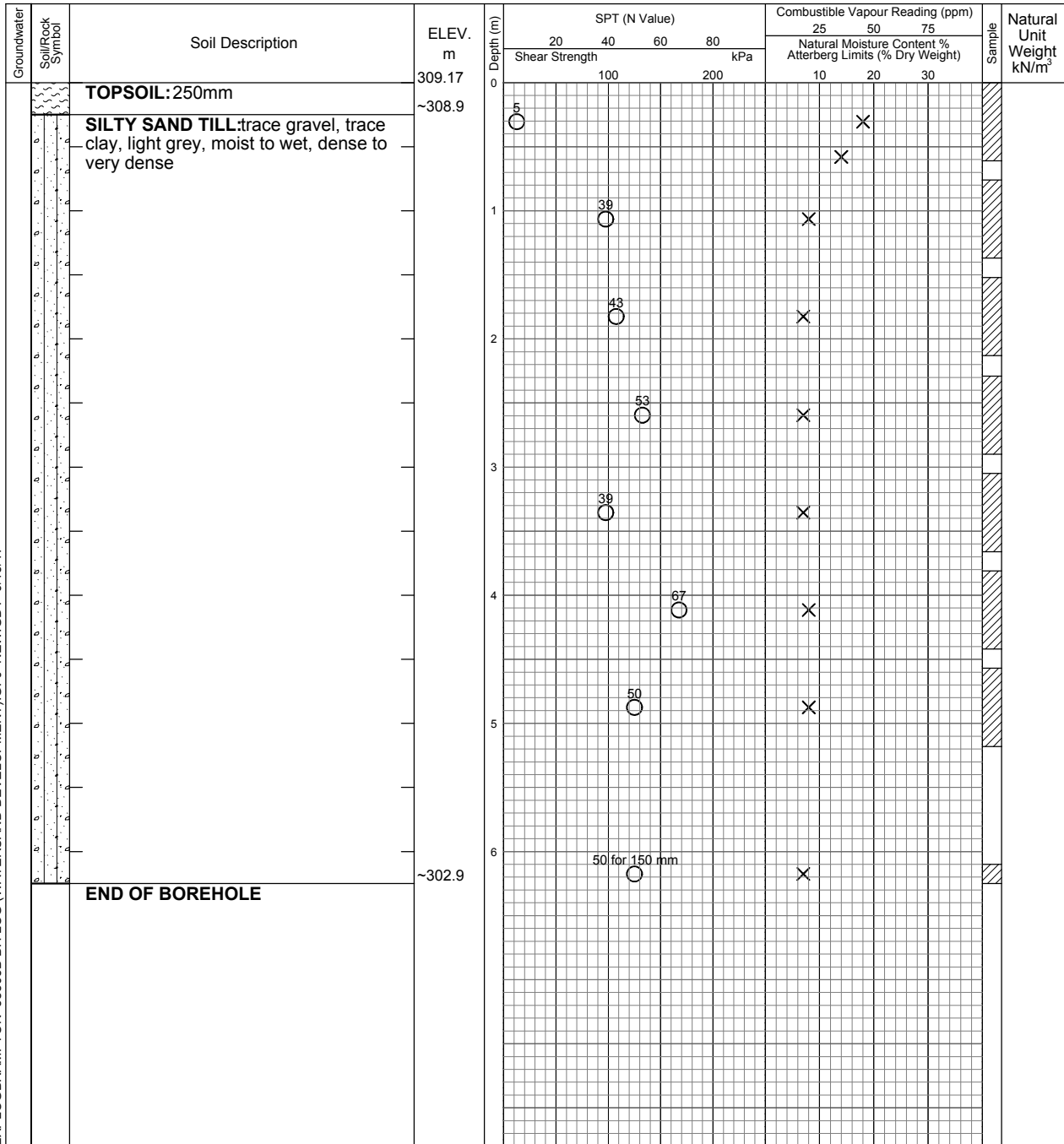


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.10



Log of Borehole E31

Project No. BRM-00038305-B0

Drawing No. 199

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

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

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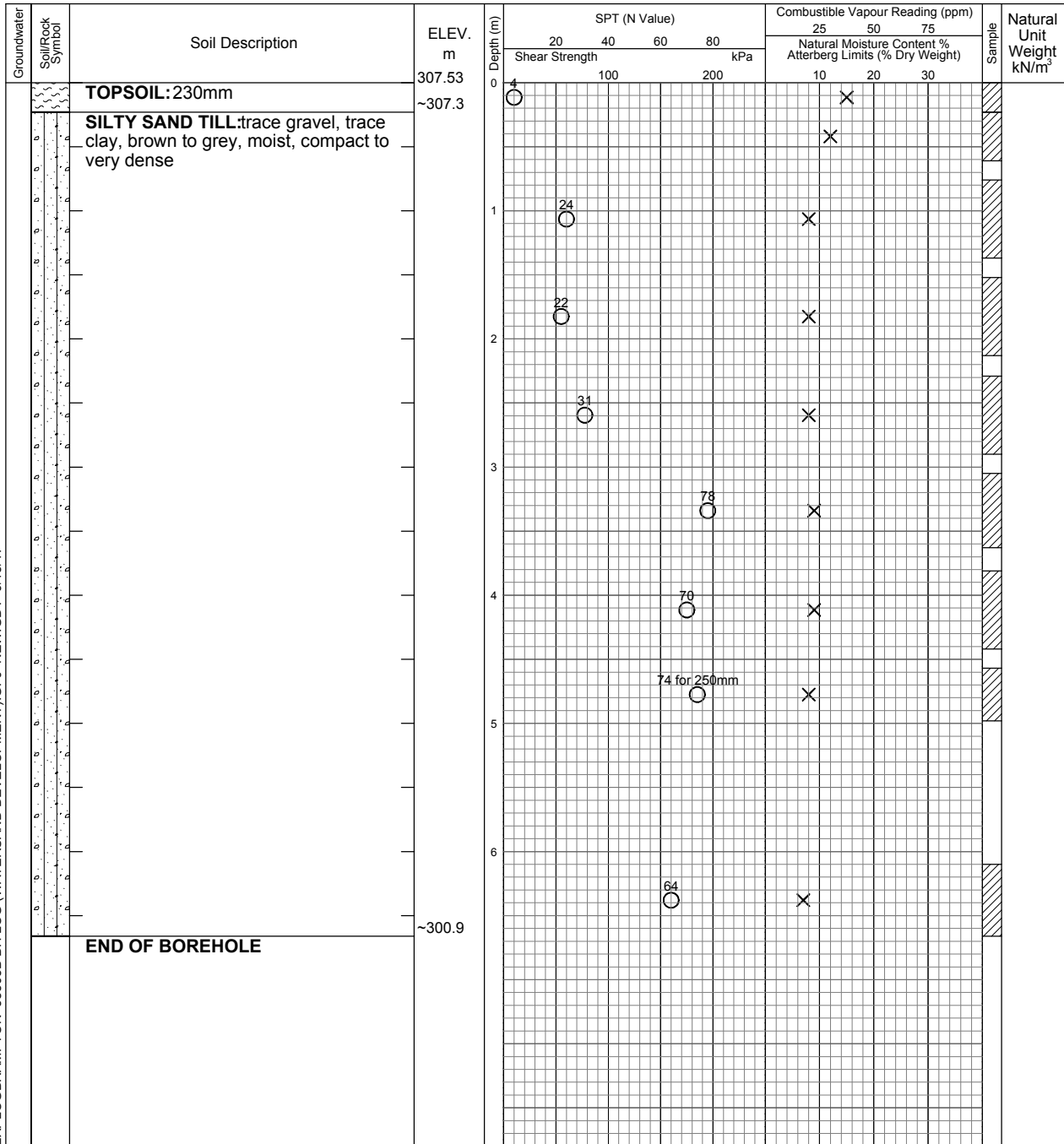
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.66



Log of Borehole E37

Project No. BRM-00038305-B0

Drawing No. 200

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

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

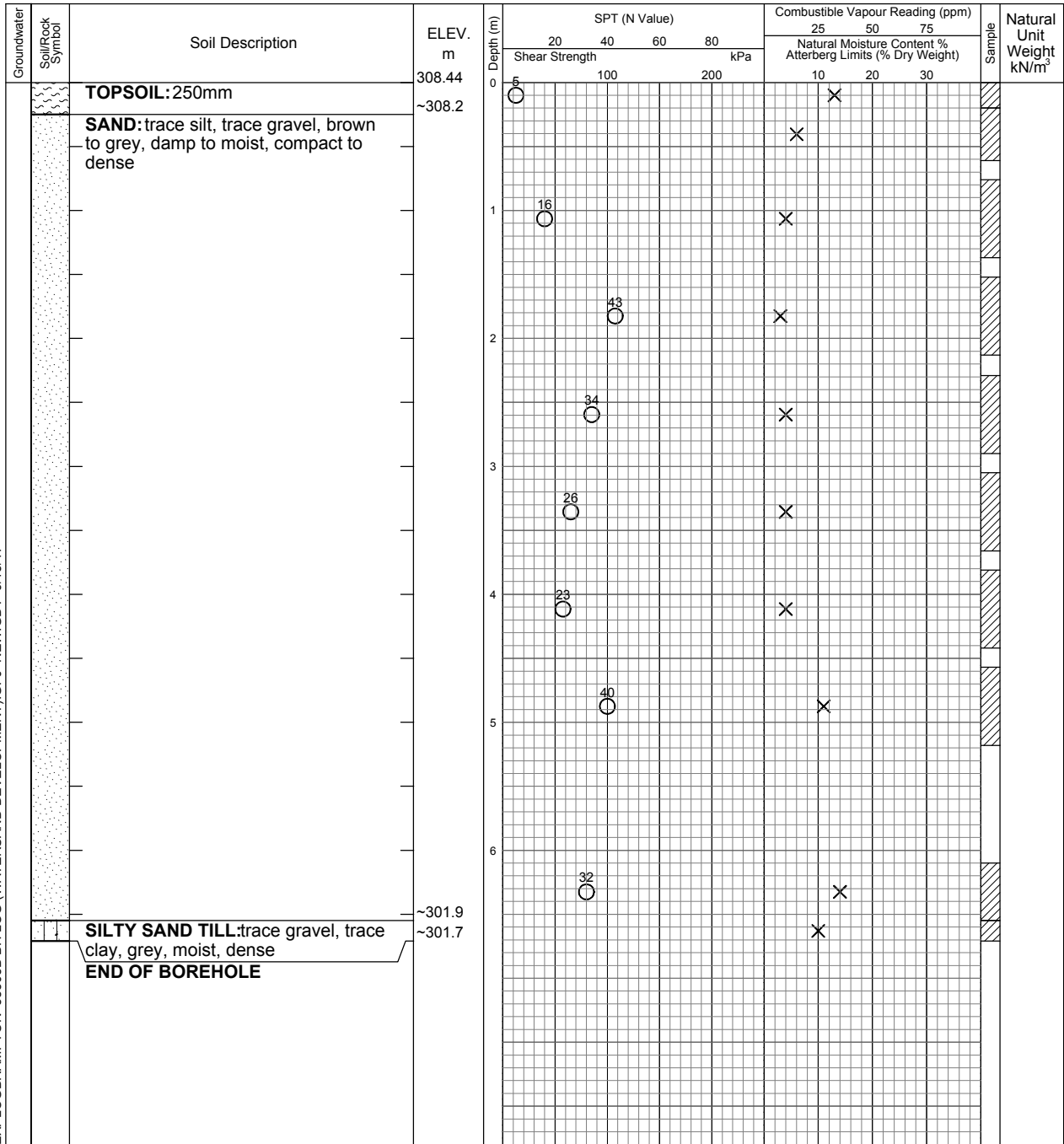


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71



Log of Borehole E38

Project No. BRM-00038305-B0

Drawing No. 201

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

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

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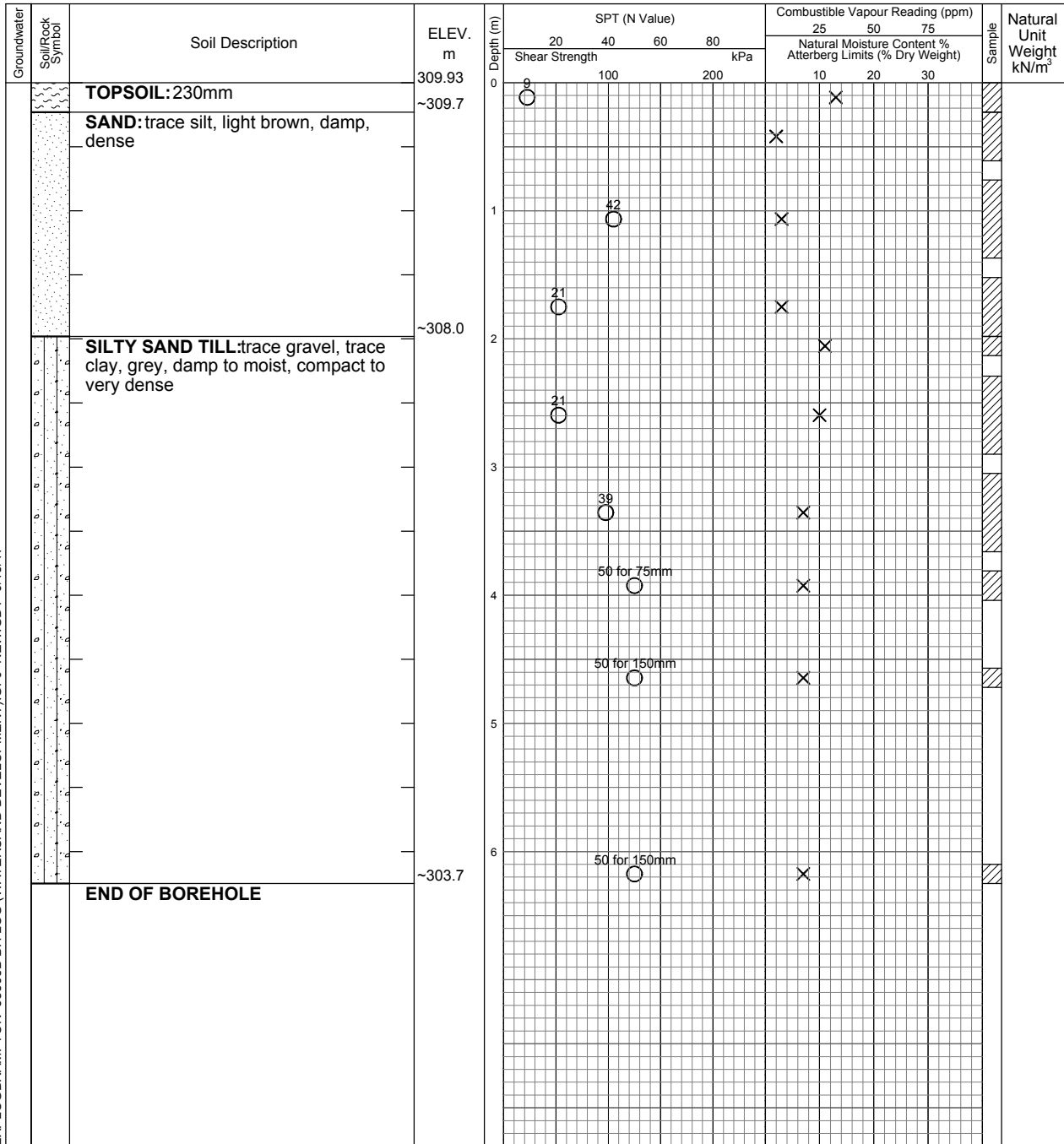
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



Log of Borehole E39

Project No. BRM-00038305-B0

Drawing No. 202

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

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

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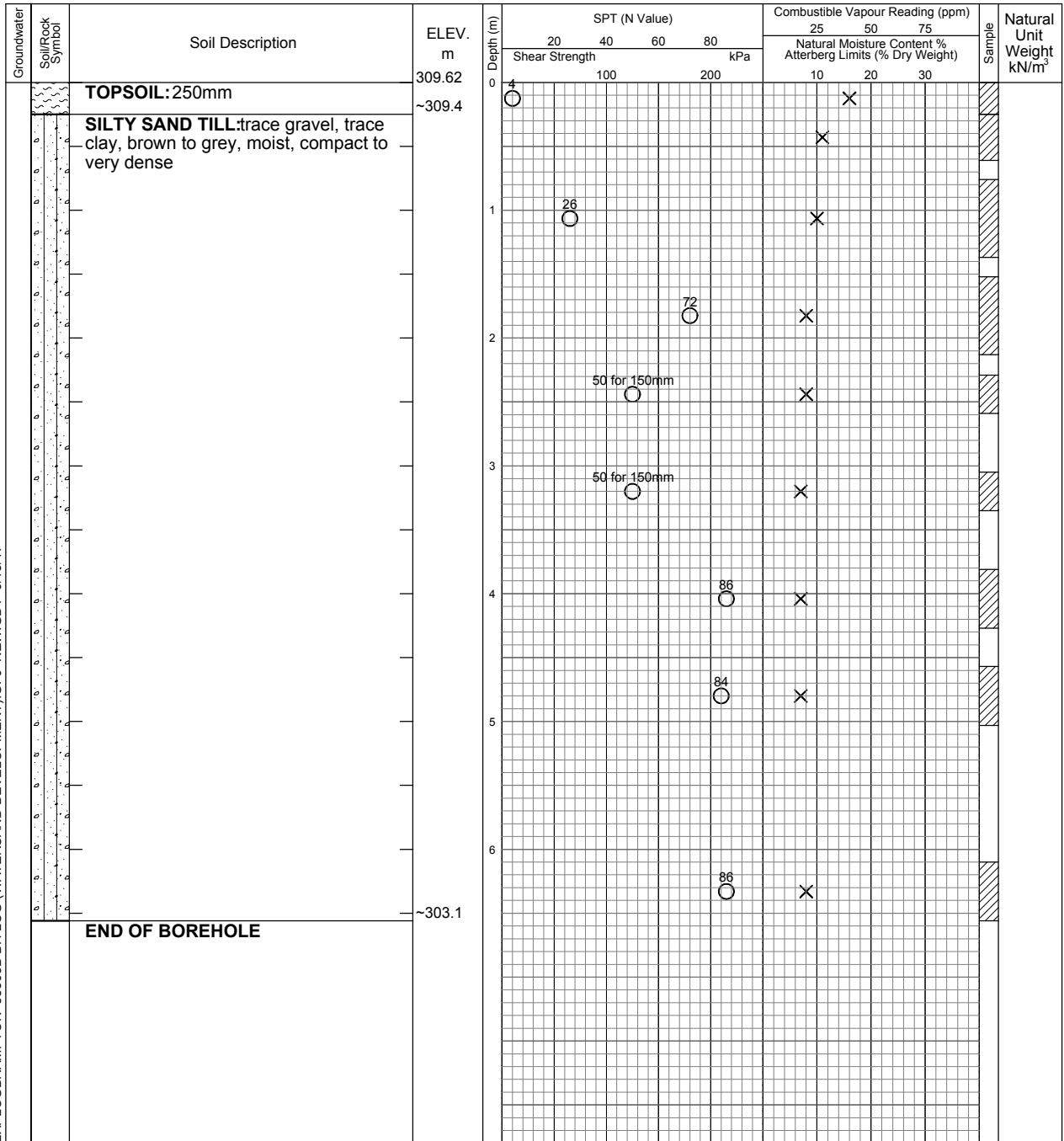
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.56

Log of Borehole E40

Project No. BRM-00038305-B0

Drawing No. 203

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 9, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

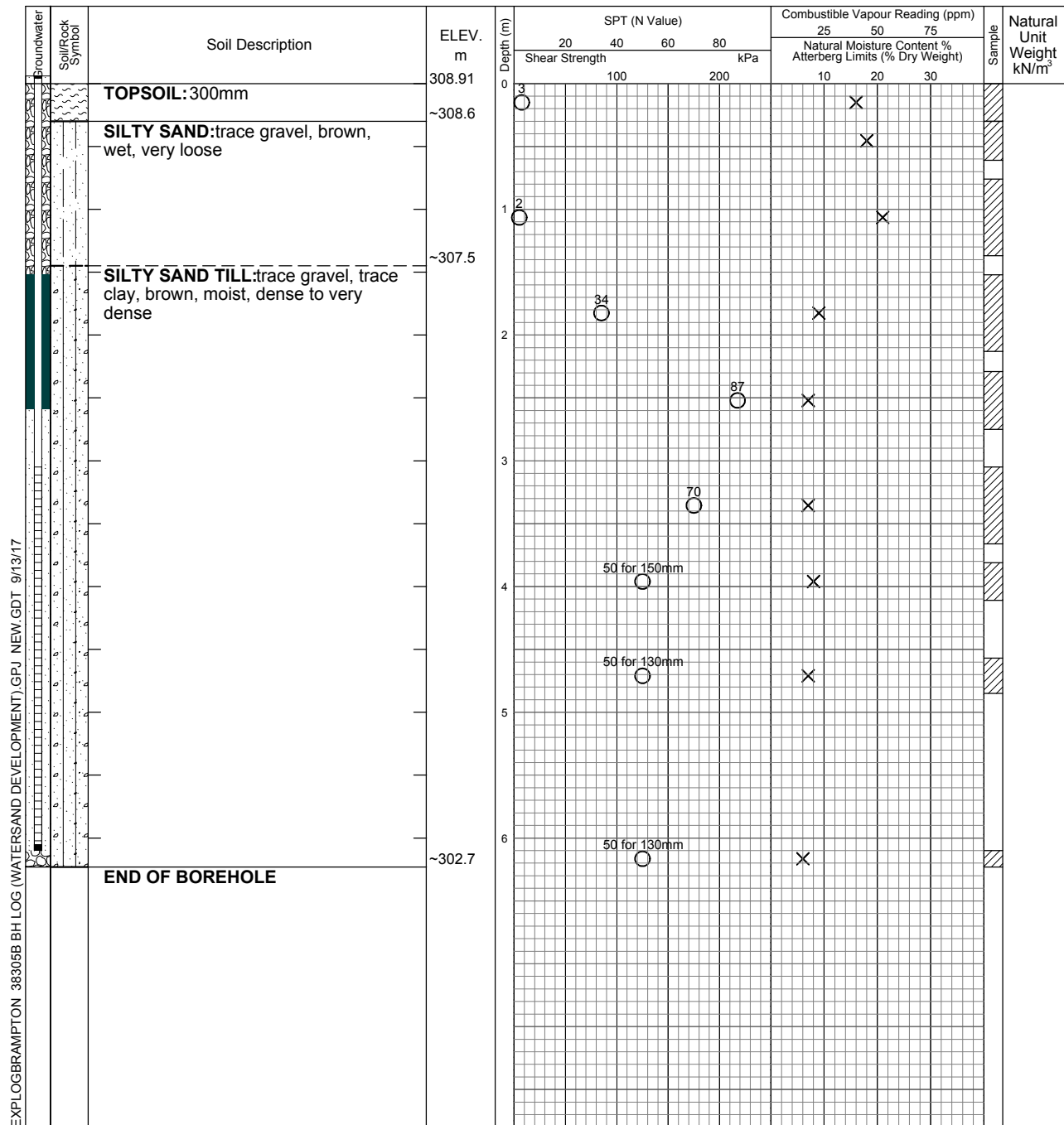
Undrained Triaxial at

% Strain at Failure

Penetrometer

Drill Type: CME55 - Track Mount

Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
June 22, 2017	Dry	-
August 18, 2017	Dry	-

Log of Borehole E41

Project No. BRM-00038305-B0

Drawing No. 204

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

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

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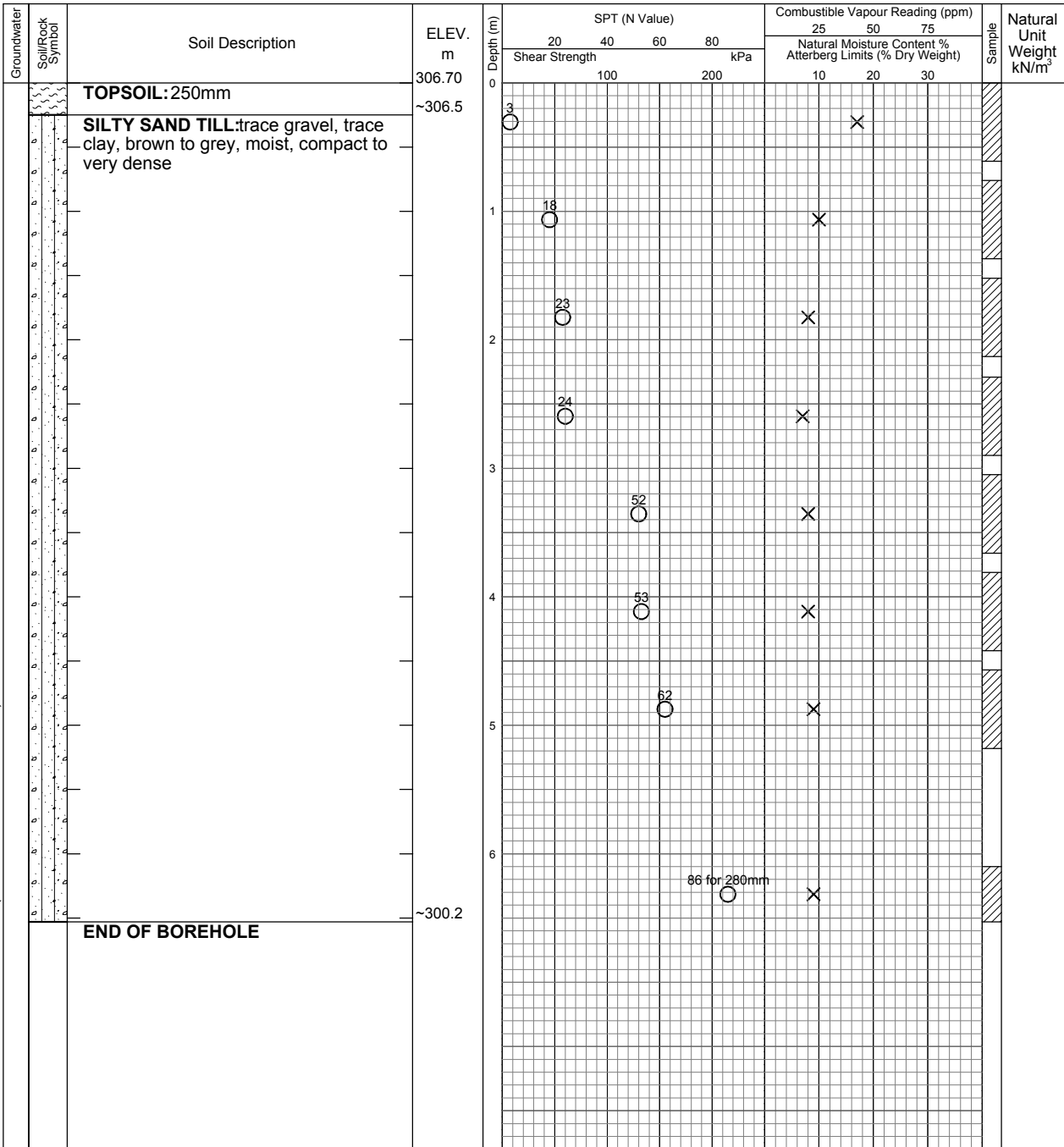
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.53

Log of Borehole E46

Project No. BRM-00038305-B0

Drawing No. 205

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

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

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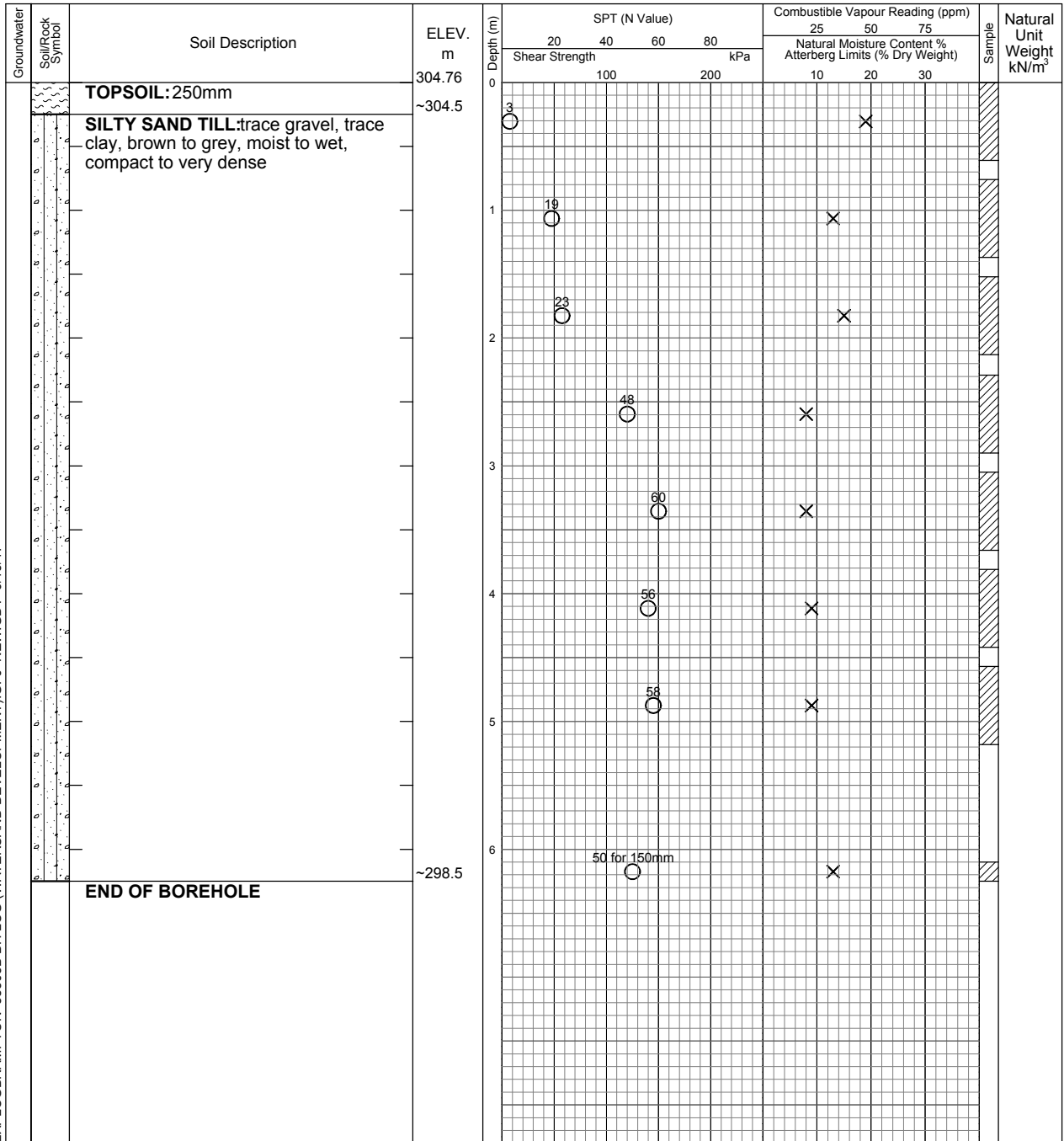
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



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



Log of Borehole E47

Project No. BRM-00038305-B0

Drawing No. 206

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

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

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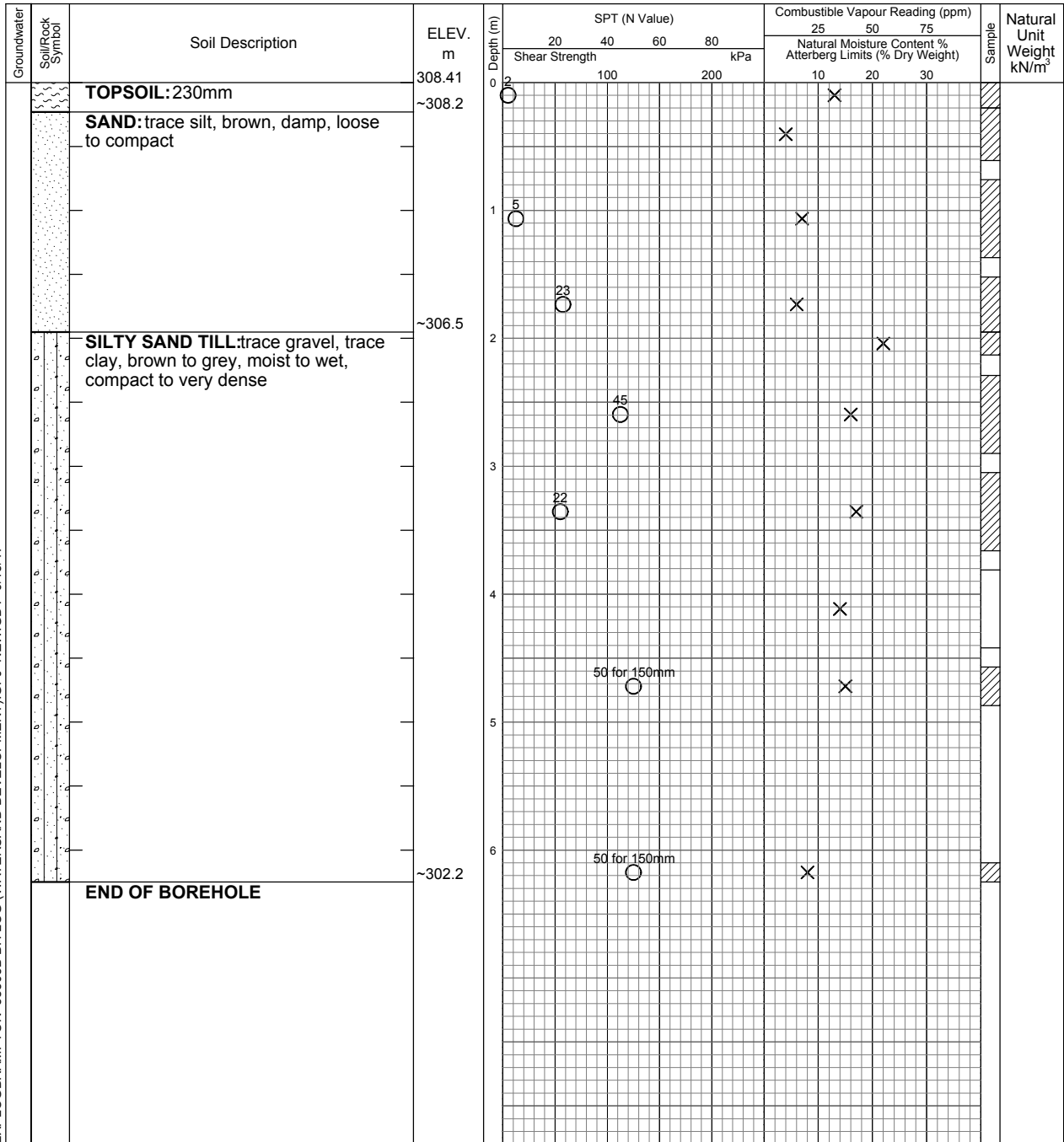
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E48

Project No. BRM-00038305-B0

Drawing No. 207

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

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

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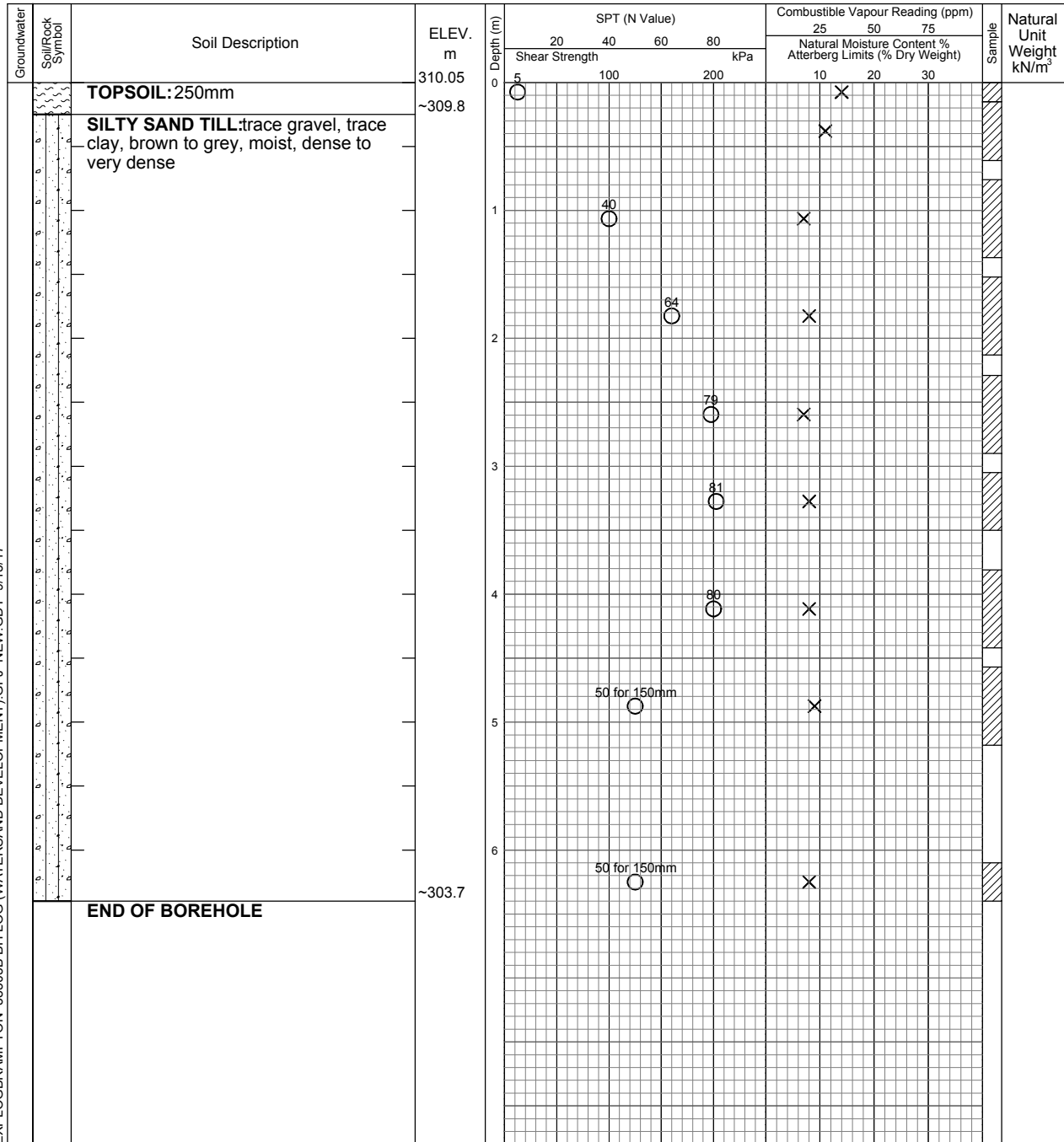
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40



Log of Borehole E49

Project No. BRM-00038305-B0

Drawing No. 208

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

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

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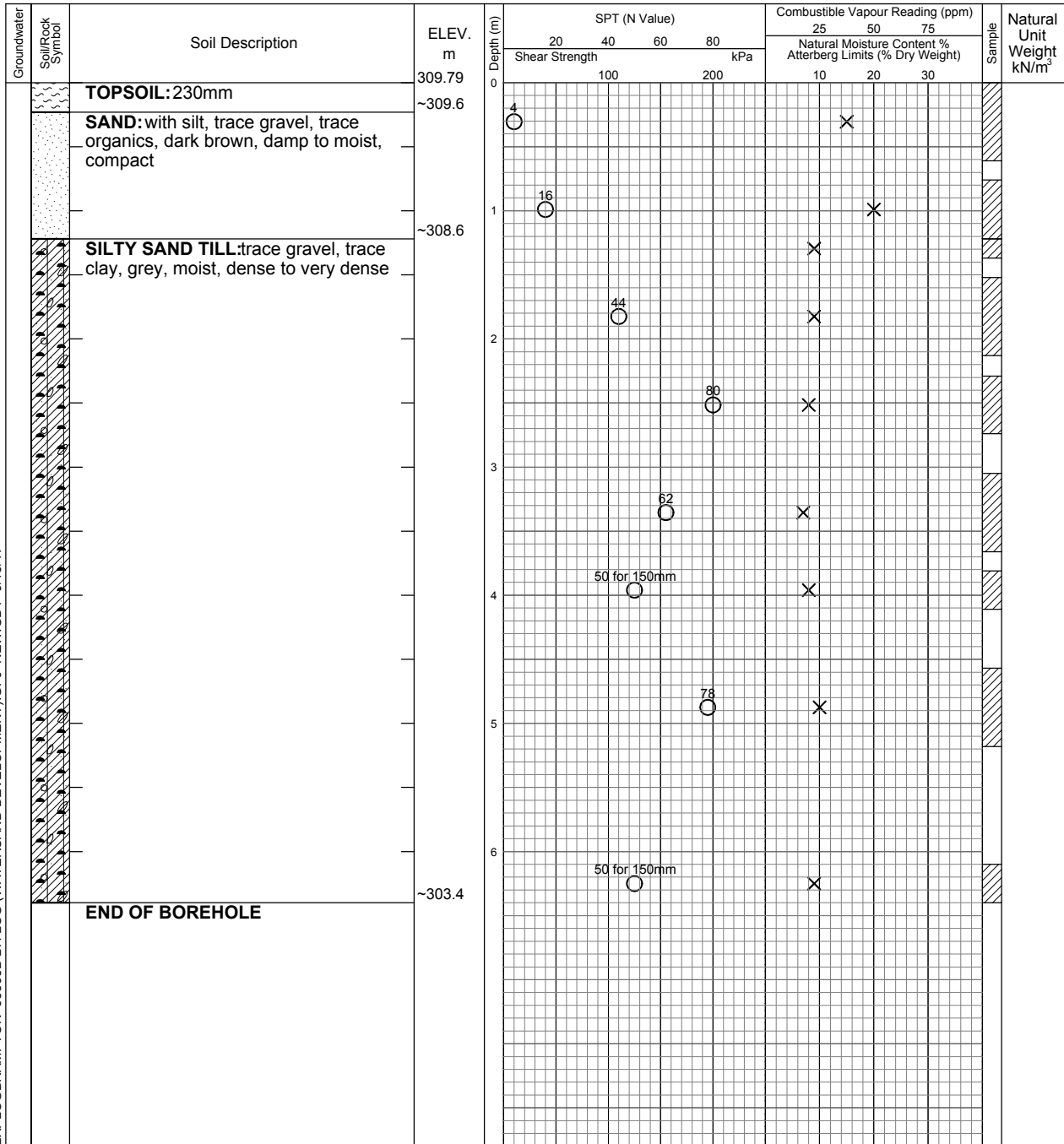
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40

Log of Borehole E50

Project No. BRM-00038305-B0

Drawing No. 209

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 9, 2017

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

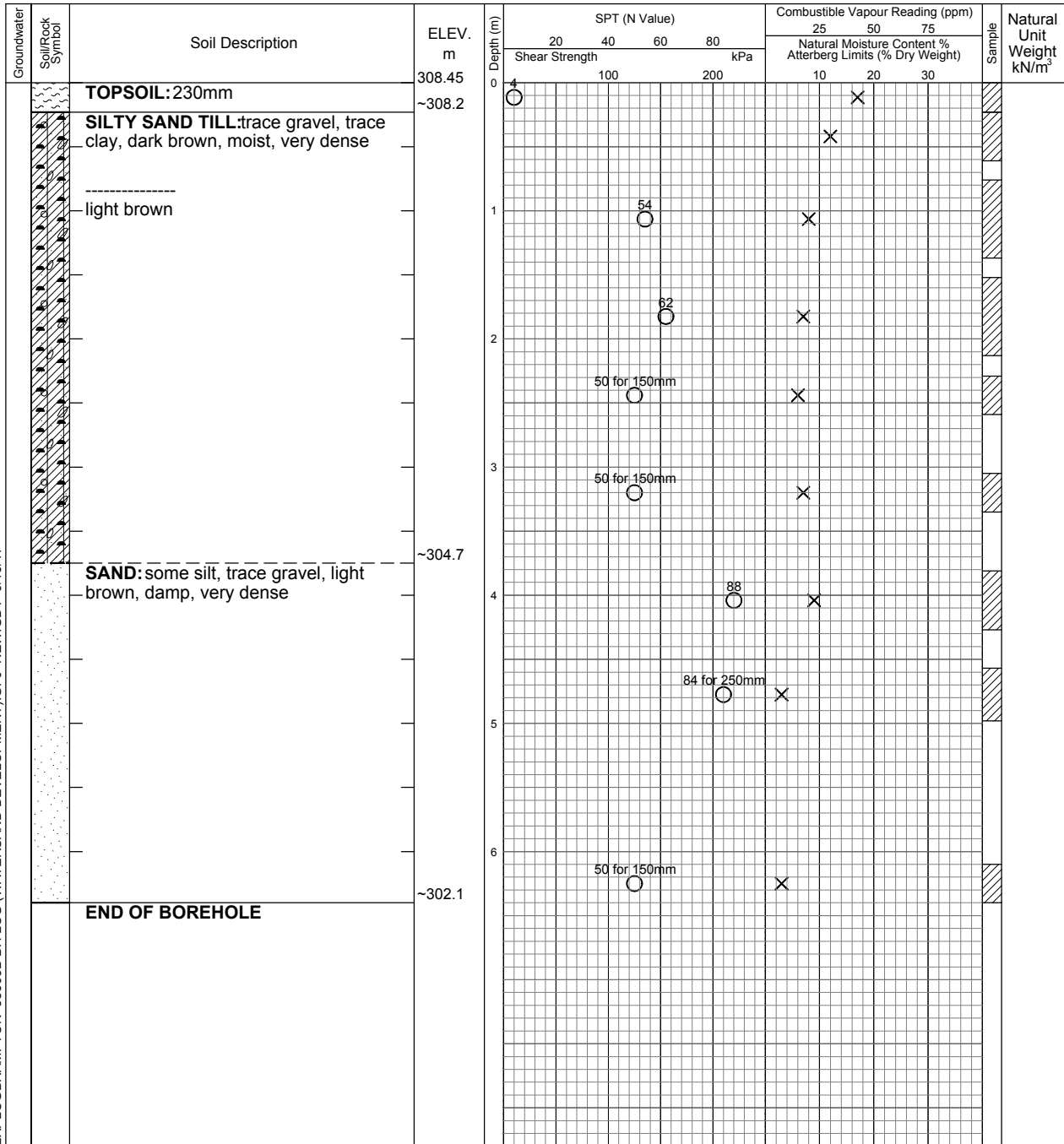


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40

Log of Borehole E4

Project No. BRM-00038305-B0

Drawing No. 211

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

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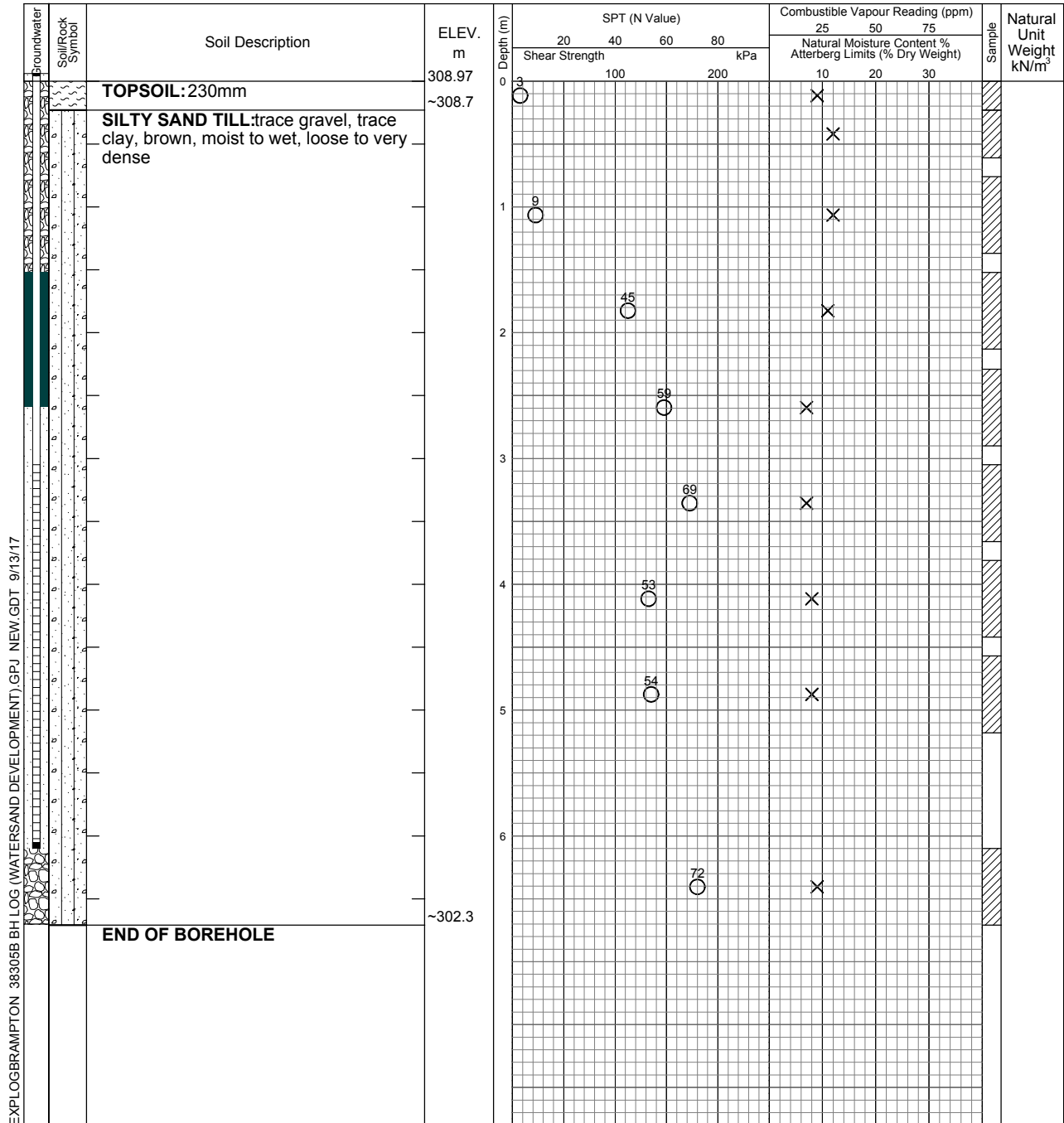
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT). GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
June 22, 2017	4.58	-
August 18, 2017	Dry	-

Log of Borehole E5

Project No. BRM-00038305-B0

Drawing No. 212

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

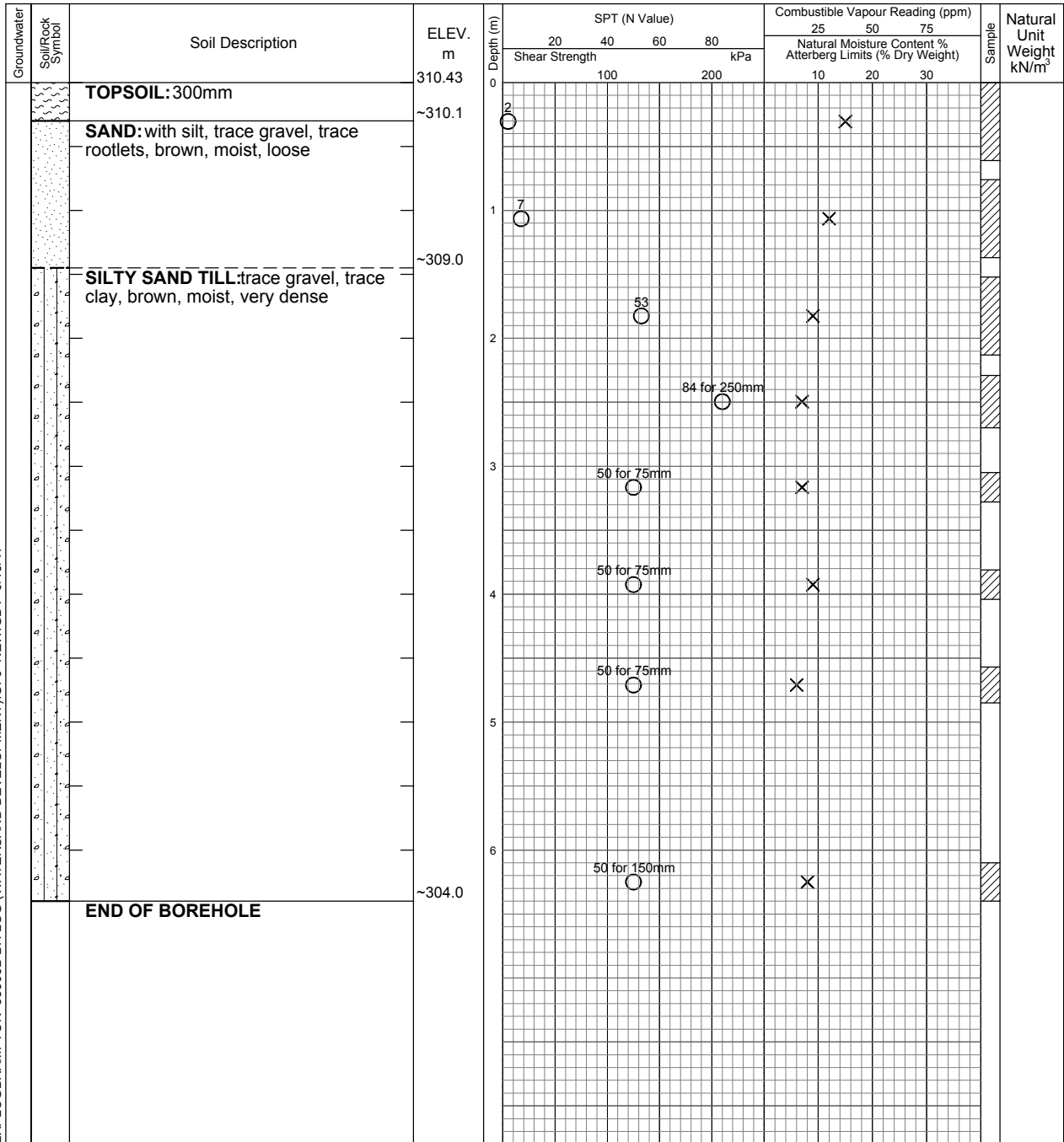


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40



Log of Borehole E6

Project No. BRM-00038305-B0

Drawing No. 213

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

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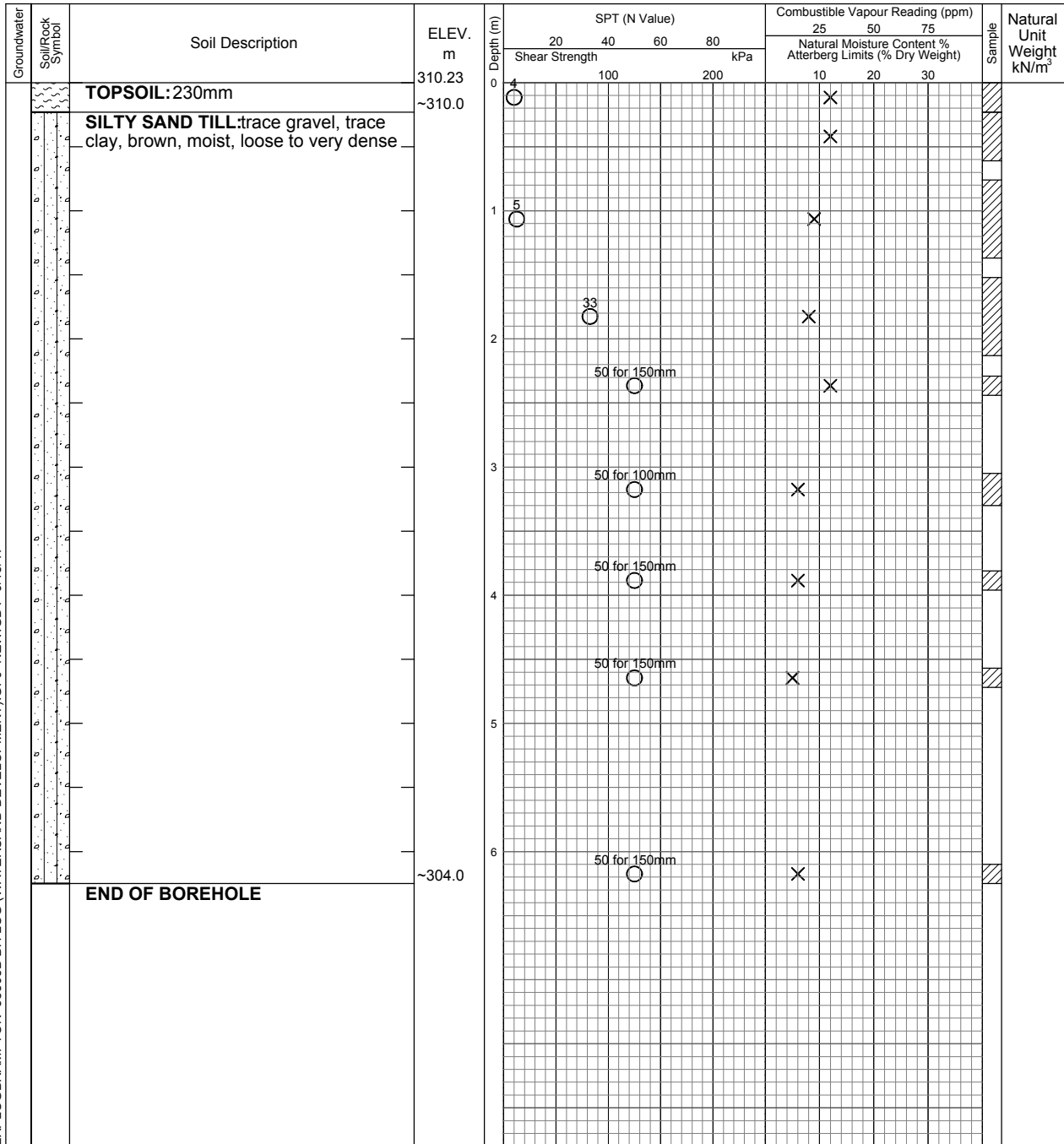
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E13

Project No. BRM-00038305-B0

Drawing No. 214

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 8, 2017

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

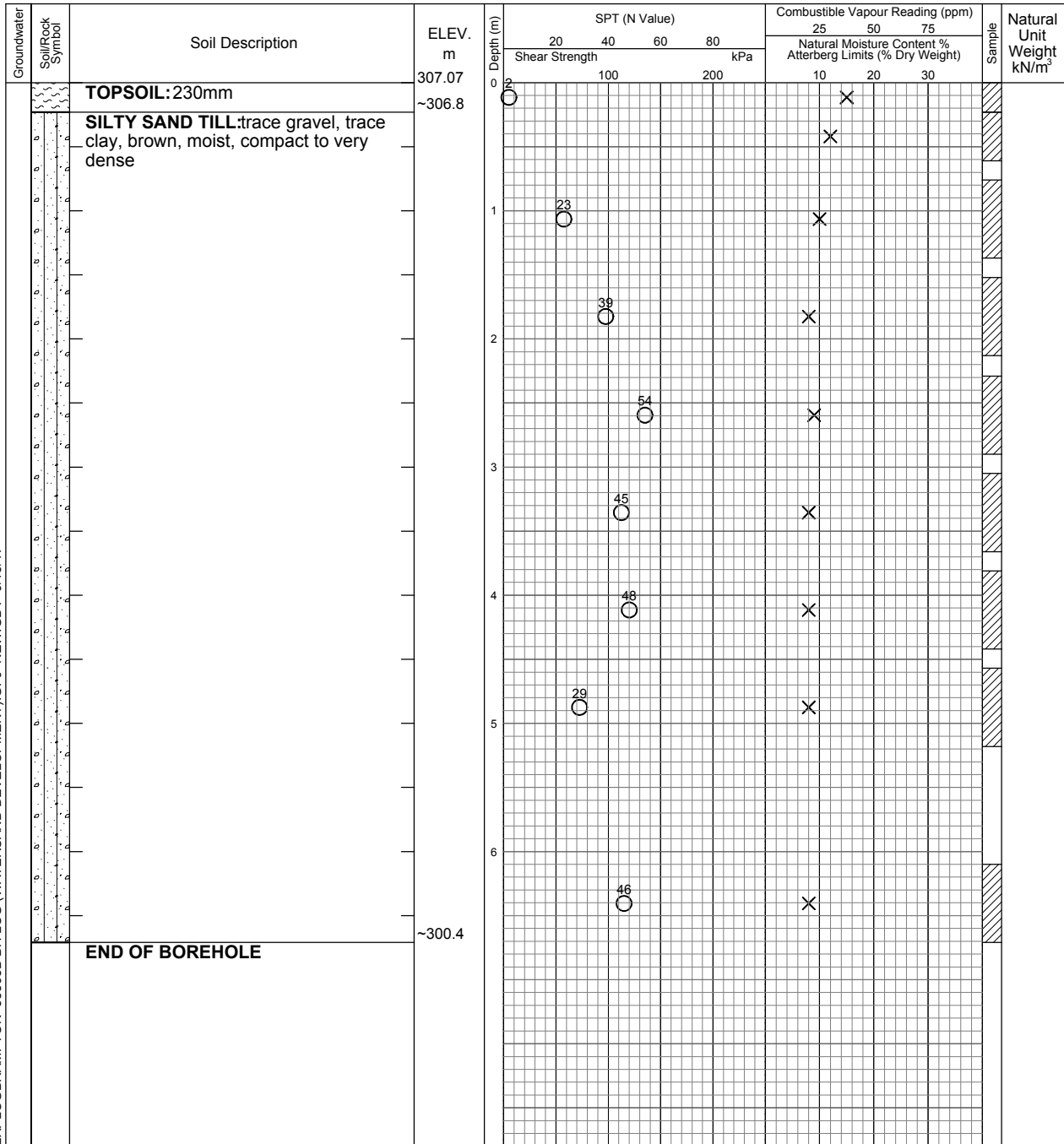


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71



Log of Borehole E14

Project No. BRM-00038305-B0

Drawing No. 215

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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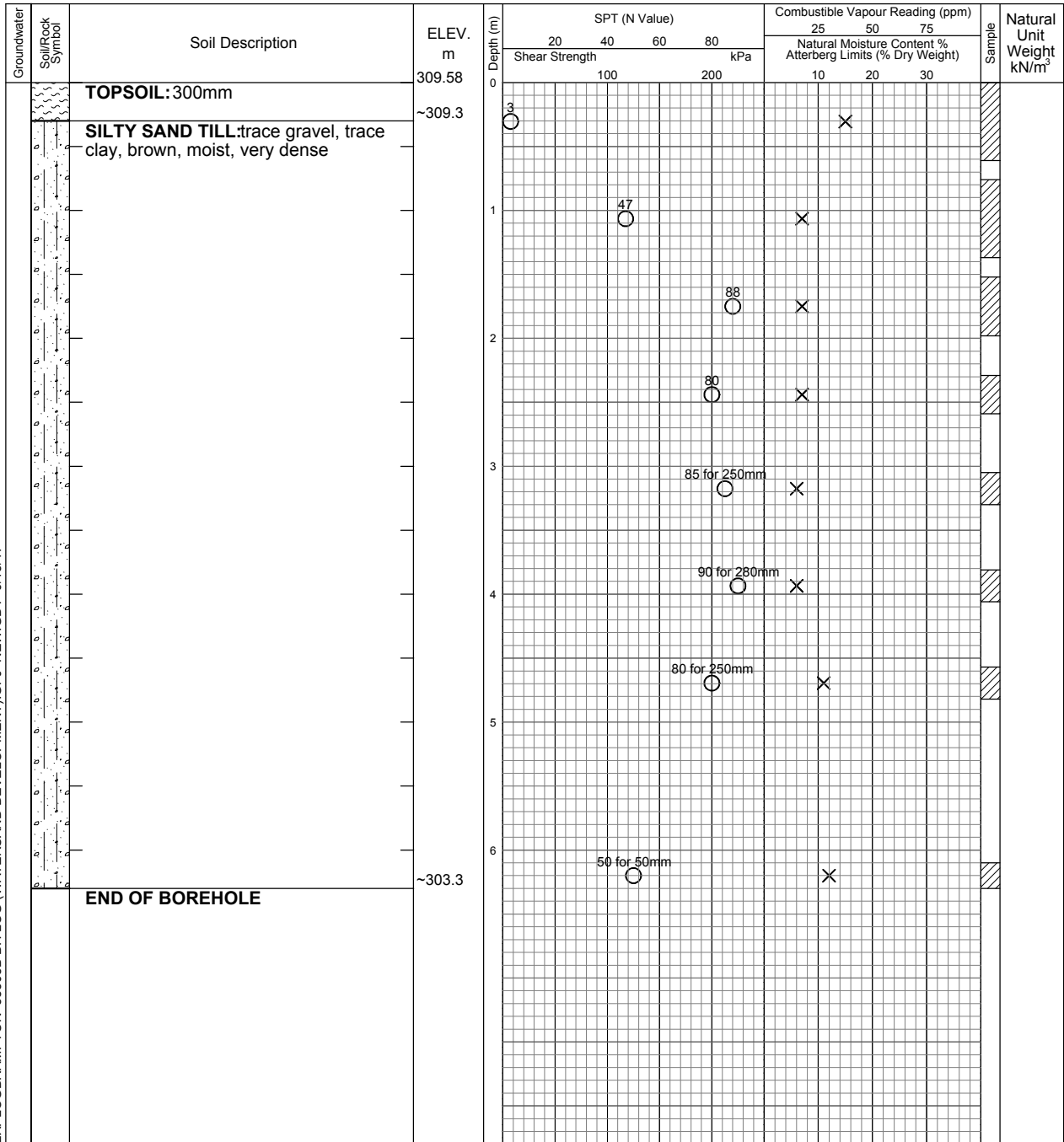
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	5.64	5.64



Log of Borehole E15

Project No. BRM-00038305-B0

Drawing No. 216

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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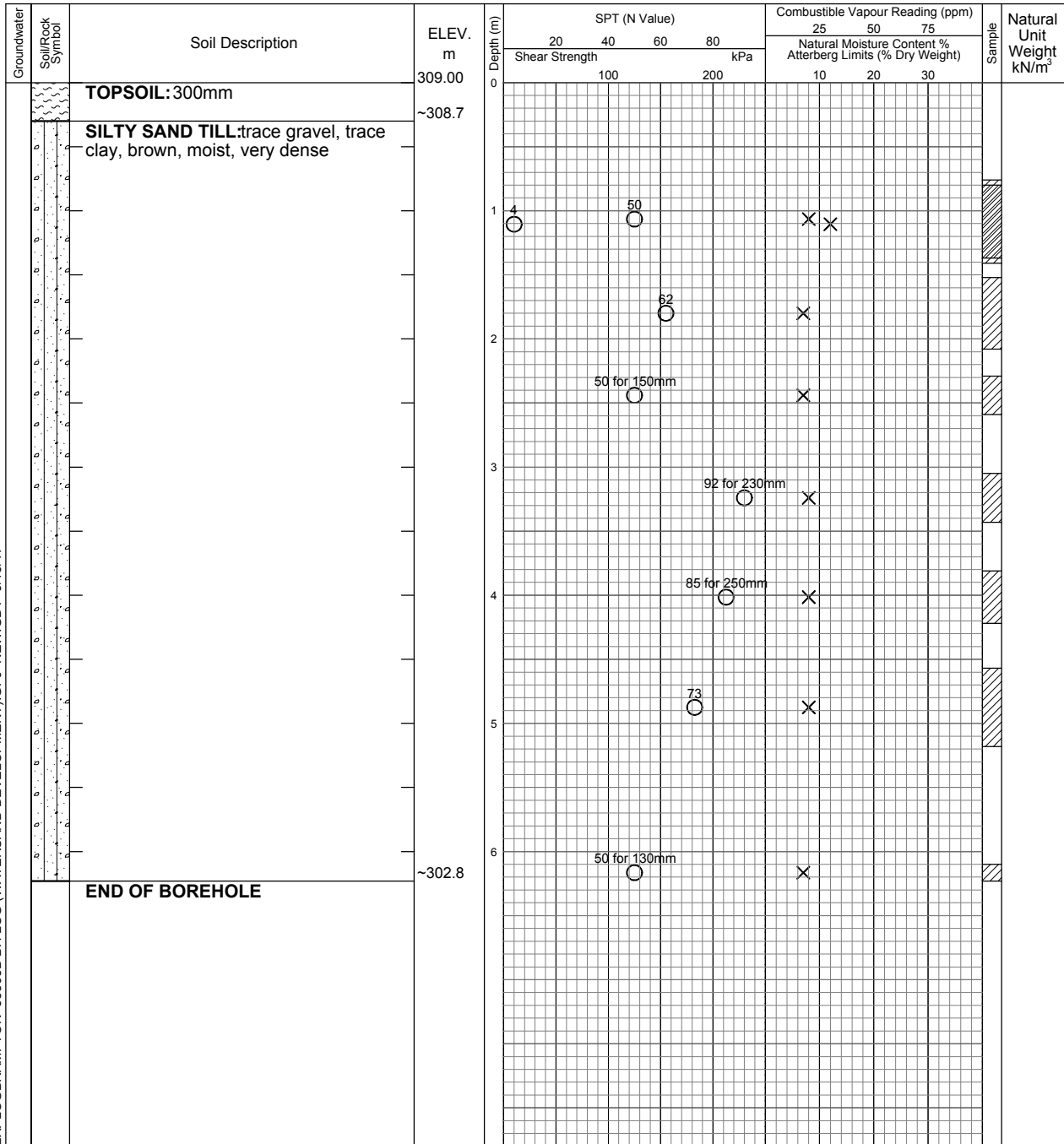
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.38



Log of Borehole E23

Project No. BRM-00038305-B0

Drawing No. 217

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

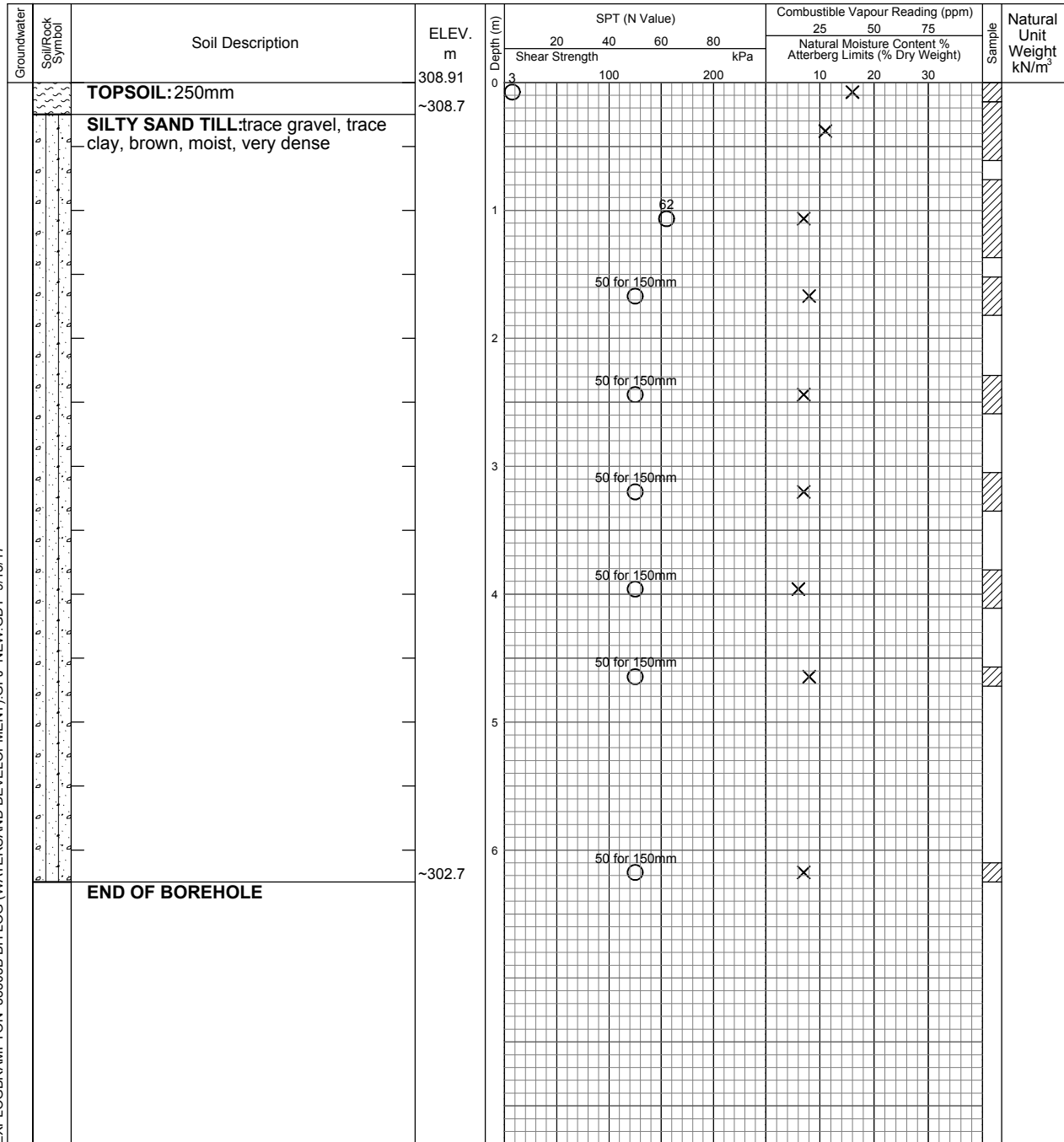


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E32

Project No. BRM-00038305-B0

Drawing No. 218

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

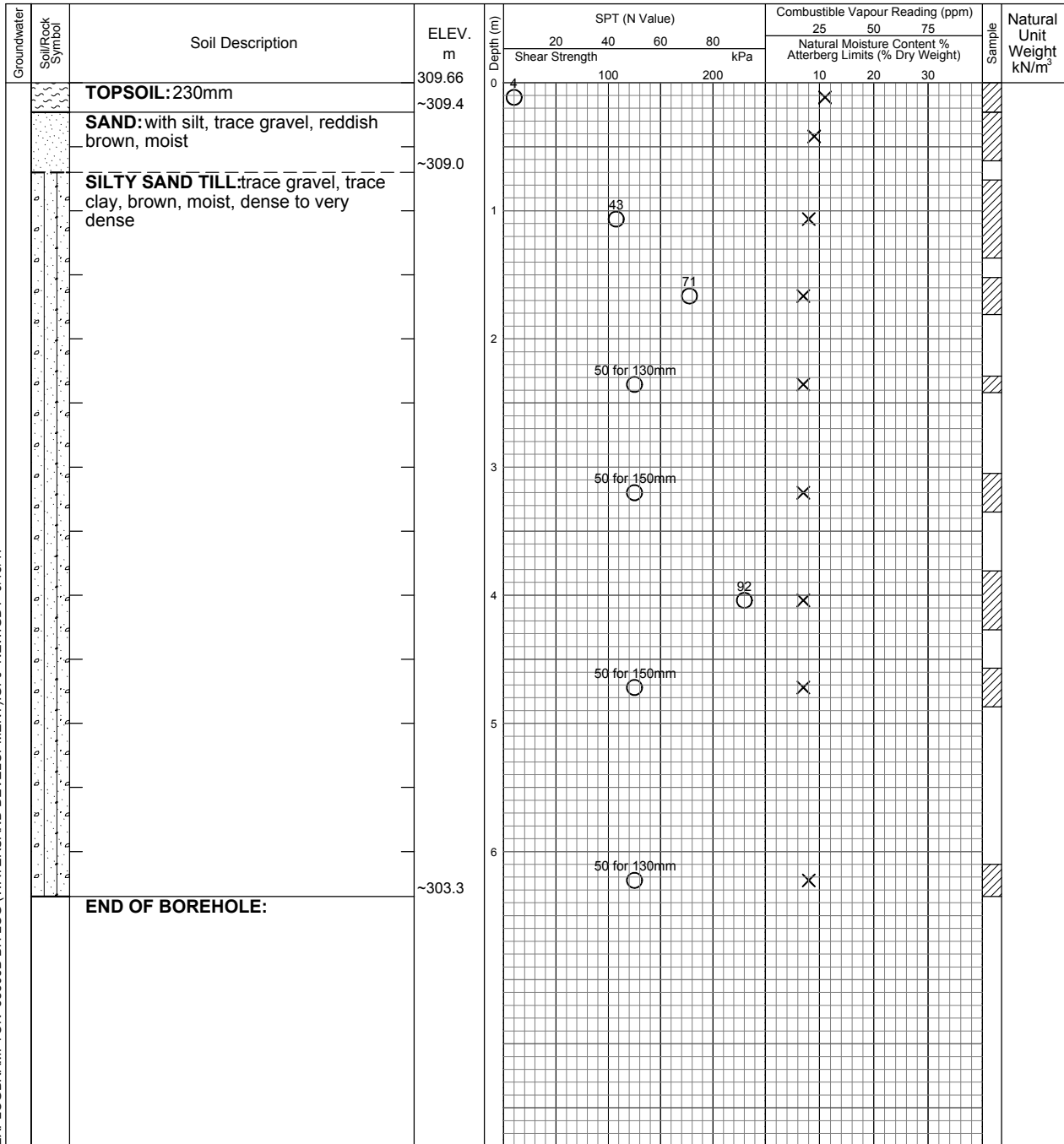


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPU NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.35



Log of Borehole E33

Project No. BRM-00038305-B0

Drawing No. 219

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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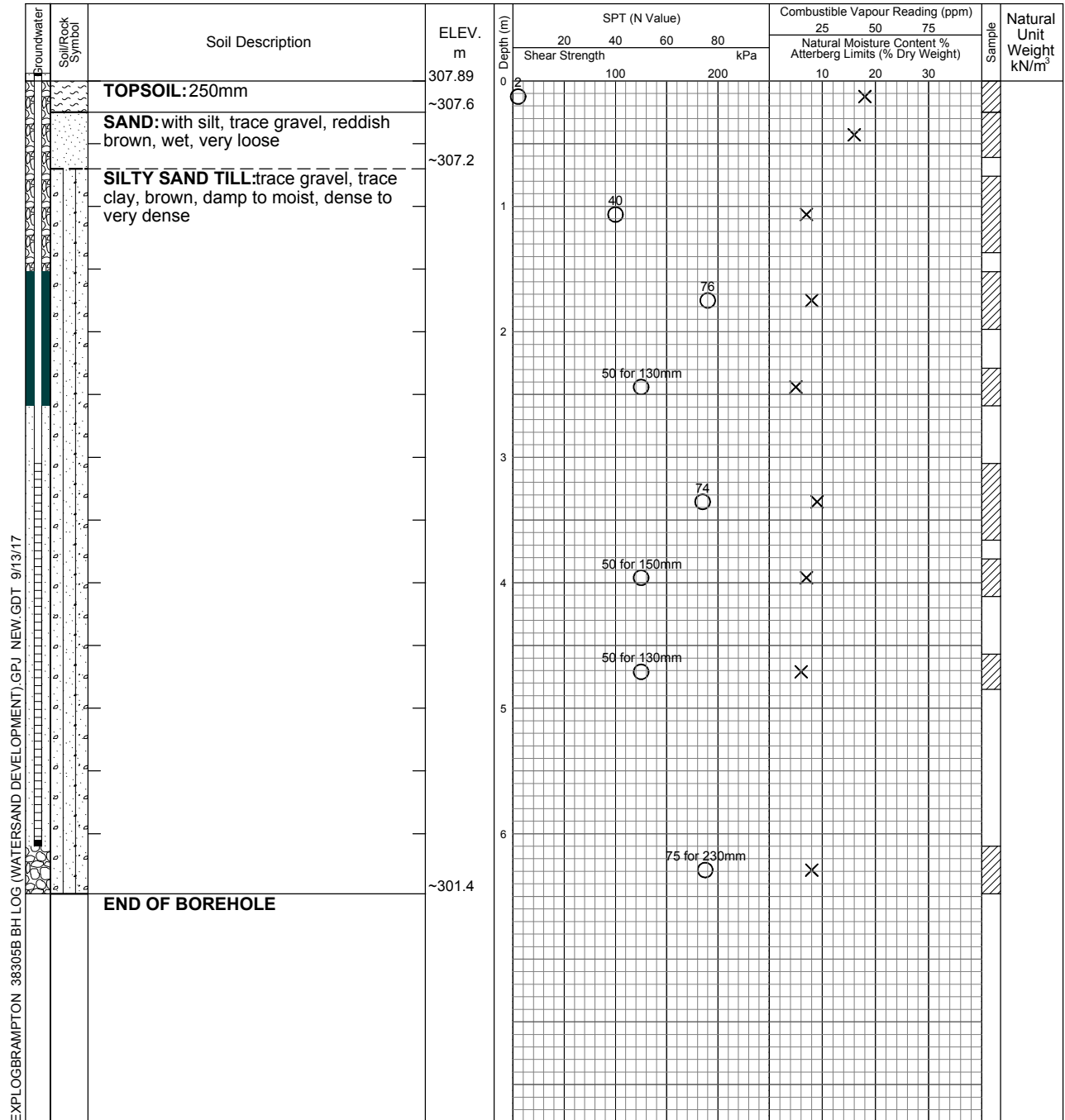
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.38
June 22, 2017	Dry	-
August 18, 2017	Dry	-

Log of Borehole E42

Project No. BRM-00038305-B0

Drawing No. 220

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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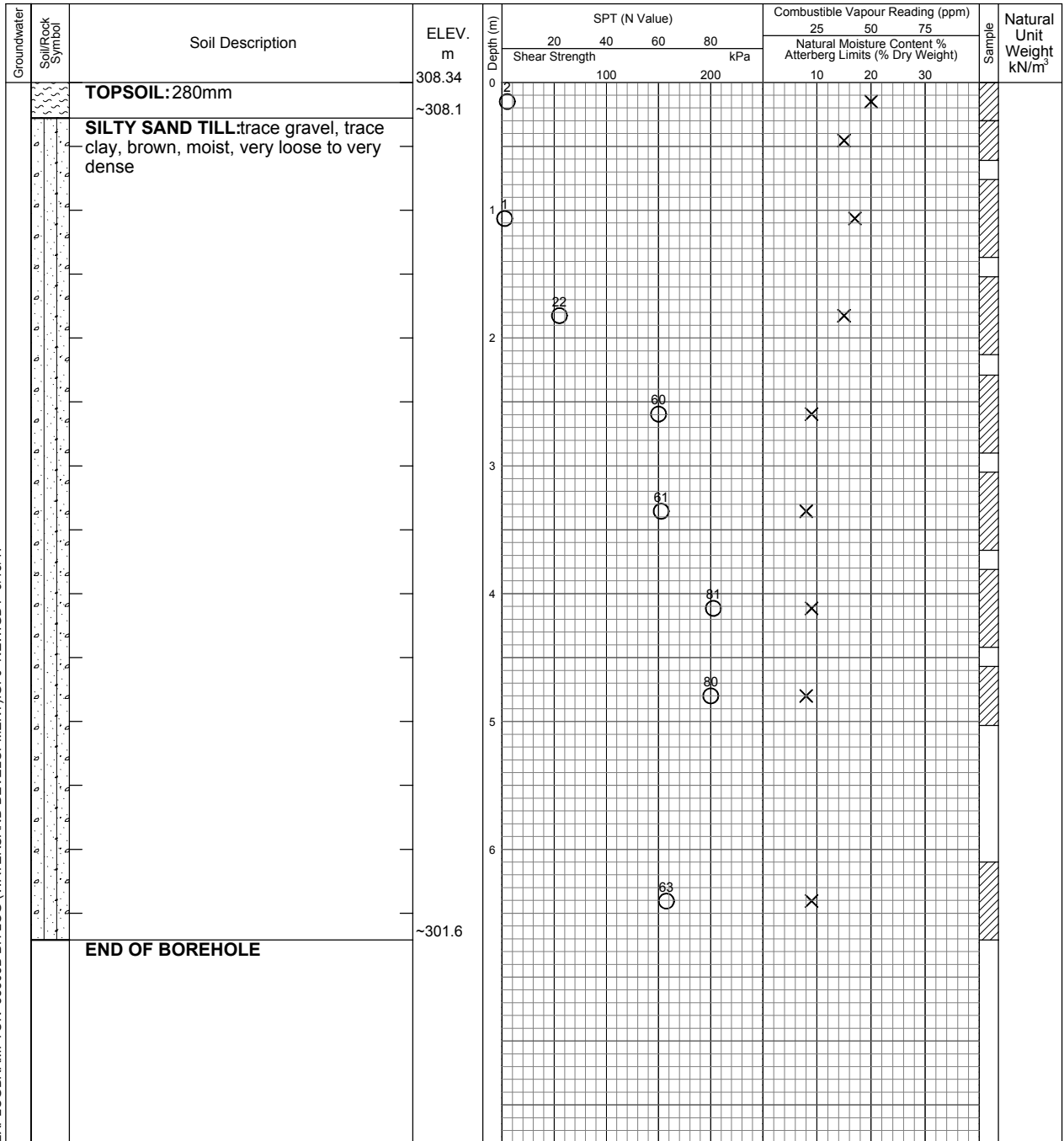
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71

Log of Borehole E51

Project No. BRM-00038305-B0

Drawing No. 221

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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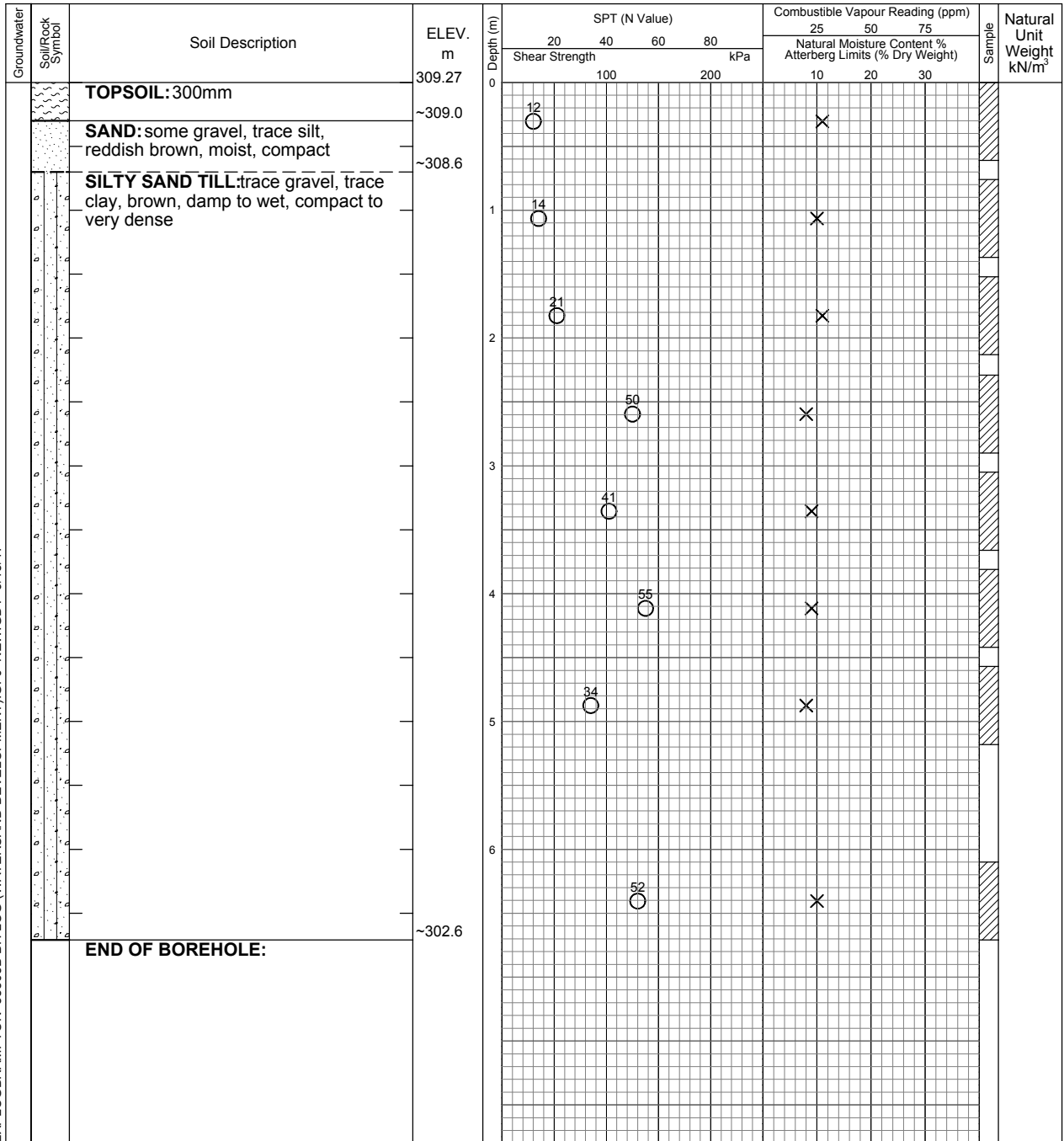
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



Log of Borehole E52

Project No. BRM-00038305-B0

Drawing No. 222

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 7, 2017

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

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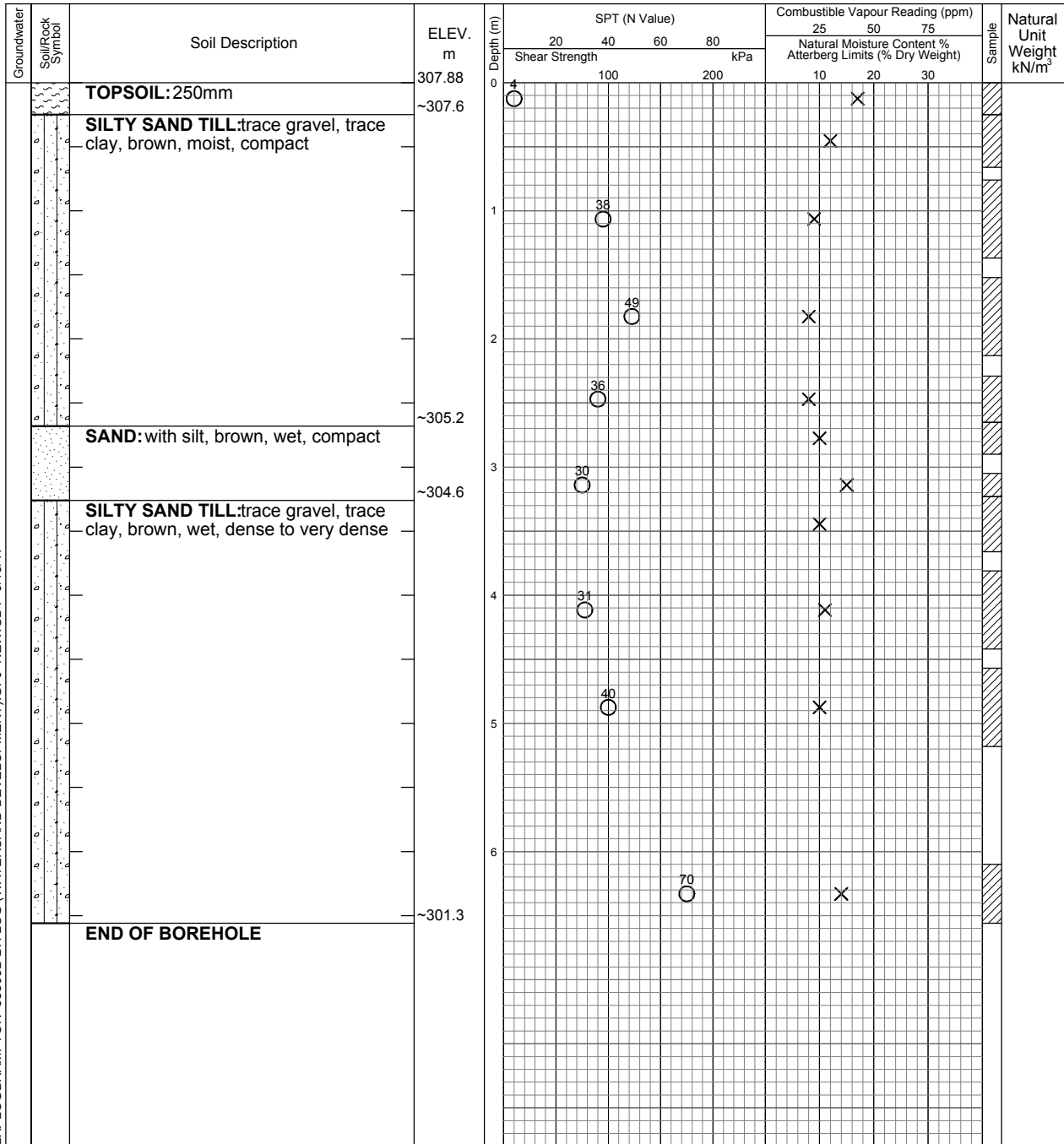
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	3.04	3.04



Log of Borehole E8

Project No. BRM-00038305-B0

Drawing No. 224

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

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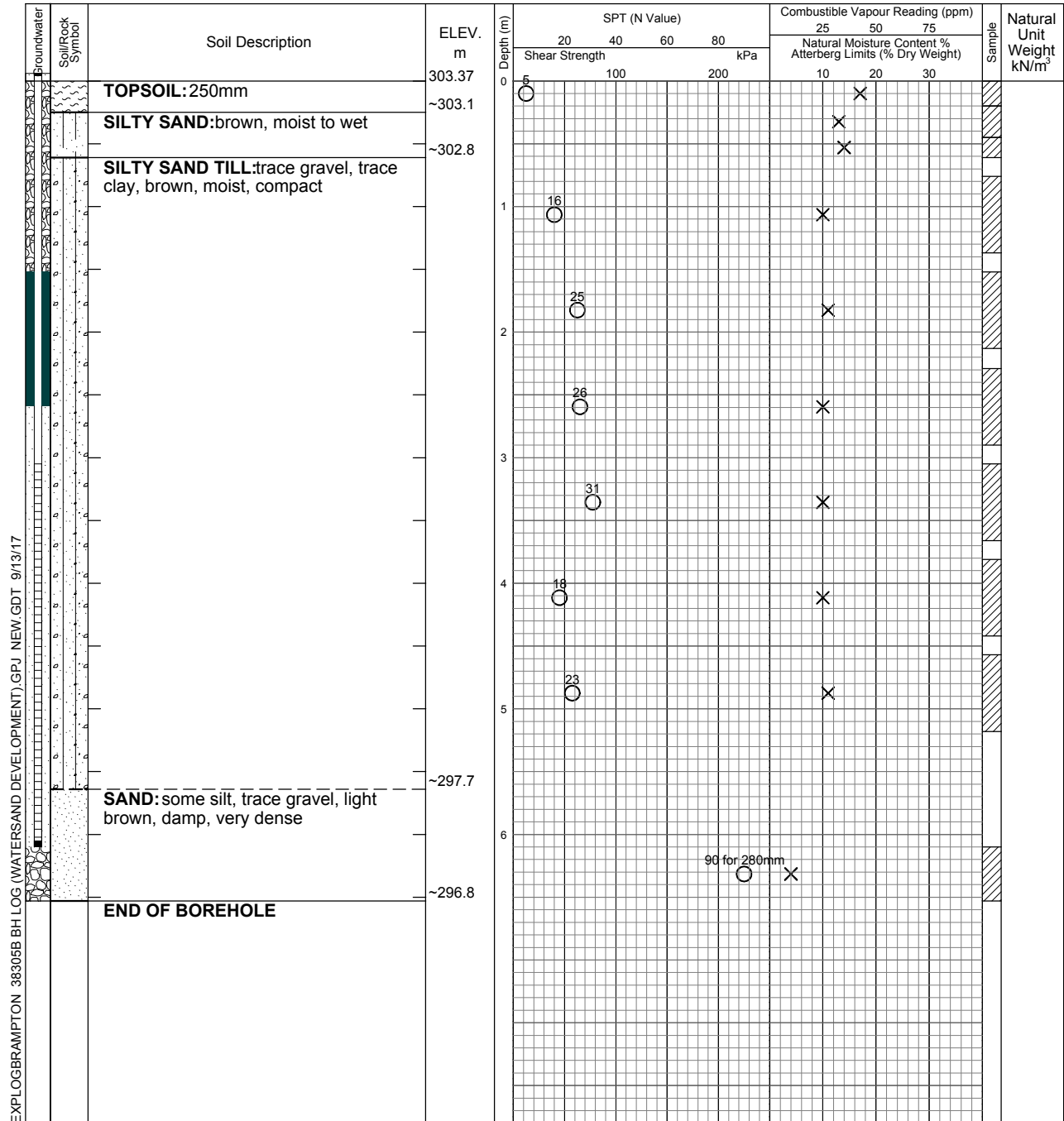
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Datum: Geodetic



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	-
June 22, 2017	Dry	-
August 18, 2017	Dry	-

Log of Borehole E16

Project No. BRM-00038305-B0

Drawing No. 225

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

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

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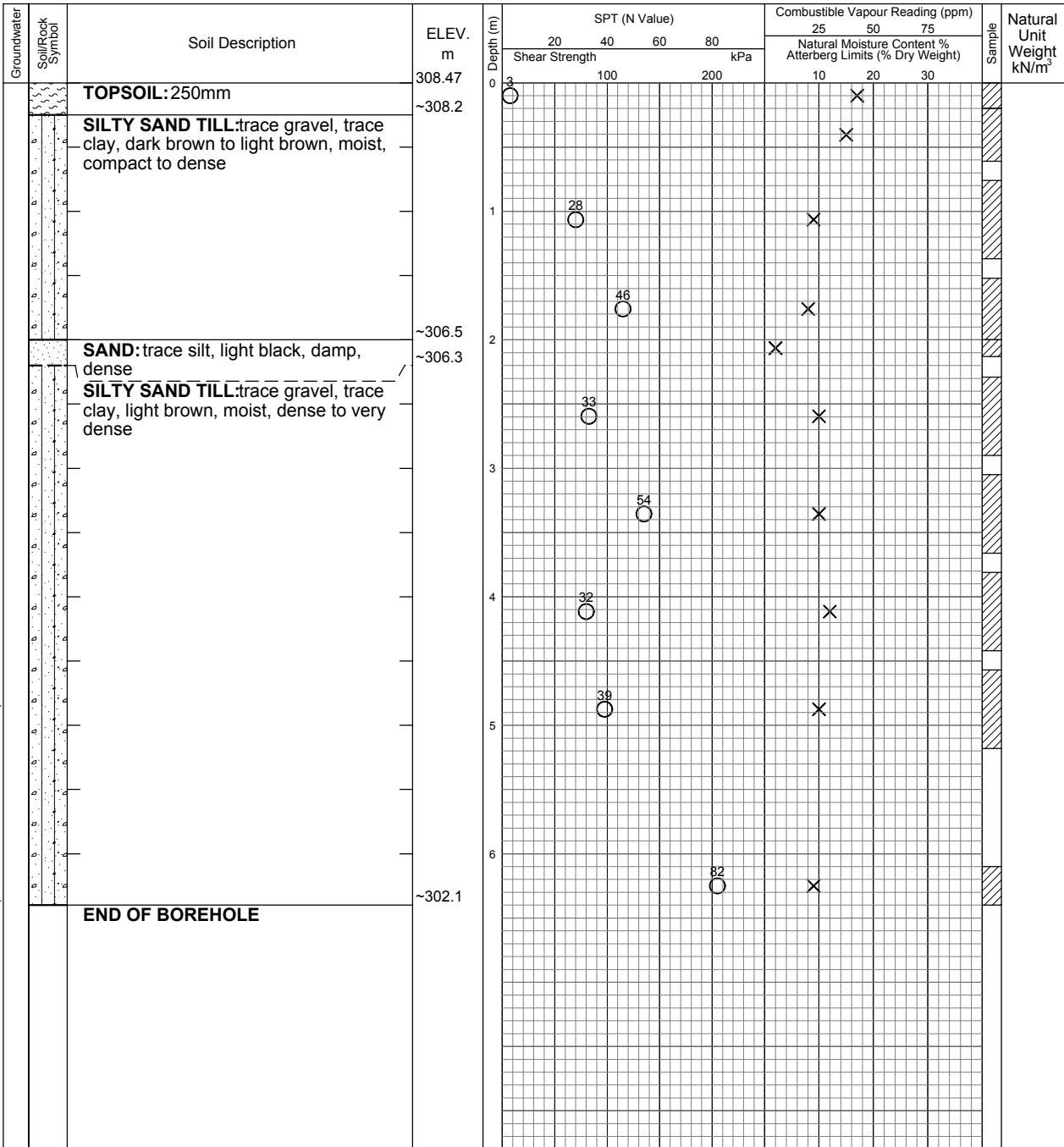
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40

Log of Borehole E17

Project No. BRM-00038305-B0

Drawing No. 226

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

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

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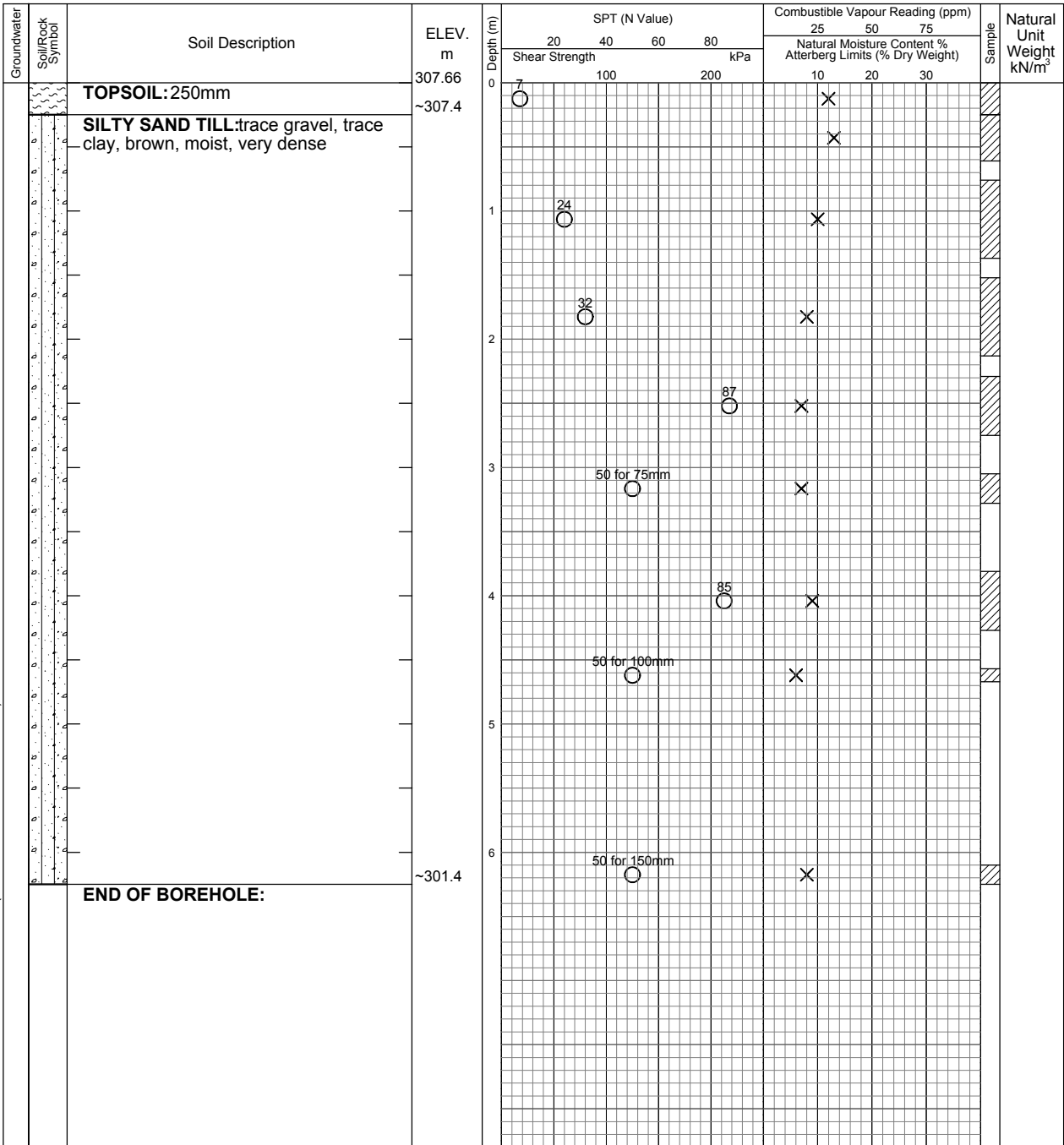
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E18

Project No. BRM-00038305-B0

Drawing No. 227

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

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

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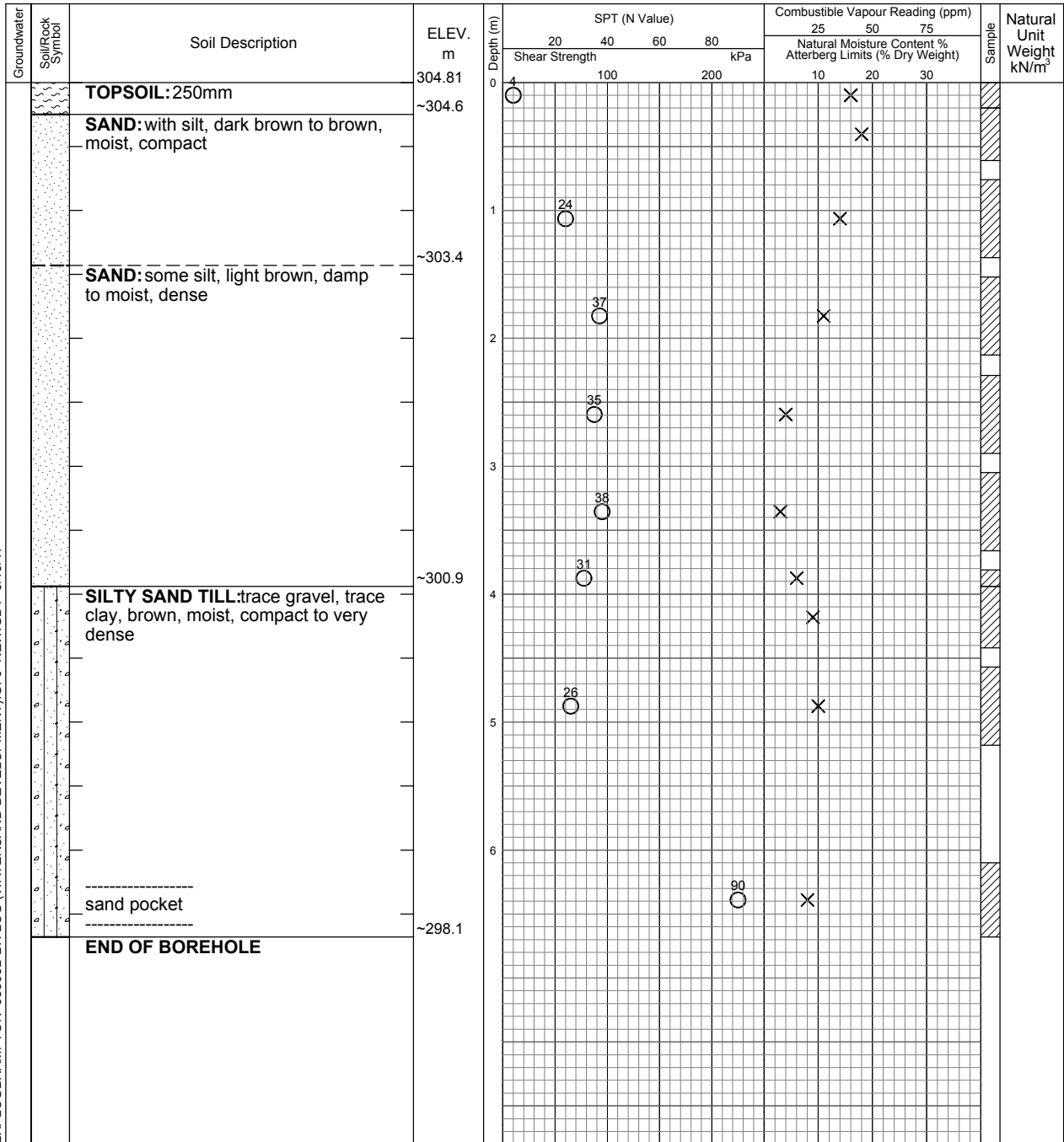
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.68



Log of Borehole E25

Project No. BRM-00038305-B0

Drawing No. 228

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

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

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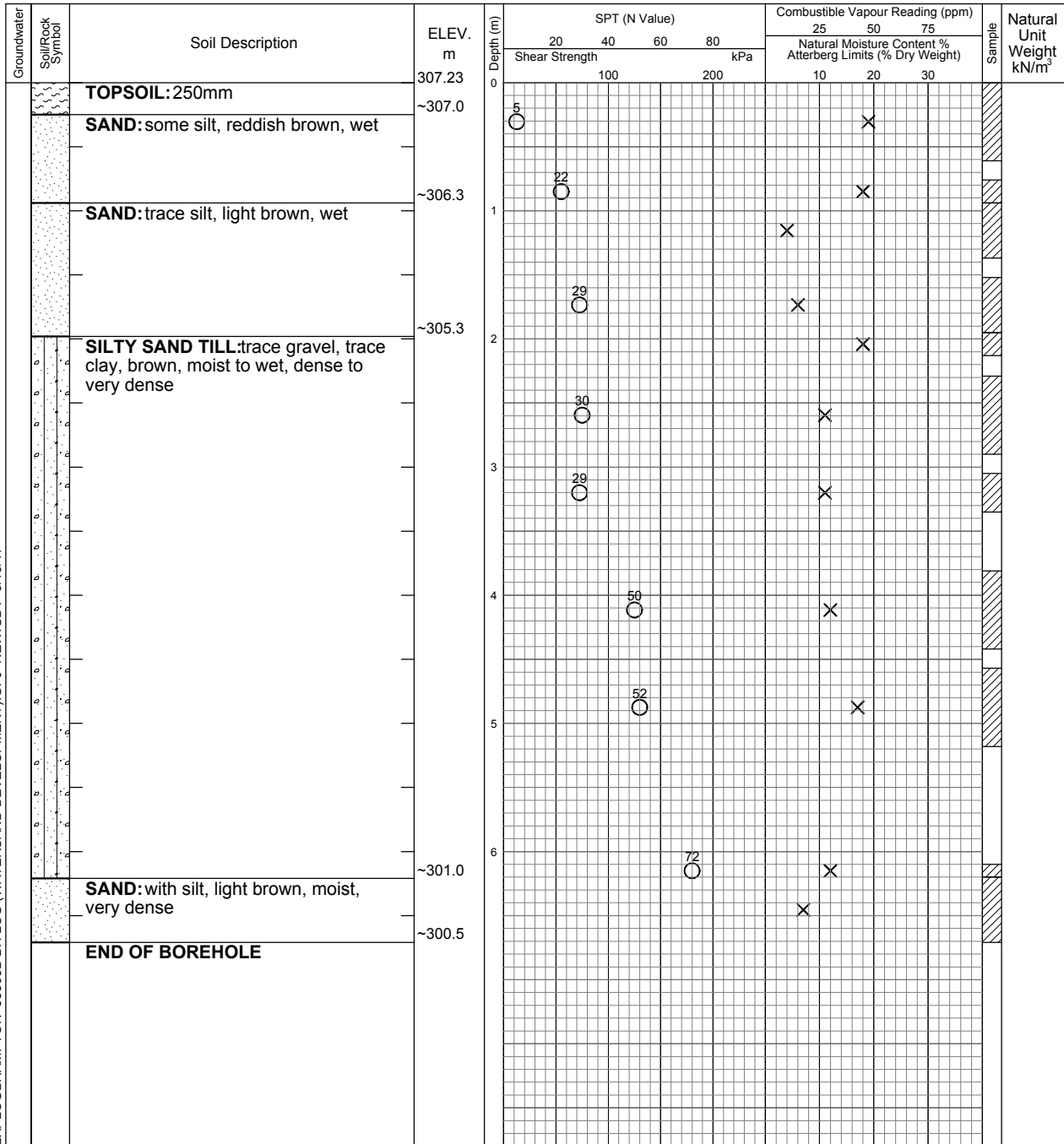
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.71



Log of Borehole E26

Project No. BRM-00038305-B0

Drawing No. 229

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

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

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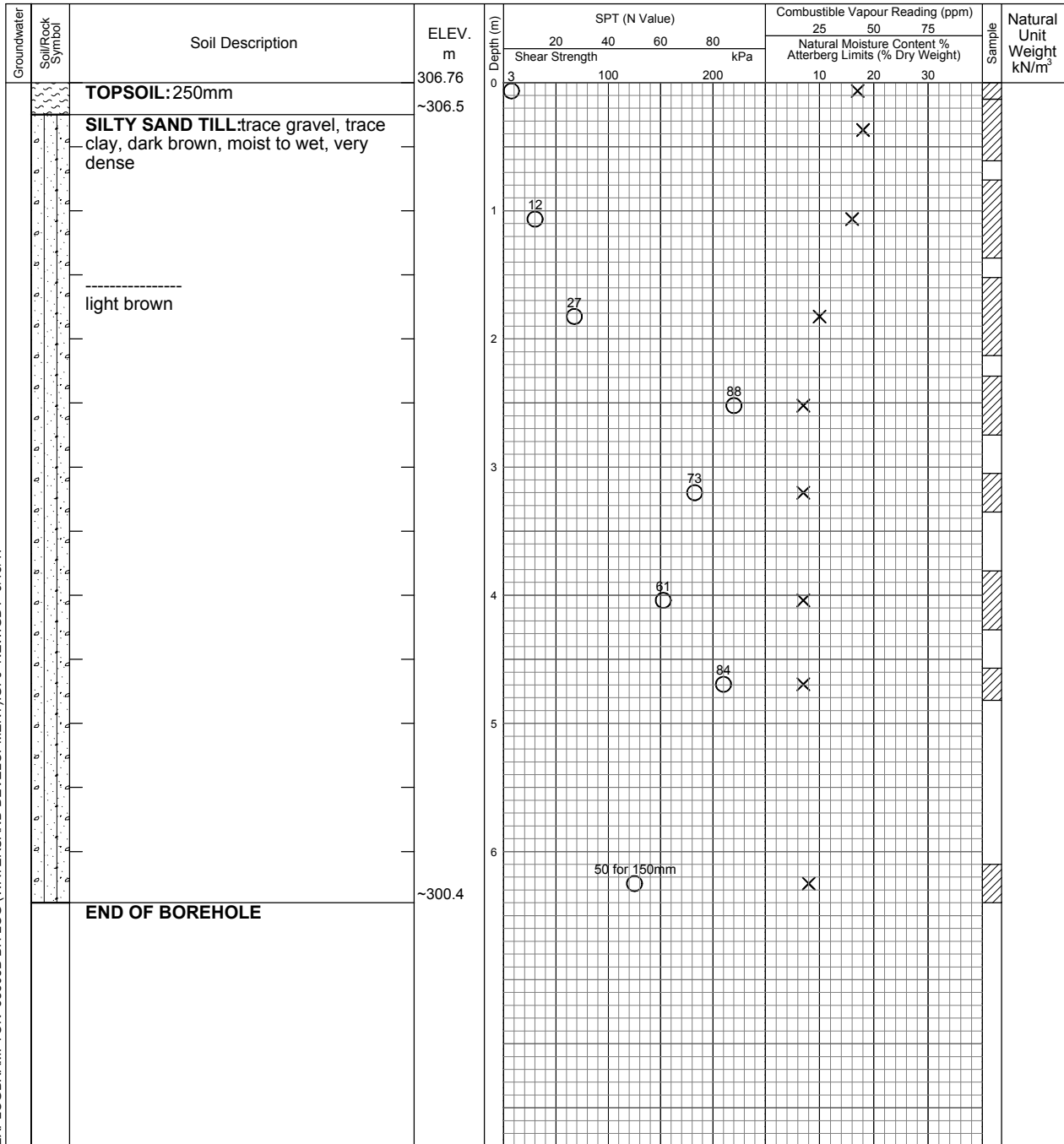
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17

Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.40



Log of Borehole E34

Project No. BRM-00038305-B0

Drawing No. 230

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

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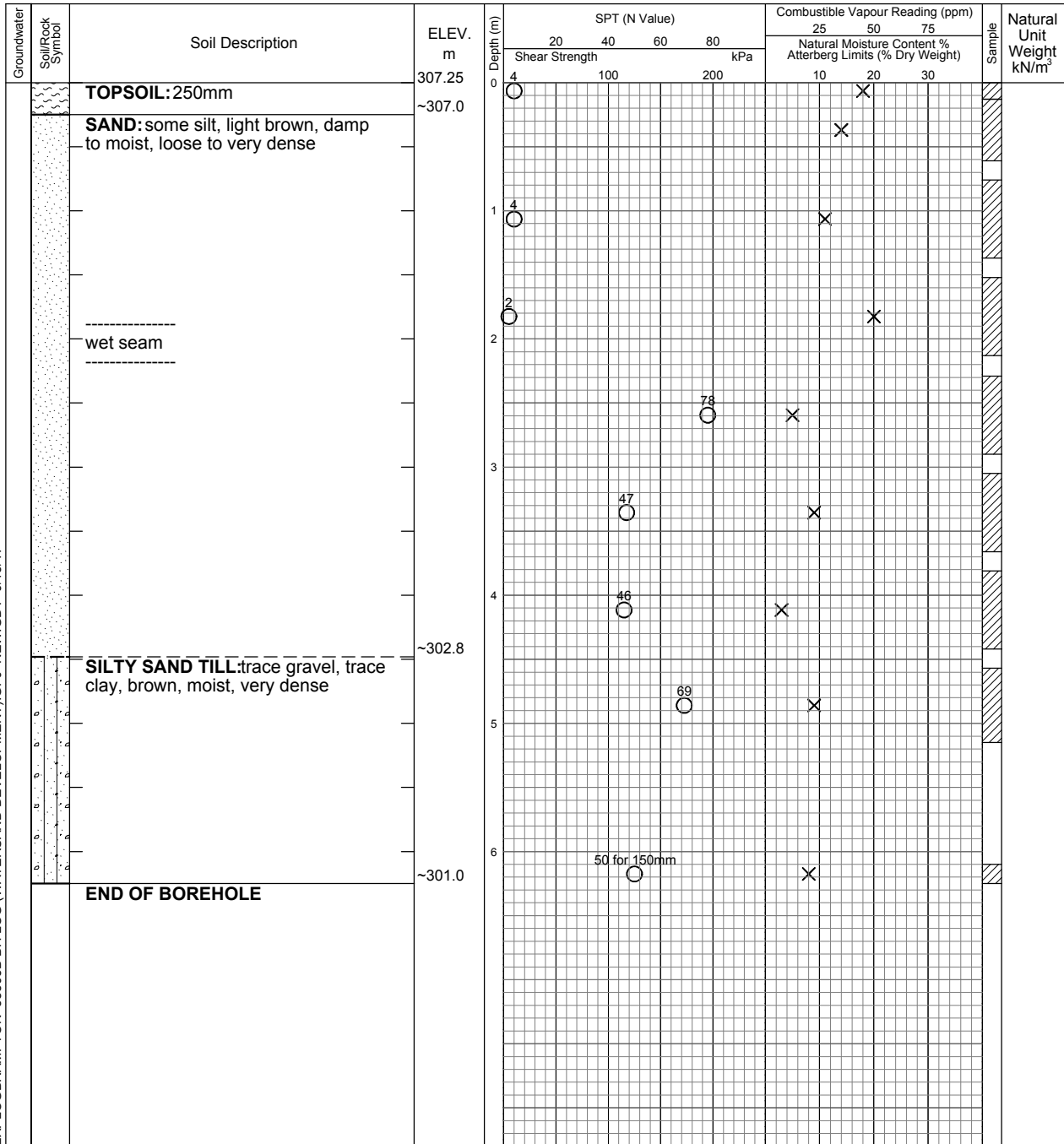
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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E35

Project No. BRM-00038305-B0

Drawing No. 231

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

Auger Sample

SPT (N) Value

Drill Type: CME55 - Track Mount

Dynamic Cone Test

Shelby Tube

Datum: Geodetic

Field Vane Test

Combustible Vapour Reading

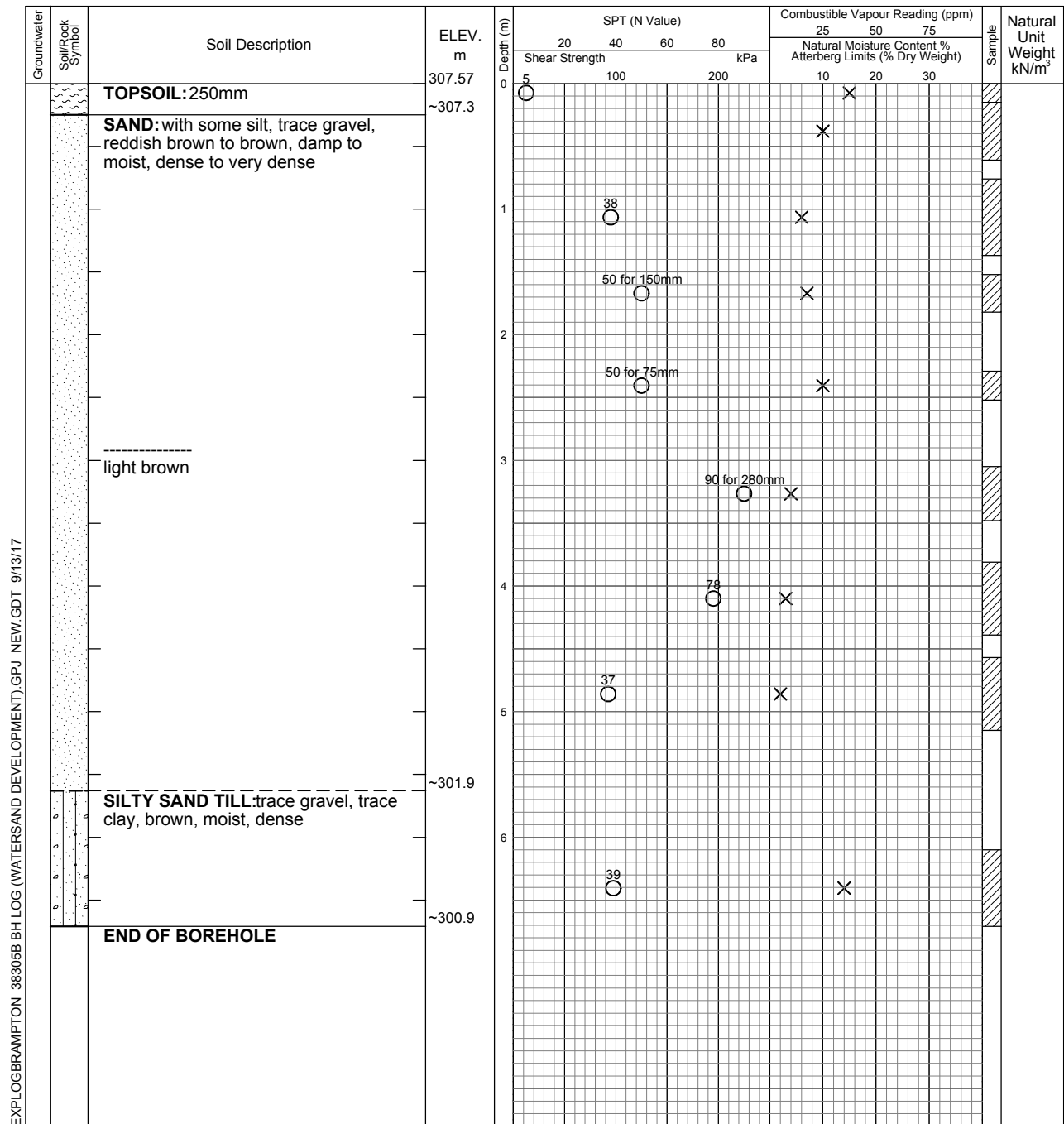
Natural Moisture

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



Log of Borehole E36

Project No. BRM-00038305-B0

Drawing No. 232

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

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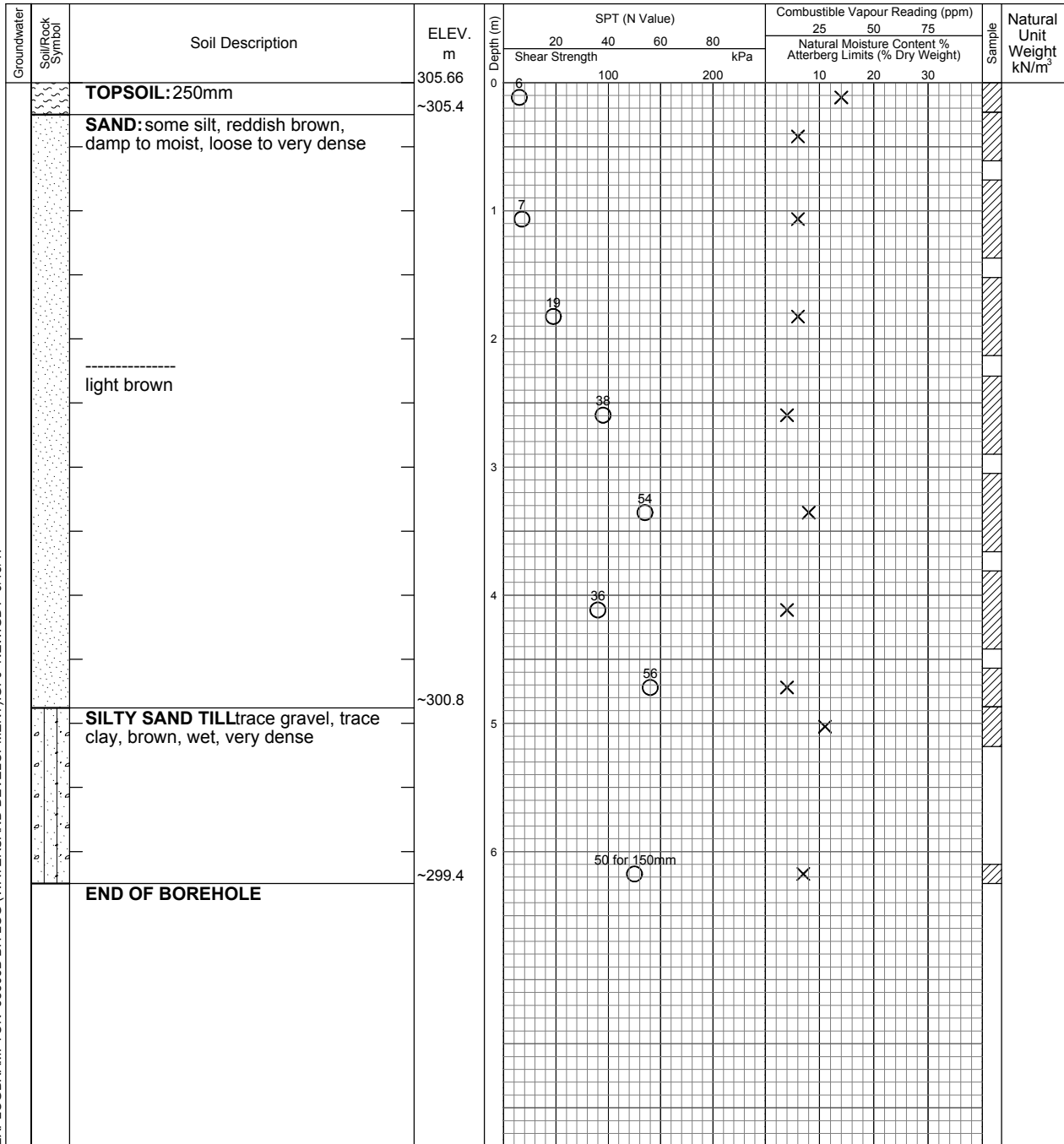
✕

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Datum: Geodetic



EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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

Log of Borehole E44

Project No. BRM-00038305-B0

Drawing No. 233

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

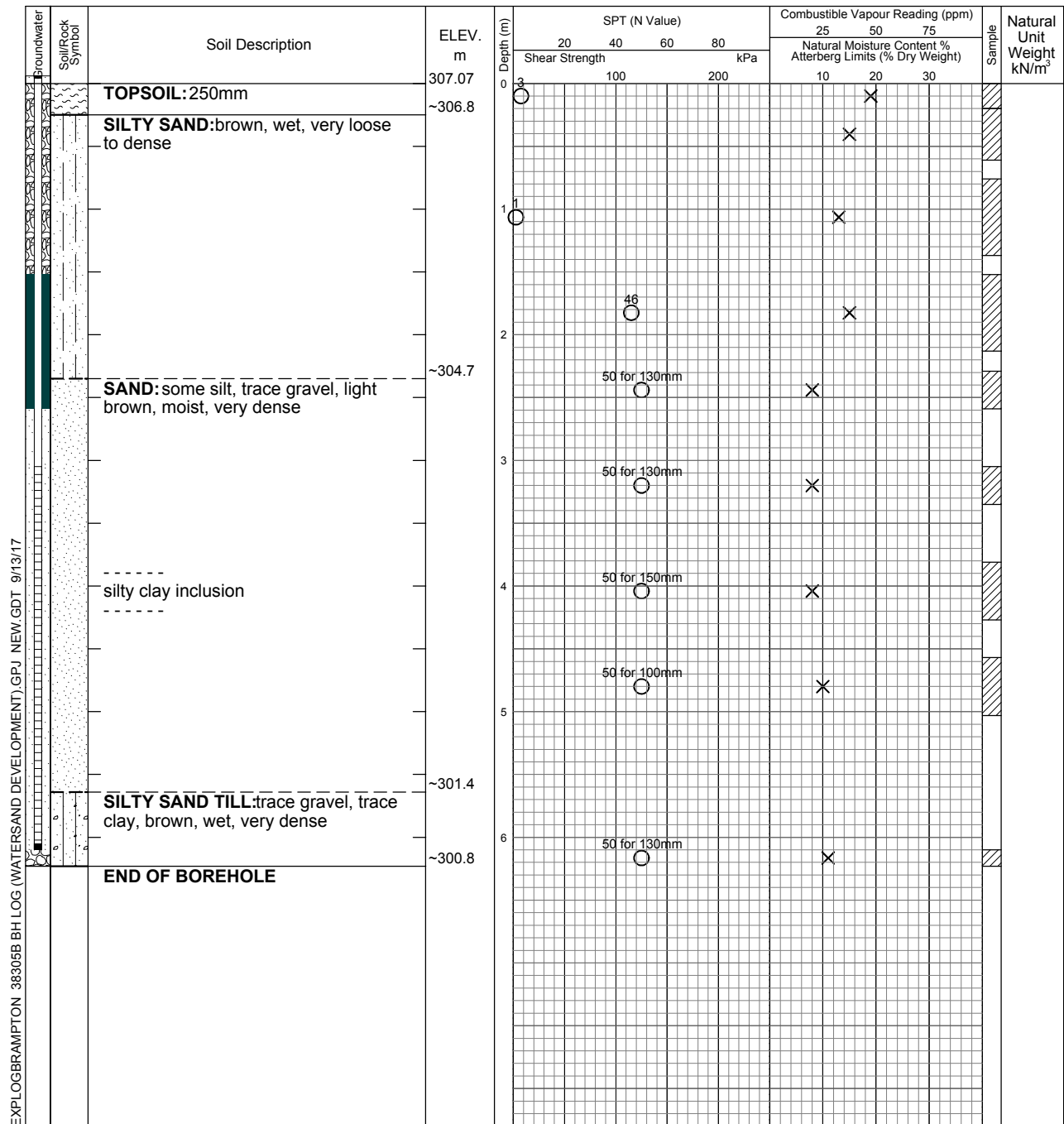
Natural Moisture

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	5.54	-
August 18, 2017	Dry	-



Log of Borehole E45

Project No. BRM-00038305-B0

Drawing No. 234

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

☐

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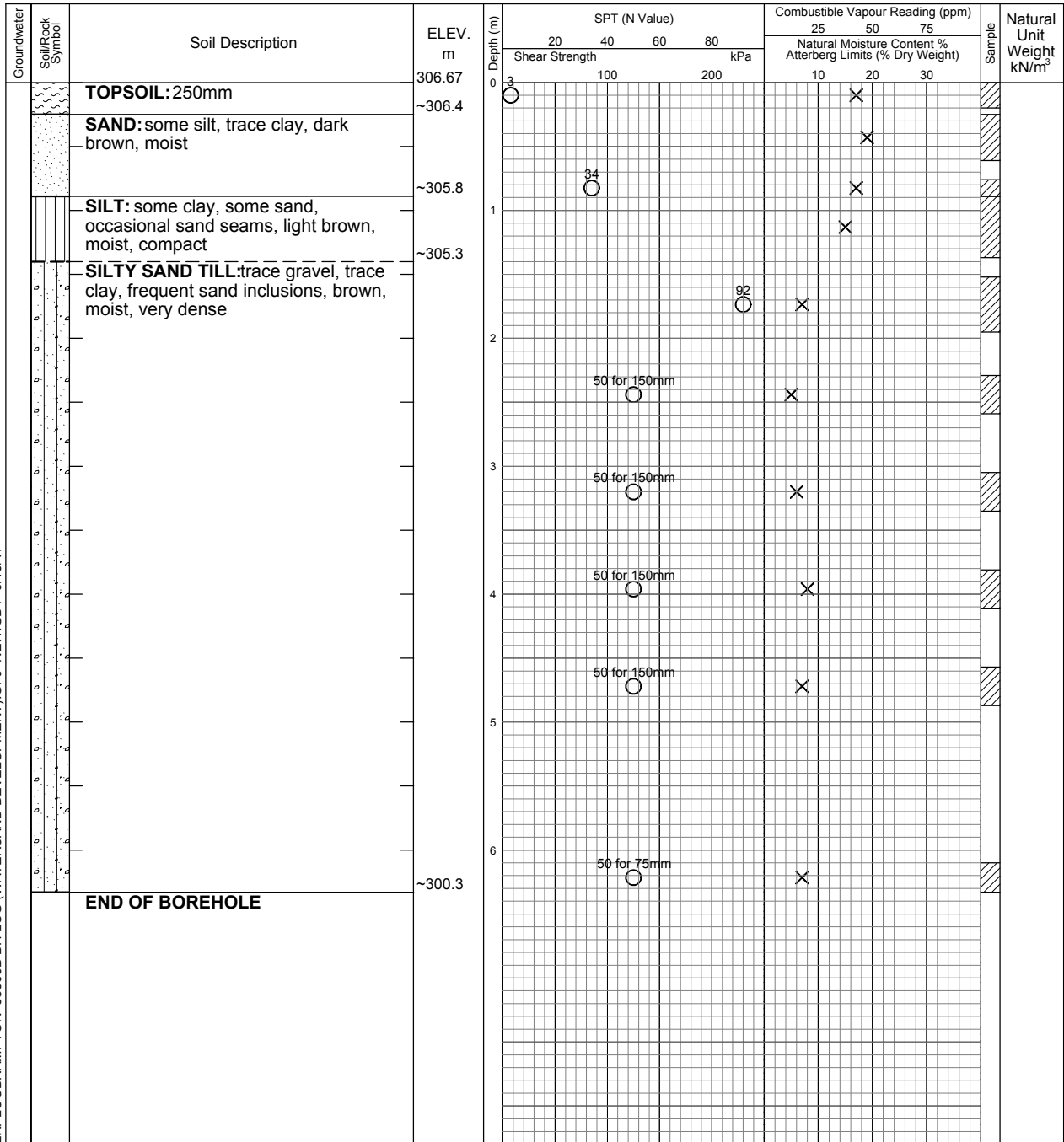
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33



Log of Borehole E53

Project No. BRM-00038305-B0

Drawing No. 235

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

☐

✕

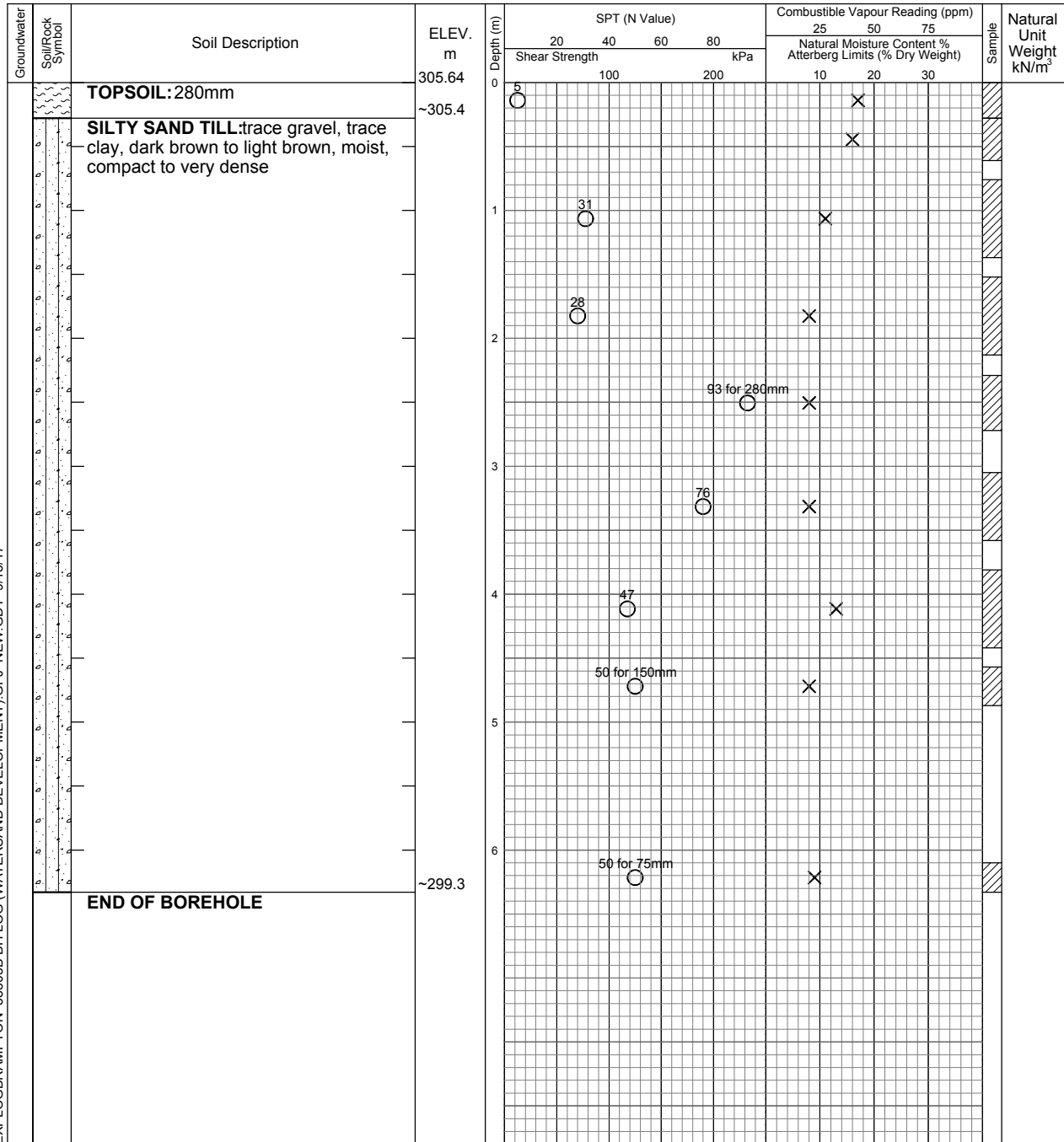
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW GDT 9/13/17



Elapsed Time	Water Level (m)	Hole Open to (m)
Upon Completion	Dry	6.33



Log of Borehole E54

Project No. BRM-00038305-B0

Drawing No. 236

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

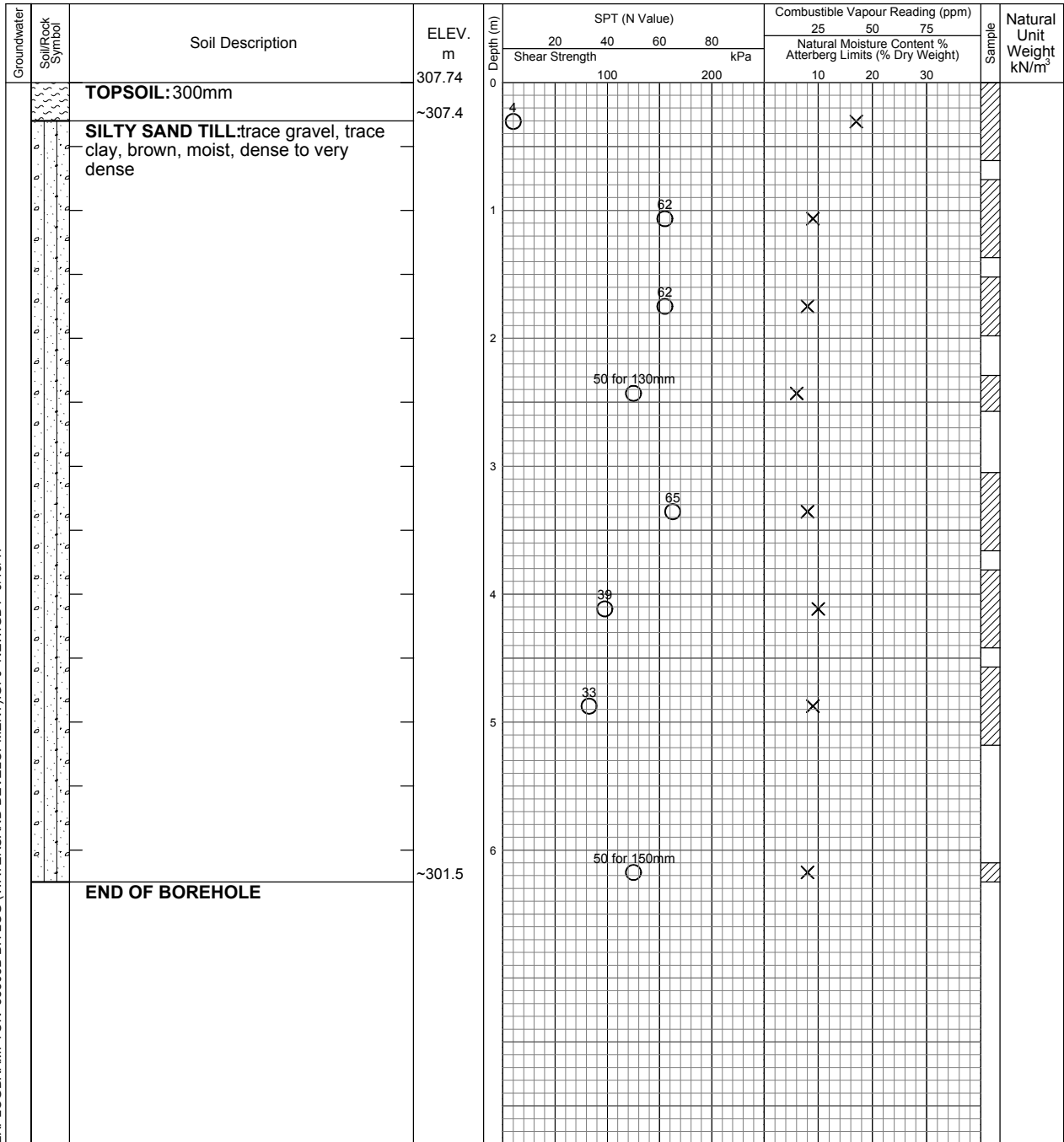


Penetrometer



Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT).GPJ NEW.GDT 9/13/17



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



Log of Borehole E55

Project No. BRM-00038305-B0

Drawing No. 237

Project: Geotechnical and Hydrogeological Investigation

Sheet No. 1 of 1

Location: McKay Road West & Veterans Drive, Barrie

Proposed Watersand Development

Date Drilled: June 6, 2017

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

☐

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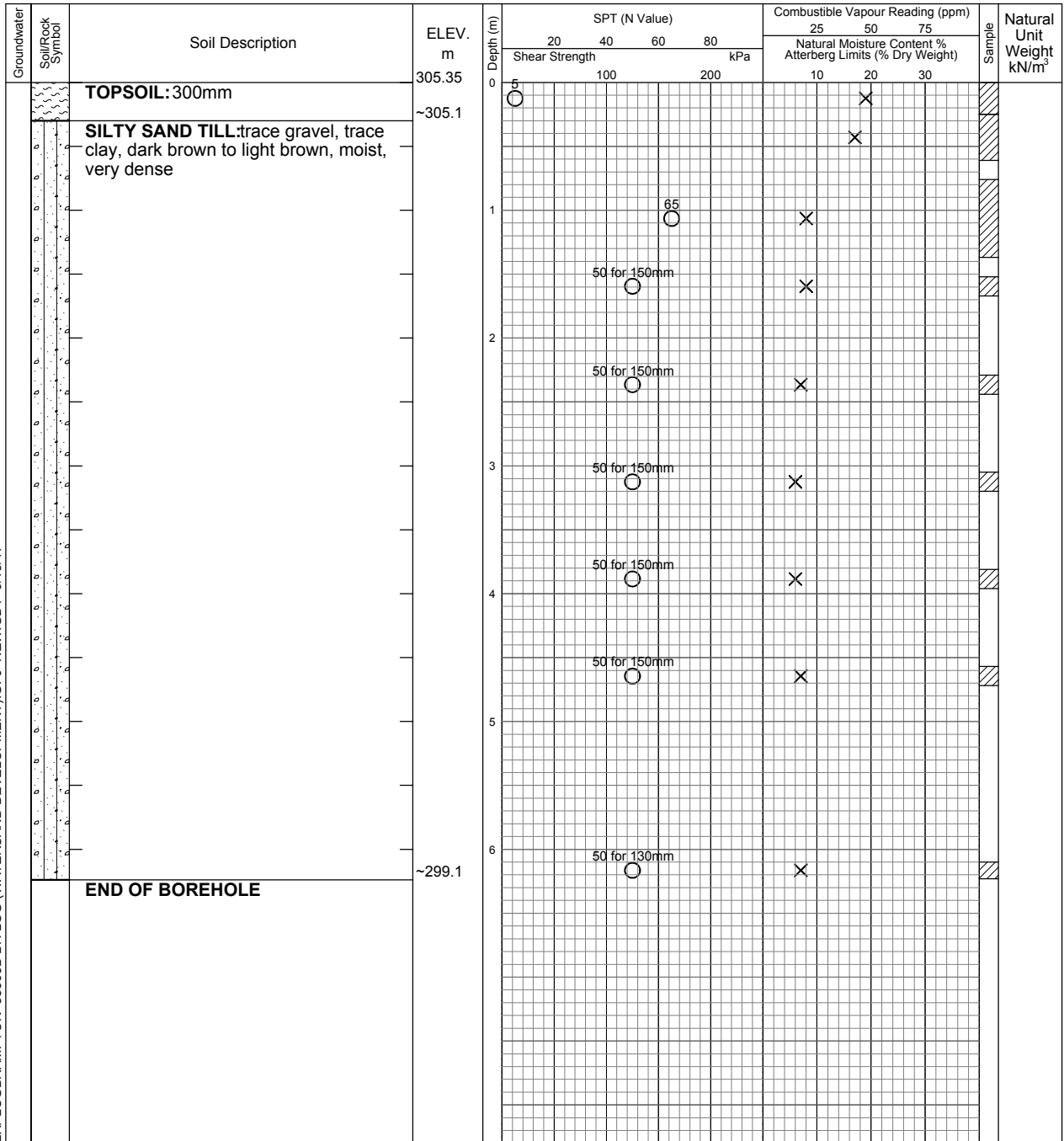
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Datum: Geodetic

EXPLOGBRAMPTON 38305B BH LOG (WATERSAND DEVELOPMENT), GPU NEW GDT 9/13/17



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



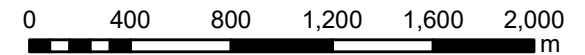
Appendix B: Nottawasaga Valley Conservation Authority Land Use Map



Data Source: Nottawasaga Valley Conservation Authority (NVCA), 2017.

Legend

- Approximate Site Boundary
- NVCA Jurisdiction
- Wooded Area
- NVCA Regulated Area
- Hedgerow



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PROJECT TITLE:

HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

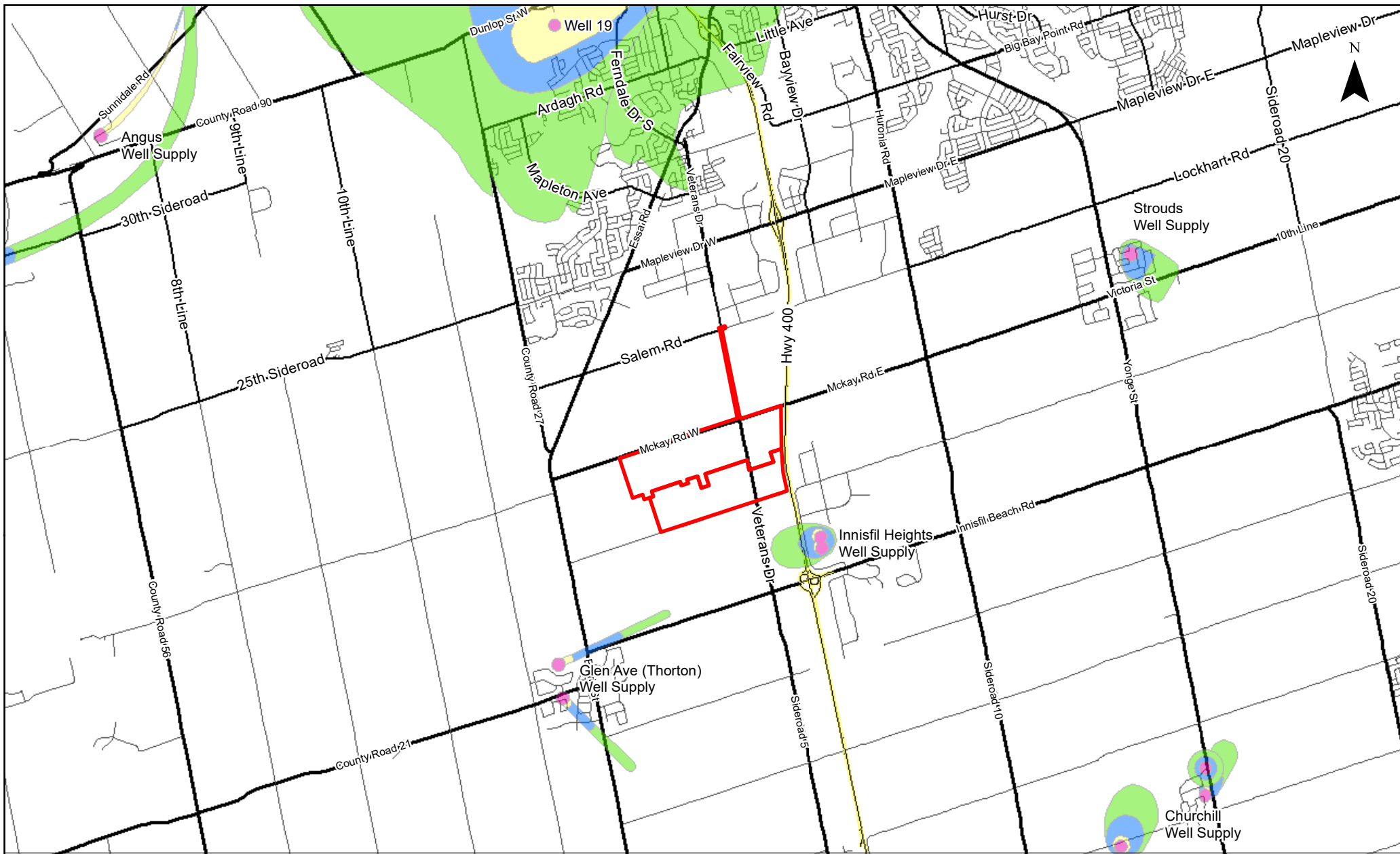
NVCA LANDUSE
DESIGNATIONS

PROJECT No.:	BRM-00038305-C0	DWN:	AC
SCALE:	AS NOTED	CHKD:	RS
DATE:	SEPTEMBER 2017	DWG. No.:	Appendix C

Appendix C: MECP Water Well Records Summary Table

On-Site										
WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
5701174	602765	4906272	10379067	11/2/1966			1076	3.7	Livestock	Water Supply
5701175	603520	4906583	10379068	8/25/1967			568	2.4	Domestic	Water Supply
5701176	603670	4906629	10379069	7/24/1955			547	40.2	Livestock	Water Supply
5701177	604172	4906412	10379070	10/9/1967			461	14.0	Domestic	Water Supply
5723082	604101	4906139	10400693	10/30/1987			276	24.7	Domestic	Water Supply
5725453	602933	4905755	10403048	8/31/1989			961	11.9	Domestic	Water Supply
Off-Site										
WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
5701124	603109	4904992	10379017	12/11/1965			1325	33.2	Livestock	Water Supply
5701125	603884	4905308	10379018	8/25/1966			799	21.3	Domestic	Water Supply
5701169	602381	4905939	10379062	10/22/1959			1456	43.3	Domestic	Water Supply
5701170	602175	4906158	10379063	7/5/1965			1653	9.8	Domestic	Water Supply
5701173	603002	4905247	10379066	12/10/1963			1191	39.6	Livestock	Water Supply
5701247	602034	4906212	10379140	8/16/1961			1797	53.3	Livestock	Water Supply
5701251	604194	4906983	10379144	4/4/1960			951	39.3	Domestic	Water Supply
5701252	604116	4907299	10379145	6/3/1961			1228	57.3	Domestic	Water Supply
5701253	604379	4906995	10379146	7/11/1954			1047			Abandoned-Supply
5701254	604429	4906980	10379147	9/17/1962			1062	42.1	Domestic	Water Supply
5701255	604170	4907504	10379148	8/11/1967			1440	34.7	Domestic	Water Supply
5701256	605254	4907281	10379149	7/22/1966			1849	21.3	Domestic	Water Supply
5701388	603767	4908539	10379281	9/14/1957			2435	36.6	Livestock	Water Supply
5701391	603837	4908665	10379284	2/14/1967			2560	43.6	Livestock	Water Supply
5705725	604064	4905373	10383604	8/22/1968			769	20.4	Domestic	Water Supply
5705928	604214	4906923	10383805	3/19/1970			905	44.2	Domestic	Water Supply
5706227	602464	4906363	10384099	3/28/1969			1388	2.7	Domestic	Water Supply
5707034	603864	4906823	10384880	11/21/1969			719	12.5	Domestic	Water Supply
5708465	604104	4907523	10386294	26231			1445	44.2	Domestic	Water Supply
5708872	603534	4906723	10386699	6/29/1972			684	18.9	Domestic	Water Supply
5713133	603674	4908073	10390884	10/17/1975			1974	39.9	Domestic	Water Supply
5714284	603164	4905023	10392017	5/26/1977			1269	32.0	Domestic	Water Supply
5714349	603714	4906773	10392081	5/14/1977			678		Domestic	Water Supply
5714396	603614	4906773	10392128	6/27/1977			701	44.8	Domestic	Water Supply
5715062	603764	4905273	10392782	4/20/1977			834	37.8	Domestic	Water Supply
5715354	604014	4907473	10393069	7/20/1978			1381	35.4	Domestic	Water Supply
5715832	601914	4906173	10393538	9/7/1978			1915	3.7	Domestic	Water Supply
5729266	602287	4906292	10406840	1/31/1992			1552	48.8	Domestic	Water Supply
5734726	603826	4907492	10412256	11/16/1999			1387	48.5	Domestic	Water Supply
5739384	603581	4906699	11178628	11/26/2004		INNISFIL	643		Not Used	Abandoned-Other
5741361	603739	4908198	11695000	10/13/2006	3719 SALEM RD	BARRIE	2095		Not Used	Observation Wells
7188373	603735	4908102	1004169420	9/4/2012			1999			Abandoned-Other
7194724	605460	4906037	1004230880	10/12/2012			1633			
7215645	604476	4908490	1004701890	3/11/2012	60 SALEM RD.	BARRIE	2471	45.7	Domestic	Water Supply
7241017	605047	4907137	1005342070	3/27/2015	MCKAY RD	Barrie	1597		Monitoring	Observation Wells
7284059	604145	4906882		1/12/2016		INNISFIL TOWNSHIP	839			
7270840	605013	4907091		8/16/2016	HWY 400 & MCKAY ROAD SE CORNER	BARRIE	1542		Not Used	Abandoned-Other

Appendix D: Wellhead Protection Areas



Data Source: Part 1 (Lake Simcoe) Chapter 8 & 10, Nottawasaga Valley Chapter 12 - Wellhead Protection Area (WHPA) Delineation. South Georgian Bay Lake Simcoe Source Protection Region Assessment Report. South Georgian Bay-Lake Simcoe Protection Committee, 2015.

Legend

- Approximate Site Boundary
- WHPA-A (100 m Zone)
- WHPA-C (2 - 5 Year Zone)
- WHPA-B (0 - 2 Year Zone)
- WHPA-D (20 - 25 Year Zone)



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PROJECT TITLE:

HYDROGEOLOGICAL INVESTIGATION
WATERSAND DEVELOPMENT
BARRIE / INNISFIL HEIGHTS, ONTARIO

DRAWING TITLE:

WELL HEAD
PROTECTION AREAS

PROJECT No.:
BRM-00038305-C0

SCALE:
AS NOTED

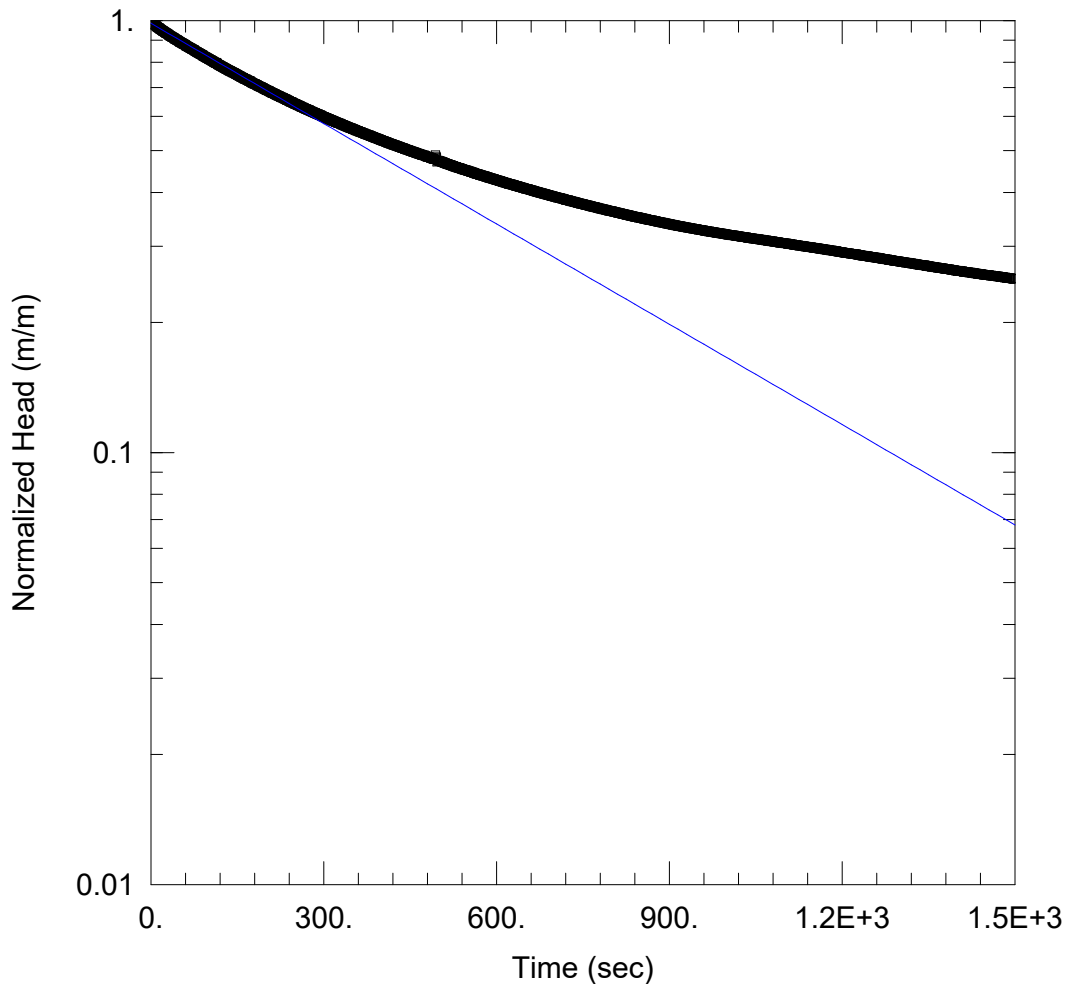
DATE:
SEPTEMBER 2017

DWN:
AS

CHKD:
RS

DWG. No.:
Appendix D

Appendix E: SWRT Procedures and Results



FALLING HEAD - SWRT - BH-17

Data Set: I:\...\17.aqt

Date: 10/12/17

Time: 10:02:57

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-17

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 5.76 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-17)

Initial Displacement: 1.61 m

Static Water Column Height: 5.76 m

Total Well Penetration Depth: 5.76 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

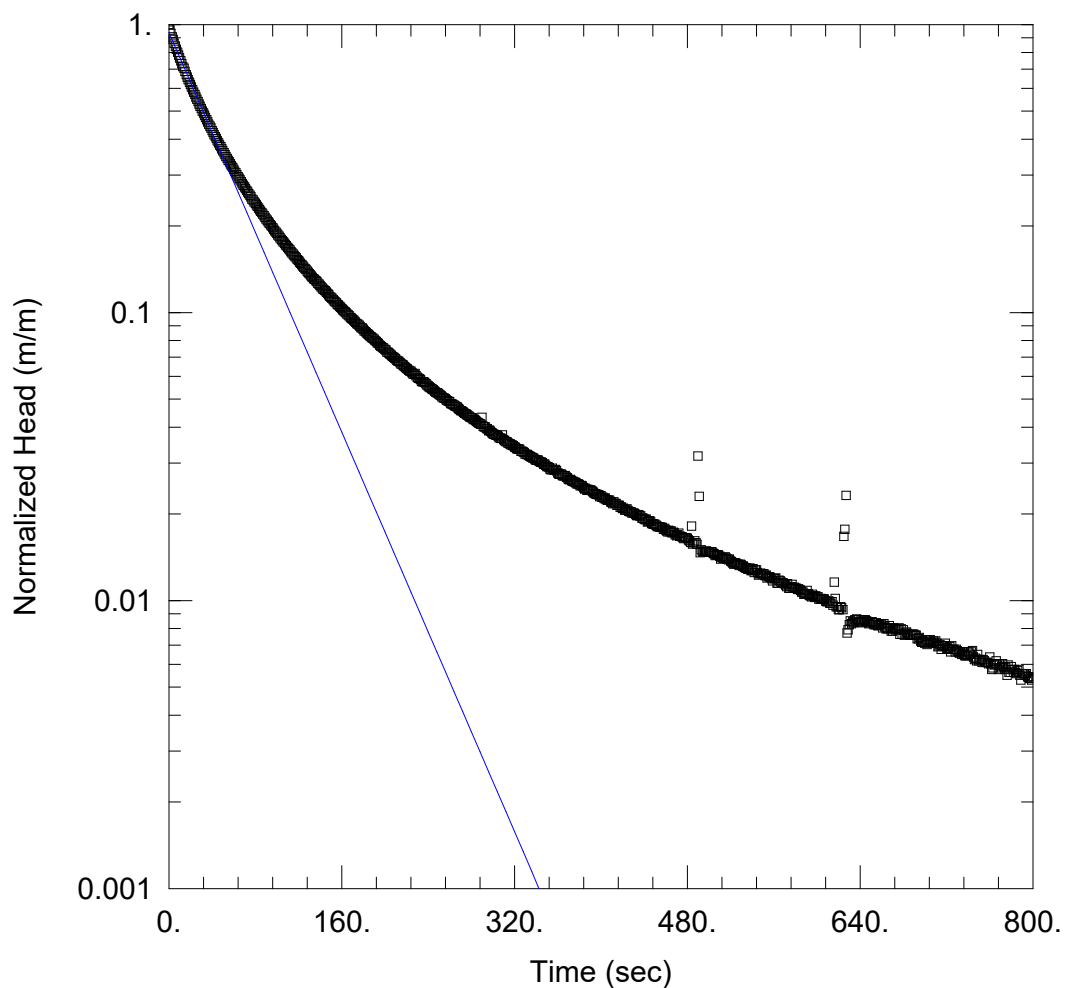
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 7.816E-7$ m/sec

$y_0 = 1.586$ m



FALLING HEAD - SWRT - BH-54

Data Set: I:\...\54.aqt

Date: 10/12/17

Time: 10:07:19

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-54

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 4.19 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-54)

Initial Displacement: 1.497 m

Static Water Column Height: 4.09 m

Total Well Penetration Depth: 4.09 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

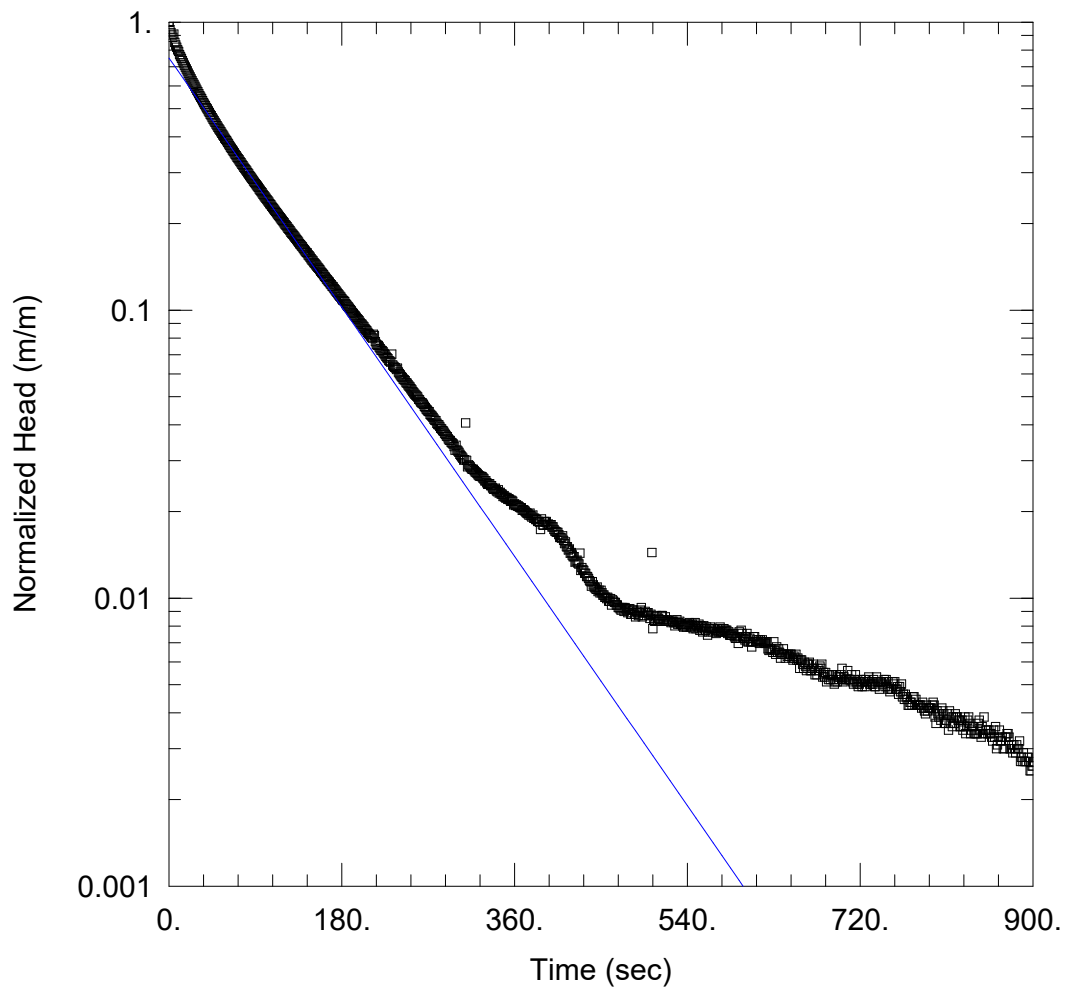
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 7.271\text{E-}6$ m/sec

$y_0 = 1.405$ m



SWRT-FALLING HEAD- BH-62

Data Set: I:\...\BH62.aqt
 Date: 10/12/17

Time: 16:10:08

PROJECT INFORMATION

Company: Exp services
 Project: BRM-00038305
 Location: Watersand
 Test Well: BH-62
 Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 3.2 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-62)

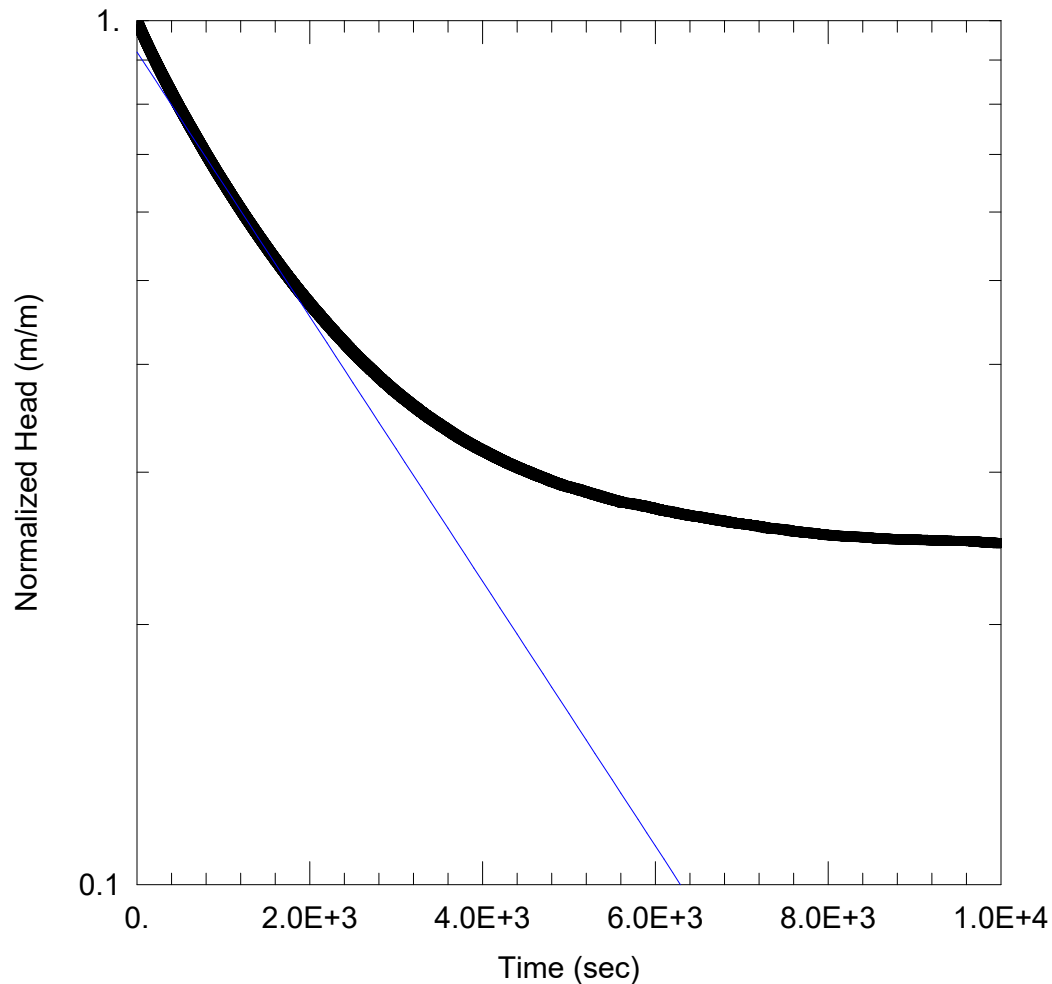
Initial Displacement: 1.034 m
 Total Well Penetration Depth: 3. m
 Casing Radius: 0.0254 m

Static Water Column Height: 2.979 m
 Screen Length: 3. m
 Well Radius: 0.1 m

SOLUTION

Aquifer Model: Unconfined
 $K = 4.05E-6$ m/sec

Solution Method: Hvorslev
 $y_0 = 0.7766$ m



FALLING HEAD - SWRT - BH-64 (A) D

Data Set: I:\...\64 (a) D.aqt

Date: 10/12/17

Time: 10:27:53

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-64 (a) D

Test Date: August 17, 2017

AQUIFER DATA

Saturated Thickness: 12.64 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-64 (a) D)

Initial Displacement: 2.627 m

Static Water Column Height: 12.04 m

Total Well Penetration Depth: 12.04 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

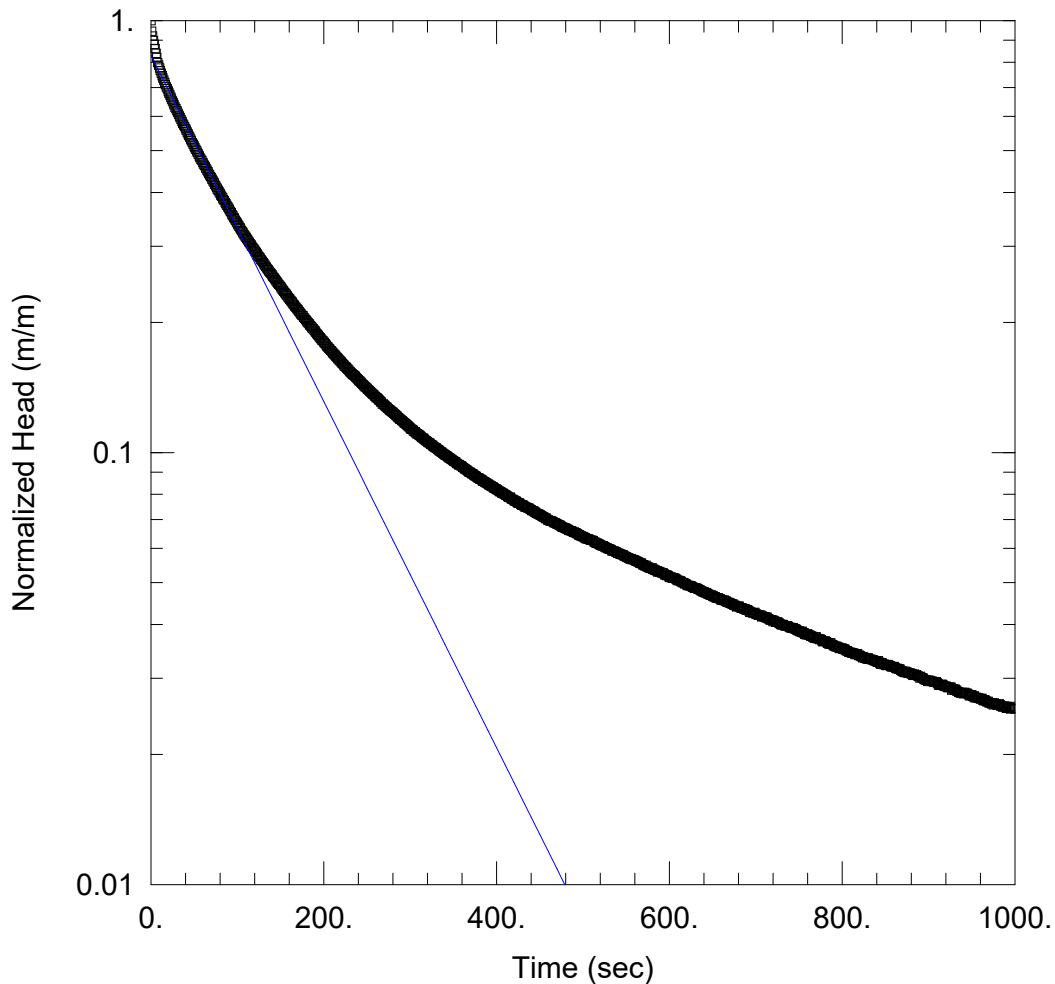
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 1.284E-7$ m/sec

$y_0 = 2.416$ m



FALLING HEAD - SWRT - BH-64 (B) S

Data Set: I:\...\64 (b) S.aqt

Date: 10/12/17

Time: 10:42:08

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-64 (b) S

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 3.76 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-64 (b) S)

Initial Displacement: 1.595 m

Static Water Column Height: 3.76 m

Total Well Penetration Depth: 3.76 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

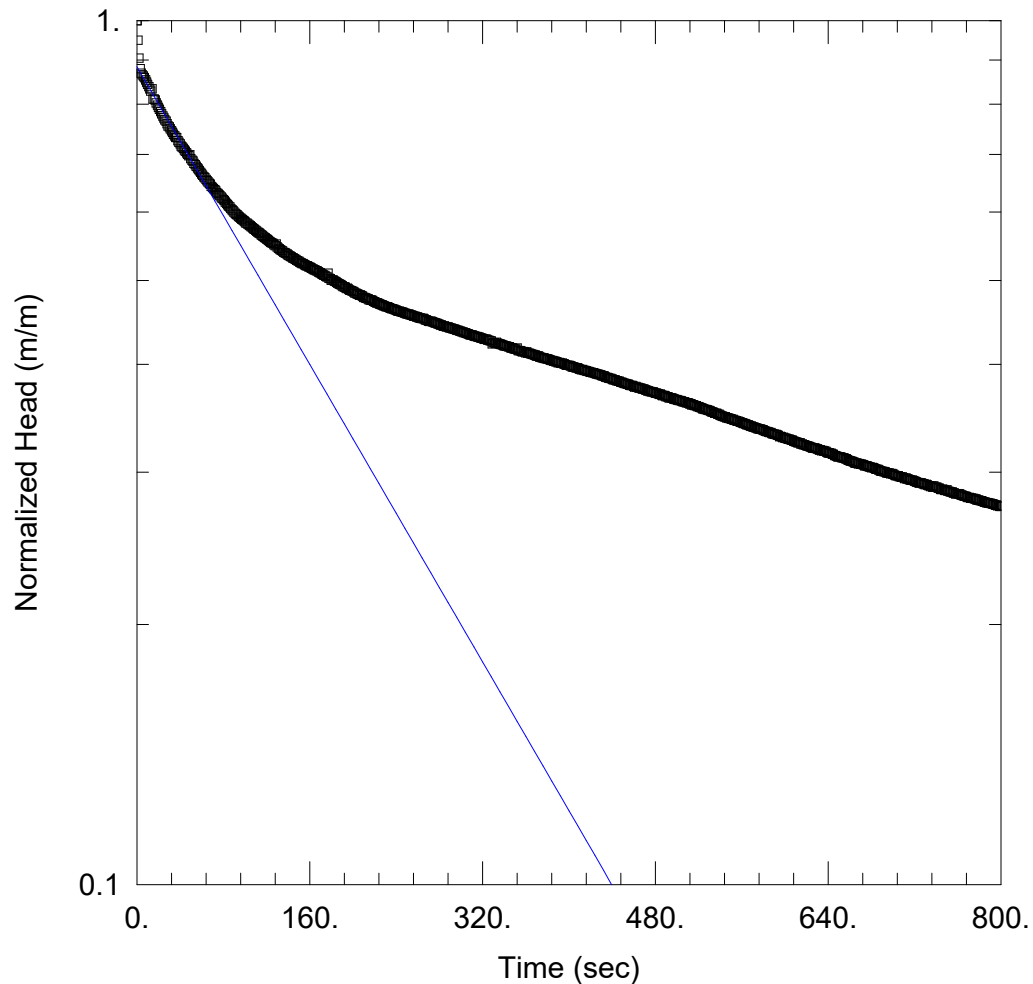
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 4.048E-6$ m/sec

$y_0 = 1.326$ m



FALLING HEAD - SWRT - BH-68

Data Set: I:\...\68.aqt

Date: 10/12/17

Time: 10:59:55

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-68

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 2.03 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-68)

Initial Displacement: 0.7231 m

Static Water Column Height: 2.03 m

Total Well Penetration Depth: 3. m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

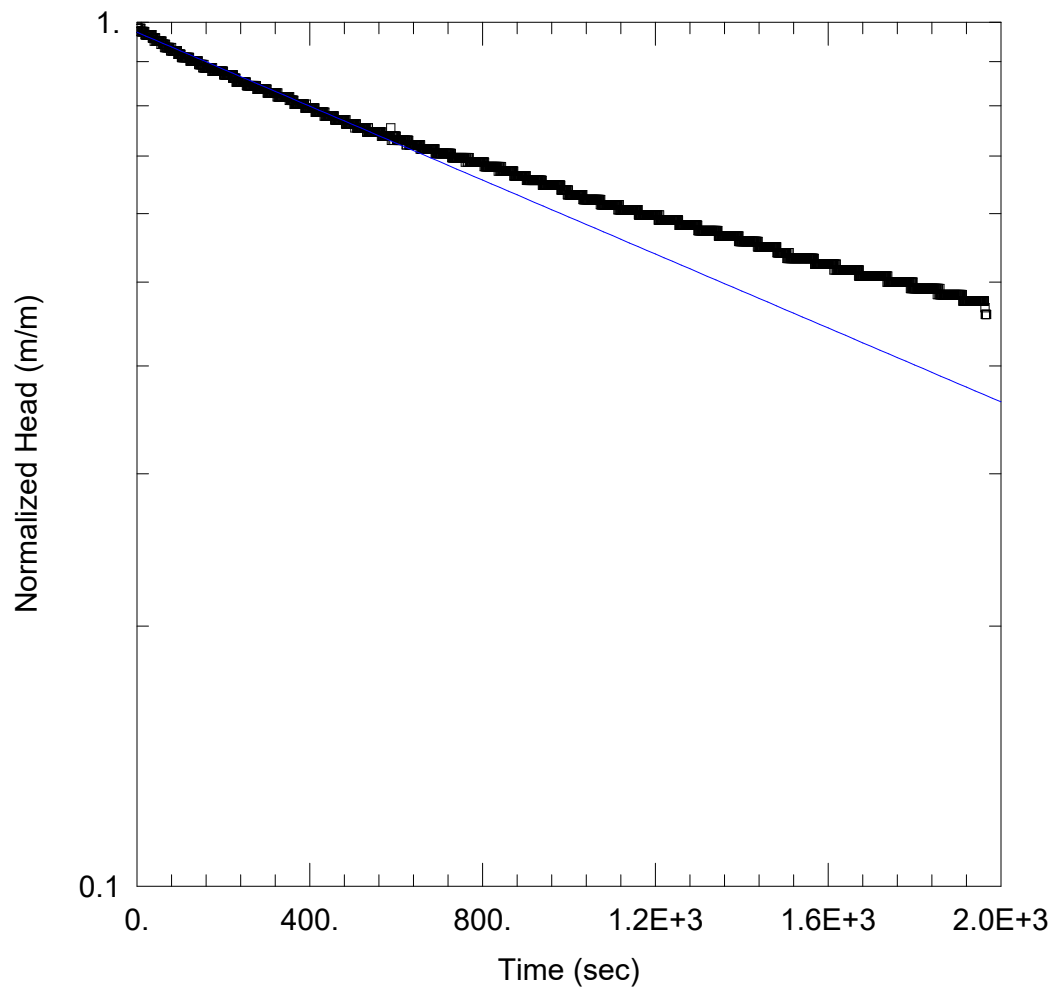
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 4.172E-6$ m/sec

$y_0 = 0.6391$ m



SWRT-FALLING HEAD- BH-119

Data Set: I:\...\BH 119.aqt
 Date: 10/12/17

Time: 17:41:32

PROJECT INFORMATION

Company: Exp services
 Project: BRM-00038305
 Location: Watersand
 Test Well: BH-119
 Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 2. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-119)

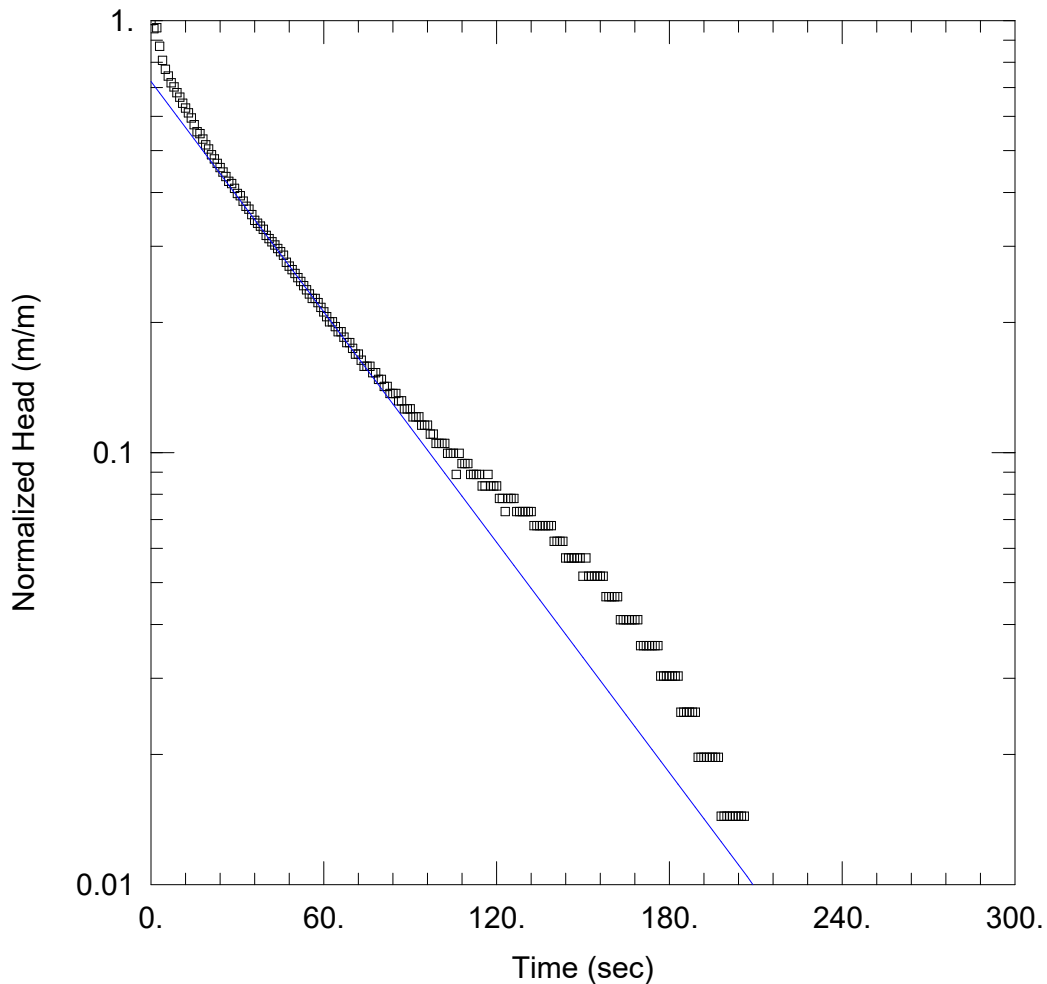
Initial Displacement: 0.366 m
 Total Well Penetration Depth: 3. m
 Casing Radius: 0.0254 m

Static Water Column Height: 1.97 m
 Screen Length: 3. m
 Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
 $K = 4.21E-7$ m/sec

Solution Method: Hvorslev
 $y_0 = 0.3563$ m



FALLING HEAD - SWRT - BH-151

Data Set: I:\...\BH 151.aqt

Date: 10/12/17

Time: 17:54:04

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-151

Test Date: August 17, 2017

AQUIFER DATA

Saturated Thickness: 1.55 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-151)

Initial Displacement: 0.563 m

Static Water Column Height: 1.51 m

Total Well Penetration Depth: 3. m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

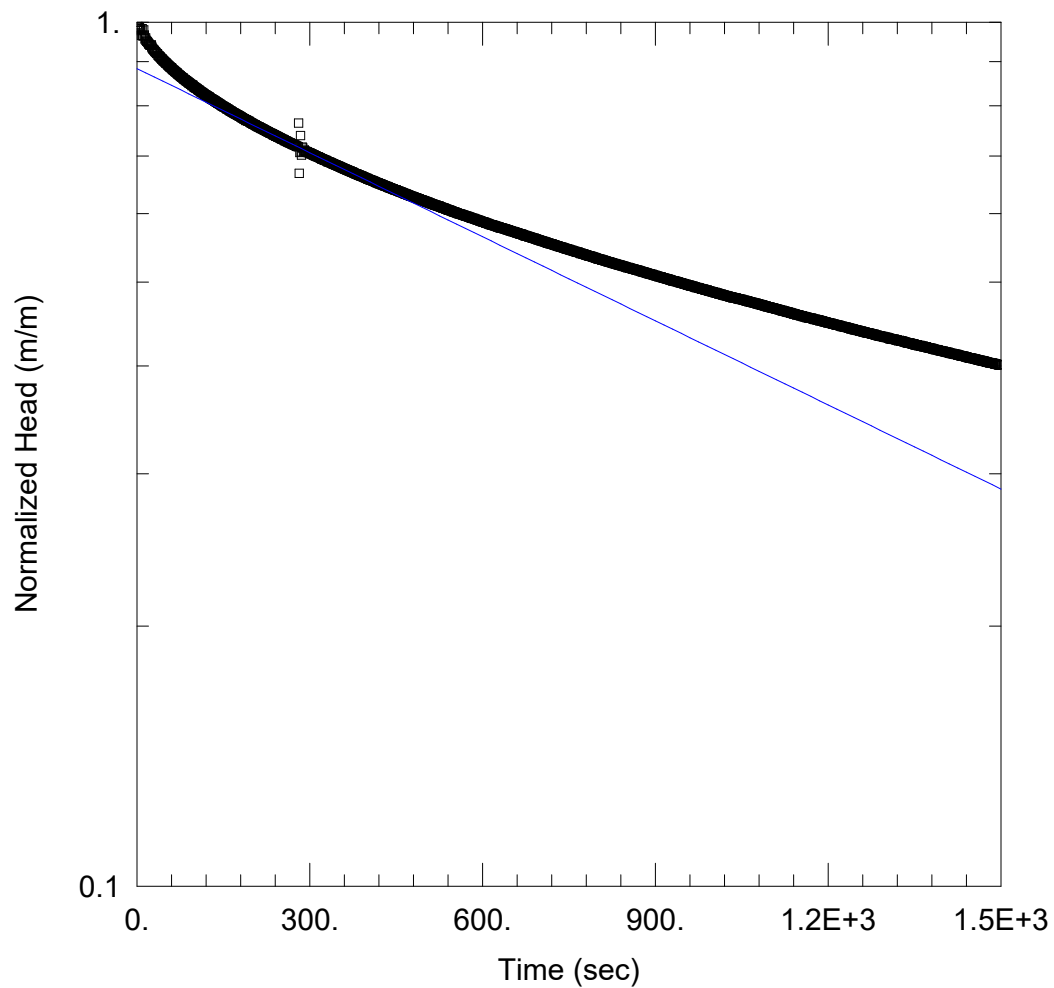
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 2.257E-5$ m/sec

$y_0 = 0.407$ m



SWRT-FALLING HEAD- BH-A2 (B) S

Data Set: I:\...\BH A2 (b) S.aqt
 Date: 10/12/17

Time: 18:16:42

PROJECT INFORMATION

Company: Exp services
 Project: BRM-00038305
 Location: Watersand
 Test Well: BH-A2 (b) S
 Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 4. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-A2 S)

Initial Displacement: 1.098 m
 Total Well Penetration Depth: 3.62 m
 Casing Radius: 0.0254 m

Static Water Column Height: 3.62 m
 Screen Length: 3. m
 Well Radius: 0.1016 m

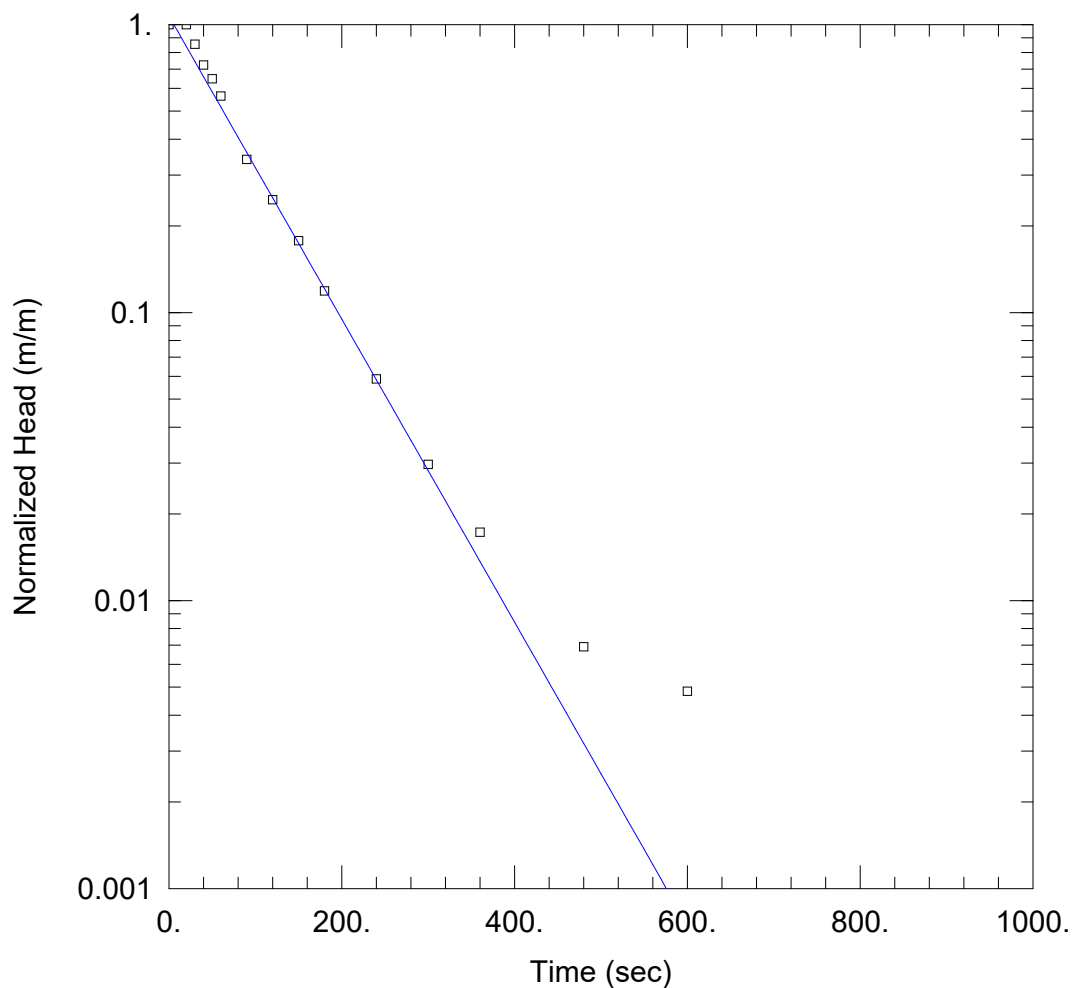
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 2.72E-7$ m/sec

$y_0 = 0.9699$ m



FALLING HEAD - SWRT - BH-A2 (A) D

Data Set: I:\...\A2(a)D_rev.aqt

Date: 10/12/17

Time: 15:24:15

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-A2 (a) D

Test Date: August 17, 2017

AQUIFER DATA

Saturated Thickness: 2.3 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-A2 (a) D)

Initial Displacement: 1.447 m

Static Water Column Height: 2.26 m

Total Well Penetration Depth: 3. m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

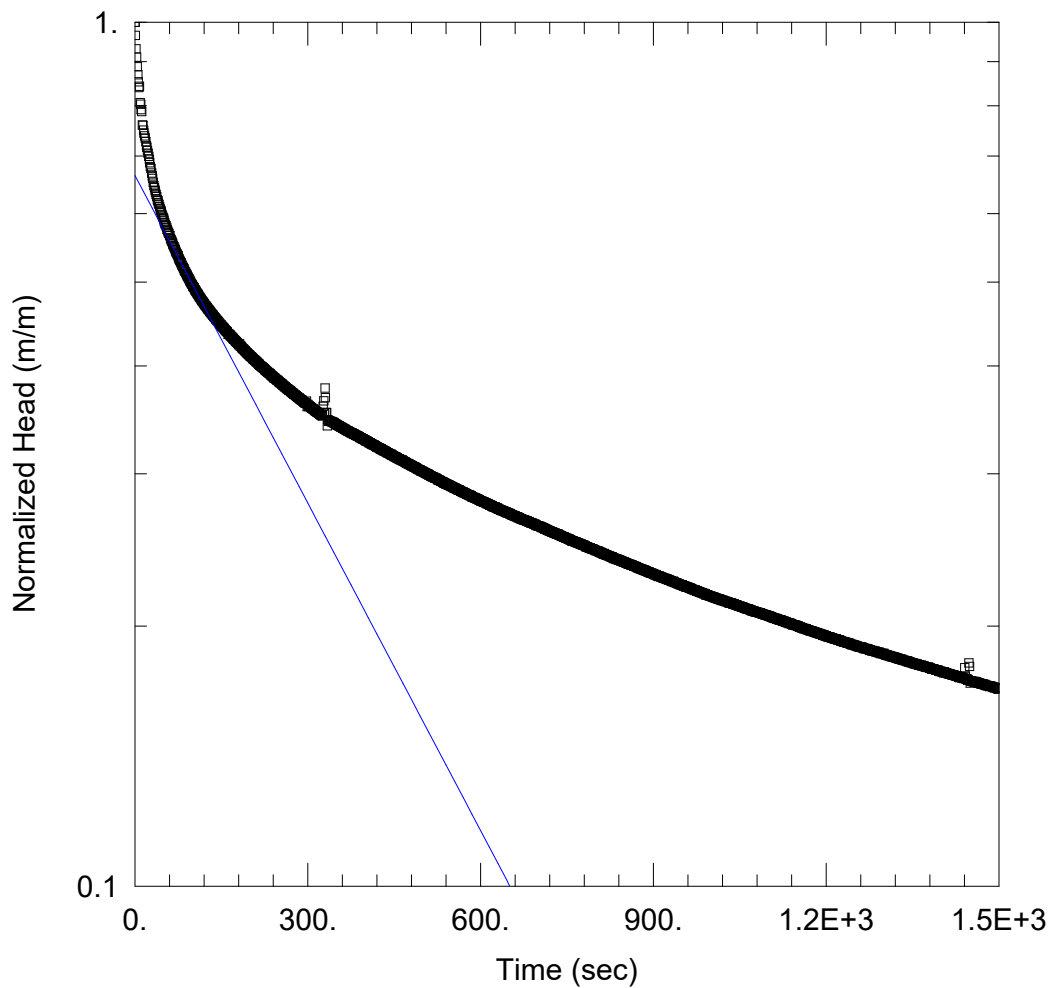
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 9.002E-6$ m/sec

$y_0 = 1.548$ m



SWRT-FALLING HEAD-BH-A3 (B) S

Data Set: I:\...\BH A3 (b) S.aqt
 Date: 10/13/17

Time: 11:22:02

PROJECT INFORMATION

Company: Exp services
 Project: BRM-00038305
 Location: Watersand
 Test Well: BH-A3 (b) S
 Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 3. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-A3 (b) S)

Initial Displacement: 1.459 m
 Total Well Penetration Depth: 3. m
 Casing Radius: 0.0254 m

Static Water Column Height: 2.95 m
 Screen Length: 3. m
 Well Radius: 0.1016 m

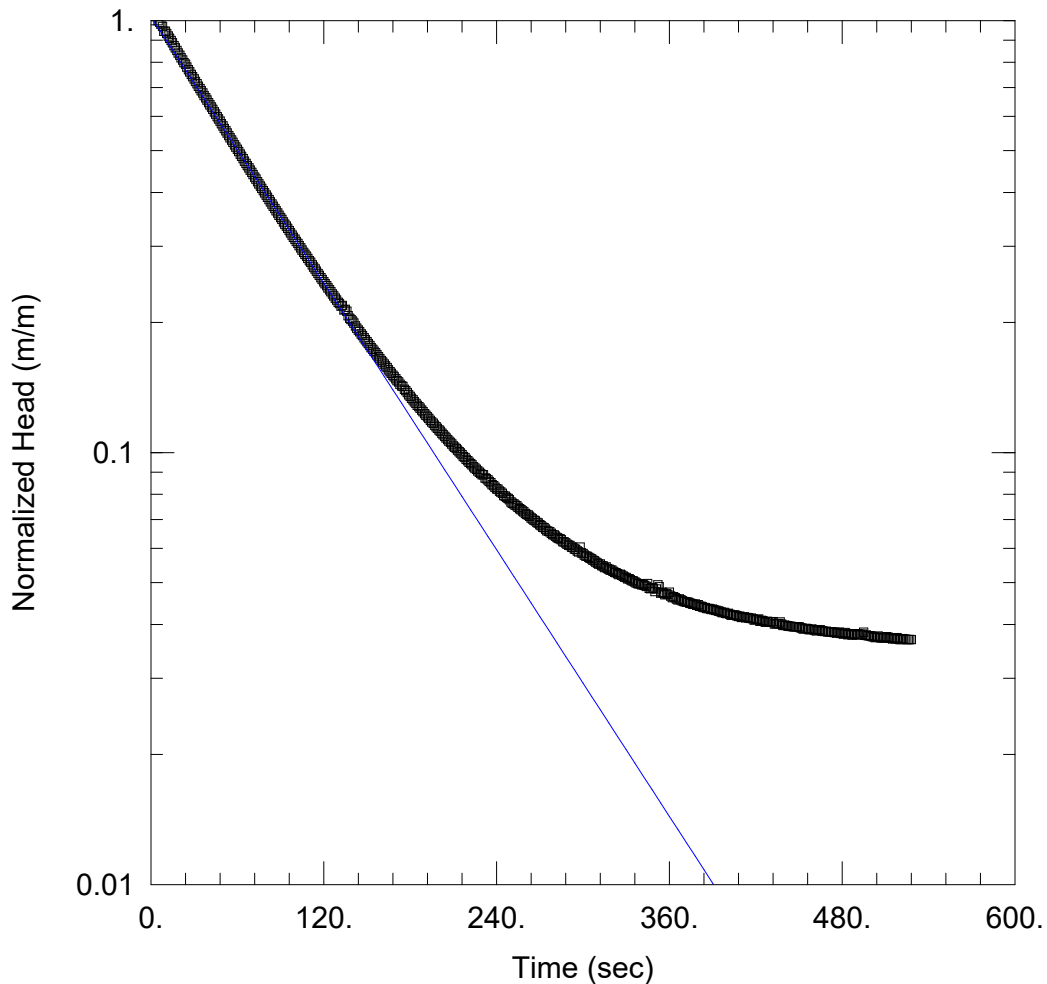
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 1.657E-6$ m/sec

$y_0 = 0.9691$ m



FALLING HEAD - SWRT - BH-A3 (A) D

Data Set: I:\...\A3(b)D_rev.aqt

Date: 10/12/17

Time: 15:56:09

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-A3 (a) D

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 4.2 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-A3 (a) D)

Initial Displacement: 1.618 m

Static Water Column Height: 4.19 m

Total Well Penetration Depth: 4.19 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

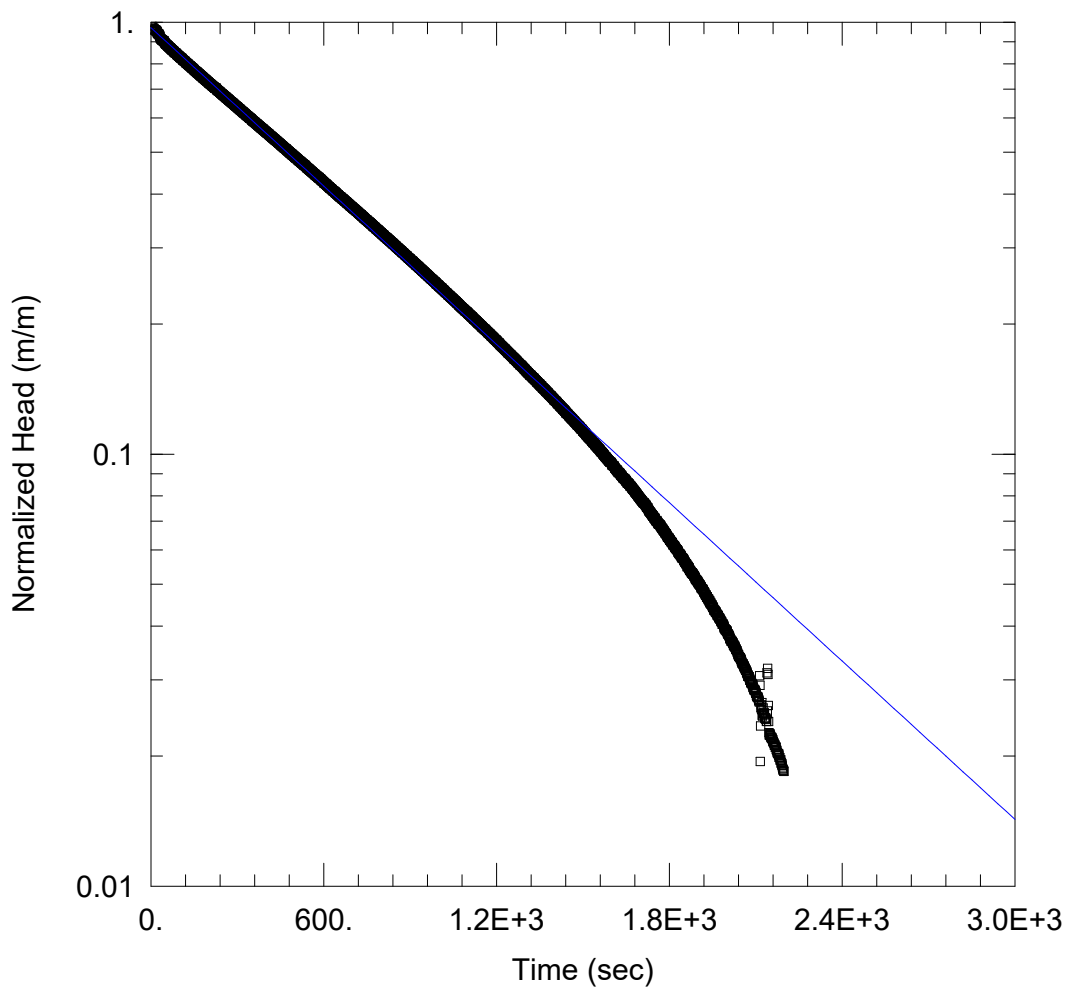
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 4.311\text{E-}6$ m/sec

$y_0 = 1.652$ m



SWRT-FALLING HEAD-BH-C2 (A) D

Data Set: I:\...\BHC2 (a) D.aqt
 Date: 10/12/17

Time: 16:20:39

PROJECT INFORMATION

Company: Exp services
 Project: BRM-00038305
 Location: Watersand
 Test Well: BH-C2 (a) D
 Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 14. m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-C2 (a) D)

Initial Displacement: 1.801 m
 Total Well Penetration Depth: 13.98 m
 Casing Radius: 0.0254 m

Static Water Column Height: 13.98 m
 Screen Length: 3. m
 Well Radius: 0.1016 m

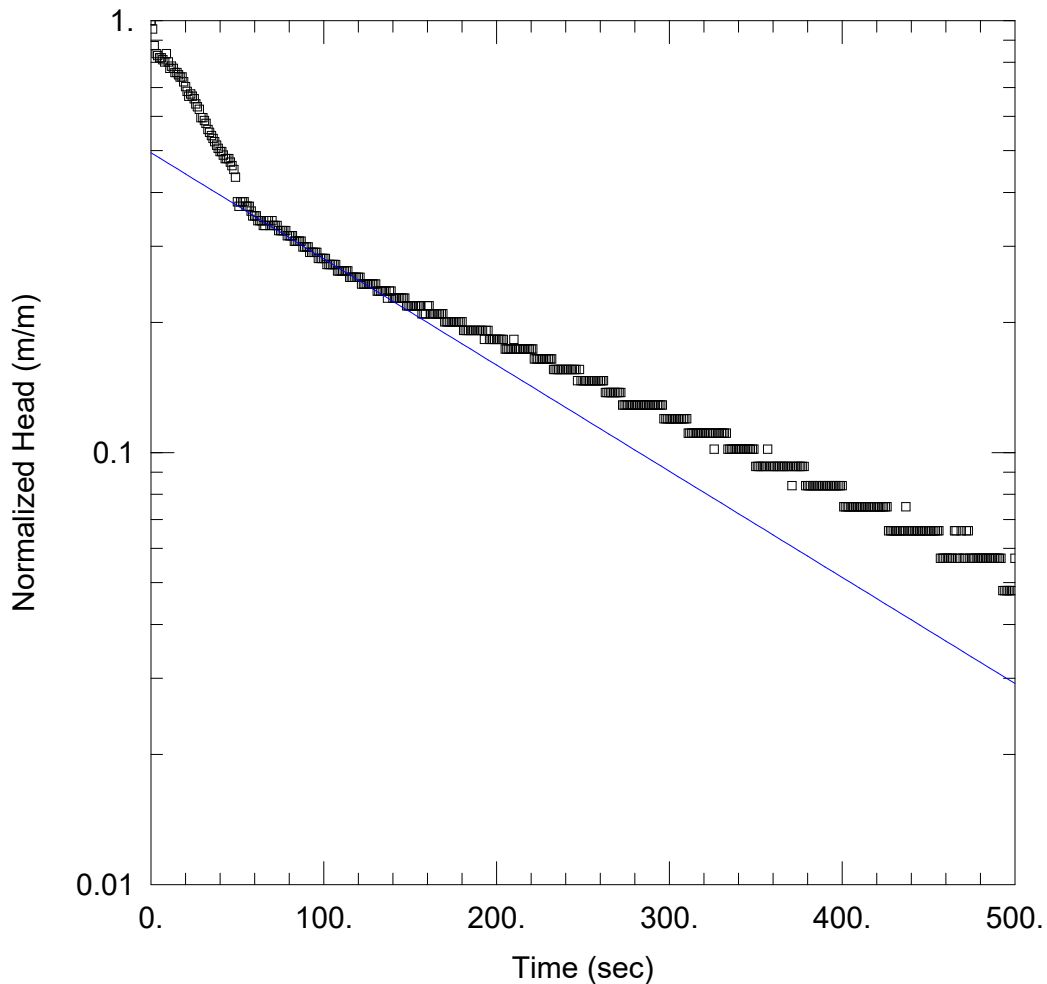
SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 5.122E-7$ m/sec

$y_0 = 1.748$ m



FALLING HEAD - SWRT - BH-C2 (B) S

Data Set: I:\...\C2 (b) S.aqt
Date: 10/13/17

Time: 11:40:24

PROJECT INFORMATION

Company: Exp services
Client: Watersand Development c/o DG
Project: BRM-00038305-C0
Location: McKay Rd W & Veterans Dr
Test Well: BH-C2 (b) S
Test Date: August 17, 2017

AQUIFER DATA

Saturated Thickness: 2.3 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-C2 (b) S)

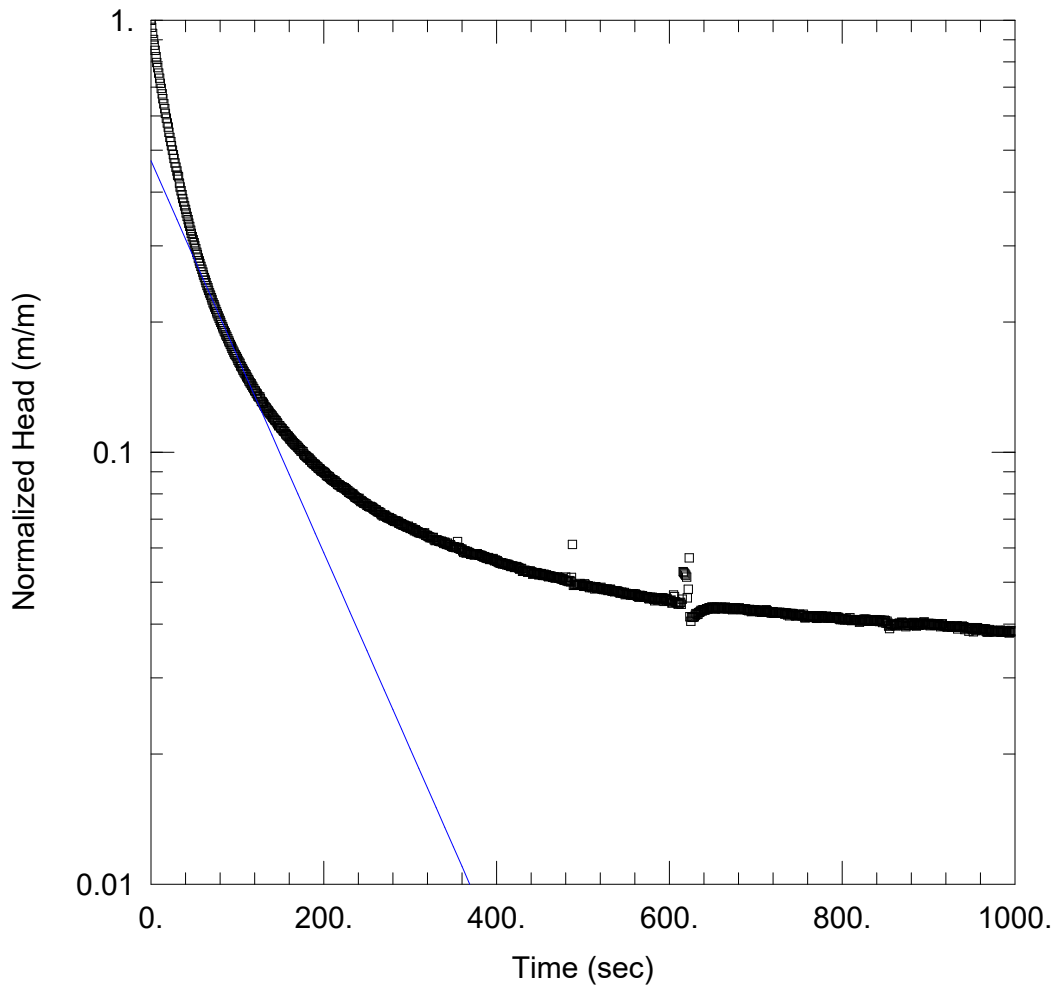
Initial Displacement: 0.334 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m

Static Water Column Height: 2.27 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
 $K = 4.205E-6$ m/sec

Solution Method: Hvorslev
 $y_0 = 0.1651$ m



SWRT- FALLING HEAD-BH-C3 (A) D

Data Set: I:\...\C3 (a) D.aqt
Date: 10/12/17

Time: 16:41:31

PROJECT INFORMATION

Company: Exp services
Project: BRM-00038305
Location: Watersand
Test Well: BH-C3 (a) D
Test Date: 09/08/17

AQUIFER DATA

Saturated Thickness: 13.5 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-C3 D)

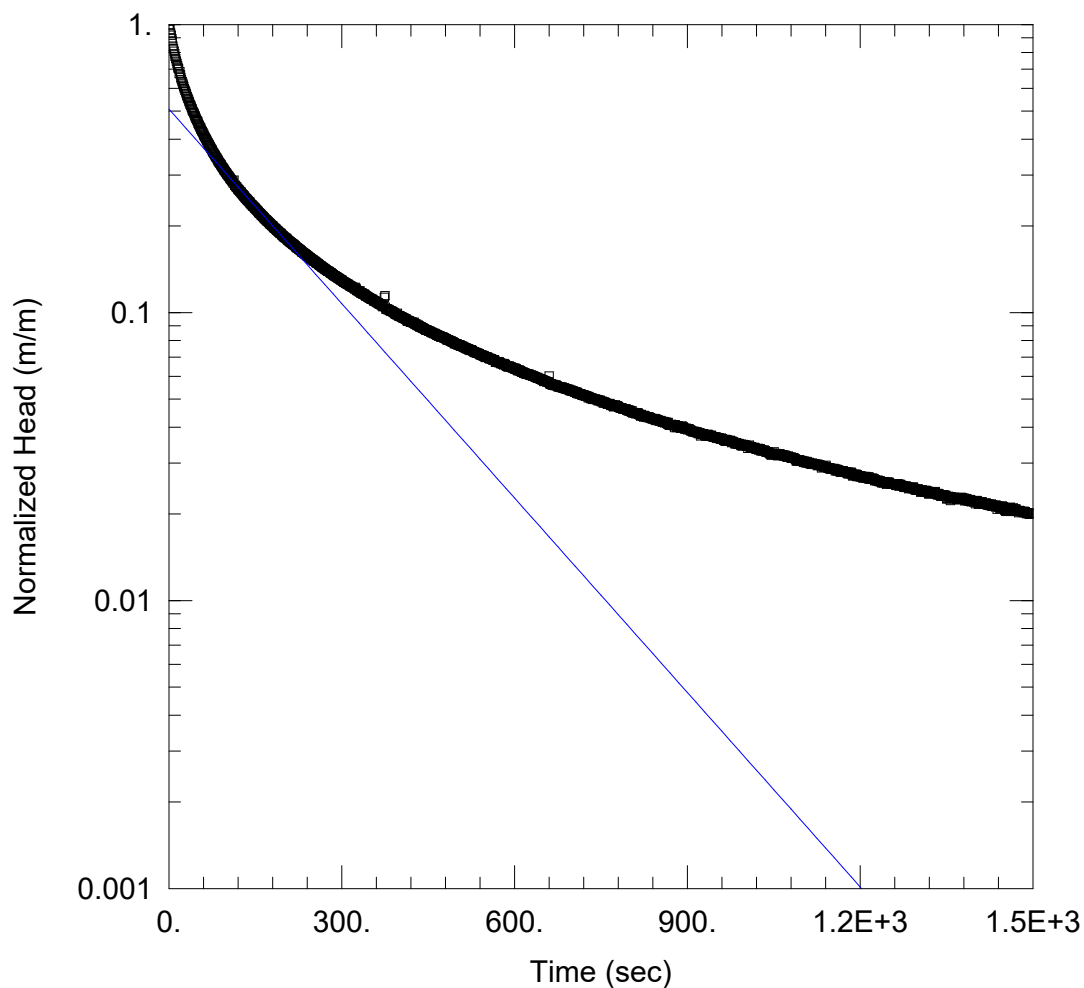
Initial Displacement: 1.216 m
Total Well Penetration Depth: 13.04 m
Casing Radius: 0.0254 m

Static Water Column Height: 13.04 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Confined
 $K = 3.805E-6$ m/sec

Solution Method: Hvorslev
 $y_0 = 0.575$ m



FALLING HEAD - SWRT -BH-C3 (B) S

Data Set: I:\...\C3 (b) S.aqt

Date: 10/12/17

Time: 17:11:47

PROJECT INFORMATION

Company: Exp services

Client: Watersand Development c/o DG

Project: BRM-00038305-C0

Location: McKay Rd W & Veterans Dr

Test Well: BH-C3 (b) S

Test Date: August 9, 2017

AQUIFER DATA

Saturated Thickness: 3.7 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (BH-C3 S)

Initial Displacement: 1.239 m

Static Water Column Height: 3.24 m

Total Well Penetration Depth: 3.24 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined

Solution Method: Hvorslev

$K = 1.887E-6$ m/sec

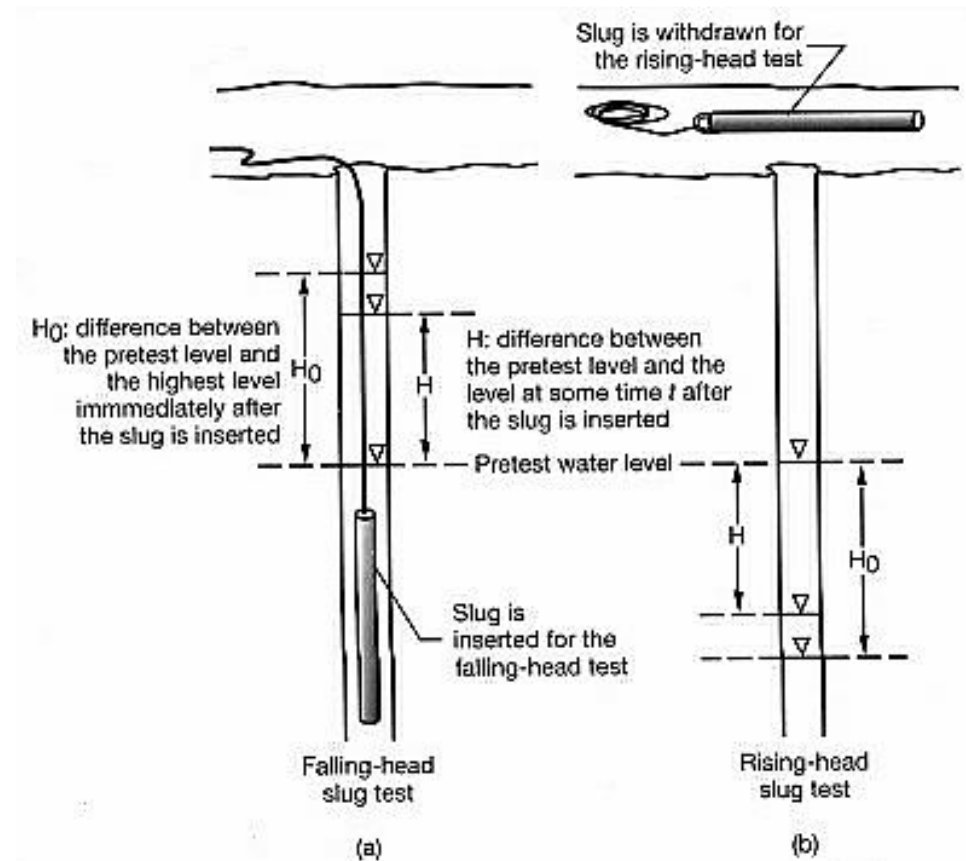
$y_0 = 0.6296$ m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.





Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.
$$(\text{Static Water Level} - \text{Dynamic Water Level}) \cdot .95 + \text{Static Water Level} = 95\% \text{ Recovery Value}$$
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.



Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
 - a. Affix the rope to the bailer.
 - b. Remove the waterra tubing and place in garbage bag
 - c. Record static water level measurement again.
 - d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
 - e. Quickly lower the bailer into the well and remove.
 - f. Continue this process until the water level will reduce no further.
 - g. Record the dynamic water level.
3. If using **waterra** to bail the water:
 - a. Pump the water into graduated bucket until the water level will reduce no further.
 - b. Record how much water has been removed.
 - c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix F: Laboratory Certificates of Analysis

Your P.O. #: ENV-BRM
Your Project #: BRM-00038305-C0
Site Location: WATERSAND
Your C.O.C. #: 624773-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/08/29

Report #: R4680954

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H8167

Received: 2017/08/17, 19:37

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sewer Use By-Law Semivolatile Organics	1	2017/08/21	2017/08/22	EPA 8270 CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2017/08/18	2017/08/23	CAM SOP-00427	SM 22 5210B m
Chloride by Automated Colourimetry	1	N/A	2017/08/21	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	1	N/A	2017/08/22	CAM SOP-00416	SM 22 5220 D m
Total Cyanide	1	2017/08/21	2017/08/22	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2017/08/19	2017/08/22	CAM SOP-00449	SM 22 4500-F C m
Mercury in Water by CVAA	1	2017/08/21	2017/08/21	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/08/25	CAM SOP-00447	EPA 6020B m
Neutral Chlorinated in Water by GC/ECD	1	2017/08/24	2017/08/25	CAM SOP-00317	EPA 8121 m
Animal and Vegetable Oil & Grease	1	N/A	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520B m
Total Oil and Grease	1	2017/08/21	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520A m
pH	1	N/A	2017/08/22	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/08/22	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2017/08/21	CAM SOP-00464	EPA 375.4 m
Sulphide	1	N/A	2017/08/21	CAM SOP-00455	SM 22 4500-S G m
Total Kjeldahl Nitrogen in Water	1	2017/08/19	2017/08/23	CAM SOP-00938	OMOE E3516 m
Total PAHs (Barrie Sewer By-law) (1)	1	N/A	2017/08/23	CAM SOP - 00301	EPA 8270 m
TPH (Heavy Oil) (2)	1	2017/08/21	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520F m
Total Suspended Solids	1	2017/08/18	2017/08/21	CAM SOP-00428	SM 22 2540D m
Volatile Organic Compounds in Water	1	N/A	2017/08/21	CAM SOP-00226	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Your P.O. #: ENV-BRM
Your Project #: BRM-00038305-CO
Site Location: WATERSAND
Your C.O.C. #: 624773-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/08/29
Report #: R4680954
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H8167

Received: 2017/08/17, 19:37

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Total PAHs include only those PAHs specified in the sewer use by-law.

(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Deepthi Shaji, Project Manager

Email: dshaji@maxxam.ca

Phone# (905)817-5700 Ext:5807

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID			EYS494		
Sampling Date			2017/08/17 14:00		
COC Number			624773-01-01		
	UNITS	Criteria	BH 62	RDL	QC Batch
Calculated Parameters					
Total Animal/Vegetable Oil and Grease	mg/L	150	ND	0.50	5125187
Inorganics					
Total Chemical Oxygen Demand (COD)	mg/L	600	16	4.0	5127511
Fluoride (F-)	mg/L	10	ND	0.10	5127705
Total Kjeldahl Nitrogen (TKN)	mg/L	100	0.32	0.10	5127498
Phenols-4AAP	mg/L	0.1	ND	0.0010	5130714
Dissolved Sulphate (SO4)	mg/L	1500	ND	1.0	5126314
Sulphide	mg/L	1	ND	0.020	5129296
Total Cyanide (CN)	mg/L	1.2	ND	0.0050	5128970
Dissolved Chloride (Cl)	mg/L	1500	88	1.0	5126312
Petroleum Hydrocarbons					
Total Oil & Grease	mg/L	-	ND	0.50	5128704
Total Oil & Grease Mineral/Synthetic	mg/L	15	ND	0.50	5128714
Metals					
Mercury (Hg)	mg/L	0.01	ND	0.0001	5128003
Semivolatile Organics					
1-Methylnaphthalene	ug/L	-	ND	0.3	5129030
2-Methylnaphthalene	ug/L	-	ND	0.3	5129030
Acenaphthene	ug/L	-	ND	0.3	5129030
Acenaphthylene	ug/L	-	ND	0.3	5129030
Fluorene	ug/L	-	ND	0.3	5129030
Naphthalene	ug/L	-	ND	0.3	5129030
Phenanthrene	ug/L	-	ND	0.2	5129030
Anthracene	ug/L	-	ND	0.2	5129030
Fluoranthene	ug/L	-	ND	0.2	5129030
Pyrene	ug/L	-	ND	0.2	5129030
Benzo(a)anthracene	ug/L	-	ND	0.2	5129030
Chrysene	ug/L	-	ND	0.2	5129030
Benzo(b/j)fluoranthene	ug/L	-	ND	0.2	5129030
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172					
ND = Not detected					

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID			EYS494		
Sampling Date			2017/08/17 14:00		
COC Number			624773-01-01		
	UNITS	Criteria	BH 62	RDL	QC Batch
Benzo(k)fluoranthene	ug/L	-	ND	0.2	5129030
Benzo(a)pyrene	ug/L	-	ND	0.2	5129030
Indeno(1,2,3-cd)pyrene	ug/L	-	ND	0.2	5129030
Dibenz(a,h)anthracene	ug/L	-	ND	0.2	5129030
Benzo(g,h,i)perylene	ug/L	-	ND	0.2	5129030
Calculated Parameters					
Total PAHs	ug/L	-	ND	0.92	5125746
Volatile Organics					
Benzene	ug/L	10	ND	1.0	5122341
1,2-Dichlorobenzene	ug/L	50	ND	2.0	5122341
1,4-Dichlorobenzene	ug/L	80	ND	2.0	5122341
Ethylbenzene	ug/L	60	ND	1.0	5122341
Methylene Chloride(Dichloromethane)	ug/L	90	ND	5.0	5122341
1,1,2,2-Tetrachloroethane	ug/L	60	ND	2.0	5122341
Tetrachloroethylene	ug/L	60	ND	1.0	5122341
Toluene	ug/L	20	ND	2.0	5122341
Trichloroethylene	ug/L	50	ND	1.0	5122341
p+m-Xylene	ug/L	-	ND	1.0	5122341
o-Xylene	ug/L	-	ND	1.0	5122341
Total Xylenes	ug/L	300	ND	1.0	5122341
Pesticides & Herbicides					
Hexachlorobenzene	ug/L	0.1	ND	0.050	5133901
Surrogate Recovery (%)					
2,4,6-Tribromophenol	%	-	80		5129030
2-Fluorobiphenyl	%	-	22 (1)		5129030
D14-Terphenyl (FS)	%	-	84		5129030
D5-Nitrobenzene	%	-	25 (2)		5129030
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172					
ND = Not detected					
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.					
(2) Some surrogate recoveries were below the lower control limits due to matrix interferences. This may represent a lower bias in some results.					

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID			EYS494		
Sampling Date			2017/08/17 14:00		
COC Number			624773-01-01		
	UNITS	Criteria	BH 62	RDL	QC Batch
D8-Acenaphthylene	%	-	36		5129030
1,3,5-Tribromobenzene	%	-	63		5133901
2,4,5,6-Tetrachloro-m-xylene	%	-	60		5133901
Decachlorobiphenyl	%	-	65		5133901
Hexabromobenzene	%	-	74		5133901
4-Bromofluorobenzene	%	-	101		5122341
D4-1,2-Dichloroethane	%	-	106		5122341
D8-Toluene	%	-	100		5122341
No Fill	No Exceedance				
Grey	Exceeds 1 criteria policy/level				
Black	Exceeds both criteria/levels				
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172					

BARRIE STORM SEWER BYLAW (2012-172)

Maxxam ID				EYS494		
Sampling Date				2017/08/17 14:00		
COC Number				624773-01-01		
	UNITS	Criteria	Criteria-2	BH 62	RDL	QC Batch
Inorganics						
Total BOD	mg/L	300	15	ND	2.0	5125453
pH	pH	6.0:9.5	6.0:9.5	7.46		5127706
Total Suspended Solids	mg/L	350	15	16	10	5126562
Metals						
Total Aluminum (Al)	ug/L	50000	-	2300	5.0	5130337
Total Antimony (Sb)	ug/L	5000	-	ND	0.50	5130337
Total Arsenic (As)	ug/L	1000	-	ND	1.0	5130337
Total Barium (Ba)	ug/L	5000	-	50	2.0	5130337
Total Bismuth (Bi)	ug/L	5000	-	ND	1.0	5130337
Total Cadmium (Cd)	ug/L	700	1	ND	0.10	5130337
Total Chromium (Cr)	ug/L	2000	80	ND	5.0	5130337
Total Cobalt (Co)	ug/L	5000	-	1.3	0.50	5130337
Total Copper (Cu)	ug/L	2000	10	4.0	1.0	5130337
Total Iron (Fe)	ug/L	50000	-	3000	100	5130337
Total Lead (Pb)	ug/L	700	50	1.2	0.50	5130337
Total Manganese (Mn)	ug/L	5000	-	110	2.0	5130337
Total Molybdenum (Mo)	ug/L	5000	-	ND	0.50	5130337
Total Nickel (Ni)	ug/L	2000	50	2.9	1.0	5130337
Total Phosphorus (P)	ug/L	-	-	160	100	5130337
Total Selenium (Se)	ug/L	1000	-	ND	2.0	5130337
Total Silver (Ag)	ug/L	400	-	ND	0.10	5130337
Total Tin (Sn)	ug/L	5000	-	ND	1.0	5130337
Total Vanadium (V)	ug/L	5000	-	4.1	0.50	5130337
Total Zinc (Zn)	ug/L	2000	40	25	5.0	5130337
No Fill	No Exceedance					
Grey	Exceeds 1 criteria policy/level					
Black	Exceeds both criteria/levels					
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172						
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172						
ND = Not detected						

Maxxam Job #: B7H8167
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ENV-BRM

TEST SUMMARY

Maxxam ID: EYS494
Sample ID: BH 62
Matrix: Water

Collected: 2017/08/17
Shipped:
Received: 2017/08/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	5129030	2017/08/21	2017/08/22	Kathy Horvat
Biochemical Oxygen Demand (BOD)	DO	5125453	2017/08/18	2017/08/23	Prakash Piya
Chloride by Automated Colourimetry	KONE	5126312	N/A	2017/08/21	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5127511	N/A	2017/08/22	Neil Dassanayake
Total Cyanide	SKAL/CN	5128970	2017/08/21	2017/08/22	Xuanhong Qiu
Fluoride	ISE	5127705	2017/08/19	2017/08/22	Yogesh Patel
Mercury in Water by CVAA	CV/AA	5128003	2017/08/21	2017/08/21	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5130337	N/A	2017/08/25	Prempal Bhatti
Neutral Chlorinated in Water by GC/ECD	GC/ECD	5133901	2017/08/24	2017/08/25	Joy Zhang
Animal and Vegetable Oil & Grease	BAL	5125187	N/A	2017/08/22	Automated Statchk
Total Oil and Grease	BAL	5128704	2017/08/21	2017/08/22	Amjad Mir
pH	AT	5127706	N/A	2017/08/22	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5130714	N/A	2017/08/22	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5126314	N/A	2017/08/21	Deonarine Ramnarine
Sulphide	ISE/S	5129296	N/A	2017/08/21	Tahir Anwar
Total Kjeldahl Nitrogen in Water	SKAL	5127498	2017/08/19	2017/08/23	Rajni Tyagi
Total PAHs (Barrie Sewer By-law)	CALC	5125746	N/A	2017/08/23	Automated Statchk
TPH (Heavy Oil)	BAL	5128714	2017/08/21	2017/08/22	Amjad Mir
Total Suspended Solids	BAL	5126562	2017/08/18	2017/08/21	Xue Zheng Li(Scott)
Volatile Organic Compounds in Water	P&T/MS	5122341	N/A	2017/08/21	Dina Wang

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	8.7°C
-----------	-------

Cooler custody seal was present and intact.

OC Pesticide Analysis: Due to the nature of the sample matrix, a smaller portion of the sample was extracted. DLs were adjusted accordingly.

Sample EYS494 [BH 62] : VOC Water Analysis: Due to foaming, sample required dilution. The detection limits were adjusted accordingly.

Results relate only to the items tested.

Maxxam Job #: B7H8167
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ENV-BRM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5122341	4-Bromofluorobenzene	2017/08/21	104	70 - 130	104	70 - 130	101	%				
5122341	D4-1,2-Dichloroethane	2017/08/21	105	70 - 130	104	70 - 130	105	%				
5122341	D8-Toluene	2017/08/21	99	70 - 130	99	70 - 130	97	%				
5129030	2,4,6-Tribromophenol	2017/08/22			82	10 - 130	60	%				
5129030	2-Fluorobiphenyl	2017/08/22			44	30 - 130	67	%				
5129030	D14-Terphenyl (FS)	2017/08/22			87	30 - 130	85	%				
5129030	D5-Nitrobenzene	2017/08/22			45	30 - 130	69	%				
5129030	D8-Acenaphthylene	2017/08/22			48	30 - 130	68	%				
5133901	1,3,5-Tribromobenzene	2017/08/25	60	30 - 130	68	30 - 130	75	%				
5133901	2,4,5,6-Tetrachloro-m-xylene	2017/08/25	55	30 - 130	60	30 - 130	61	%				
5133901	Decachlorobiphenyl	2017/08/25	65	30 - 130	66	30 - 130	69	%				
5133901	Hexabromobenzene	2017/08/25	74	30 - 130	71	30 - 130	76	%				
5122341	1,1,2,2-Tetrachloroethane	2017/08/21	105	70 - 130	105	70 - 130	ND, RDL=0.20	ug/L				
5122341	1,2-Dichlorobenzene	2017/08/21	80	70 - 130	96	70 - 130	ND, RDL=0.20	ug/L				
5122341	1,4-Dichlorobenzene	2017/08/21	81	70 - 130	99	70 - 130	ND, RDL=0.20	ug/L				
5122341	Benzene	2017/08/21	101	70 - 130	100	70 - 130	ND, RDL=0.10	ug/L				
5122341	Ethylbenzene	2017/08/21	92	70 - 130	98	70 - 130	ND, RDL=0.10	ug/L				
5122341	Methylene Chloride(Dichloromethane)	2017/08/21	89	70 - 130	88	70 - 130	ND, RDL=0.50	ug/L				
5122341	o-Xylene	2017/08/21	90	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L				
5122341	p+m-Xylene	2017/08/21	92	70 - 130	103	70 - 130	ND, RDL=0.10	ug/L				
5122341	Tetrachloroethylene	2017/08/21	90	70 - 130	96	70 - 130	ND, RDL=0.10	ug/L				
5122341	Toluene	2017/08/21	96	70 - 130	96	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5122341	Total Xylenes	2017/08/21					ND, RDL=0.10	ug/L				
5122341	Trichloroethylene	2017/08/21	95	70 - 130	95	70 - 130	ND, RDL=0.10	ug/L				
5125453	Total BOD	2017/08/23					ND, RDL=2.0	mg/L	NC	25	93	80 - 120
5126312	Dissolved Chloride (Cl)	2017/08/21	NC	80 - 120	103	80 - 120	ND, RDL=1.0	mg/L	0.085	20		
5126314	Dissolved Sulphate (SO4)	2017/08/21	NC	75 - 125	101	80 - 120	ND, RDL=1.0	mg/L	1.6	20		
5126562	Total Suspended Solids	2017/08/21					ND, RDL=10	mg/L	5.5	25	99	85 - 115
5127498	Total Kjeldahl Nitrogen (TKN)	2017/08/22	117	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	3.5	20	100	80 - 120
5127511	Total Chemical Oxygen Demand (COD)	2017/08/22	99	75 - 125	99	75 - 125	ND, RDL=4.0	mg/L	17	25		
5127705	Fluoride (F-)	2017/08/22	107	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	6.3	20		

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00038305-CO
Site Location: WATERSAND
Your P.O. #: ENV-BRM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5127706	pH	2017/08/22			102	98 - 103			0.26	N/A		
5128003	Mercury (Hg)	2017/08/21	99	75 - 125	97	80 - 120	ND, RDL=0.0001	mg/L	NC	20		
5128704	Total Oil & Grease	2017/08/22			98	85 - 115	ND, RDL=0.50	mg/L	0.86	25		
5128714	Total Oil & Grease Mineral/Synthetic	2017/08/22			94	85 - 115	ND, RDL=0.50	mg/L	1.2	25		
5128970	Total Cyanide (CN)	2017/08/23	85	80 - 120	103	80 - 120	ND, RDL=0.0050	mg/L	NC (1)	20		
5129030	1-Methylnaphthalene	2017/08/22			47	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	2-Methylnaphthalene	2017/08/22			45	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	Acenaphthene	2017/08/22			53	30 - 130	ND, RDL=0.3	ug/L	25	40		
5129030	Acenaphthylene	2017/08/22			48	30 - 130	ND, RDL=0.3	ug/L	28	40		
5129030	Anthracene	2017/08/22			83	30 - 130	ND, RDL=0.2	ug/L	1.2	40		
5129030	Benzo(a)anthracene	2017/08/22			96	30 - 130	ND, RDL=0.2	ug/L	5.9	40		
5129030	Benzo(a)pyrene	2017/08/22			90	30 - 130	ND, RDL=0.2	ug/L	5.0	40		
5129030	Benzo(b,j)fluoranthene	2017/08/22			98	30 - 130	ND, RDL=0.2	ug/L	5.2	40		
5129030	Benzo(g,h,i)perylene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	5.0	40		
5129030	Benzo(k)fluoranthene	2017/08/22			110	30 - 130	ND, RDL=0.2	ug/L	2.7	40		
5129030	Chrysene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	1.2	40		
5129030	Dibenz(a,h)anthracene	2017/08/22			96	30 - 130	ND, RDL=0.2	ug/L	4.7	40		
5129030	Fluoranthene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	3.0	40		
5129030	Fluorene	2017/08/22			64	30 - 130	ND, RDL=0.3	ug/L	8.9	40		
5129030	Indeno(1,2,3-cd)pyrene	2017/08/22			91	30 - 130	ND, RDL=0.2	ug/L	2.0	40		
5129030	Naphthalene	2017/08/22			48	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	Phenanthrene	2017/08/22			81	30 - 130	ND, RDL=0.2	ug/L	2.2	40		
5129030	Pyrene	2017/08/22			104	30 - 130	ND, RDL=0.2	ug/L	2.9	40		
5129296	Sulphide	2017/08/21	90	80 - 120	91	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5130337	Total Aluminum (Al)	2017/08/25	NC	80 - 120	101	80 - 120	ND, RDL=5.0	ug/L	1.7	20		
5130337	Total Antimony (Sb)	2017/08/25	104	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L				
5130337	Total Arsenic (As)	2017/08/25	104	80 - 120	101	80 - 120	ND, RDL=1.0	ug/L				
5130337	Total Barium (Ba)	2017/08/25	98	80 - 120	98	80 - 120	ND, RDL=2.0	ug/L				

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ENV-BRM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5130337	Total Bismuth (Bi)	2017/08/25	101	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L				
5130337	Total Cadmium (Cd)	2017/08/25	102	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	13	20		
5130337	Total Chromium (Cr)	2017/08/25	97	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L	1.8	20		
5130337	Total Cobalt (Co)	2017/08/25	105	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L				
5130337	Total Copper (Cu)	2017/08/25	106	80 - 120	102	80 - 120	ND, RDL=1.0	ug/L	0.80	20		
5130337	Total Iron (Fe)	2017/08/25	104	80 - 120	102	80 - 120	ND, RDL=100	ug/L	2.1	20		
5130337	Total Lead (Pb)	2017/08/25	102	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5130337	Total Manganese (Mn)	2017/08/25	98	80 - 120	98	80 - 120	ND, RDL=2.0	ug/L				
5130337	Total Molybdenum (Mo)	2017/08/25	99	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L				
5130337	Total Nickel (Ni)	2017/08/25	101	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	6.7	20		
5130337	Total Phosphorus (P)	2017/08/25	NC	80 - 120	110	80 - 120	ND, RDL=100	ug/L				
5130337	Total Selenium (Se)	2017/08/25	105	80 - 120	104	80 - 120	ND, RDL=2.0	ug/L				
5130337	Total Silver (Ag)	2017/08/25	98	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L				
5130337	Total Tin (Sn)	2017/08/25	95	80 - 120	101	80 - 120	ND, RDL=1.0	ug/L				
5130337	Total Vanadium (V)	2017/08/25	98	80 - 120	96	80 - 120	ND, RDL=0.50	ug/L				
5130337	Total Zinc (Zn)	2017/08/25	103	80 - 120	104	80 - 120	ND, RDL=5.0	ug/L	2.7	20		
5130714	Phenols-4AAP	2017/08/22	106	80 - 120	100	85 - 115	ND, RDL=0.0010	mg/L	NC	20		

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ENV-BRM

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5133901	Hexachlorobenzene	2017/08/25	57	50 - 130	63	50 - 130	ND, RDL=0.0050	ug/L	NC	40		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference $\leq 2 \times$ RDL).

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).




Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Exceedence Summary Table – Barrie Sanitary Sewer
Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						
The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

Exceedence Summary Table – Barrie Storm Sewer
Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
BH 62	EYS494-06	Total Suspended Solids	15	16	10	mg/L
The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name: #30554 exp Services Inc		Company Name: SAA.		Quotation #: B459971 STREAM2		Maxxam Job #:	
Attention: Central Services		Attention: FRANCOIS CHARTIER		P.O. #: ENV-BRM		Bottle Order #:	
Address: 1595 Clark Blvd		Address: CHANTEL.SIMON@EXP.COM.		Project: WATER SAND		624773	
Brampton ON L6T 4V1				Project Name: BRM-00038305-CO		COC #:	
(905) 793-9800 x				Site #: CS.		Project Manager:	
Email: Karen.Burke@exp.com		Email: FRANCOIS.CHARTIER@EXP.COM		Sampled By:		 C#624773-01-01	
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY				Turnaround Time (TAT) Required: Please provide advance notice for rush projects			
Regulation 153 (2011) ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table		Other Regulations ☐ CCME ☒ Sanitary Sewer Bylaw ☐ Reg 558 ☒ Storm Sewer Bylaw ☐ MISA Municipality: BARRIE ☐ PWQO ☐ Other		Special Instructions		Regular (Standard) TAT: (will be applied if Rush TAT is not specified). Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.	
Include Criteria on Certificate of Analysis (Y/N)? Y				Job Specific Rush TAT (if applies to entire submission) Date Required: _____ Time Required: _____ Rush Confirmation Number: _____ (call lab for #)			
Sample Barcode Label		Sample (Location) Identification		Date Sampled		Time Sampled	
Matrix		Field Filtered (please circle): Metals / Hg / Cr / VI		Barrie Sanitary and Storm Sewer Bylaw (2012-172)		ANALYSIS REQUESTED (PLEASE BE SPECIFIC)	
1	BH 62	17/08/17	2:00	GW	N	X	
2							
3							
4							
5							
6							
7							
8							
9							
10							
* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)		Time		RECEIVED BY: (Signature/Print)	
Chantel Simon / [Signature]		17/08/17		7:30		Taru [Signature] Taru [Signature]	
						Date: (YY/MM/DD) 17/08/17	
						Time 19:32	
						# jars used and not submitted	
						Laboratory Use Only	
						Time Sensitive	
						Temperature (°C) on Receipt	
						Custody Seal Present	
						Yes	
						No	
						Intact	
						White: Maxxa Yellow: Client	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT [WWW.MAXXAM.CA/TERMS](http://www.maxxam.ca/terms).

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Your P.O. #: ERM-ENV
Your Project #: BRM-00038305-C0
Site Location: WATERSAND
Your C.O.C. #: 617369-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/08/29

Report #: R4680943

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H8179

Received: 2017/08/17, 19:37

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sewer Use By-Law Semivolatile Organics	1	2017/08/21	2017/08/22	EPA 8270 CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2017/08/18	2017/08/23	CAM SOP-00427	SM 22 5210B m
Chloride by Automated Colourimetry	1	N/A	2017/08/21	CAM SOP-00463	EPA 325.2 m
Chemical Oxygen Demand	1	N/A	2017/08/22	CAM SOP-00416	SM 22 5220 D m
Total Cyanide	1	2017/08/21	2017/08/22	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2017/08/19	2017/08/22	CAM SOP-00449	SM 22 4500-F C m
Mercury in Water by CVAA	1	2017/08/21	2017/08/21	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/08/24	CAM SOP-00447	EPA 6020B m
Neutral Chlorinated in Water by GC/ECD	1	2017/08/24	2017/08/25	CAM SOP-00317	EPA 8121 m
Animal and Vegetable Oil & Grease	1	N/A	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520B m
Total Oil and Grease	1	2017/08/21	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520A m
pH	1	N/A	2017/08/22	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/08/22	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2017/08/21	CAM SOP-00464	EPA 375.4 m
Sulphide	1	N/A	2017/08/21	CAM SOP-00455	SM 22 4500-S G m
Total Kjeldahl Nitrogen in Water	1	2017/08/19	2017/08/23	CAM SOP-00938	OMOE E3516 m
Total PAHs (Barrie Sewer By-law) (1)	1	N/A	2017/08/23	CAM SOP - 00301	EPA 8270 m
TPH (Heavy Oil) (2)	1	2017/08/21	2017/08/22	CAM SOP-00326	EPA1664B m, SM5520F m
Total Suspended Solids	1	2017/08/18	2017/08/21	CAM SOP-00428	SM 22 2540D m
Volatile Organic Compounds in Water	1	N/A	2017/08/21	CAM SOP-00226	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Your P.O. #: ERM-ENV
Your Project #: BRM-00038305-C0
Site Location: WATERSAND
Your C.O.C. #: 617369-01-01

Attention: Francois Chartier

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/08/29

Report #: R4680943

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7H8179

Received: 2017/08/17, 19:37

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Total PAHs include only those PAHs specified in the sewer use by-law.

(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Deepthi Shaji, Project Manager

Email: dshaji@maxxam.ca

Phone# (905)817-5700 Ext:5807

=====

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				EYS547	EYS547		
Sampling Date				2017/08/17 12:00	2017/08/17 12:00		
COC Number				617369-01-01	617369-01-01		
	UNITS	Criteria	Criteria-2	BHA2-S	BHA2-S Lab-Dup	RDL	QC Batch
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	150	-	ND		0.50	5125187
Inorganics							
Total BOD	mg/L	300	15	ND		2.0	5125454
Total Chemical Oxygen Demand (COD)	mg/L	600	-	8.0		4.0	5127511
Fluoride (F-)	mg/L	10	-	ND		0.10	5127705
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	ND (1)		0.50	5127498
pH	pH	6.0:9.5	6.0:9.5	7.84			5127706
Phenols-4AAP	mg/L	0.1	-	ND		0.0010	5130714
Total Suspended Solids	mg/L	350	15	25		10	5126562
Dissolved Sulphate (SO4)	mg/L	1500	-	13	11	1.0	5127698
Sulphide	mg/L	1	-	ND		0.020	5129296
Total Cyanide (CN)	mg/L	1.2	-	ND		0.0050	5128970
Dissolved Chloride (Cl)	mg/L	1500	-	13	11	1.0	5127697
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	-	-	ND		0.50	5128704
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	ND		0.50	5128714
Metals							
Mercury (Hg)	mg/L	0.01	-	ND		0.0001	5128003
Semivolatile Organics							
1-Methylnaphthalene	ug/L	-	-	ND		0.3	5129030
2-Methylnaphthalene	ug/L	-	-	ND		0.3	5129030
Acenaphthene	ug/L	-	-	ND		0.3	5129030
Acenaphthylene	ug/L	-	-	ND		0.3	5129030
Fluorene	ug/L	-	-	ND		0.3	5129030
Naphthalene	ug/L	-	-	ND		0.3	5129030
No Fill	No Exceedance						
Grey	Exceeds 1 criteria policy/level						
Black	Exceeds both criteria/levels						
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172							
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172							
ND = Not detected							
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.							

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				EYS547	EYS547		
Sampling Date				2017/08/17 12:00	2017/08/17 12:00		
COC Number				617369-01-01	617369-01-01		
	UNITS	Criteria	Criteria-2	BHA2-S	BHA2-S Lab-Dup	RDL	QC Batch
Phenanthrene	ug/L	-	-	ND		0.2	5129030
Anthracene	ug/L	-	-	ND		0.2	5129030
Fluoranthene	ug/L	-	-	ND		0.2	5129030
Pyrene	ug/L	-	-	ND		0.2	5129030
Benzo(a)anthracene	ug/L	-	-	ND		0.2	5129030
Chrysene	ug/L	-	-	ND		0.2	5129030
Benzo(b/j)fluoranthene	ug/L	-	-	ND		0.2	5129030
Benzo(k)fluoranthene	ug/L	-	-	ND		0.2	5129030
Benzo(a)pyrene	ug/L	-	-	ND		0.2	5129030
Indeno(1,2,3-cd)pyrene	ug/L	-	-	ND		0.2	5129030
Dibenz(a,h)anthracene	ug/L	-	-	ND		0.2	5129030
Benzo(g,h,i)perylene	ug/L	-	-	ND		0.2	5129030
Calculated Parameters							
Total PAHs	ug/L	-	-	ND		0.92	5125746
Volatile Organics							
Benzene	ug/L	10	-	ND		2.5	5122341
1,2-Dichlorobenzene	ug/L	50	-	ND		5.0	5122341
1,4-Dichlorobenzene	ug/L	80	-	ND		5.0	5122341
Ethylbenzene	ug/L	60	-	ND		2.5	5122341
Methylene Chloride(Dichloromethane)	ug/L	90	-	ND		13	5122341
1,1,2,2-Tetrachloroethane	ug/L	60	-	ND		5.0	5122341
Tetrachloroethylene	ug/L	60	-	ND		2.5	5122341
Toluene	ug/L	20	-	ND		5.0	5122341
Trichloroethylene	ug/L	50	-	ND		2.5	5122341
p+m-Xylene	ug/L	-	-	ND		2.5	5122341
o-Xylene	ug/L	-	-	ND		2.5	5122341
Total Xylenes	ug/L	300	-	ND		2.5	5122341
No Fill	No Exceedance						
Grey	Exceeds 1 criteria policy/level						
Black	Exceeds both criteria/levels						
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172							
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172							
ND = Not detected							

BARRIE SANITARY SEWER BYLAW (2012-172)

Maxxam ID				EYS547	EYS547		
Sampling Date				2017/08/17 12:00	2017/08/17 12:00		
COC Number				617369-01-01	617369-01-01		
	UNITS	Criteria	Criteria-2	BHA2-S	BHA2-S Lab-Dup	RDL	QC Batch
Pesticides & Herbicides							
Hexachlorobenzene	ug/L	0.1	-	ND	ND	0.050	5133901
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	-	-	76			5129030
2-Fluorobiphenyl	%	-	-	41			5129030
D14-Terphenyl (FS)	%	-	-	86			5129030
D5-Nitrobenzene	%	-	-	50			5129030
D8-Acenaphthylene	%	-	-	57			5129030
1,3,5-Tribromobenzene	%	-	-	60	68		5133901
2,4,5,6-Tetrachloro-m-xylene	%	-	-	64	63		5133901
Decachlorobiphenyl	%	-	-	66	68		5133901
Hexabromobenzene	%	-	-	73	74		5133901
4-Bromofluorobenzene	%	-	-	100			5122341
D4-1,2-Dichloroethane	%	-	-	104			5122341
D8-Toluene	%	-	-	98			5122341
No Fill	No Exceedance						
Grey	Exceeds 1 criteria policy/level						
Black	Exceeds both criteria/levels						
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
Lab-Dup = Laboratory Initiated Duplicate							
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172							
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172							
ND = Not detected							

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID				EYS547		
Sampling Date				2017/08/17 12:00		
COC Number				617369-01-01		
	UNITS	Criteria	Criteria-2	BHA2-S	RDL	QC Batch
Metals						
Total Aluminum (Al)	ug/L	50000	-	200	5.0	5130729
Total Antimony (Sb)	ug/L	5000	-	ND	0.50	5130729
Total Arsenic (As)	ug/L	1000	-	ND	1.0	5130729
Total Barium (Ba)	ug/L	5000	-	75	2.0	5130729
Total Bismuth (Bi)	ug/L	5000	-	ND	1.0	5130729
Total Cadmium (Cd)	ug/L	700	1	ND	0.10	5130729
Total Chromium (Cr)	ug/L	2000	80	ND	5.0	5130729
Total Cobalt (Co)	ug/L	5000	-	ND	0.50	5130729
Total Copper (Cu)	ug/L	2000	10	1.4	1.0	5130729
Total Iron (Fe)	ug/L	50000	-	280	100	5130729
Total Lead (Pb)	ug/L	700	50	ND	0.50	5130729
Total Manganese (Mn)	ug/L	5000	-	13	2.0	5130729
Total Molybdenum (Mo)	ug/L	5000	-	1.7	0.50	5130729
Total Nickel (Ni)	ug/L	2000	50	ND	1.0	5130729
Total Phosphorus (P)	ug/L	-	-	ND	100	5130729
Total Selenium (Se)	ug/L	1000	-	ND	2.0	5130729
Total Silver (Ag)	ug/L	400	-	ND	0.10	5130729
Total Tin (Sn)	ug/L	5000	-	ND	1.0	5130729
Total Vanadium (V)	ug/L	5000	-	3.1	0.50	5130729
Total Zinc (Zn)	ug/L	2000	40	ND	5.0	5130729
No Fill	No Exceedance					
Grey	Exceeds 1 criteria policy/level					
Black	Exceeds both criteria/levels					
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Criteria: The City of Barrie Discharges to Sanitary Sewers By Law 2012-172						
Criteria-2: The City of Barrie Discharges to Storm Sewers By Law 2012-172						
ND = Not detected						

Maxxam Job #: B7H8179
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ERM-ENV

TEST SUMMARY

Maxxam ID: EYS547
Sample ID: BHA2-S
Matrix: Water

Collected: 2017/08/17
Shipped:
Received: 2017/08/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sewer Use By-Law Semivolatile Organics	GC/MS	5129030	2017/08/21	2017/08/22	Kathy Horvat
Biochemical Oxygen Demand (BOD)	DO	5125454	2017/08/18	2017/08/23	Prakash Piya
Chloride by Automated Colourimetry	KONE	5127697	N/A	2017/08/21	Deonarine Ramnarine
Chemical Oxygen Demand	SPEC	5127511	N/A	2017/08/22	Neil Dassanayake
Total Cyanide	SKAL/CN	5128970	2017/08/21	2017/08/22	Xuanhong Qiu
Fluoride	ISE	5127705	2017/08/19	2017/08/22	Yogesh Patel
Mercury in Water by CVAA	CV/AA	5128003	2017/08/21	2017/08/21	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5130729	N/A	2017/08/24	Prempal Bhatti
Neutral Chlorinated in Water by GC/ECD	GC/ECD	5133901	2017/08/24	2017/08/25	Joy Zhang
Animal and Vegetable Oil & Grease	BAL	5125187	N/A	2017/08/22	Automated Statchk
Total Oil and Grease	BAL	5128704	2017/08/21	2017/08/22	Amjad Mir
pH	AT	5127706	N/A	2017/08/22	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5130714	N/A	2017/08/22	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5127698	N/A	2017/08/21	Deonarine Ramnarine
Sulphide	ISE/S	5129296	N/A	2017/08/21	Tahir Anwar
Total Kjeldahl Nitrogen in Water	SKAL	5127498	2017/08/19	2017/08/23	Rajni Tyagi
Total PAHs (Barrie Sewer By-law)	CALC	5125746	N/A	2017/08/23	Automated Statchk
TPH (Heavy Oil)	BAL	5128714	2017/08/21	2017/08/22	Amjad Mir
Total Suspended Solids	BAL	5126562	2017/08/18	2017/08/21	Xue Zheng Li(Scott)
Volatile Organic Compounds in Water	P&T/MS	5122341	N/A	2017/08/21	Dina Wang

Maxxam ID: EYS547 Dup
Sample ID: BHA2-S
Matrix: Water

Collected: 2017/08/17
Shipped:
Received: 2017/08/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	KONE	5127697	N/A	2017/08/21	Deonarine Ramnarine
Neutral Chlorinated in Water by GC/ECD	GC/ECD	5133901	2017/08/24	2017/08/25	Joy Zhang
Sulphate by Automated Colourimetry	KONE	5127698	N/A	2017/08/21	Deonarine Ramnarine

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	9.3°C
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Cooler custody seal was present and intact.

Sample EYS547 [BHA2-S] : VOC Water Analysis: Due to foaming, sample required dilution. The detection limits were adjusted accordingly.

Results relate only to the items tested.

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ERM-ENV

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5122341	4-Bromofluorobenzene	2017/08/21	104	70 - 130	104	70 - 130	101	%				
5122341	D4-1,2-Dichloroethane	2017/08/21	105	70 - 130	104	70 - 130	105	%				
5122341	D8-Toluene	2017/08/21	99	70 - 130	99	70 - 130	97	%				
5129030	2,4,6-Tribromophenol	2017/08/22			82	10 - 130	60	%				
5129030	2-Fluorobiphenyl	2017/08/22			44	30 - 130	67	%				
5129030	D14-Terphenyl (FS)	2017/08/22			87	30 - 130	85	%				
5129030	D5-Nitrobenzene	2017/08/22			45	30 - 130	69	%				
5129030	D8-Acenaphthylene	2017/08/22			48	30 - 130	68	%				
5133901	1,3,5-Tribromobenzene	2017/08/25	60	30 - 130	68	30 - 130	75	%				
5133901	2,4,5,6-Tetrachloro-m-xylene	2017/08/25	55	30 - 130	60	30 - 130	61	%				
5133901	Decachlorobiphenyl	2017/08/25	65	30 - 130	66	30 - 130	69	%				
5133901	Hexabromobenzene	2017/08/25	74	30 - 130	71	30 - 130	76	%				
5122341	1,1,2,2-Tetrachloroethane	2017/08/21	105	70 - 130	105	70 - 130	ND, RDL=0.20	ug/L				
5122341	1,2-Dichlorobenzene	2017/08/21	80	70 - 130	96	70 - 130	ND, RDL=0.20	ug/L				
5122341	1,4-Dichlorobenzene	2017/08/21	81	70 - 130	99	70 - 130	ND, RDL=0.20	ug/L				
5122341	Benzene	2017/08/21	101	70 - 130	100	70 - 130	ND, RDL=0.10	ug/L				
5122341	Ethylbenzene	2017/08/21	92	70 - 130	98	70 - 130	ND, RDL=0.10	ug/L				
5122341	Methylene Chloride(Dichloromethane)	2017/08/21	89	70 - 130	88	70 - 130	ND, RDL=0.50	ug/L				
5122341	o-Xylene	2017/08/21	90	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L				
5122341	p+m-Xylene	2017/08/21	92	70 - 130	103	70 - 130	ND, RDL=0.10	ug/L				
5122341	Tetrachloroethylene	2017/08/21	90	70 - 130	96	70 - 130	ND, RDL=0.10	ug/L				
5122341	Toluene	2017/08/21	96	70 - 130	96	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5122341	Total Xylenes	2017/08/21					ND, RDL=0.10	ug/L				
5122341	Trichloroethylene	2017/08/21	95	70 - 130	95	70 - 130	ND, RDL=0.10	ug/L				
5125454	Total BOD	2017/08/23					ND, RDL=2.0	mg/L	11	25	104	80 - 120
5126562	Total Suspended Solids	2017/08/21					ND, RDL=10	mg/L	5.5	25	99	85 - 115
5127498	Total Kjeldahl Nitrogen (TKN)	2017/08/22	117	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	3.5	20	100	80 - 120
5127511	Total Chemical Oxygen Demand (COD)	2017/08/22	99	75 - 125	99	75 - 125	ND, RDL=4.0	mg/L	17	25		
5127697	Dissolved Chloride (Cl)	2017/08/21	109	80 - 120	104	80 - 120	ND, RDL=1.0	mg/L	11	20		
5127698	Dissolved Sulphate (SO4)	2017/08/21	106	75 - 125	104	80 - 120	ND, RDL=1.0	mg/L	19	20		
5127705	Fluoride (F-)	2017/08/22	107	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	6.3	20		

Maxxam Job #: B7H8179
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00038305-C0
Site Location: WATERSAND
Your P.O. #: ERM-ENV

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5127706	pH	2017/08/22			102	98 - 103			0.26	N/A		
5128003	Mercury (Hg)	2017/08/21	99	75 - 125	97	80 - 120	ND, RDL=0.0001	mg/L	NC	20		
5128704	Total Oil & Grease	2017/08/22			98	85 - 115	ND, RDL=0.50	mg/L	0.86	25		
5128714	Total Oil & Grease Mineral/Synthetic	2017/08/22			94	85 - 115	ND, RDL=0.50	mg/L	1.2	25		
5128970	Total Cyanide (CN)	2017/08/23	85	80 - 120	103	80 - 120	ND, RDL=0.0050	mg/L	NC (1)	20		
5129030	1-Methylnaphthalene	2017/08/22			47	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	2-Methylnaphthalene	2017/08/22			45	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	Acenaphthene	2017/08/22			53	30 - 130	ND, RDL=0.3	ug/L	25	40		
5129030	Acenaphthylene	2017/08/22			48	30 - 130	ND, RDL=0.3	ug/L	28	40		
5129030	Anthracene	2017/08/22			83	30 - 130	ND, RDL=0.2	ug/L	1.2	40		
5129030	Benzo(a)anthracene	2017/08/22			96	30 - 130	ND, RDL=0.2	ug/L	5.9	40		
5129030	Benzo(a)pyrene	2017/08/22			90	30 - 130	ND, RDL=0.2	ug/L	5.0	40		
5129030	Benzo(b/j)fluoranthene	2017/08/22			98	30 - 130	ND, RDL=0.2	ug/L	5.2	40		
5129030	Benzo(g,h,i)perylene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	5.0	40		
5129030	Benzo(k)fluoranthene	2017/08/22			110	30 - 130	ND, RDL=0.2	ug/L	2.7	40		
5129030	Chrysene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	1.2	40		
5129030	Dibenz(a,h)anthracene	2017/08/22			96	30 - 130	ND, RDL=0.2	ug/L	4.7	40		
5129030	Fluoranthene	2017/08/22			99	30 - 130	ND, RDL=0.2	ug/L	3.0	40		
5129030	Fluorene	2017/08/22			64	30 - 130	ND, RDL=0.3	ug/L	8.9	40		
5129030	Indeno(1,2,3-cd)pyrene	2017/08/22			91	30 - 130	ND, RDL=0.2	ug/L	2.0	40		
5129030	Naphthalene	2017/08/22			48	30 - 130	ND, RDL=0.3	ug/L	39	40		
5129030	Phenanthrene	2017/08/22			81	30 - 130	ND, RDL=0.2	ug/L	2.2	40		
5129030	Pyrene	2017/08/22			104	30 - 130	ND, RDL=0.2	ug/L	2.9	40		
5129296	Sulphide	2017/08/21	90	80 - 120	91	80 - 120	ND, RDL=0.020	mg/L	NC	20		
5130714	Phenols-4AAP	2017/08/22	106	80 - 120	100	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5130729	Total Aluminum (Al)	2017/08/24	114	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L				
5130729	Total Antimony (Sb)	2017/08/24	102	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L				
5130729	Total Arsenic (As)	2017/08/24	102	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L				

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00038305-CO
Site Location: WATERSAND
Your P.O. #: ERM-ENV

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5130729	Total Barium (Ba)	2017/08/24	95	80 - 120	97	80 - 120	ND, RDL=2.0	ug/L				
5130729	Total Bismuth (Bi)	2017/08/24	98	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L				
5130729	Total Cadmium (Cd)	2017/08/24	102	80 - 120	101	80 - 120	ND, RDL=0.10	ug/L				
5130729	Total Chromium (Cr)	2017/08/24	99	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L				
5130729	Total Cobalt (Co)	2017/08/24	103	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L				
5130729	Total Copper (Cu)	2017/08/24	103	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L				
5130729	Total Iron (Fe)	2017/08/24	99	80 - 120	96	80 - 120	ND, RDL=100	ug/L				
5130729	Total Lead (Pb)	2017/08/24	99	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L				
5130729	Total Manganese (Mn)	2017/08/24	98	80 - 120	97	80 - 120	ND, RDL=2.0	ug/L				
5130729	Total Molybdenum (Mo)	2017/08/24	101	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L				
5130729	Total Nickel (Ni)	2017/08/24	100	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L				
5130729	Total Phosphorus (P)	2017/08/24	104	80 - 120	107	80 - 120	ND, RDL=100	ug/L				
5130729	Total Selenium (Se)	2017/08/24	108	80 - 120	107	80 - 120	ND, RDL=2.0	ug/L				
5130729	Total Silver (Ag)	2017/08/24	99	80 - 120	100	80 - 120	ND, RDL=0.10	ug/L				
5130729	Total Tin (Sn)	2017/08/24	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L				
5130729	Total Vanadium (V)	2017/08/24	98	80 - 120	95	80 - 120	ND, RDL=0.50	ug/L				
5130729	Total Zinc (Zn)	2017/08/24	101	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L				
5133901	Hexachlorobenzene	2017/08/25	57	50 - 130	63	50 - 130	ND, RDL=0.0050	ug/L	NC	40		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

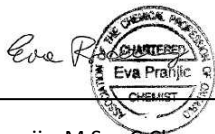
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).


The seal is circular with the text "THE CHEMICAL PROFESSION" around the top edge and "CANADA" around the bottom edge. In the center, it says "CHARTERED", "Eva Pranjić", and "CHEMIST".

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Exceedence Summary Table – Barrie Sanitary Sewer
Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						
The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

Exceedence Summary Table – Barrie Storm Sewer
Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
BHA2-S	EYS547-06	Total Suspended Solids	15	25	10	mg/L
The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.						

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name: #30554 exp Services Inc		Company Name: SAA		Quotation #: WATER STREAM 2		Maxxam Job #:	
Attention: Central Services		Attention: FRANCOIS.CHARTIER		P.O. #: ENV-BRM		Bottle Order #:	
Address: 1595 Clark Blvd		Address: CHANTEL.SIMON@EXP.COM		Project: WATERSAND		COC #:	
Brampton ON L6T 4V1				Project Name: BRM-00038305-CO		Project Manager:	
Tel: (905) 793-9800 x		Tel: (905) 793-0641 x		Site #:		Deepthi Shaji	
Email: Karen.Burke@exp.com		Email: FRANCOIS.CHARTIER@EXP.COM		Sampled By: CS		Turnaround Time (TAT) Required:	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011) ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table _____			Other Regulations ☐ CCME ☒ Sanitary Sewer Bylaw ☐ Reg 558 ☒ Storm Sewer Bylaw ☐ MISA Municipality: BARRIE ☐ PWQO ☐ Other _____			Special Instructions 			ANALYSIS REQUESTED (PLEASE BE SPECIFIC) 			Turnaround Time (TAT) Required: Please provide advance notice for rush projects Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details. ☒		
Include Criteria on Certificate of Analysis (C/N)? ☒			Field Filtered (Please circle): Metals / Hg / Cr VI N X			BARRIE SANITARY AND STORM WATER BYLAW			Job Specific Rush TAT (if applies to entire submission) Date Required: _____ Time Required: _____ Rush Confirmation Number: _____ (call lab for #)					
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix										
1	BH A2-S	17/08/17	12:00	GW	N	X					17 PLEASE LAB ANALYSIS FOR IANON			
2				GW										
3				GW										
4				GW										
5				GW										
6				GW										
7				GW										
8				GW										
9				GW										
10				GW										

17-Aug-17 19:37
 Deepthi Shaji
 B7H8179
 HG2 ENV-667

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
Chantel Simon/Chantel		17/08/17	7:30	Tanner/Chantel Simon		17/08/17	19:37		Time Sensitive	Temperature (°C) on Recept	Custody Seal	Yes	No
										8/10/10	Intact		

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

White: Maxxa Yellow: Client

Appendix G: Construction Dewatering Flow Rate Estimates

APPENDIX G: Construction Dewatering Calculations

Watersands
BRM-00038305-C0

Table G-1: Flow all Sides of the Excavation

Parameters	Symbols	Unit	Basements	Shallow Sewers and Watermain	SWMP	Deep Sewer (13 mbgs)
Geological Formation	-	-	Glacial Deposit	Glacial Deposit	Glacial Deposit	Glacial Deposit
Ground Elevation	-	masl	310.00	312.00	307.50	312.00
Highest Groundwater Elevation	-	masl	307.00	305.16	304.00	305.16
Top of the Water-Bearing Zone	-	masl	307.00	305.16	304.00	305.16
Base of the Water-Bearing Zone	-	masl	303.50	302.00	298.50	295.00
Height of Static Water Table Above the Base of the Water-Bearing Zone	H	m	3.50	3.16	5.50	10.16
Dewatered Elevation Target	-	masl	306.50	305.00	301.50	298.00
Height of Target Water Level Above the Base of Water-Bearing Zone	h _{ow}	m	3.00	3.00	3.00	3.00
Hydraulic Conductivity	K	m/s	2.10E-06	2.10E-06	2.10E-06	2.30E-05
Length of Excavation	-	m	100.00	50.00	200.00	50.00
Width of Excavation	-	m	100.00	5.00	100.00	5.00
Method to Calculate Radius of Influence	-	-	Sichardt	Sichardt	Sichardt	Sichardt
Radius of Influence from Sides of Excavation	Ro	m	2.17	0.70	10.87	103.01
Distance to Linear Source from Sides of excavation	Lo=Ro/2	m	1.09	0.35	5.43	51.51
Dewatering Flow Rate (unconfined linear flow component)	Q	m³/day	108.51	28.28	212.85	199.94
Factor of Safety	FS	-	2.00	2.00	2.00	2.00
Dewatering Flow Rate (multiplied by factor of safety)	Q.FS	m³/day	217	57	426	400

Table G-2: Precipitation Estimate

Location	Assumed Precipitaiton Event (mm)	Length of Excavation (m)	Width of Excavation (m)	Rainwater Collection (m³)
Basement	15	100	100	150
Shallow Sewer and watermain systems		50	5	4
SWMP		200	100	300
Deep Sewer		50	5	4

Table G-3: Total Flow Estimate, including Precipitation Volume

Parameters	Symbols	Unit	Value
Basement	Q (Total)	m³/day	367
Shallow Sewer and watermain systems			60
SWMPs			726
Deep Sewer			404

Notes:
meals - meters above sea level

Analytical Solution for Estimating Plane Flow from an Unconfined Aquifer to a Fully-Penetrating Excavation

$$Q_w = Kx \frac{H^2 - h_w^2}{L_o}$$

Where:

(Based on the DuPuy Equation)

Q_i = Flow rate per unit length of excavation (m³/s)

K = Hydraulic conductivity (m/s)

H = Height of static water table above base of water-bearing zone (m)

h_{ow} = Height of target water level above the base of water-bearing zone (m)

L_o=Distance of Influence (m)