Preliminary Geotechnical Investigation

700 Gordon Street, Whitby Ontario

Ontrio Infrastructure and Lands Corporation

GHD | 111 Brunel Road, Suite 200 Mississauga Ontario L4Z 1X3

076896 | Report No 4| September 30 2016

Table of Contents

1. Introduction 1
2. Method of Investigation 2
   - 2.1 Safety Planning 2
   - 2.2 Borehole Location Clearance 2
   - 2.3 Field Investigation 3
   - 2.4 Geotechnical Laboratory Testing 5
3. Subsurface Conditions 5
   - 3.1 Stratigraphy 5
   - 3.2 Ground Cover 6
   - 3.3 Earth Fill 6
   - 3.4 Native Sandy Silt to Sand Till 6
   - 3.5 Silty Clay to Clayey Silt Till 7
   - 3.6 Gravelly Clay 7
   - 3.7 Sand and Gravel 7
   - 3.8 Bedrock 7
   - 3.9 Geotechnical Laboratory Test Results 8
     - 3.9.1 Gradation Analysis 8
     - 3.9.2 Atterberg Limits Tests 9
     - 3.9.3 Soil Unit Weight Tests 9
   - 3.10 Groundwater Conditions 9
4. Engineering Discussion and Assessment 11
   - 4.1 General 11
   - 4.2 Site Preparation and Grading 11
   - 4.3 Foundations 12
     - 4.3.1 Conventional Spread/Strip Footings 12
     - 4.3.1 Foundations on Engineered Fill 13
   - 4.4 Slab-On-Grade 14
     - 4.4.1 Perimeter Drainage 14
     - 4.4.2 Subfloor Drainage 15
   - 4.5 Seismic Site Classification 15
   - 4.6 Depth of Frost Penetration 16
   - 4.7 Lateral Earth Pressures 16
5. Pavement Design 17
   - 5.1 Subgrade Preparation 17

5.2 Recommended Pavement Structure 17
5.3 Drainage 18
6. Construction Consideration 18
6.1 Site Servicing 18
6.2 Excavation and Temporary Shoring 19
6.3 Temporary Ground Water Control 20
6.4 Backfilling 21
6.5 Construction Monitoring 22
6.6 Soil Corrosivity Potential 22
6.6.1 Corrosivity on Construction Concrete 23
6.6.2 Corrosivity on Grey Ductile Cast Iron 23
7. Limitations of the Investigation 25

Figure Index

Figure 1 Site Location Map
Figure 2 Site Plan and Investigative Locations

Appendix Index

Appendix A Borehole Logs
Appendix B Geotechnical Laboratory Test Results
Appendix C Soil Corrosivity Test Results

1. Introduction

GHD Limited (GHD) has been retained by Ontario Infrastructure and Lands Corporation (Infrastructure Ontario/IO) to undertake a preliminary geotechnical investigation at the property located on 700 Gordon Street in Whitby, Ontario, hereinafter referred to as the "Site". The Site Location Map is provided on Figure 1.

The Site has an approximate area of 3.5 hectares and is currently occupied by a number of existing buildings, driveways, parking areas, and landscaped areas that are part of a complex operated by the Ontario Shores Centre for Mental Health Sciences.

The geotechnical investigation was required to develop a preliminary understanding of opportunities and constraints on the subject property in preparation for future development. The information gathered in this investigation will be used to assess the types of development and will be used as a supporting document for revitalization of the area.

- The purpose of this preliminary geotechnical investigation was to understand the subsurface soil and groundwater conditions at the study area, and to provide professional opinions, comments and recommendations to Infrastructure Ontario for the design and construction of structures. The scope of work of the conducted geotechnical investigation included completion of the following: Advancing eleven (11) geotechnical boreholes to 4.4 to 13.9 m below ground surface (mBGS) including one borehole to 30 mBGS or auger refusal on bedrock to delineate the subsurface ground stratigraphy and geotechnical properties and to define soil, bedrock and groundwater conditions,
- Installation of shallow monitoring wells in six (6) of the drilled boreholes and three (3) additional deeper monitoring wells were installed adjacent to three shallow wells for hydrogeological monitoring purposes.
- Carrying out laboratory soil testing and analysis of select samples for soil classification and to evaluate ground geotechnical properties as well as to assess soil corrosivity on construction materials,
- Preparation of a geotechnical engineering report providing professional opinions, comments and recommendations regarding the design and construction of building foundations, floor slab, site servicing and pavements, along with
- Assessment of the anticipated construction conditions pertaining to excavation, temporary shoring, backfilling, and groundwater control during construction.

The work of the geotechnical investigation was carried out in accordance to GHD work plan and cost estimate dated May 19, 2016 and subsequent IO comments provided on September 14, 2016.

This report summarizes the activities and findings of the performed geotechnical investigation and contains the findings of the investigation, together with our recommendations and comments. These recommendations and comments are based on factual information and are intended only for use of Infrastructure Ontario design engineers and their affiliates.

The anticipated construction conditions pertaining to excavation, temporary groundwater control, and backfilling are discussed also in this report, but only with regard to how these might influence the design. Construction methods described in this report must not be considered as specifications or recommendations to the contractors or as the only suitable methods. The data and their interpretation presented in this report may not be sufficient to assess all of the factors that may have an effect upon the construction. Prospective contractors, therefore, should evaluate the factual information, obtain additional subsurface data as they might deem necessary and select their construction methods, sequencing and equipment based on their own experience on similar projects.

On-going liaison with GHD during the final design and construction phase of the project is recommended to ensure that the comments and recommendations provided in this report are applicable and/or correctly interpreted and implemented.

The attached 'Limitations of the Investigation' is an integral part of this report.

2. Method of Investigation

The field investigation protocols and methodologies are presented below:

2.1 Safety Planning

Upon project initiation, a Site-specific Health and Safety Plan (HASP) was prepared for implementation during the field investigation program. The HASP presents the visually observed Site conditions to identify potential physical hazards to field personnel. Required personal protective equipment was also listed in the HASP. It is mandatory for all GHD personnel involved in the field program, to read the HASP and have a copy of the HASP available at the Site during the investigative work. Health and Safety requirements in the HASP were implemented during the field investigation program.

2.2 Borehole Location Clearance

Prior to initiating the subsurface investigation activities, all applicable utility companies (gas, hydro, network cables, water, waste water, etc.) were contacted through Ontario One-Call, to demarcate the location of their respective underground utilities and to ensure that the service lines will not be damaged during the investigative works.

In addition, GHD carried out a precondition survey to document the current condition of the ground surface at and in the vicinity of the boreholes and also along the proposed travel pathway of the drilling equipment in order to establish a baseline condition prior to the fieldwork. The precondition survey consisted of a visual, walk-through inspection of the Site and documentation using photographs. The re-inspection of the Site conditions and all required remedial work was carried out after all fieldwork was complete.

2.3 Field Investigation

The fieldwork program associated with the present geotechnical investigation was conducted at the Site during the period of July 18 and August 12, 2016 and consisted of advancing a total of fourteen (14) exploratory geotechnical boreholes. The boreholes were advanced to depths ranging between 4.4 and 13.9 mBGS. It is noted that BH08-16 was intended to be advanced to a depth of 30 mBGS, however, due to auger refusal the borehole was terminated at 13.9 mBGS. In addition, a monitoring well consisting of a 50 mm O.D. diameter was installed in six (6) of the drilled boreholes at depths ranging between 4.3 and 4.9 m below ground surface (mBGS). The boreholes and monitoring wells have been denoted as MW01-16, BH02-16, MW03-16, BH04-16, MW05-16, BH06-16 to BH09-16, MW10-16, BH11-16, MW12-16, BH13-16 and MW14-16. In three (3) locations, deeper monitoring wells were installed in boreholes advanced adjacent to the shallow monitoring wells. These wells are identified by the designation of D (Deep) or S (Shallow) in the well identification number. The locations of the drilled boreholes and monitoring wells are shown on Figure 2.

The drilling work was carried out utilizing a track mounted power auger drilling rig (Diedrich D-53) supplied and operated by Walker Drilling Limited (Walker), the GHD specialist drilling sub-contractor, under the full-time supervision of a GHD experienced technical representative. The borehole locations were established by GHD and all drilling operations and fieldwork were completed in the presence of a GHD representative. The boreholes were advanced using 228 mm O.D. hollow stem augers and soil samples were collected every 0.75 metres to 4 mBGS, and every 1.5 meters interval thereafter to the termination depth of drilling.

The GHD supervisor logged the borings and examined the samples as they were obtained. All sampling was conducted using a 50 mm outside diameter split spoon sampler in accordance with the specifications of the Standard Penetration Test Method (ASTM D1586). In addition, at each borehole location the compactness condition[1] or consistency of the subsurface soil layers were assessed using the Standard Penetration Test (SPT) method, by recording the number of blows ('N' values/penetration numbers) required to drive a conventional split barrel soil sampler, 0.3 m into the material.

The recovered samples were sealed in clean, airtight containers and transferred to the GHD Mississauga laboratory, where they were reviewed by a senior geotechnical engineer to confirm their classification and assignment of select samples for geotechnical laboratory testing. The detailed description of the individual soil units and groundwater conditions and ground stratigraphy as encountered at the borehole locations are recorded on the accompanying borehole logs presented in Appendix A.

Groundwater level observations and measurements were made in the boreholes as drilling proceeded and upon completion of drilling. In order to measure the more stabilized ground water table in the area, a 50 mm O.D. diameter monitoring well (schedule 40 PVC screen and riser pipe) were installed in MW1-16, MW3-16, MW5-16, MW10-16, MW12-16 and MW14-16. Three (3) of the monitoring wells (MW5-16, MW10-16, and MW12-16) consisted of two wells installed at different horizons for hydrogeological monitoring purposes to further investigate whether at these locations

[1] *as indicated in the Canadian Foundation Engineering Manual (CFEM)*

artesian conditions are present at depth. These monitoring wells have been identified by the addition of letters D or S in the well identification. The screen length used for the monitoring wells was 3 metres and silica sand pack was placed at the tip of the monitoring well and extended at least 0.6 m above the screen. The wells were backfilled using sand around and beyond the screen interval and bentonite to the ground surface. Details of monitoring well construction are presented on the attached borehole logs (Appendix A).

All of the drilled boreholes that did not contain a monitoring well were backfilled using cement additive to prevent settlement at the borehole locations. The boreholes were grouted from bottom upward upon completion and sealed with a cement-bentonite grout in accordance with Ontario Regulation 903. A cement-bentonite-water composition of 1:1:4 was used to prepare the boreholes backfilling grout. Excess soil cuttings were collected and temporarily stored in drums and preserved on Site for off-Site disposal at a later date.

The UTM coordinates of the ground surface at each borehole or monitoring well location (northing, easting and elevation) were surveyed by GHD experienced survey team, using UTM NAD 83 coordinate system with geodetic elevations and a Town of Whitby geodetic benchmark[2]. It is noted that the study area was essentially flat with a maximum grade difference of approximately 2.2 m at the drilled borehole locations. The table below presents the UTM coordinates of the borehole and monitoring well locations.

Table 2.3 Drilled Boreholes Depth and Ground Surface Coordinates

BH ID.	Depth (m)	Northing	Easting	Geodetic Elevation (m)
MW01-16	12.25	4857313.49	665416.10	81.62
BH02-16	12.33	4857325.54	665455.38	80.16
MW03-16	4.35	4857335.63	665495.84	79.24
BH04-16	12.33	4857269.36	665426.34	81.85
MW05D-16	12.23	4857281.61	665468.67	81.00
MW05S-16	4.97	4857281.78	665470.31	81.00
BH06-16	12.28	4857298.38	665512.58	79.31
BH07-16	12.75	4857228.46	665525.14	80.29
BH08-16	13.14	4857219.75	665479.43	81.00
BH09-16	12.63	4857212.28	665435.88	81.94
MW10D-16	12.72	4857157.24	665451.18	81.98
MW10S-16	7.62	4857155.17	665448.72	82.00
BH11-16	12.33	4857167.92	665491.59	81.61
MW12D-16	12.63	4857177.72	665533.66	80.73

[2] Benchmark (Township of Whitby, Station 0011967U010, Orthometric Elevation 77.221 m, located on Brock Street Bridge over small creek,1.0 km south of C.N.RY., 2.9 km south of Post Office, Tablet in top of concrete curb on west side of Road, 61 cm from south end of Bridge, 61 cm from east edge of curb, 30 cm above road level) was used as a reference point for surveying purposes.

Table 2.3 Drilled Boreholes Depth and Ground Surface Coordinates

BH ID.	Depth (m)	Northing	Easting	Geodetic Elevation (m)
MW12S-16	4.85	4857177.03	665535.31	80.66
BH13-16	11.87	4857114.18	665462.75	82.27
MW14-16	12.46	4857126.61	665503.17	81.57

It is noted that the elevation of the ground surface at the borehole locations are considered accurate to within 25 mm.

2.4 Geotechnical Laboratory Testing

Prior to the geotechnical laboratory testing program, the soil samples were subjected to tactile examination by an experienced GHD geotechnical engineer who confirmed the field descriptions and selected representative samples for detailed testing.

Geotechnical laboratory testing has been carried out on select soil samples. This testing included moisture content determination on all recovered samples, eighteen (18) grain size analysis on select representative samples, and twelve (12) Atterberg limits tests on the same samples selected for grain size. Soil classifications had been conducted in accordance to the Unified Soil Classification System. Additionally, six (6) unit weight tests have been conducted on select, relatively intact samples. The soil testing program conformed to the latest edition of the following standards:

ASTM D6913 —Standard Test Method for Particle Size Distribution (Gradation) of Soils using Sieve Analysis
ASTM D 422 — Standard Test Method for Particle Size Analysis of Soils‖ (Hydrometer Analysis)
ASTM D4318 —Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils‖
ASTM D 7263—Unit Weight of Soil Specimens
ASTM D2487 —Standard Practice for Classification of Soils for engineering purposes (Unified Soil Classification System)

The results of water content tests on the extracted soil samples are reported in the log of the drilled boreholes presented in Appendix A. The results of the grain size analysis and Atterberg Limits tests as well as soil unit weight tests are discussed in more detail in Section 3.0 and the associated gradation curves and plasticity charts are presented in Appendix B. The Unified Soil Classification System (USCS) was used for soil description and classification.

3. Subsurface Conditions

3.1 Stratigraphy

The subsurface conditions encountered at the Site during the current geotechnical investigation are summarized below and are also presented on the accompanying borehole logs (Appendix A). It is noted that the subsurface conditions are confirmed at the borehole locations only, and may vary at other locations. The general stratigraphy at the Site consists of topsoil and surficial fill or disturbed

native soil underlain by native silty clay to sand and gravel deposits. A brief description of each soil stratum is presented below.

3.2 Ground Cover

All of the drilled boreholes and monitoring wells were located in a grass covered area and encountered a surficial layer of topsoil, with the exception of MW05-16 and BH11-16, where clayey silt and sandy silt earth fill soils were encountered. The topsoil generally consisted of soils similar to the underlying fill soil, and comprised of silty clay to silty sand, with rootlets and organic matter. The thickness of the topsoil layer ranged between 75 and 300 mm at the borehole locations. Classification of this material was based solely on visual observation, tactile examination and texture evidence. It is noted that the thickness of topsoil can vary between and beyond the borehole locations.

3.3 Earth Fill

Earth fill was encountered below the surficial topsoil (where present) or at the ground surface in all of the drilled boreholes. The fill materials extended to depths varying from approximately 0.8 to 2.3 mBGS. The fill composition is in general heterogeneous, consisting of silty clay to silty sand. Rootles, topsoil inclusions and cobble fragments were occasionally observed within the fill samples.

SPT ‘N’ values within the earth fill layer varied between 6 and 32 blows per 0.3 m of penetration indicating a variable degree of compaction for the fill materials, ranging from firm to hard consistencies or compact relative densities. The moisture content of the fill samples extracted from the borings varied between 4 and 33 percent by weight, indicating a damp to very moist condition. The higher moisture content values within the fill samples are likely due to the presence of elevated clay content or presence of organics within the extracted samples.

It was noted that at some test-locations, due to the sandy nature of the fill and underlying native deposit, the extent of fill had been estimated based on the soil samples extracted. The thickness and quality of the fill can vary between and beyond the borehole locations.

3.4 Native Sandy Silt to Sand Till

The predominant type of native deposits all boreholes advanced at the Site except BH06-16 consisted of sandy silt to sand glacial till with trace to some clay and gravel that, extended to the termination depth of the boreholes. The deposits are generally brown to grey in colour.

SPT ‘N’ values within the native granular stratum varied between 19 blows per 0.3 m of penetration and greater than 50 blows per 75 mm of penetration(refusal), indicating a compact to very dense, condition of the deposit. The relatively lower penetration numbers were related to the near-the-surface soils and soil relative density generally improved with depth.

Water content measurements obtained from extracted samples varied generally between 2 and 19 percent by weight, indicating damp to moist and wet condition. The relatively higher moisture content values are generally associated with the higher percentage of fine-grained soil inclusions and localized wet conditions.

3.5 Silty Clay to Clayey Silt Till

Silty Clay to Clayey Silt glacial till soils with some sand to sandy and trace to some gravel were encountered in BH02-16, BH04-14, BH05D-16, BH09-16, BH10-16, BH11-16, MW12D-16, and BH13-16 below the Sandy Silt to Sand Till layer at a depth of 2.3 to 9.6 mBGS, and extended to a depth of 8.2 to 13.0 mBGS embedded within the coarse-grained silty sand to sand soil, and locally above or below the granular deposits. The Silty Clay to Clayey Silt glacial till was also encountered immediately beneath the earth fill layer in BH06-16 and extended to a depth of 12.2 mBGS.

All of the Penetration numbers (SPT 'N' values) within the native fine-grained clayey soils were in excess of 30 blows per 150 mm of penetration (refusal), indicating a hard consistency of the deposits.

Water content measurements obtained from the extracted samples of the clayey soils varied generally between 3 and 21 percent by weight, indicating damp to moist condition. The relatively higher moisture content values are generally associated with the higher percentage of fine-grained soil inclusions and localized wet conditions.

3.6 Gravelly Clay

A deposit of gravelly clay with some sand and trace to some silt was encountered in MW10D-16, underlying the sandy silt till at 11.4 mBGS and extended to the termination depth of the monitoring well (12.7 m). A SPT 'N' value of 83 was recorded within the deposit indicating its hard consistency.

The borehole terminated within the clayey deposit due to refusal to augering and sampling. This deposit could be a transition between the overburden and the underlying bedrock.

3.7 Sand and Gravel

Sand and gravel with some silt and trace clay was encountered in BH13-16 at 6.4 mBGS and extended to the underlying bedrock at 10.1 m. The SPT'N' values recorded within the deposit was in excess of 50 blows for 125 mm advance of the probe, indicating a very dense relative density of the material.

A gradation analysis conducted on a select sample of the soil unit indicated that it contained 40 percent gravel, 43 percent sand, 14 percent silt and 3 percent clay content.

The measured moisture content of two obtained samples of the above noted soil unit was 7 percent related to its moist/wet condition.

3.8 Bedrock

Shale bedrock was encountered/inferred in all of the investigated locations (with the exception of MW05S-16, BH07-16, MW10D-16, MW10S-16, BH11-16, MW12D-16 and MW12S-16) at depths ranging between 4.3 and 13.1 (Elevations 67.0 to 75.0 m).

Rock coring was conducted in BH08-16 for a short length (0.7 m) to confirm the presence of bedrock. The bedrock in the area consists of bluish and grey shale with interbeds of limestone, siltstone and dolostone of Georgian Bay formation. Based on our experiences, the upper portions

of the bedrock is commonly weathered for a depth of 600 to 1000 mm and within this weathered zone hard limestone layers or lenses are common.

3.9 Geotechnical Laboratory Test Results

Prior to the geotechnical laboratory testing, the soil samples have been subject to tactile examination by an experienced GHD geotechnical engineer who confirmed the field descriptions and selected representative samples for detailed testing.

3.9.1 Gradation Analysis

Grain size analyses consisting of sieve and hydrometer testing were carried out on eighteen (18) select samples extracted from the drilled boreholes, at depths varying between 1.7 and 12.6 mBGS. The results of these tests are summarized in the following table and the grain size distribution test results are presented in Appendix B.

Table 3.9.1 Results of Grain Size Analysis

Borehole Identification Number	Sample Number	Depth m	Gravel %	Sand %	Silt %	Clay * %	Fines Silt & Clay %
MW01-16	SS3	1.7-2.0	2	52	37	9	46
BH02-16	SS6	4.7-5.0	0	2	56	42	98
MW03-16	SS3	1.7-2.0	2	51	35	12	47
MW03-16	SS5B	3.2-3.5	3	88	NA	NA	9
BH04-16	SS4	2.4-2.7	11	38	43	8	51
BH05-16	SS5	3.2-3.5	1	55	34	10	44
BH06-16	SS5	3.2-3.5	3	44	41	12	53
BH07-16	SS5A	3.2-3.3	8	59	27	6	33
BH07-16	SS5B	3.3-3.4	1	59	33	7	40
BH08-16	SS6	4.7-5.0	14	57	23	6	29
BH09-16	SS3	1.7-2.0	7	50	30	13	43
BH09-16	SS6	4.7-5.0	3	46	38	13	51
BH09-16	SS9	9.3-9.6	0	47	42	11	53
BH11-16	SS5	3.2-3.5	4	53	31	12	43
MW12D-16	SS5	12.3-12.6	2	24	55	19	74
BH13-16	SS5	3.0-3.2	10	44	35	11	46
BH13-16	SS6	4.6-4.8	2	53	32	13	45
BH13-16	SS8	7.0-7.3	40	43	14	3	17

** Soil particles <2μ*

The results of the grain size analysis tests are also reported on the respective borehole logs.

3.9.2 Atterberg Limits Tests

Atterberg limits tests have been conducted on twelve (12) select samples extracted from the drilled boreholes. These samples were selected at depths ranging between 1.7 and 12.6 mBGS. The plasticity charts related to the conducted Atterberg Limits Tests are provided in Appendix B. A summary of the obtained results is presented in the following table.

Table 3.9.2 Results of Atterberg Limits Tests on Fine-Grained Soils

Borehole No.	Sample No.	Sample Depth	Liquid Limit	Plastic Limit	Plasticity Index	Water Content	Soil Classification
BH02-16	SS6	4.7-5.0	31	15	16	15	Silty Clay
MW03-16	SS3	1.7-2.0	17	11	6	6	Silty Sand
BH04-16	SS4	2.4-2.7	Non-Plastic (np)			3	Silty Sand/ Sandy Silt
BH05-16	SS5	3.2-3.5	16	10	6	5	Silty Sand
BH06-16	SS5	3.2-3.5	17	11	6	8	Silty Clay/ Clayey Silt
BH07-16	SS5A	3.2-3.3	Non-Plastic (np)			6	Silty Sand
BH07-16	SS5B	3.3-3.4	Non-Plastic (np)				Silty Sand
BH08-16	SS6	4.7-5.0	Non-Plastic (np			2	Silty Sand
BH09-16	SS3	1.7-2.0	18	11	7	6	Silty Sand
BH09-16	SS6	4.7-5.0	13	10	3	15	Clayey Silt/ Silt
BH11-16	SS5	3.2-3.5	16	10	6	NA	Silty Sand
MW12D-16	SS5	12.3-12.6	19	11	8	14	Silty Clay
BH13-16	SS6	4.6-4.8	16	10	6	6	Silty Sand

NA: Not Available

3.9.3 Soil Unit Weight Tests

Six (6) soil unit weight tests have been conducted on select relatively undisturbed soil samples the materials extracted from Borehole BH06-16 at depths ranging between 0.9 and 11.1 mBGS. The tabulated results are provided in Appendix B.

It was noted that the bulk unit weight of the tested soil samples ranged between 21.7 and 26.1 kN/m^3, with an average value of 23.4 KN/m^3.

3.10 Groundwater Conditions

As part of the investigation, groundwater observations were made in each of the boreholes as they were drilled and upon completion of drilling. The observed conditions are reflected in the logs of the drilled boreholes presented in Appendix A.

In order to obtain groundwater levels in a more stabilized condition, monitoring wells have been installed at the location of MW01-16, MW03-16, MW05-16, MW10-16, MW12-16 and MW14-16. In addition, three (3) of the monitoring wells (MW05-16, MW10-16, and MW12-16) consisted of

consisted of wells installed at two different elevations in two separate boreholes drilled adjacent to each other to determine whether artesian condition at depth is present at these locations. These monitoring wells have been identified by the addition of letters D (Deep) or S (Shallow) in the well identification. The boreholes for installation of the monitoring wells were advanced using hollow stem augers to the final depth. The screened sections of the monitoring wells were installed below the assessed local ground water table to investigate fluctuations of the near-the-surface water table.

The wells were constructed with 50 mm (O.D.) Schedule 40 PVC screen and casing. The well screens were 1.5 m or 3.0 m long and pre-slotted (No. 10 slot). The screen was surrounded with sand that was placed around the screen and was extended generally to 0.6 m above the top of the screen. The monitoring wells were sealed with bentonite that extended from the top of the filter sand.

The GHD field personnel returned to the site on August 16, 2016 several days following installation to measure water levels in the installed piezometers/monitoring wells. The ground water level measurements are presented on the attached borehole logs (Appendix A) and a summary of the information on the installed monitoring wells and ground water level measurements is provided in the following table.

Table 3.6 Summary of Groundwater Levels

Borehole No.	Installation Date 2016	Ground Surface Elevation (m)	Depth of the Well (m)	Water Level Readings mBGS[1] / mAMSL[2]	
				Upon Completion	August 16, 2016
MW01-16	July 18	81.62	4.70/76.92	4.65/76.97	3.62/78.00
MW03-16	July 18	79.24	4.3574.69	4.11/75.13	3.16/76.08
MW05D-16	August 4	81.00	12.20/68.80	Dry	2.64/78.36
MW05S-16	August 4	81.00	4.57/76.43	Dry	3.45/77.55
MW10D-16	August 12	81.98	11.59/70.39	Dry	4.12/77.86
MW10S-16	August 12	81.98	5.69/76.29	Dry	5.84/76.14
MW12D-16	July 25	80.73	10.21/70.52	Dry	3.25/77.48
MW12S-16	July 22	80.66	4.63/76.03	4.11/76.55	3.38/77.28
MW14-16	August 12	81.57	10.67/70.90	4.52/77.05	3.90/77.67

Notes:
1- Metres Below Ground Surface
2- Metres Above Mean Sea Level

The measured depth of the groundwater levels within these wells ranged between 2.6 and 5.84 mBGS (Elev. 76.1 and 78.4 m) indicating relatively shallow groundwater table at this Site.

A slight artesian condition (water head difference) of 0.8 m and 1.7 m was recorded in the deep and shallow monitoring wells installed in MW05-16 and MW10-16 respectively. The water level in MW12D-16 and MW12S16 were similar (no grade difference), indicating no artesian condition at this location.

It is recommended that a more thorough investigation of the groundwater table be carried out during the detail design phase to study the fluctuations of the groundwater level at the Site.

It is noted that the ground water table in the area could be subject to seasonal fluctuation and could rise in response to major weather events.

4. Engineering Discussion and Assessment

4.1 General

The Site has an approximate area of 3.5 hectares and is currently occupied by a number of existing buildings, driveways, parking areas, and landscaped areas that are part of a complex operated by the Ontario Shores Centre for Mental Health Sciences.

The conducted geotechnical investigation was required to develop a preliminary understanding of opportunities and constraints on the subject property in preparation for future development. The information gathered in this investigation will be used to assess the types of development and will be used as a supporting document for revitalization of the area.

The native undisturbed soils at this site are in general competent to support conventional spread/strip footings to support the structural loads. Based on the findings obtained at the borehole locations, the native subgrade soils below any surficial fill consist in general of compact to very dense sandy soils or hard clayey deposits. Conventional footings or relatively short augered piers placed on the undisturbed native soils may be used for supporting the structural footings and loads.

Additional investigations may be required during the detailed design phase of the project when the layout and ultimate configuration and loading of the proposed structure/s are confirmed.

The following sections provide our engineering comments and recommendations on the above topics as well as other geotechnical related design and construction issues.

4.2 Site Preparation and Grading

Based on the subsurface conditions encountered in the drilled boreholes, the Site is generally underlain by fill materials extending to depths ranging between 0.8 to 2.3 mBGS, overlying native coarse-grained sandy/gravelly materials or fine-grained till soils. The existing fill materials across the Site were found to be slightly variable in relative density or consistency.

A floor slab of a building can be constructed on the existing fill provided the upper portion of the layer is removed as described in Section 4.4. In proposed pavement areas, it is recommended to remove only the surficial vegetative cover containing rootlets, organic matters and any earth fill materials found to contain significant amounts of organics prior to site grading activities

The subgrade soils exposed after the removal of the surficial topsoil and fill materials as described above should be visually inspected, compacted, and proof rolled using large axially loaded vibratory equipment. Any soft, organic, or unacceptable areas should be subexcavated, removed as directed by the Geotechnical Engineer and replaced with suitable clean earth fill materials placed in thin layers (150 mm thick or less) and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD).

The earth fill materials found to contain significant amounts of deleterious materials or organics should be removed from the Site and should not be used as backfill. Also, care will be required during excavation to separate any fill materials that appear to contain significant organics from the clean earth fill.

The earth fill at the Site that is free of topsoil and deleterious material, and the native soils encountered at the Site, are generally suitable for reuse as backfill to raise site grades where required or can be used to backfill against foundation walls or as trench backfill during installation of buried services, provided the materials are free of deleterious and organic material, and is within the optimum moisture content. The sandy soils in general appear to exhibit moisture contents which are considered to be near or slightly below the laboratory optimum for compactable soil. Some of the samples obtained below the anticipated groundwater table appear to exhibit moisture contents which are considered to be above the laboratory optimum for compactable soil, and drying of these soils may be required during construction. If such native soils are to be reused as a structural fill, it should be anticipated that reworking of the soils through slight drying the wet soil will be necessary to facilitate compaction. Control of moisture content during placement and compaction will be essential for maintaining adequate compaction.

4.3 Foundations

The common practice for the SLS design of most structure and building foundations is to limit the foundation total and differential settlements to the above noted values. However, other serviceability criteria for the buildings may be determined by the structural engineer considering tolerable settlement values that would not restrict the use or operation of the proposed structure.

4.3.1 Conventional Spread/Strip Footings

Conventional spread or strip footings must extend below any existing fill and be placed on the undisturbed compact to very dense native granular soil or hard clayey soils. Footings can be designed for a factored geotechnical resistance at Ultimate Limit State (ULS) of 450 kPa, and a geotechnical reaction at Serviceability Limit State (SLS) of 300 kPa. The minimum depths at which these bearing pressures are available at the borehole locations are shown in the table below, subject to a detailed design geotechnical investigation and on Site verification during construction.

Table 4.3.1 Depths of Footings on Native Soils (mBGS)

Borehole Number	Minimum Founding Depth Below Existing Grade/Elevation (m) Factored geotechnical resistance at ULS = 450 kPa; Geotechnical reaction at SLS = 300 kPa
MW01-16	0.8/80.8
BH02-16	0.8/79.4
MW03-16	1.5/77.7
BH04-16	1.5/80.3
MW05D-16	0.8/80.2
MW05S-16	0.8/80.2
BH06-16	0.8/78.5
BH07-16	0.8/79.5

Table 4.3.1 Depths of Footings on Native Soils (mBGS)

Borehole Number	Minimum Founding Depth Below Existing Grade/Elevation (m) Factored geotechnical resistance at ULS = 450 kPa; Geotechnical reaction at SLS = 300 kPa
BH08-16	0.8/80.2
BH09-16	1.5/80.4
MW10D-16	1.5/80.5
MW10S-16	1.5/80.5
BH11-16	0.8/80.8
MW12D-16	0.8/80.0
MW12S-16	0.8/80.0
BH13-16	2.3/80.0
MW14-16	1.5/80.0

Higher bearing capacities could be available at the same or deeper depths if required, pending further investigation.

The total and differential settlements are expected not to exceed 25 mm and 19 mm respectively for footings designed and constructed in accordance with the above noted criteria. These values are usually within tolerable limits for most types of structures.

Adjacent footings at different elevations should be stepped at a slope not steeper than ten (10) Horizontal to seven (7) Vertical. As well, footings close to underground services should be set back from services. It is also recommended that the lowest footing be constructed first in order to avoid undermining the footings at higher elevations.

The building perimeter foundations and those foundations within unheated areas should be protected from frost effects by at least 1.2 m of earth cover according to OPSD 3090.101 or equivalent insulation.

The minimum footing dimensions and other footing requirements should be designed in accordance to the latest edition of the Ontario Building Code (OBC) and recommendations provided in the latest edition of Canadian Foundation Engineering Manual (CFEM).

It is recommended that once the details of the loadings and foundation sizes are determined, adetailed design geotechnical investigation is conducted and a refined settlement analysis is carried out for verification.

4.3.1 Foundations on Engineered Fill

To avoid stepping down the footings in the areas where underlying the footings the competent subgrade surface is present at different elevations, or where footing/Site grade raise requires, consideration can be given to placing conventional footings on engineered fill. In such condition, a maximum net allowable bearing pressure of up to 150 kPa for SLS design and 225 kPa for a factored ULS design can be used for foundations placed on engineered fill.

Prior to placing engineered fill it will be necessary to remove all surficial fill in the footing areas to the top of the native soil stratum and exposed subgrade surfaces should be inspected, approved by

the Geotechnical Engineer, and proof rolled to confirm the presence of competent native soils. The engineered fill should be placed in 150 mm thick layers and compacted to 100 percent SPMDD.

4.4 Slab-On-Grade

The slab-on-grade of a building can be constructed using a standard slab-on-grade technique, provided that the prepared subgrade consists of well compacted fill or native soils. Depending on the final site grading levels selected for a slab, the subgrade for the slab construction will likely consist of existing earth fill, engineered fill materials placed as part of the site grading operations, or native soils.

Due to the relative density and nature of the existing fill across the Site it is possible to leave some of the existing fill in place beneath a floor slab. It is recommended that the existing fill beneath the slab-on-grade or permanent slab be partially subexcavated to remove half of the existing fill layer thickness, or up to 0.9 m below grade, whichever is less, and the exposed surface should be inspected and heavily proof rolled. Any area observed to be soft/loose should be subexcavated further and replaced with engineered fill in accordance with Section 4.2. The grade should be then raised with an acceptable engineered fill placed in shallow lifts (not more than 200 mm thickness) and carefully compacted to not less than 98% of the material's Standard Proctor Maximum Dry Density (SPMDD). Alternatively, consideration can be given to using a structural slab that is supported by the building foundation. A qualified geotechnical engineer should review the condition of the subgrade beneath the slab-on-grade.

A minimum of 200 mm thick layer of 20 mm crushed stone should be placed between the prepared subgrade and the floor slab to act as moisture barrier. For the structural design of the concrete slab-on-grade, a combined modulus of subgrade/granular base reaction coefficient (k) of 60 MPa/m can be used.

If one level or two levels of basement are considered for a building, due to the relatively elevated groundwater level in the area and the depth of installation of the basement floor slab, and if the design is in favor of a drained basement mechanism, installation of perimeter drainage and underfloor basement drainage system will be required. The following presents the geotechnical comments and recommendations on these installations.

4.4.1 Perimeter Drainage

A permanent perimeter wall drainage system will need to be installed at the foundation level for building/s basement walls to collect and direct groundwater. The perimeter drainage system should consist of Terrafix Terradrain™ 200, Mirafi Miradrain™ 5000, and/or similar products. As an alternative, a 100 mm diameter flexible weeping tile could be placed adjacent to the base of the footing around the exterior perimeter of the basement foundation wall. The pipe should be fully enveloped in 19 mm clear stone (OPSS 1010), which in turn is fully wrapped in a non-woven geotextile such as Terrafix 270R or equal. The perimeter drainage system should be provided with a collector pipe at the base of the foundation wall that drains to a sump pit and discharges to a positive frost-free outlet. The discharge pipe should not be connected to other discharge piping, such as roof leads or other sumps.

4.4.2 Subfloor Drainage

Due to the potential for high water table at the Site, asubfloor drainage system should be installed beneath the floor slab. The subfloor drainage system should consist of a 300 mm layer of 19 mm clear stone, separated from the underlying soils by filter fabric (Terrafix 270R, or equivalent) with 100 mm diameter perforated pipes placed a maximum of 5 m apart discharging to appropriate sump structures for a positive outlet. As an alternative, the subfloor drains could consist of 100 mm diameter perforated flexible weepers installed within trenches cut 300 mm below the top of subgrade and infilled with 19 mm clear stone (OPSS 1010). The clear stone should be fully enveloped with a non-woven geotextile such as Terrafix 270R or equal. Subdrains should discharge to a positive frost-free outlet such as a sump. The discharge pipe should not be connected to other discharge piping, such as roof leads or other sumps.

Underneath the slab, the subfloor drainage blanket (capillary break blanket) could be made up of a 200 mm thick base course layer consisting of 19 mm size clear stone (OPSS Granular ‘A’), placed to improve the support for the floor slab. The basement floor base course should be nominally compacted with vibratory equipment to a uniform high density. Below the clear stone, a non-woven geotextile filter fabric having a F.O.S. of 80 microns should be placed as a separator between the subgrade and the clear stone. This filter fabric should be overlapped with the filter fabric used as a separator for the perimeter drainage system.

The roof runoff should be collected and directed through solid pipes away from the building and to a positive outlet and the surfaces surrounding the structure should be graded to direct water away from the Building. The discharge pipe should not be connected to other discharge piping, such as roof leads or other sumps.

The floor slabs of the below grade structures such as basements, if below the groundwater level, should be designed for hydraulic uplift and provided with water proofing measures. Additional recommendations for subfloor drainage and waterproofing measures can be provided in the detailed design geotechnical investigation, following a review of proposed building/s or structure/s plans.

Where the groundwater level is in excess of 2 m below the underside of the floor slab, an effective drainage system is in place in the study area and, the exterior grade is at least 200 mm below the underside of the slab, then a subfloor drainage system will not be required.

4.5 Seismic Site Classification

The 2012 Ontario Building Code (OBC2012) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the 2012 OBC, the Seismic Site Class is a function of soil profile, and is based on the average properties of the subsurface strata to a depth of 30 m below the ground surface. The 2012 OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

- Average shear wave velocity
- Average Standard Penetration Test (SPT) values (uncorrected for overburden)

- Average undrained shear strength

Based on the results of the conducted geotechnical investigation and considering the maximum depth of investigation, the Site can be classified as Class 'C' (Very Dense Soil and Soft Rock) for seismic load calculations subjected to code requirements. The corresponding acceleration-based Site coefficient (F_a) and velocity-based Site coefficient (F_v) can be obtained from Table 4.1.8.4.B and Table 4.1.8.4.C, accordingly, of the NBC-2010. Based on the information obtained from the field investigation at the Site there is no evidence of existence of soil types that satisfy the conditions of Site Class "E" type soils (NBCC 2010 -Table 4.1.8.4.A) within the investigated depth of overburden.

4.6 Depth of Frost Penetration

A permanent soil cover of 1.2 m or its thermal equivalent synthetic insulation is required for frost protection of foundations (foundations in unheated areas). All exterior footings, footings beneath unheated areas and foundations exposed to freezing temperatures should have at least such earth cover or equivalent synthetic insulation for frost protection. During winter construction exposed surfaces to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

4.7 Lateral Earth Pressures

Any retaining structures must be designed to resist lateral earth pressure. Structures subject to unbalanced earth pressures such as shoring systems and other similar structures must be designed to resist a pressure that can be calculated based on the following equation:

$P = K [\gamma(h-h_w) + \gamma' h_w + q] + \gamma_w.h_w$

where:

P = the horizontal pressure at depth, h (m)

K = the earth pressure coefficient,

γ = the bulk unit weight of soil, (kN/m^3)

γ' = the submerged unit weight of soil, (kN/m^3)

γ_w = the unit weight of water, (kN/m^3)

h_w = the depth below the groundwater level (m)

q = the complete surcharge loading (kPa)

Where elevated groundwater level is not anticipated to be present or that a perimeter drainage system is used to eliminate hydrostatic pressures on the soil retaining structure, the above noted expression will be simplified as follows:

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

Based on the subsurface conditions encountered at the Site, the following design parameters may be used for the design of the soil retaining structures:

Table 4.7 - Design Parameters for Active, At Rest, and Passive Earth Pressures

Soil	Dry Unit Weight γ (kN/m^3)	Angle of Internal Friction	Coefficient of Lateral Earth Pressure		
		ϕ	Coefficient of Active Earth Pressure K_a	Coefficient of at Rest Earth Pressure K_o	Coefficient of Passive Earth Pressure K_p
Earth Fill	19	28	0.4	0.5	2.7
Native Sand Soil	20	30	0.3	0.5	3.0
Granular “A”	21	38	0.3	0.4	4.2
Granular “B”	21	35	0.3	0.4	3.7

Note: *Values given for horizontal earth pressures are for horizontal backfill. For sloping backfill, the design requirements outlined in the Canadian Foundation Engineering Manual should be used.*

It is to be noted that large deformation will be required prior to the full mobilization of passive earth pressure and mobilization of full active or passive resistance requires a measurable and significant wall movement or rotation. Therefore, unless the structural element can tolerate these deflections, the at-rest earth pressure should be used in design.

5. Pavement Design

5.1 Subgrade Preparation

Earth fill consisting predominantly of silty clay to silty sand soils was encountered in all boreholes. The existing fill is considered suitable to support pavements for potential access roads and parking areas subject to proof-rolling, re-compaction, inspection and approval by qualified personnel. The finished subgrade must be free of all loose and deleterious materials. It is recommended that any subgrade surfaces comprising of existing fill be inspected for obvious soft/loose areas and presence of deleterious materials. Should such areas be found, GHD can provide appropriate advice for replacement of the material and addressing local weak areas at that time.

If new fill is required to raise the grade, selected on-site fill could be used, provided it is free of any deleterious material. The fill should be placed in large areas where it can be compacted by a heavy vibratory roller. Any fill placed to increase or level the grade must be compacted to a minimum 98 percent SPMDD in lifts not exceeding 200 mm. In-situ density testing to monitor the effectiveness of the compaction equipment in achieving the required densities is also recommended.

5.2 Recommended Pavement Structure

The following table summarizes the minimum pavement structures recommended for the design of the potential driveways and parking areas. The pavement designs include a Heavy Duty for access routes and a Standard Duty for car parking areas.

Table 5.2 Recommended Pavement Structure

Pavement Layer	Compaction Requirements	Light Duty Pavement Design	Heavy Duty Pavement Design
Surface Course Asphaltic Concrete HL3 (OPSS 1150)	91% to 96.5% Maximum Relative Density (OPSS 310)	40 mm	40 mm
Base Course Asphaltic Concrete HL8 (OPSS 1150)	92% to 97.5% Maximum Relative Density (OPSS 310)	50 mm	60 mm
Base Course: Granular 'A' or 19mm Crusher Run (OPSS1010)	100% Standard Proctor Maximum Dry Density	150 mm	150 mm
Sub-base Course: Granular B or 50mm Crusher Run (OPSS1010)	98% Standard Proctor Maximum Dry Density	250 mm	350 mm

If pavement construction occurs in wet inclement weather it may be necessary to provide additional subgrade support for construction traffic by increasing the thickness of the granular sub-base.

5.3 Drainage

Grading adjacent to pavement areas should be designed so that water is not allowed to pond adjacent to the outside edges of the pavement. Also, the road subgrade should be free of depressions and sloped (preferably at a minimum grade of two percent) to provide effective drainage toward the edge of road and toward catch basins.

6. Construction Consideration

6.1 Site Servicing

Underground service lines can be founded on either undisturbed native soils or a prepared fill subgrade. The suitability of the native soils to provide adequate support for buried services must be verified and confirmed on site by qualified geotechnical personnel experienced in such works.

It is recommended that prior to commencing the construction of the site servicing, consideration be given to the excavation of a series of trial excavations along the alignment of the proposed service lines to determine more accurately the soil behavior and whether or not any dewatering works will be required.

The bedding and sand cover materials for the pipes should be adequately compacted to provide support and protection. Provided the base of the service line is free of all loose and deleterious materials, the pipe bedding should comply with a Class B bedding configuration as per the requirements of OPSD 802.030 (rigid pipe) and/or OPSD 802.010 (flexible pipe). Where a loose deposit is present at the base of excavation or disturbance of the trench base has occurred, the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill. If the native soil at pipe founding level is too wet silty/clayey soil, clear stone may be used as bedding material, but must be wrapped with a suitable filter fabric.

If existing fill materials are found at the pipe invert level, the exposed subgrade should be visually inspected. Wet, soft/loose, highly organic or otherwise unsuitable fills should be sub-excavated and replaced with bedding materials or clean fills compacted to minimum of 95% SPMDD.

Trench spoils should not be placed closer than one metre, or half the trench depth, from the top of the trench sidewalls and the safety guidelines provided by OHSA (Section 6.2) should be strictly adhered to for the open excavations.

Backfilling of trenches can be accomplished by reusing the excavated soils or similar fill material or granular soil, provided the moisture content of the material is maintained within ±2 percent of optimum and the fill is free of topsoil, organics and any deleterious material. The fill placed in excavated trenches should be in loose lifts not exceeding 200 mm thick and compacted to not less than 95 percent of its Standard Proctor Maximum Dry Density (SPMDD). Alternatively, if the excavated soils are not suitable for backfilling, the service pipes can be backfilled using OPSS Granular “B” material or approved earth fill compacted to at least 95 % of its Standard Proctor Maximum Dry Density (SPMDD).

6.2 Excavation and Temporary Shoring

Excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. The OHSA regulations require that if workmen must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four broad soil types as summarized in the following table:

Table 6.2 – Maximum Site Slope Inclination for Excavations

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 metre of bottom	1 horizontal to 1 vertical
2	Within 1.2 metre of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

OHSA Section 226 defines the four soil types as follows:

Type 1 soil:

a) Hard, very dense, and only able to be penetrated with difficulty by a small sharp object
b) Has a low natural moisture content and a high degree of internal strength
c) Has no signs of water seepage; and
d) Can be excavated only by mechanical equipment

Type 2 soil:

a) Very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;
b) Has a low to medium natural moisture content and a medium degree of internal strength; and
c) Has a damp appearance after it is excavated

Type 3 soil:
a) Stiff to firm and compact to loose in consistency or is previously excavated soil;
b) Exhibits signs of surface cracking;
c) Exhibits signs of water seepage;
d) If it is dry, may run easily into a well-defined conical pile; and
e) Has a low degree of internal strength

Type 4 soil:
a) Soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;
b) Runs easily or flows, unless it is completely supported before excavating procedures;
c) Has almost no internal strength;
d) Wet or muddy; and
e) Exerts substantial fluid pressure on its supporting system (Ontario Regulation 213/91, s. 226-5)

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes.

The fill within the Site above the groundwater table can be classified as Type 3 soils. If affected by groundwater seepage, these soils must be considered as Type 4 soils. The compact granular soils identified at deeper depths must also be considered Type 3 soils above groundwater level and as Type 4 if affected by ground water. The hard or dense to very dense soil type native materials could be considered as Type 2 when not impacted by seepage. Below the local ground water table, these soils could be considered as type 3 or for regarding their behavior (to the discretion of the Site Geotechnical Engineer). The highest number soil type identified in an excavation must govern the excavation slopes from top to bottom of the excavation.

Unsupported excavations would be temporarily stable for short time periods at angles of 1.5H:1.0V in the existing fill material and cohesionless granular soils but will require erosion protection to minimize sloughing, riling and washout. If the above recommended excavation side slopes cannot be maintained due to lack of space or any other reason, the excavation sides must be supported by an engineered shoring system. The shoring system should be designed in accordance with the latest edition of Canadian Engineering Foundation Manual (CFEM) and the OHSA Regulations for Construction Projects.

The fill and native deposits, to be penetrated for foundation construction at this Site, could contain cobble and boulder sized particles. Excavations carried out using mechanical excavators and auger machines may be slow if significant amounts of cobbles and boulders are encountered. The risk and responsibility for these issues must be addressed in the contract documents for foundation and excavation contractors.

6.3 Temporary Ground Water Control

The measured depth of the groundwater table within wells installed at the Site ranged between 2.64 and 5.84 mBGS (Elev. 76.08 and 78.36 m) indicating a relatively shallow groundwater table at this

Site. A slight artesian condition (water head difference) of 0.8 m and 1.7 m was recorded in the MW05-15 and MW10-16 deep and shallow monitoring wells respectively. No grade difference was noted between the water level in MW12D-16 and MW12S16. Based on the water level information obtained at the Site, shallow foundation for a slab-on-grade structure (no basement) will likely not extend to depths deeper than the local ground water seepage. However, a building with one or two level of basement will likely encounter groundwater seepage. Due to the granular nature of the native soils, excavations carried out below the water table will encounter significant water seepage and unsupported excavations cannot safely proceed until such time the groundwater table is lowered to a minimum depth of 0.5 m below the base of the excavation has been achieved. Due to the generally granular nature of the native deposits, it is likely that seepage, if encountered, can be managed using filtered sumps. The water table should be lowered by pumping from sealed, closely spaced well points.

Surface run-off should be directed away from the open excavations. The design, equipment, installation, maintenance, and removal of water control methods during excavation and backfill operations should be the responsibility of the contractor. The contractor should assess the ambient ground water level at the Site and decide the method and technique of dewatering based on the soils information provided in this report. The contractor should be prepared to remove any groundwater or precipitation runoff from within the excavations. This should be possible in most instances by the strategic placement of sumps.

6.4 Backfilling

Backfilling of excavations can be accomplished by reusing the excavated inorganic soils or similar fill material provided the moisture content is maintained within two percent (2%) of optimum. Based on the results of laboratory testing, the granular fill and native soils encountered in the boreholes are generally suitable for re-use on the site. The sandy soils in general appear to exhibit moisture contents which are considered to be near or slightly below the laboratory optimum for compactable soil. Some of the samples obtained below the anticipated groundwater table appear to exhibit moisture contents which are considered to be above the laboratory optimum for compactable soil, and drying of these soils may be required during construction. If such native soils are to be reused as a structural fill, it should be anticipated that reworking of the soils through slight drying the wet soil will be necessary to facilitate compaction. Control of moisture content during placement and compaction will be essential for maintaining adequate compaction.

Backfill materials used for Site grading or backfilling in settlement sensitive areas should be placed in thin lifts not exceeding 200 mm and thoroughly compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). Boulders larger than 150 mm should be excluded from the backfilling material in the settlement sensitive areas such as beneath pavements and concrete slabs.

All excavations must be widened sufficiently to accommodate the appropriate compaction equipment. Provided the trenches are backfilled with materials similar to the adjacent subgrade soils then frost tapers will not be required.

6.5 Construction Monitoring

The foundation installations must be closely monitored and inspected by qualified personnel to ensure that the founding achieved is consistent with the design bearing intended by the design engineer. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code 2012.

The ground conditions will vary across the site depending on the final design grades and therefore, the preparation of the sub-grade and the compaction of all materials should be monitored at the time of construction to confirm material quality and thickness and to ensure adequate compaction.

All backfilling should be supervised to ensure that proper materials are employed and that adequate compaction is achieved. Strict quality control guidelines should be followed during the placement of fill materials.

Qualified Geotechnical personnel should inspect and test all stages of the development. Specifically, they should ensure that the materials and conditions comply with this geotechnical assessment report. In addition, qualified geotechnical personnel should provide material testing services prior to and during foundation preparation and construction. Should soil conditions be encountered that vary from those described in this report, our office should be informed immediately such that the proper measures are undertaken.

6.6 Soil Corrosivity Potential

Corrosivity testing was carried out on six (6) select samples extracted from the boreholes in accordance with ASTM and CSA Standards and the results were compared with CSA standards to determine the potential of sulphate attack on concrete and with the American Water Works Association (AWWA) C 105 to assess soil corrosivity potential on ductile iron pipes and fittings. Corrosivity testing as described by the American Water Works Association (AWWA) includes soil resistivity, pH, sulphide indication, redox potential, and moisture content. Points are assigned to the sample based on the results of the tests. A soil that has a total point score of 10 or more is considered to be potentially corrosive to ductile iron pipe. The potential for sulphate attack on concrete (class of exposure) is determined using Table 3 provided in CSA A23.1-04.

The selected soil samples were submitted to AGAT Laboratory (AGAT) for chemical analyses. AGAT has indicated that they can determine sulphide and chloride using a chromatograph, the pH using a pH meter, resistivity using an electrical conductivity test and redox using a redox potential electrode. These test procedures vary from AWWA and therefore some interpretation of the data was required in order to assess corrosion potential. AGAT has indicated that they can determine water-soluble sulphate content using analytical procedures in accordance with CSA Standard A23.2-3B. All samples were placed into laboratory-supplied containers, labelled and submitted under chain-of-custody protocol to AGAT. Analytical results received from the laboratory are provided in Appendix C.

6.6.1 Corrosivity on Construction Concrete

The potential for sulphate attack on construction concrete (class of exposure) is determined using Table 3 provided in CSA A23.1-09. Table 3 of the Canadian Standards Association (CSA) document A23.1 04/A23.2 09 'Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete' classifies the degree of exposure into the following three (3) classes:

Table 6.5.1 – Construction Concrete Degree (Class) of Exposure

Degree (Class) of Exposure	Water Soluble (SO4) in Soil Sample (%)
Very Severe (S-1)	> 2.0
Severe (S-2)	0.20 – 2.0
Moderate (S-3)	0.10 – 0.20

The aggressiveness of the soil on concrete in contact with the soils was evaluated by performing water-soluble sulphate content tests on six (6) select soil samples. The tests revealed that the sulphate concentrations in the soil samples were between 5 and 210 µg/g or between 0.0005 and 0.0210 %.

The results of sulphate ion content analysis indicate the soil samples contain low levels of sulphate ion that are below the class of exposure levels outlined in CSA A23.1-04. Therefore, in view of the test results, the degree of exposure of the sub-surface construction concrete to sulphate ion content from Site soils within the vicinity of the tested samples/boreholes is considered to be low and no special precautions are required to provide protection against sulphate attack such as special cements or mixtures. As such, ordinary Type 10 Portland Cement could be used for the design of the concrete mix as far as soil exposure is concerned. However, concrete in contact with sewage may require a higher class of sulphate resistance. The analytical data are attached to this report in Appendix C.

6.6.2 Corrosivity on Grey Ductile Cast Iron

In order to evaluate soil corrosivity on grey ductile cast iron elements, six (6) select soil samples were subject to corrosivity package. The analysis for soil corrosivity was conducted on a system of assigning points based on the results of the chemical tests, as described in Table A.1 of the American Water Works Association (AWWA) publication ANSI/AWWA C105/A21.5-10. Based on the AWWA publication points system, a soil that has a total score of 10 or greater is considered to be potentially corrosive to ductile iron pipe.

The ANSI/AWWA rating System uses soil resistivity, pH value, redox potential, sulphide content and drainage conditions as the main indicators of soil aggressiveness. In this procedure, a point system is used to evaluate the corrosivity of the tested soil. Points are assigned to each indicator in accordance with its anticipated contribution to the total corrosion potential of the soil as determined by laboratory testing and visual examination of the soil.

The chemical analysis was carried out by AGAT Laboratories (AGAT), a specialist chemical testing laboratory. The test results are provided in Appendix C. The sulphide and chloride concentrations of the samples tested were measured using a chromatograph, the pH using a pH meter, resistivity using an electrical conductivity test, and redox using a redox potential electrode. Some interpretation of the data was required in order to assess corrosion potential.

It is noted that sulphide analysis presented in AWWA is a qualitative test where a positive, trace, or negative determination is based on the presence of bubbles as a result of a chemical reaction. The results obtained by AGAT present a concentration that is unrelated to the scale provided by AWWA. It was assumed that samples with a laboratory result less than the reported detection limit (RDL) for sulphide would be considered to have a 'trace' condition (score of 2) and results greater than the RDL would be considered to be positive and a maximum score of 3.5 was selected. Also, for moisture content determination, the observations at the time of drilling were used for this analysis and the determination of wet, moist or dry were obtained from the description presented on the borehole logs.

As noted above, the chloride content of each sample was also tested. However, since the AWWA system does not use chloride as an indicator of corrosivity, an assessment of the potential contribution of the measured chloride concentration to corrosion was based on our experience on similar soil condition.

Table below summarizes the ANSI/AWWA rating of the tested soil samples on their potential for corrosion towards buried grey or ductile cast iron pipe. A reference score of 10 points indicates limit of soil corrosion potential.

Table 6.6.2 - ANSI/AWWA Soil Corrosivity Potential

Parameter	Parameter Concentration / ANSI/AWWA Point Rating					
	MW01-16 SS3	BH02-16 SS3	BH06-16 SS5	BH07-16 SS3	MW12-16 SS3	BH13-16 SS3
Depth (m)	1.7-2.0	1.7–2.0	3.2-3.5	1.7-2.0	1.7-2.0	1.7-2.0
Soil Type	Silty Sand	Silty Sand	Silty Clay	Silty Sand	Silty Sand	Silty Clay
Sulfide (%)	<0.05/2	<0.05/2	0.50/3.5	<0.05/2	<0.05/2	<0.05/2
pH (Units)	8.39/0	8.68/3	8.25/0	8.96/3	8.55/3	8.28/0
Resistivity ((Ω*cm))	11600/0	12200/0	3160/0	6620/0	10200/0	5050/0
Redox Potential (mV)	283/0	327/0	249/0	267/0	263/0	265/0
Natural Moisture Content (%)	Poor Drainage /2	Poor Drainage /2	Poor Drainage /2	Poor Drainage /2	Poor Drainage /2	Poor Drainage /2
Total Points	4.0	7.0	5.5	7.0	7.0	4.0

Based on the test results and using the guidelines provided in the AWWA publication ANSI/AWWA C105/A21.5-10, all of the tested samples were assigned a score that ranged between 4.0 and 7.0 points. Therefore, according to the ANSI/AWWA rating system, these soil samples do not pose an elevated potential for corrosion on grey or ductile iron pipe.

It is noted that there may be other overriding factors in the assessment of soil corrosion potential, such as application of deicing salts on the ground and subsequent leaching into the subsurface soils, stray currents, the nature of effluent conveyed by underground pipes, etc.

7. Limitations of the Investigation

This report is intended solely for Ontario Infrastructure and Land Corporation and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the geotechnical engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only (five geotechnical exploratory boreholes). The subsurface conditions confirmed at the test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (ex. excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the

test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

All of which is Respectfully Submitted,

GHD

Shahkar Shahangian, Ph. D., CHEBAP, P. Eng.

Karl Roechner, M.A.Sc., P. Eng.

Figures

Source: Microsoft Product Screen Shot(s) Reprinted with permission from Microsoft Corporation, Acquisition Date MAY 2011, Accessed: 2016

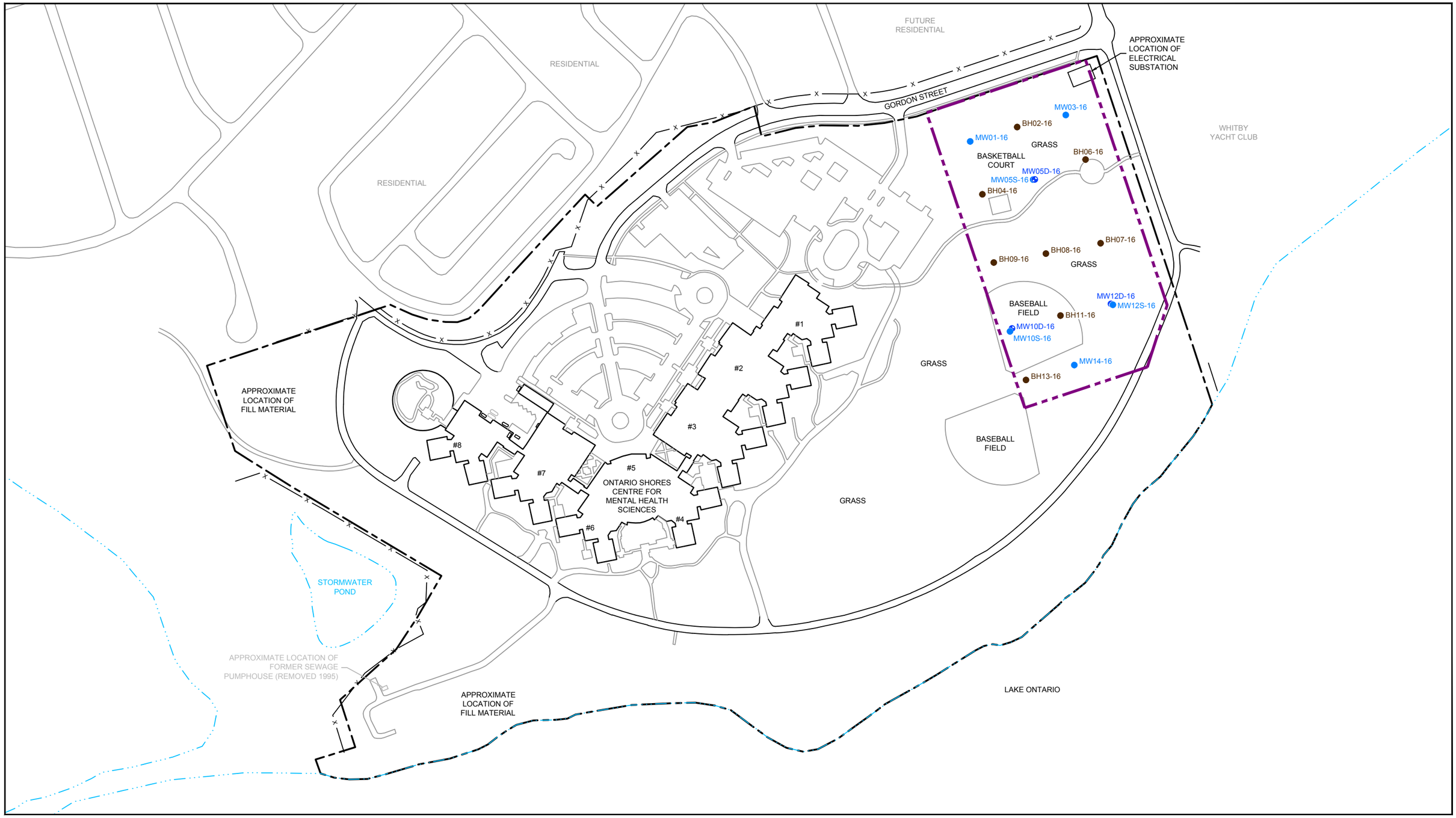
INFRASTRUCTURE ONTARIO
700 GORDON STREET, WHITBY, ONTARIO
PRELIMINARY GEOTECHNICAL INVESTIGATION

076896-00
Aug 16, 2016

SITE LOCATION MAP

FIGURE 1

CAD File: I:\CAD\6-chars\07----\0768--\076896\076896-REPORTS\076896-00(004)GN\076896-00(004)GN-TO003.DWG



SOURCE: J.D. BARNES LIMITED., REFERENCE NO. 06-25-812-00, DATED MAR 7, 2006.

0 30 60 90m

LEGEND

- PROPERTY BOUNDARY
- SITE BOUNDARY
- FENCE LINE
- WATER LINE
- BOREHOLE LOCATION
- SHALLOW MONITORING WELL
- DEEP MONITORING WELL

INFRASTRUCTURE ONTARIO
700 GORDON STREET, WHITBY, ONTARIO
PRELIMINARY GEOTECHNICAL INVESTIGATION

076896-00

Aug 18, 2016

SITE PLAN AND INVESTIGATIVE LOCATIONS

FIGURE 2

CAD File: I:\CAD\6-chars\07----\0768--\076896\076896-REPORTS\076896-00(004)GN\076896-00(004)GN-TO002.DWG

Appendices

Appendix A
Borehole Logs

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

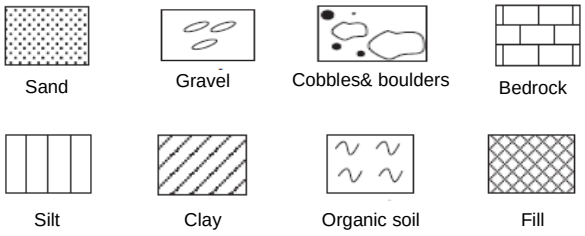
Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu) (P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
ST: Shelby tube
AG: Auger
SSE, GSE, AGE: Environmental sampling
PS: Piston sample (Osterberg)
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
γ: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor

REFERENCE No.: 076896 ENCLOSURE No.: 1

BOREHOLE No.: MW01-16
ELEVATION: 81.62 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 18 July 2016 DATE (FINISH): 18 July 2016

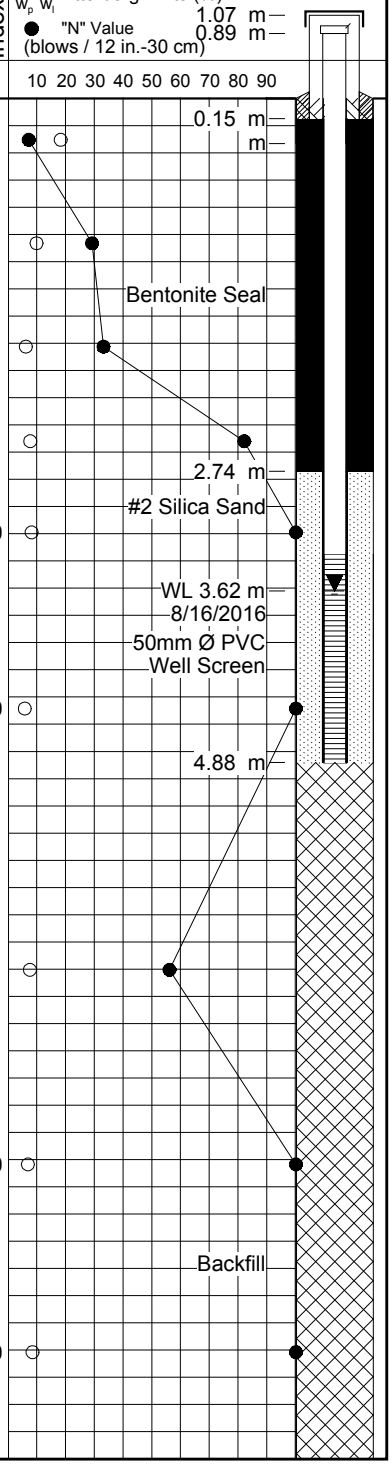
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.62		GROUND SURFACE			%			N
	0.08	81.54		TOPSOIL with rootlets : 75 mm						
1				FILL : SILTY SAND, trace clay and gravel, oxidized seams, brown, moist, firm		SS1	58	18	3-3-4-10	7
2										
	0.76	80.86		NATIVE : SILTY SAND TILL, oxidized seams, brown, moist, compact to dense						
3	1.0					SS2	100	10	11-13-16-32	29
4										
5				hard						
6				Gravel : 2%, Sand : 52%, Silt : 37%, Clay : 9%		SS3	100	6	12-15-18-30	33
7	2.0									
	2.29	79.33		SANDY SILT TILL, trace clay and gravel, oxidized stains, brown, moist, very dense						
8						SS4	75	8	16-32-50	82
9										
10	3.0					SS5	50	8	42-50/ 125mm	100
11										
12										
13	4.0									
14						SS6	71	6	24-45-50/ 125mm	100
15										
16										
17	5.0									
18										
19										
20	6.0			grey						
21						SS7	67	7	17-26-30-36	56
22										
23	7.0									
24										
25										
26	8.0					SS8	59	7	21-41-50/ 125mm	100
27										
28										
29										
30	9.0					SS9	100	8	50/ 125mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 1

BOREHOLE No.: MW01-16
ELEVATION: 81.62 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 18 July 2016 DATE (FINISH): 18 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N	Shear test (Cu) △ Field, Sensitivity (S) □ Lab, ○ Water content (%), w_p w_l Atterberg limits (%), ● "N" Value (blows / 12 in.-30 cm) 10 20 30 40 50 60 70 80 90
		81.62		GROUND SURFACE							
33											
34											
35											
36	11.0					SS10	100	9	24-50/ 75mm	100	
37											
38											
39	12.0										
40	12.20	69.42		SHALE-BEDROCK, inferred, grey		SS11	100	11	50/ 50mm	100	12.25 m
41	12.25	69.37									
42				**END OF BOREHOLE:**							
43	13.0			NOTE :							
44				End of Borehole at 12.25 m bgs							
45				Groundwater level measured at 4.65 m upon completion							
46	14.0			50 mm diameter monitoring well installed at 4.70 m bgs							
47				Groundwater level at 3.62 m bgs on August 16, 2016							
48				bgs denotes 'below ground surface'							
49	15.0										
50											
51											
52	16.0										
53											
54											
55											
56	17.0										
57											
58											
59	18.0										
60											
61											
62	19.0										
63											
64											
65											

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 2

BOREHOLE No.: BH02-16
ELEVATION: 80.16 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 28 July 2016 DATE (FINISH): 28 July 2016

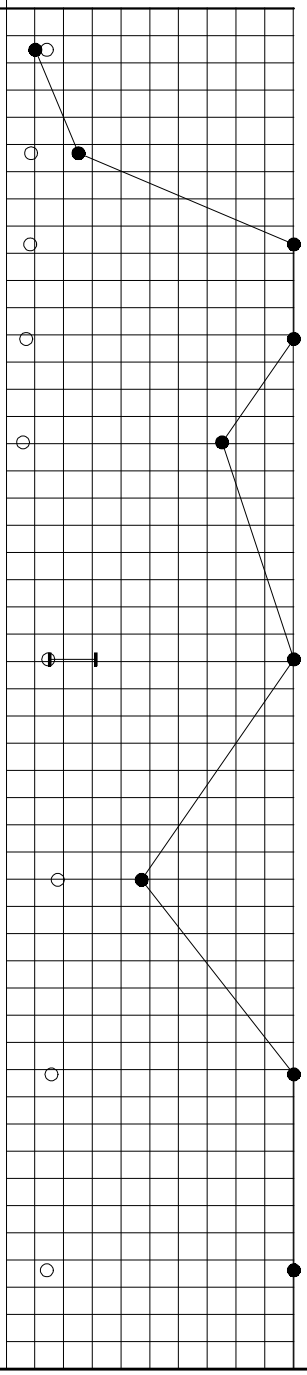
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.16		GROUND SURFACE			%			N
				TOPSOIL with rootlets : 300 mm						
1	0.30	79.86		FILL : SILTY CLAY, some sand and gravel, oxidized stains, mottled brown and grey, moist, stiff		SS1	50	14	3-5-5-7	10
2	0.76	79.40		NATIVE : SILTY SAND TILL, brown/grey, moist, compact to very dense		SS2	100	9	7-9-16-27	25
3	1.0									
4										
5						SS3	79	8	18-37-50/ 125mm	100
6	2.0									
7						SS4	63	7	28-43-50/ 100mm	100
8										
9										
10	3.0	77.11		SILTY CLAY/CLAYEY SILT TILL, trace to some sand, occasional gravel, grey, damp to moist, hard		SS5	83	6	18-29-46-50/ 100mm	75
11	3.05									
12										
13	4.0									
14										
15				Gravel : 0%, Sand : 2%, Silt : 56%, Clay : 42%		SS6	42	15	39-50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0			some silt		SS7	29	18	12-16-31-36	47
21										
22										
23	7.0									
24										
25										
26						SS8	75	16	19-37-50/ 125mm	100
27	8.0									
28										
29										
30	9.0									
31						SS9	67	14	18-42/ 100mm	100
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 2

BOREHOLE No.: BH02-16
ELEVATION: 80.16 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 28 July 2016 DATE (FINISH): 28 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.16		GROUND SURFACE			%			N
	11.0			shale fragments		SS10	8	11	50/ 50mm	100
	12.0									
12.20		67.96		SHALE-BEDROCK, weathered, grey		SS11	2	22	50/ 125mm	100
12.33		67.83		**END OF BOREHOLE:**						
	13.0			NOTE : End of Borehole at 12.33 m bgs on inferred bedrock Borehole was dry upon completion Borehole backfilled with cement grout to the top bgs denotes 'below ground surface'						
	14.0									
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 3

BOREHOLE No.: MW03-16
ELEVATION: 79.24 m

BOREHOLE REPORT

Page: 1 of 1

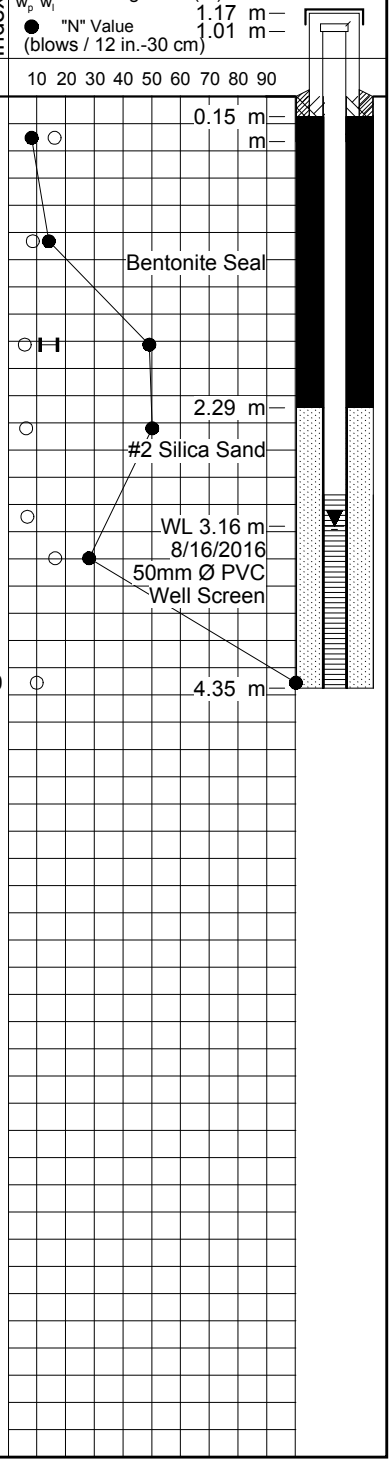
CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 18 July 2016 DATE (FINISH): 18 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 79.24	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
	0.08	79.16		GROUND SURFACE TOPSOIL with rootlets : 75 mm						
1				FILL : SILTY CLAY, some sand, trace gravel, slightly plastic, brown, moist, firm		SS1	83	16	2-3-5-8	8
2										
3	1.0			oxidized seams, greyish brown, stiff		SS2	100	8	3-6-8-11	14
4										
5	1.52	77.72		NATIVE : SILTY SAND TILL, some clay, trace gravel, brown, moist, dense to very dense		SS3	63	6	10-17-32-50	49
6										
7	2.0			Gravel : 2%, Sand : 51%, Silt : 35%, Clay : 12%		SS4	50	6	18-50	50
8										
9										
10	3.0					SS5A		7		--
	3.13	76.11		SAND TILL, trace silt and gravel, brown, wet, dense		SS5B	83	16	10-12-16-24	28
11										
12				Gravel : 3%, Sand : 88%, Clay and Silt : 9%						
13	4.0									
14	4.27	74.97				SS6	13	10	50/ 75mm	100
	4.35	74.89		BEDROCK-SHALE, inferred, grey auger refusal						
15										
16				**END OF BOREHOLE:**						
17	5.0									
18				NOTE : End of Borehole at 4.35 m bgs due to auger refusal						
19				Groundwater level measured at 4.1 m upon completion						
20	6.0			50 mm diameter monitoring well installed at 4.35 m bgs						
21				Groundwater level at 3.16 m bgs on August 16, 2016						
22				bgs denotes 'below ground surface'						
23	7.0									
24										
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 4

BOREHOLE No.: BH04-16
ELEVATION: 81.85 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 28 July 2016 DATE (FINISH): 28 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.85		GROUND SURFACE			%			N
	0.10	81.75		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand and gravel, oxidized stains, mottled grey and brown, moist, stiff to hard		SS1	17	20	2-4-8-9	12
2										
3	1.0					SS2	92	8	3-11-21-35	32
4										
5	1.52	80.33		NATIVE : SANDY SILT/SILTY SAND TILL, trace to some clay and gravel, brown, damp to moist, very dense		SS3	50	4	12-21-50/ 125mm	100
6										
7	2.0			Gravel : 11%, Sand : 38%, Silt : 43%, Clay : 8%; NP		SS4	22	3	36-50/ 125mm	100
8										
9										
10	3.0					SS5	71	4	29-31/ 10mm	75
11										
12										
13	4.0									
14										
15										
16						SS6	45	5	26-50/ 125mm	100
17	5.0			possible boulder						
18										
19										
20	6.0					SS7	25	8	50/ 125mm	100
21										
22										
23	6.86 7.0	74.99		SILTY CLAY/CLAYEY SILT TILL, some sand and gravel, trace silt, grey, moist to wet, hard						
24										
25						SS8	42	8	42-50/ 100mm	100
26	8.0									
27										
28										
29										
30	9.0					SS9	54	9	43-50/ 100mm	100
31				sand layer						
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 4

BOREHOLE No.: BH04-16
ELEVATION: 81.85 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 28 July 2016 DATE (FINISH): 28 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		81.85		GROUND SURFACE						
	11.0					SS10	46	7	36-50/ 75mm	100
	12.0									
12.20		69.65		SHALE-BEDROCK, inferred, grey		SS11	8	12	50/ 50mm	100
12.33		69.52								
	13.0			**END OF BOREHOLE:**						
	14.0			NOTE : End of Borehole at 12.33 m bgs on inferred bedrock Borehole was dry upon completion Borehole backfilled with cement grout to the top bgs denotes 'below ground surface' NP denotes 'non-plastic'						
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 5

BOREHOLE REPORT

BOREHOLE No.: MW05D-16
ELEVATION: 81.00 m
Page: 1 of 2

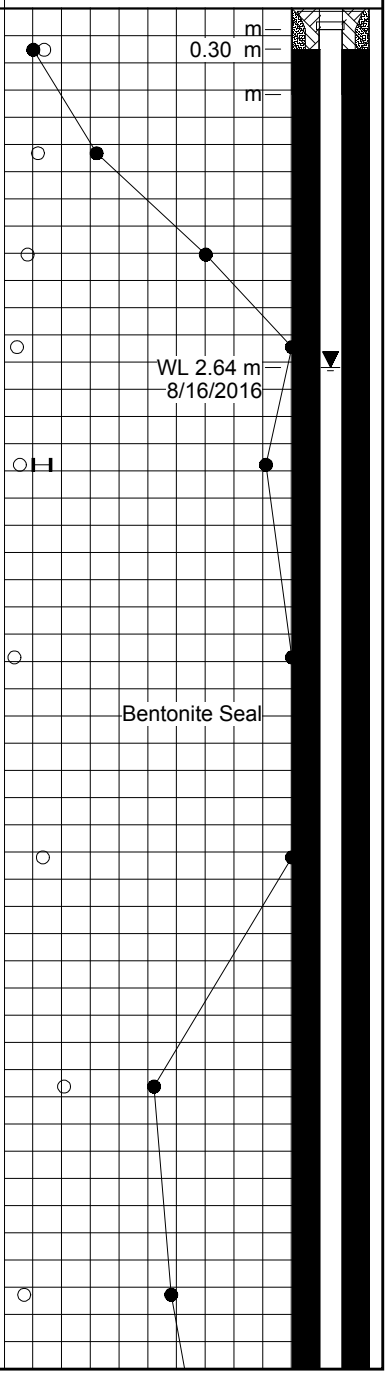
CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: P. Bodjona CHECKED BY: S. Shahangian
DATE (START): 4 August 2016 DATE (FINISH): 4 August 2016

LEGEND
SS - SPLIT SPOON
ST - SHELBY TUBE
RC - ROCK CORE
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.00		GROUND SURFACE			%			N
				FILL : CLAYEY SILT, some sand, trace gravel, trace topsoil and organics, trace rootlets, brown, moist, stiff		SS1	17	14	3-5-5-8	10
	0.76	80.24		NATIVE : SILTY SAND TILL, trace clay and gravel, brown, moist, dense to very dense		SS2	100	12	5-10-22-26	32
	1.0			very dense		SS3	91	8	12-23-47-50/ 100mm	70
	2.0			becoming grey		SS4	100	4	28-48-50/ 100mm	100
	3.0			Gravel : 1%, Sand : 55%, Silt : 34%, Clay : 10%		SS5	100	5	34-46-45-48	91
	4.0					SS6	100	3	24-48-50/ 100mm	100
	5.0									
	6.0					SS7	100	13	28-50/ 125mm	100
	6.86	74.14		SILTY CLAY/CLAYEY SILT TILL, trace sand and gravel, grey, moist to wet, hard						
	7.0					SS8	75	21	20-22-30-32	52
	8.0									
	9.0					SS9	100	7	24-25-33-32	58

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 5

BOREHOLE No.: MW05D-16
ELEVATION: 81.00 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: P. Bodjona CHECKED BY: S. Shahangian
DATE (START): 4 August 2016 DATE (FINISH): 4 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

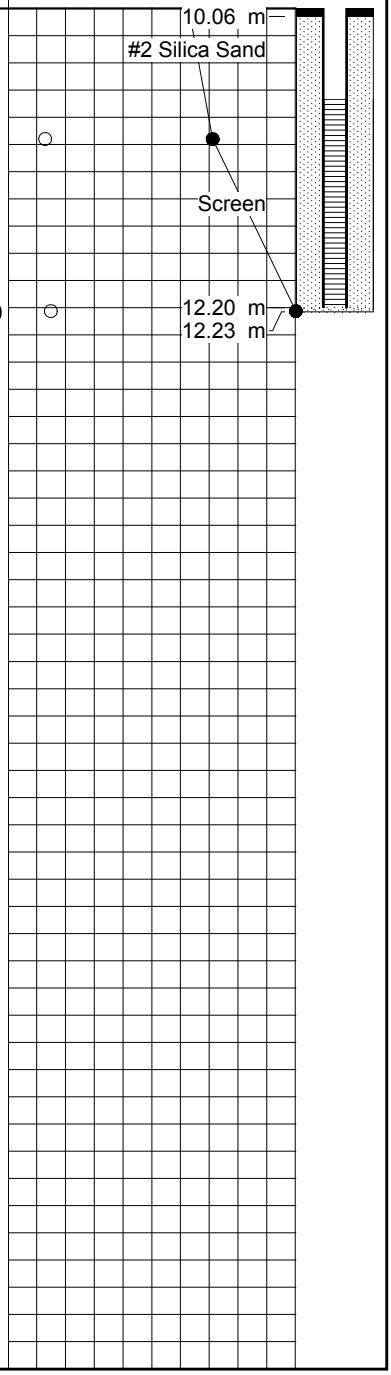
Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		81.00		GROUND SURFACE						
	11.0					SS10	100	13	18-31-40-50/ 125mm	71
	12.0									
12.20		68.80		SHALE-BEDROCK, inferred, grey		SS11	100	15	50/ 50mm	100
12.23		68.77								
	13.0									
	14.0									
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

END OF BOREHOLE:

NOTE :
End of Borehole at 12.23 m bgs due to auger refusal
Borehole was dry upon completion
50 mm diameter monitoring well installed at 12.2 m bgs
Groundwater level at 1.59 m bgs on August 12, 2018
Groundwater level at 2.64 m bgs on August 16, 2016
bgs denotes 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 5

BOREHOLE REPORT

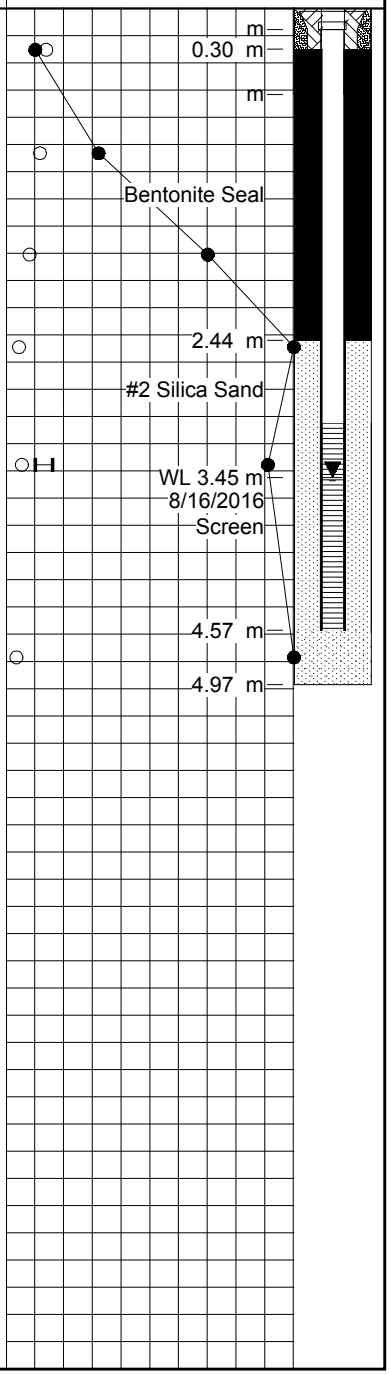
BOREHOLE No.: MW05S-16
ELEVATION: 81.00 m
Page: 1 of 1

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: P. Bodjona CHECKED BY: S. Shahangian
DATE (START): 4 August 2016 DATE (FINISH): 4 August 2016

LEGEND
- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.00		GROUND SURFACE			%			N
	0.76	80.24		FILL : CLAYEY SILT, some sand, trace gravel, trace topsoil and organics, trace rootlets, brown, moist, stiff		SS1	17	14	3-5-5-8	10
	1.0			NATIVE : SILTY SAND TILL, trace clay and gravel, brown, moist, dense to very dense		SS2	100	12	5-10-22-26	32
				very dense		SS3	91	8	12-23-47-50/ 100mm	70
	2.0			becoming grey		SS4	100	4	28-48-50/ 100mm	100
	3.0					SS5	100	5	34-46-45-48	91
	4.0					SS6	100	3	24-48-50/ 100mm	100
	4.97	76.03		**END OF BOREHOLE:**						
	5.0			NOTE : End of Borehole at 4.97 m bgs Borehole was dry upon completion 50 mm diameter monitoring well installed at 4.57 m bgs Groundwater level at 3.45 m bgs on August 16, 2016 bgs denotes 'below ground surface'						
	6.0									
	7.0									
	8.0									
	9.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)
10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 6

BOREHOLE No.: BH06-16
ELEVATION: 79.31 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 27 July 2016 DATE (FINISH): 27 July 2016

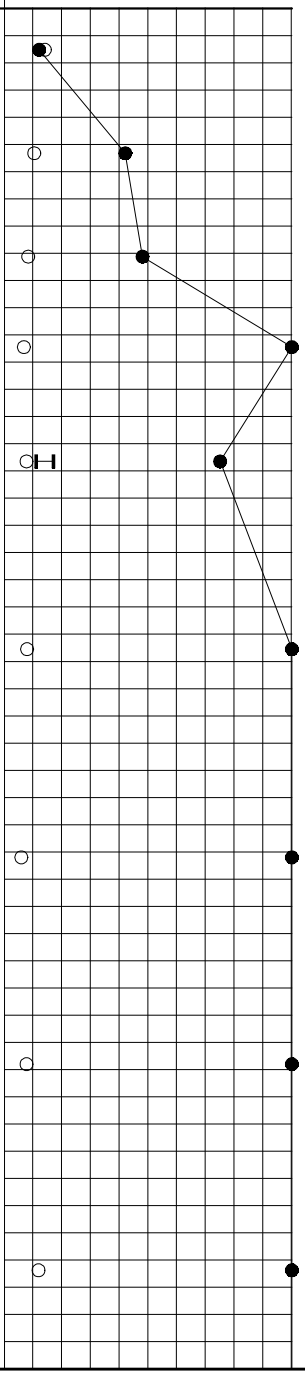
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 79.31	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
				GROUND SURFACE						
	0.15	79.16		TOPSOIL with rootlets : 150 mm						
1				FILL : SILTY CLAY, some sand, trace gravel, brown, moist, stiff		SS1	63	14	2-4-8-10	12
2										
	0.76	78.55		NATIVE : SILTY CLAY/CLAYEY SILT TILL, some sand to sandy, trace gravel, oxidized stains, slightly plastic, brown, moist, hard						
3	1.0					SS2	83	10	11-19-23-27	42
4										
5				some sand and gravel, oxidized stains, light brown to brown						
6						SS3	83	8	9-17-31-44	48
7	2.0									
8						SS4	63	7	28-43-50/ 100mm	100
9										
10	3.0			grey Gravel : 3%, Sand : 44%, Silt : 41%, Clay : 12%		SS5	83	8	18-29-46-50/ 100mm	75
11										
12										
13	4.0									
14										
15						SS6	42	8	39-50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0					SS7	29	6	28-50/ 125mm	100
21										
22										
23	7.0									
24										
25						SS8	50	8	43-50/ 125mm	100
26	8.0									
27										
28										
29										
30	9.0					SS9	46	12	27-50/ 100mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 6

BOREHOLE No.: BH06-16
ELEVATION: 79.31 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 27 July 2016 DATE (FINISH): 27 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		79.31		GROUND SURFACE						
	11.0			trace sand and gravel, shale fragments, wet		SS10	67	8	24-47-50/ 125mm	100
	12.0									
12.20		67.11		SHALE-BEDROCK, inferred, grey		SS11	2	3	50/ 75mm	100
12.28		67.03		**END OF BOREHOLE:**						
	13.0			NOTE : End of Borehole at 12.28 m bgs on inferred bedrock Borehole was dry upon completion Borehole backfilled with cement grout to the top bgs denotes 'below ground surface'						
	14.0									
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 7

BOREHOLE No.: BH07-16
ELEVATION: 80.29 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 20 July 2016 DATE (FINISH): 3 August 2016

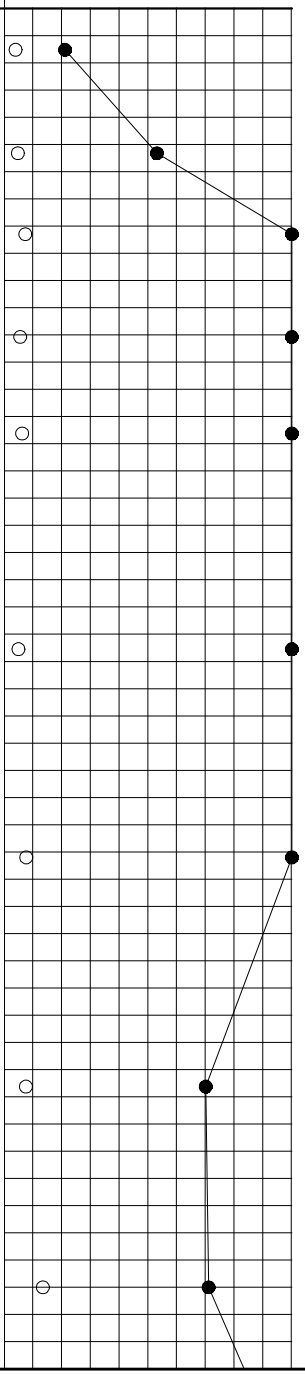
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.29		GROUND SURFACE			%			N
	0.10	80.19		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand and gravel, brown, damp, very stiff		SS1	38	4	3-9-12-16	21
2										
	0.76	79.53		NATIVE : SANDY SILT/SILTY SAND TILL, trace clay and gravel, oxidized stains, brown, moist, very dense						
3	1.0					SS2	75	5	5-11-42-45	53
4										
5						SS3	38	7	19-50/ 125mm	100
6										
7	2.0									
8						SS4	46	5	31-50/ 100mm	100
9										
10	3.0			grey Gravel : 8%, Sand : 59%, Silt : 27%, Clay : 6%; NP		SS5A	46	6	40-50/ 125mm	100
11				Gravel : 1%, Sand : 59%, Silt : 33%, Clay : 7%; NP		SS5B		--		--
12										
13	4.0									
14										
15						SS6	50	5	37-50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0					SS7	55	8	18-50/ 125mm	100
21										
22										
23	7.0									
24										
25										
26	8.0					SS8	87	7	26-31-39-45	70
27										
28										
29										
30	9.0									
31						SS9	100	13	25-28-43-50/ 50mm	71
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 7

BOREHOLE No.: BH07-16
ELEVATION: 80.29 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 20 July 2016 DATE (FINISH): 3 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.29		GROUND SURFACE			%			N
	11.0					SS10	100	10	32-50/ 125mm	100
	12.0					SS11	82	13	16-33-47-50/ 100mm	80
	12.75	67.54		**END OF BOREHOLE:**						
	13.0			NOTE : End of Borehole at 12.75 m bgs Borehole remained dry upon completion Borehole backfilled with grout up to surface bgs denotes 'below ground surface' NP denotes 'non-plastic'						
	14.0									
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 8

BOREHOLE No.: BH08-16
ELEVATION: 81.00 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 26 July 2016 DATE (FINISH): 26 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.00		GROUND SURFACE			%			N
	0.10	80.90		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand, trace gravel, brown, moist, stiff		SS1	67	14	2-3-6-7	9
2	0.76	80.24		NATIVE : SILTY SAND/SANDY SILT TILL, trace to some clay and gravel, brown, damp to moist, compact to dense						
3	1.0					SS2	50	7	5-8-11-23	19
4										
5						SS3	92	7	8-19-30-50/ 100mm	49
6	2.0									
7	2.29	78.71		very dense		SS4	88	5	23-31-50/ 125mm	100
8										
9	3.0					SS5	75	5	16-29-50/ 125mm	100
10										
11				auger grinding						
12	4.0									
13				damp Gravel : 14%, Sand : 57%, Silt : 23%, Clay : 6%; NP		SS6	75	2	28-44-50/ 125mm	100
14										
15	5.0									
16										
17	6.0			grey, moist-wet		SS7	42	5	30-46-50/ 100mm	100
18										
19	7.0									
20										
21						SS8	50	8	28-40-50/ 125mm	100
22	8.0									
23										
24	9.0									
25										
26						SS9	38	8	25-38-50/ 125mm	100
27										
28										
29										
30										
31										
32										

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 8

BOREHOLE No.: BH08-16
ELEVATION: 81.00 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 26 July 2016 DATE (FINISH): 26 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.00		GROUND SURFACE			%			N
35	11.0					SS10	75	18	26-45-50/ 100mm	100
40	12.0					SS11	71	10	31-44-50/ 100mm	100
43	13.0									
43	13.14	67.86		SHALE-BEDROCK, inferred, grey		CR12		--		--
45	13.85	67.15								
46	14.0			**END OF BOREHOLE:**						
49	15.0			NOTE : End of Borehole at 13.85 m bgs on inferred bedrock Borehole was dry upon completion Borehole backfilled with cement grout to the top bgs denotes 'below ground surface' NP denotes 'non-plastic'						
53	16.0									
56	17.0									
59	18.0									
62	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 9

BOREHOLE No.: BH09-16
ELEVATION: 81.94 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 19 July 2016 DATE (FINISH): 19 July 2016

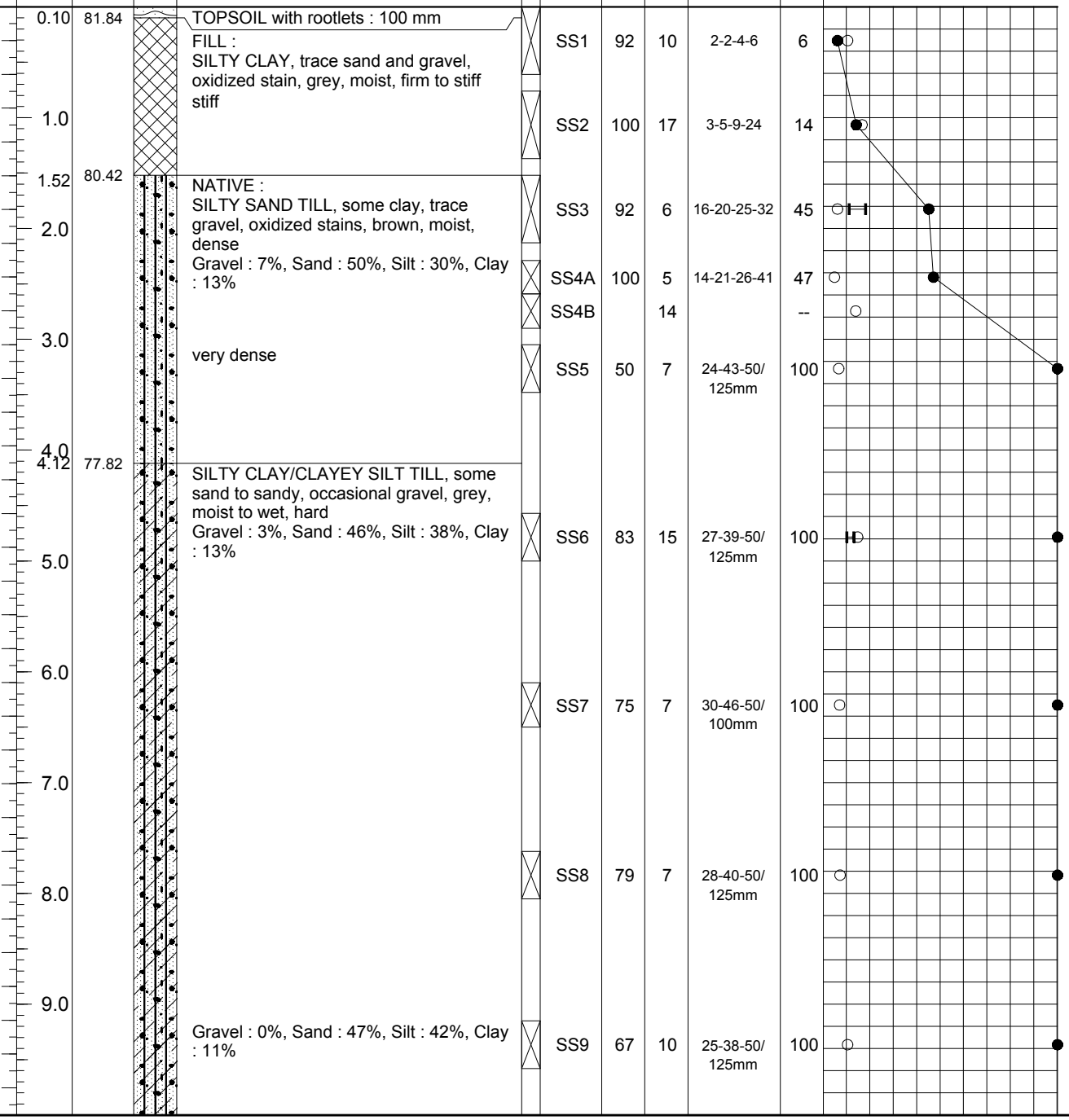
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 81.94	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
	0.10	81.84		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, trace sand and gravel, oxidized stain, grey, moist, firm to stiff		SS1	92	10	2-2-4-6	6
2										
3	1.0			stiff		SS2	100	17	3-5-9-24	14
4										
5	1.52	80.42		NATIVE : SILTY SAND TILL, some clay, trace gravel, oxidized stains, brown, moist, dense		SS3	92	6	16-20-25-32	45
6	2.0									
7				Gravel : 7%, Sand : 50%, Silt : 30%, Clay : 13%		SS4A	100	5	14-21-26-41	47
8										
9						SS4B		14		--
10	3.0			very dense		SS5	50	7	24-43-50/ 125mm	100
11										
12										
13	4.0									
	4.12	77.82		SILTY CLAY/CLAYEY SILT TILL, some sand to sandy, occasional gravel, grey, moist to wet, hard						
14										
15				Gravel : 3%, Sand : 46%, Silt : 38%, Clay : 13%		SS6	83	15	27-39-50/ 125mm	100
16	5.0									
17										
18										
19										
20	6.0					SS7	75	7	30-46-50/ 100mm	100
21										
22										
23	7.0									
24										
25										
26	8.0					SS8	79	7	28-40-50/ 125mm	100
27										
28										
29										
30	9.0			Gravel : 0%, Sand : 47%, Silt : 42%, Clay : 11%		SS9	67	10	25-38-50/ 125mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 9

BOREHOLE No.: BH09-16
ELEVATION: 81.94 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 19 July 2016 DATE (FINISH): 19 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.94		GROUND SURFACE			%			N
36	11.0					SS10	92	10	31-40-50/ 125mm	100
40	12.0			trace gravel		SS11	88	20	26-39-50/ 125mm	100
43	13.0	68.83		AUGERED to 13.11 m bgs encountered gaseous substance with odour						
	13.11			**END OF BOREHOLE:**						
	14.0			NOTE : End of Borehole at 13.11 m bgs Borehole remained open and dry upon completion bgs denotes 'below ground surface'						
49	15.0									
53	16.0									
56	17.0									
59	18.0									
62	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 10

BOREHOLE No.: MW10D-16
ELEVATION: 81.98 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

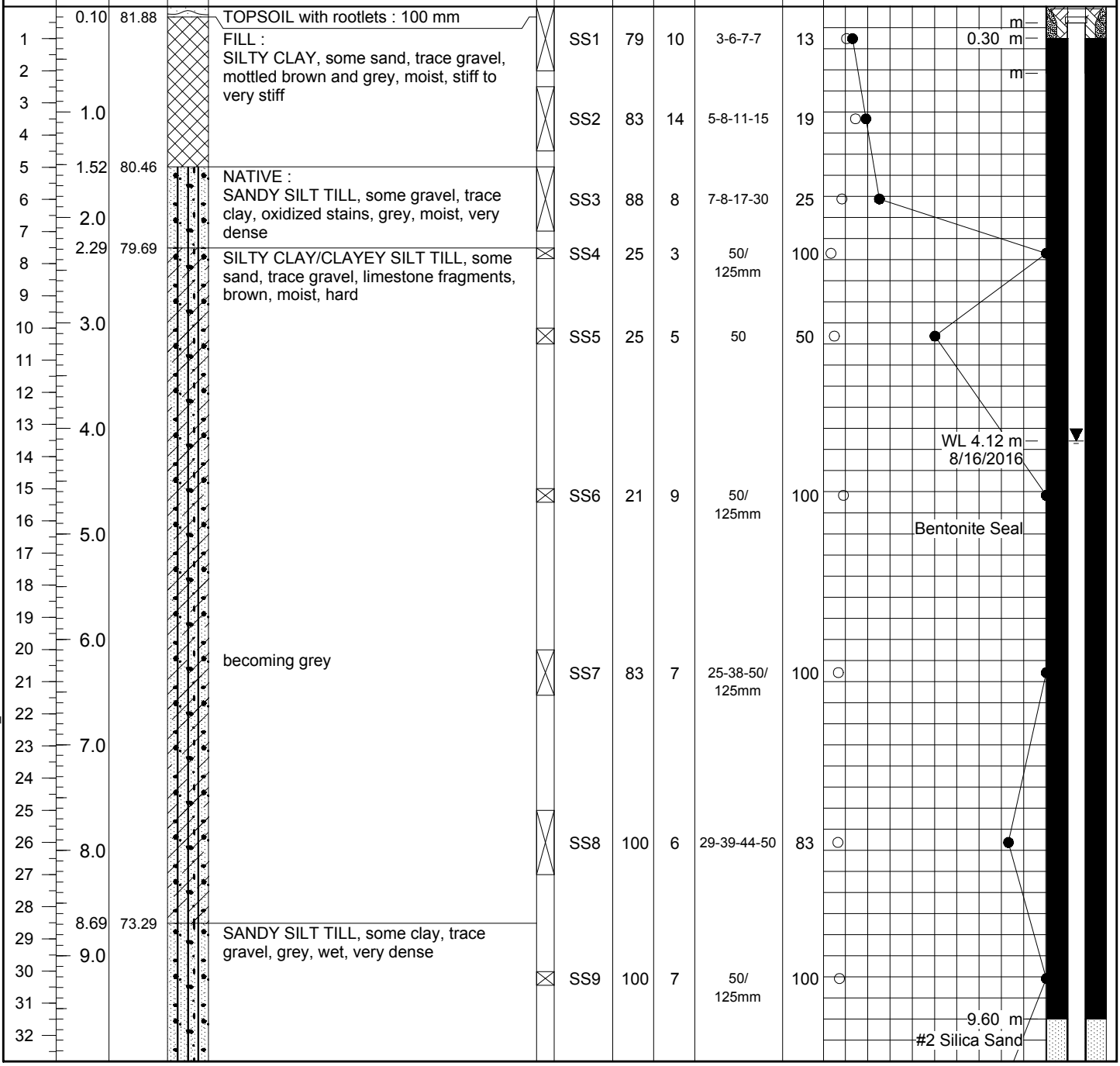
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 81.98	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
	0.10	81.88		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand, trace gravel, mottled brown and grey, moist, stiff to very stiff		SS1	79	10	3-6-7-7	13
2										
3	1.0					SS2	83	14	5-8-11-15	19
4										
5	1.52	80.46		NATIVE : SANDY SILT TILL, some gravel, trace clay, oxidized stains, grey, moist, very dense		SS3	88	8	7-8-17-30	25
6										
7	2.0									
8	2.29	79.69		SILTY CLAY/CLAYEY SILT TILL, some sand, trace gravel, limestone fragments, brown, moist, hard		SS4	25	3	50/ 125mm	100
9										
10	3.0					SS5	25	5	50	50
11										
12										
13	4.0									
14										
15						SS6	21	9	50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0			becoming grey		SS7	83	7	25-38-50/ 125mm	100
21										
22										
23	7.0									
24										
25										
26	8.0					SS8	100	6	29-39-44-50	83
27										
28										
29	8.69	73.29		SANDY SILT TILL, some clay, trace gravel, grey, wet, very dense						
30	9.0					SS9	100	7	50/ 125mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 10

BOREHOLE No.: MW10D-16
ELEVATION: 81.98 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		81.98		GROUND SURFACE						
	11.0					SS10A SS10B	100	16 14	18-31-40-50/ 125mm	-- 71
	11.43	70.55		GRAVELLY CLAY, some sand, trace to some silt, grey, wet, hard						
	12.0					SS11	100	7	25-39-44-50/ 75mm	83
	12.72	69.26								
	13.0			**END OF BOREHOLE:** NOTE : End of Borehole at 12.72 m bgs Borehole dry upon completion 50 mm diameter monitoring well installed at 11.59 m bgs Groundwater level at 4.12 m bgs on August 16, 2016 bgs denotes 'below ground surface'						
	14.0									
	15.0									
	16.0									
	17.0									
	18.0									
	19.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

Screen
11.59 m
12.72 m

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 10

BOREHOLE No.: MW10S-16
ELEVATION: 82.00 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

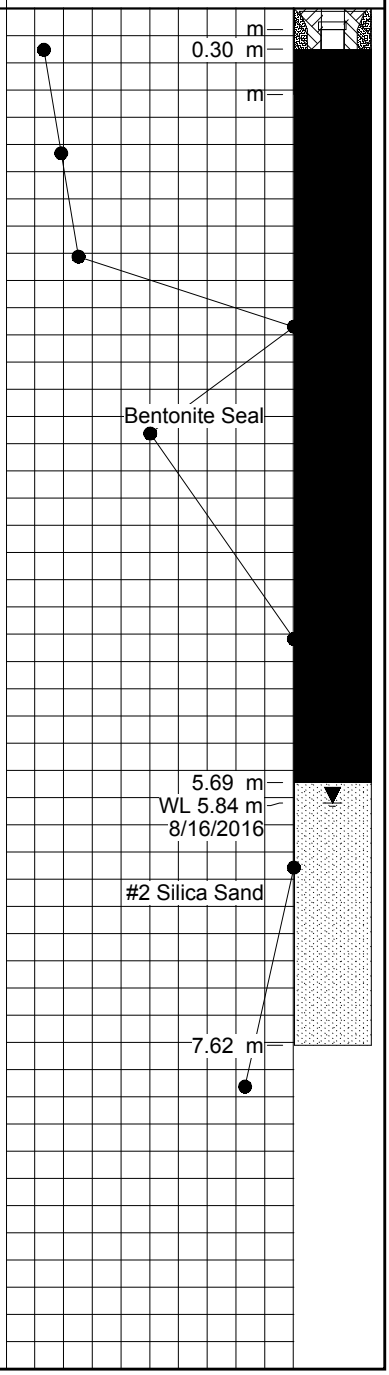
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m) 82.00	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
	0.10	81.90		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand, trace gravel, mottled brown and grey, moist, stiff to very stiff		SS1	79	--	3-6-7-7	13
2										
3	1.0					SS2	83	--	5-8-11-15	19
4										
5	1.52	80.48		NATIVE : SANDY SILT TILL, some gravel, trace clay, oxidized stains, grey, moist, compact		SS3	88	--	7-8-17-30	25
6	2.0									
7										
8	2.29	79.71		SILTY CLAY/CLAYEY SILT TILL, some sand, trace gravel, limestone fragments, brown, moist, hard		SS4	25	--	50/ 125mm	100
9										
10	3.0					SS5	25	--	50	50
11										
12										
13	4.0									
14										
15						SS6	21	--	50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0			becoming grey		SS7	83	--	25-38-50/ 125mm	100
21										
22										
23	7.0									
24										
25										
26	8.0					SS8	100	--	29-39-44-50	83
27	8.23	73.77		**END OF BOREHOLE:**						
28										
29				NOTE : End of Borehole at 8.23 m bgs Borehole dry upon completion 50 mm diameter monitoring well installed at 7.62 m bgs Groundwater level at 5.84 m bgs on August 16, 2016						
30	9.0									
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 10

BOREHOLE No.: MW10S-16
ELEVATION: 82.00 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N	Shear test (Cu) △ Field, Sensitivity (S) □ Lab, ○ Water content (%), w_p w_l Atterberg limits (%), ● "N" Value (blows / 12 in.-30 cm) 10 20 30 40 50 60 70 80 90
		82.00		GROUND SURFACE							
33				bgs denotes 'below ground surface'							
34											
35											
36	11.0										
37											
38											
39	12.0										
40											
41											
42											
43	13.0										
44											
45											
46	14.0										
47											
48											
49	15.0										
50											
51											
52	16.0										
53											
54											
55											
56	17.0										
57											
58											
59	18.0										
60											
61											
62	19.0										
63											
64											
65											

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 11

BOREHOLE No.: BH11-16
ELEVATION: 81.61 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: P. Bodjona CHECKED BY: S. Shahangian
DATE (START): 4 August 2016 DATE (FINISH): 4 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.61		GROUND SURFACE			%			N
1				FILL : SANDY SILT, trace clay, trace topsoil and organics, trace rootlets, brown, moist, compact		SS1	33	--	4-6-10-10	16
2	0.76	80.85		NATIVE : SILTY CLAY/CLAYEY SILT TILL, trace sand and gravel, brown, moist, hard		SS2	50	16	8-13-30-41	43
3	1.0									
4	1.52	80.09		SILTY SAND/SANDY SILT TILL, trace to some clay and gravel, brown, moist, very dense		SS3	100	8	10-23-38-50/ 125mm	61
5	2.0					SS4	100	5	26-50/ 125mm	100
6										
7										
8	3.0			Gravel : 4%, Sand : 53%, Silt : 31%, Clay : 12%		SS5	100	6	22-31-36-50/ 125mm	67
9										
10										
11	4.0					SS6	100	5	38-50/ 125mm	100
12										
13										
14	5.0									
15										
16										
17	6.0					SS7	100	11	27-50/ 100mm	100
18										
19										
20	7.0									
21										
22										
23	8.0					SS8	100	8	45-50/ 125mm	100
24										
25										
26	9.0									
27										
28										
29										
30						SS9	100	19	43-50/ 125mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 11

BOREHOLE No.: BH11-16
ELEVATION: 81.61 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: P. Bodjona CHECKED BY: S. Shahangian
DATE (START): 4 August 2016 DATE (FINISH): 4 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth (Feet)	Depth (Metres)	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR (%)	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR (N)
		81.61		GROUND SURFACE						
	10.21	71.40		SILTY CLAY/CLAYEY SILT TILL, trace sand and gravel, grey, wet, hard		SS10	100	13	28-29-39-46	68
	12.33	69.28				SS11	100	10	50/ 125mm	100

END OF BOREHOLE:

NOTE :
End of Borehole at 12.33 m bgs
Borehole was dry upon completion
Borehole backfilled with grout to the top
bgs denotes 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 12

BOREHOLE No.: MW12D-16
ELEVATION: 80.73 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 25 July 2016 DATE (FINISH): 25 July 2016

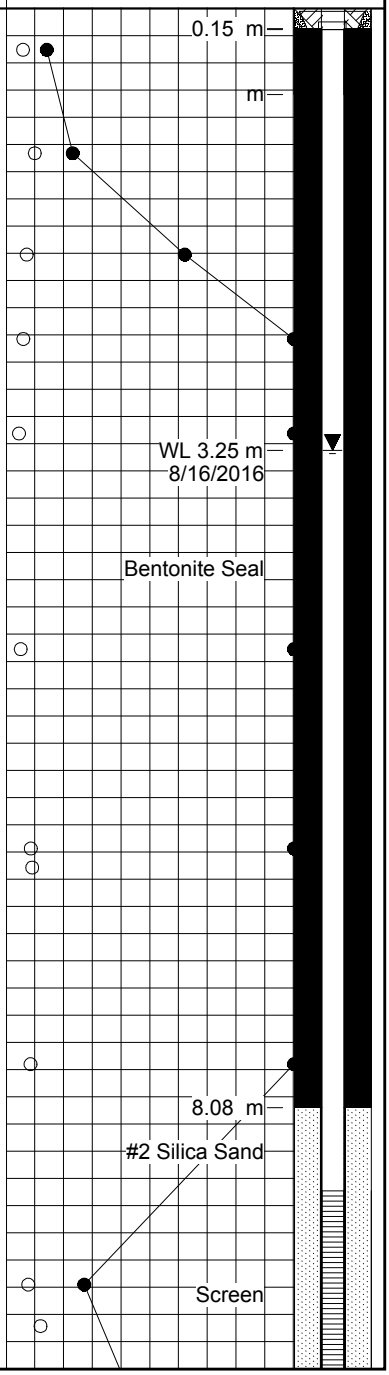
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.73		GROUND SURFACE			%			N
	0.10	80.63		TOPSOIL with rootlets : 100 mm						
1				FILL :		SS1	20	6	3-6-8-10	14
2				SILTY CLAY, some sand and gravel, brown to mottled brown and grey, moist,						
	0.76	79.97		stiff to very stiff						
3	1.0			NATIVE :		SS2	60	10	5-9-14-31	23
4				SILTY SAND/SANDY SILT TILL, trace clay and gravel, limestone fragments,						
5				brown, moist, compact to very dense						
6						SS3	50	7	9-24-38-50/ 125mm	62
7	2.0									
8				oxidized stains		SS4	50	6	36-50/ 125mm	100
9										
10	3.0					SS5	40	4	50	100
11										
12										
13	4.0									
14										
15						SS6	50	5	36-50/ 125mm	100
16										
17	5.0									
18										
19										
20	6.0					SS7A	46	8	27-50/ 125mm	100
21						SS7B		9		--
22										
23	7.0									
24										
25										
26						SS8	25	8	28-50/ 125mm	100
27	8.0									
28										
29										
30	9.0									
31						SS9A	100	8	3-10-17-39	27
	9.60	71.13								
32				SILTY CLAY/CLAYEY SILT TILL, some sand, trace gravel, grey, wet, very stiff to		SS9B		12		--

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 12

BOREHOLE No.: MW12D-16
ELEVATION: 80.73 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 25 July 2016 DATE (FINISH): 25 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

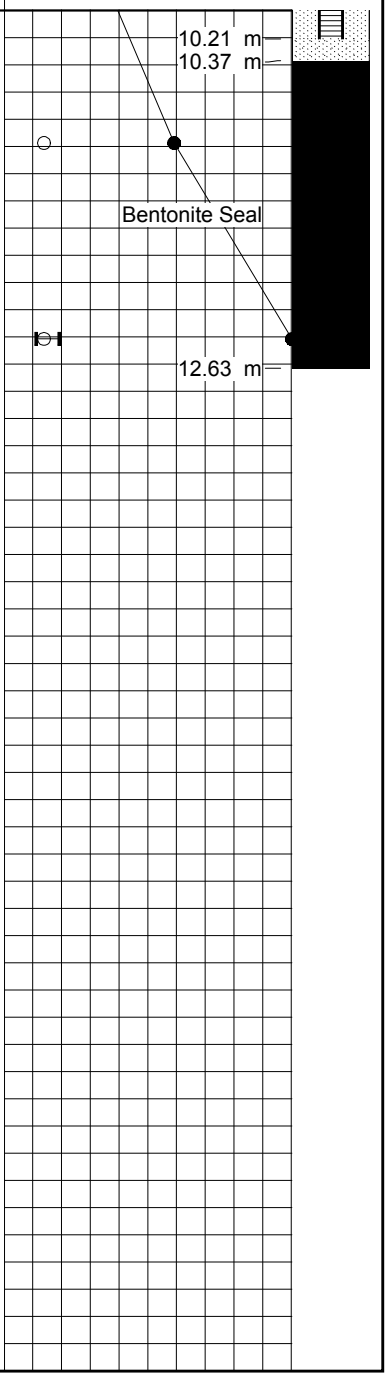
Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.73		GROUND SURFACE			%			N
	11.0			hard		SS10	95	14	16-22-37-50	59
	12.0			hard						
	12.63	68.10		Gravel : 2%, Sand : 24%, Silt : 55%, Clay : 19%		SS11	71	14	21-42-50/ 125mm	100

END OF BOREHOLE:

NOTE :
End of Borehole at 12.63 m bgs
Borehole was dry upon completion
50 mm diameter monitoring well installed at 10.21 m bgs
Groundwater level at 3.10 m bgs on August 12, 2016
Groundwater level at 3.25 m bgs on August 16, 2016
bgs denotes 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 12

BOREHOLE No.: MW12S-16
ELEVATION: 80.66 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 22 July 2016 DATE (FINISH): 22 July 2016

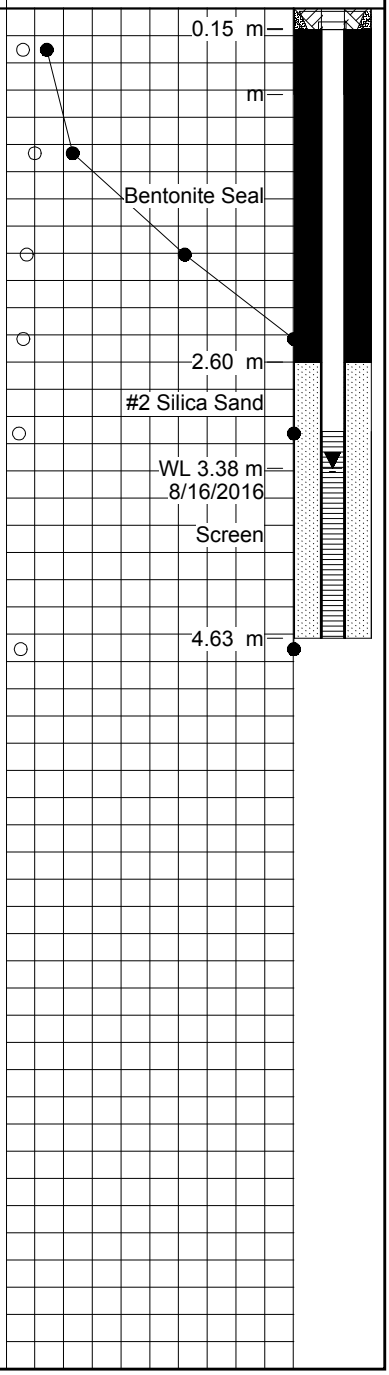
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		80.66		GROUND SURFACE			%			N
	0.10	80.56		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand and gravel, slightly plastic, brown to mottled brown		SS1	20	6	3-6-8-10	14
2										
	0.76	79.90		and grey, moist, stiff						
3	1.0			NATIVE : SILTY SAND/SANDY SILT TILL, trace clay and gravel, oxidized stains, brown,		SS2	60	10	5-9-14-31	23
4				moist, compact to very dense						
5				limestone fragments, hard						
6						SS3	50	7	9-24-38-50/ 125mm	62
7	2.0									
8						SS4	50	6	36-50/ 125mm	100
9										
10	3.0					SS5	40	4	50	100
11										
12										
13	4.0									
14										
15										
16	4.85	75.81				SS6	50	5	36-50/ 125mm	100
	5.0			**END OF BOREHOLE:**						
17										
18				NOTE :						
19				End of Borehole at 4.85 m bgs due to auger refusal						
20	6.0			Groundwater level measured at 4.11 m bgs upon completion						
21				50 mm diameter monitoring well installed at 4.66 m bgs						
22				Groundwater level at 3.47 m bgs on August 12, 2016						
23	7.0			Groundwater level at 3.38 m bgs on August 16, 2016						
24				bgs denotes 'below ground surface'						
25										
26	8.0									
27										
28										
29	9.0									
30										
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 13

BOREHOLE No.: BH13-16
ELEVATION: 82.27 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 20 July 2016 DATE (FINISH): 20 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		82.27		GROUND SURFACE			%			N
	0.10	82.17		TOPSOIL with rootlets : 100 mm						
1				FILL : SILTY CLAY, some sand and gravel, oxidized stain, brown, moist, stiff to very stiff		SS-1	33	10	4-6-7-13	13
2										
3	1.0			grey, very stiff		SS-2	63	33	6-10-13-19	23
4										
5				stiff		SS-3	58	9	3-4-9-31	13
6	2.0									
7										
	2.29	79.98		NATIVE : SILTY CLAY/CLAYEY SILT TILL, sandy, trace to some gravel, oxidized stains, brown, damp to moist, hard		SS-4	54	3	19-50/ 125mm	100
8										
9										
10	3.0			Gravel : 10%, Sand : 44%, Silt : 44%, Clay : 11%		SS-5	58	--	50/ 125mm	100
11										
12		78.46								
13	3.81 4.0			SILTY SAND, some clay, trace gravel, brown, moist, very dense						
14										
15				Gravel : 2%, Sand : 53%, Silt : 32%, Clay : 13%		SS-6	58	6	31-50/ 100mm	100
16										
17	5.0									
18						SS-7	33	7	38-50/ 125mm	100
19										
20	6.0									
21	6.40	75.87		SAND and GRAVEL, some silt, trace clay, grey, moist to wet, very dense						
22										
23	7.0			Gravel : 40%, Sand : 43%, Silt : 14%, Clay : 3%		SS-8	42	7	32-50/ 125mm	100
24										
25										
26	8.0									
27										
28						SS-9	42	7	38-50/ 125mm	100
29										
30	9.0									
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 13

BOREHOLE No.: BH13-16
ELEVATION: 82.27 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 20 July 2016 DATE (FINISH): 20 July 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		82.27		GROUND SURFACE						
33	10.06	72.21		SHALE, trace limestone, rock fragments, grey		SS-10	21	8	50/ 125mm	100
34										
35										
36	11.0									
37										
38										
39	11.87	70.40				SS-11	33	12	42-50/ 125mm	100
	12.0			**END OF BOREHOLE:**						
40				NOTE :						
41				End of Borehole at 11.87 m bgs						
42				Borehole remained open and dry upon completion						
43	13.0			bgs denotes 'below ground surface'						
44										
45										
46	14.0									
47										
48										
49	15.0									
50										
51										
52	16.0									
53										
54										
55										
56	17.0									
57										
58										
59	18.0									
60										
61										
62	19.0									
63										
64										
65										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

REFERENCE No.: 076896 ENCLOSURE No.: 14

BOREHOLE No.: MW14-16
ELEVATION: 81.57 m

BOREHOLE REPORT

Page: 1 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

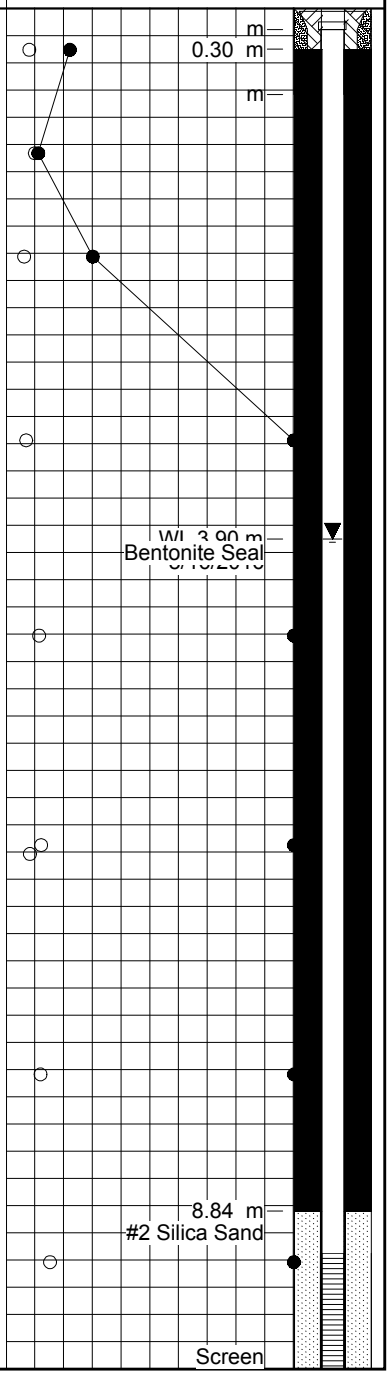
LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR
		81.57		GROUND SURFACE			%			N
	0.10	81.47		TOPSOIL : 100 mm						
1				FILL : SILTY SAND, some gravel, brown, moist, stiff to very stiff		SS1	54	8	4-9-13-15	22
2										
3	1.0			oxidized stains, stiff		SS2	75	10	3-4-7-9	11
4										
5	1.52	80.05		NATIVE : SANDY SILT/SAND TILL, some clay, trace to some gravel, oxidized stains, brown, moist to wet, dense		SS3	63	6	5-8-22-39	30
6										
7	2.0									
8						SS4		--		--
9										
10	3.0			very dense		SS5	100	7	22-50/ 100mm	100
11										
12				some gravel, trace clay						
13	4.0									
14										
15						SS6	100	11	50/ 75mm	100
16										
17	5.0									
18										
19										
20	6.0			encountered boulder at 6.2 m bgs		SS7A SS7B	100	12 8	28-50/ 125mm	100 --
21										
22										
23	7.0									
24										
25										
26	8.0					SS8	46	12	29-50/ 125mm	100
27										
28										
29										
30	9.0					SS9	100	15	50/ 125mm	100
31										
32										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90



SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

REFERENCE No.: 076896 ENCLOSURE No.: 14

BOREHOLE No.: MW14-16
ELEVATION: 81.57 m

BOREHOLE REPORT

Page: 2 of 2

CLIENT: Infrastructure Ontario (IO)
PROJECT: Preliminary Geotechnical Investigation
LOCATION: 700 Gordon Street, Whitby, Ontario
DESCRIBED BY: S. Howell CHECKED BY: S. Shahangian
DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth Feet	Depth Metres	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery TCR %	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index / SCR N
		81.57		GROUND SURFACE						
	10.21	71.36		SILTY CLAY/CLAYEY SILT TILL, trace sand and gravel, grey, wet, hard		SS10	100	16	33-50/ 75mm	100
	12.35	69.22		SHALE-BEDROCK, inferred, grey		SS11A	100	10	37-50/ 75mm	100
	12.46	69.11				SS11B		9		--

END OF BOREHOLE:

NOTE :
End of Borehole at 12.35 m bgs
Groundwater level at 4.52 m bgs upon completion
50 mm diameter monitoring well installed at 10.67 m bgs
Groundwater level at 3.90 m bgs on August 16, 2016
bgs denotes 'below ground surface'

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)
● "N" Value (blows / 12 in.-30 cm)

10 20 30 40 50 60 70 80 90

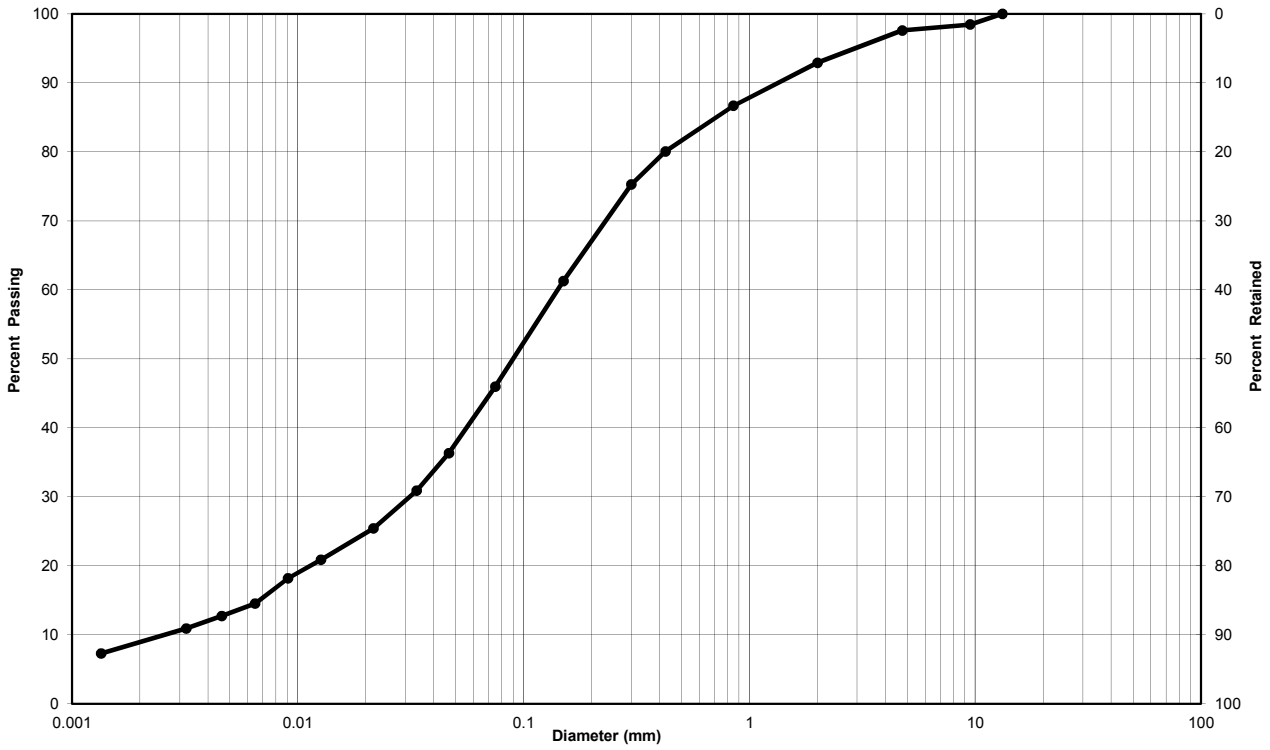
10.67 m
11.13 m
Caved In
12.35 m

SOIL LOG WITH GRAPH+WELL 076896-GEO.GPJ INSPEC_SOL.GDT 19/8/16

Appendix B
Geotechnical Laboratory Test Results

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	MW01-16	Sample No.:	SS3
Depth:	1.7m - 2.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	2	52	46

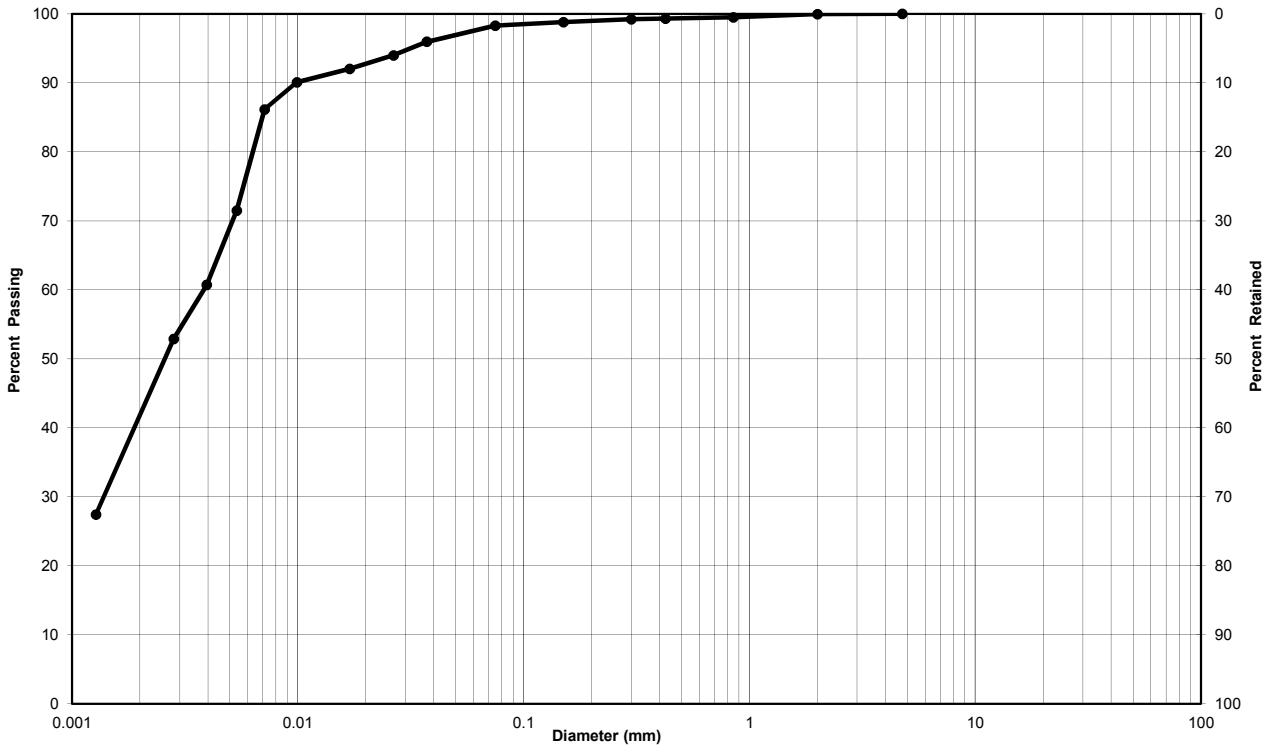
Remarks: Silt-size particles (0.074 to 0.002 mm): 37%, Clay-size particles (<0.002 mm): 9%

Gravel 2%, Sand 52%, Silt 37%, Clay 9%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1294
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH02-16	Sample No.:	SS6
Depth:	4.7m - 5.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Clay, Trace Sand	0	2	98

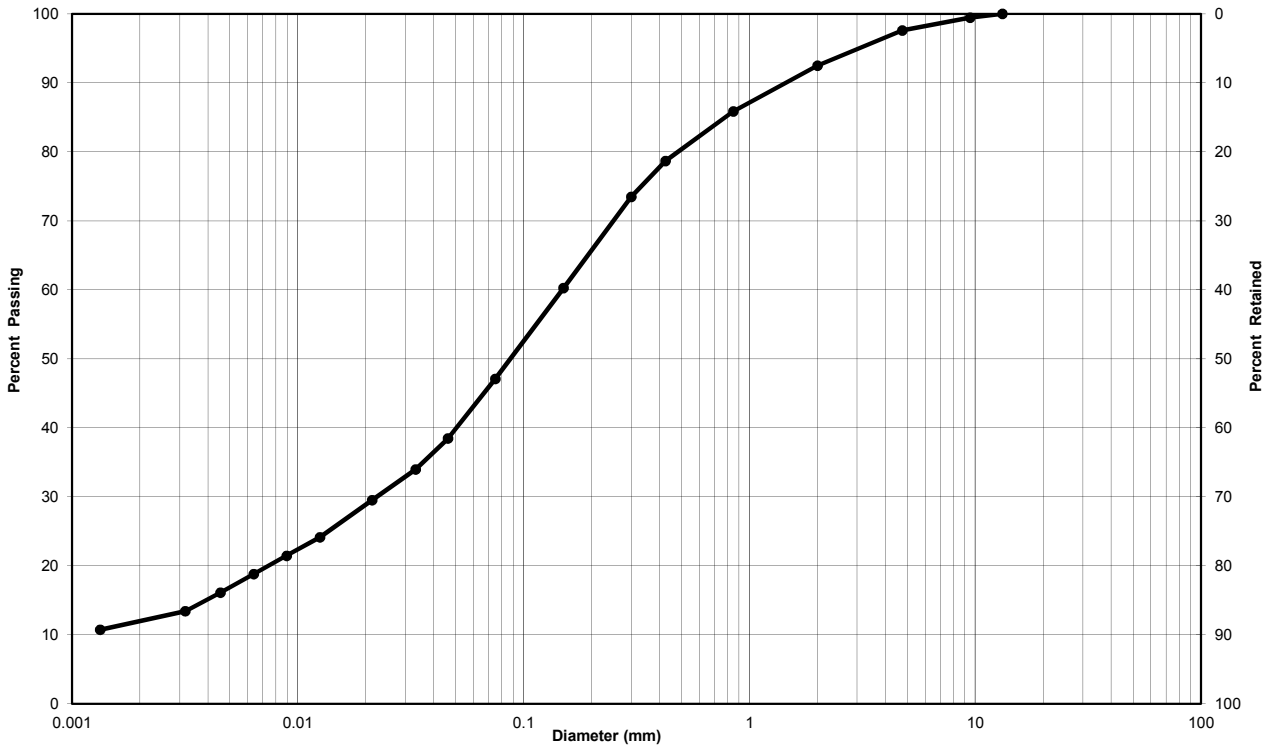
Remarks: Silt-size particles (0.074 to 0.002 mm): 56%, Clay-size particles (<0.002 mm): 42%

Gravel 0%, Sand 2%, Silt 56%, Clay 42%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	MW03-16	Sample No.:	SS3
Depth:	1.7m - 2.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	2	51	47

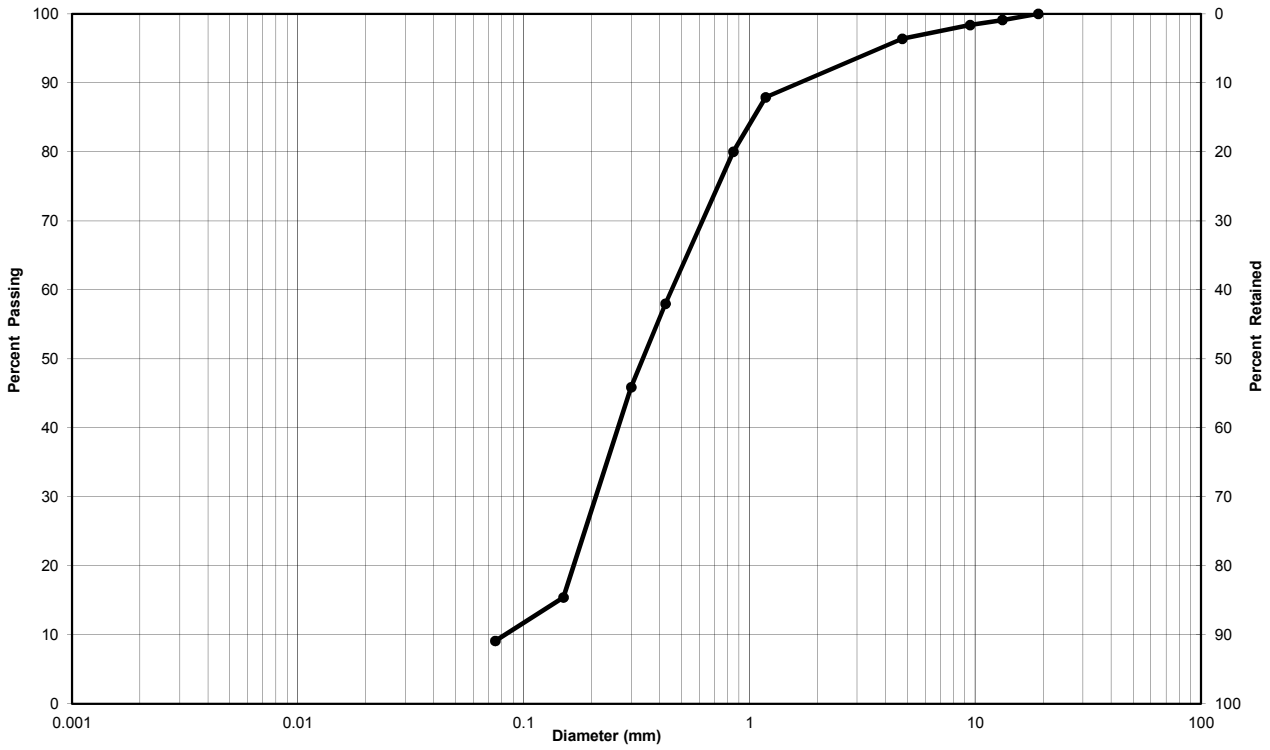
Remarks: Silt-size particles (0.074 to 0.002 mm): 35%, Clay-size particles (<0.002 mm): 12%

Gravel 2%, Sand 51%, Silt 35%, Clay 12%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	MW03-16	Sample No.:	SS5B
Depth:	3.2m - 3.5m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, Trace Silt and Gravel	3	88	9

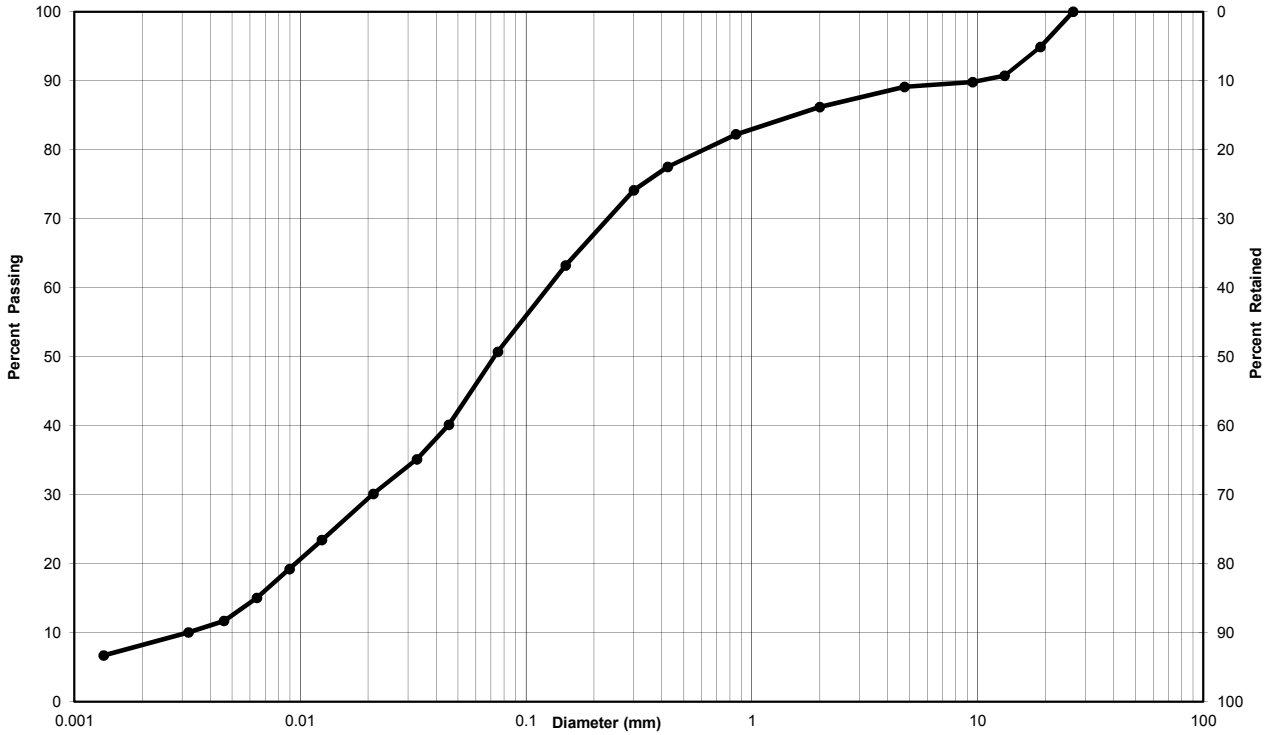
Remarks:

Gravel 3%, Sand 88%, Silt 9%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1294
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH04-16	Sample No.:	SS4
Depth:	2.4m - 2.7m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy Silt, Some Gravel, Trace Clay	11	38	51

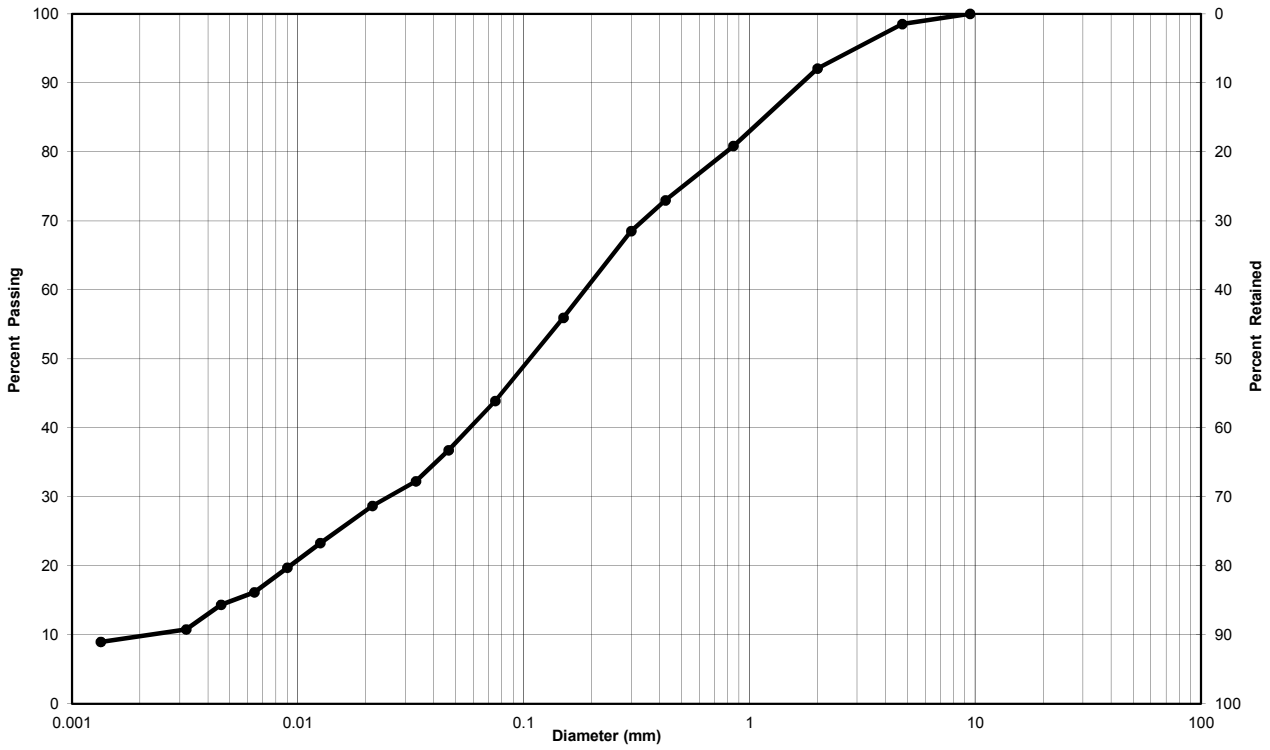
Remarks: Silt-size particles (0.074 to 0.002 mm): 43%, Clay-size particles (<0.002 mm): 8%

Gravel 11%, Sand 38%, Silt 43%, Clay 8%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1305
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	MW05-16	Sample No.:	SS5
Depth:	3.2m - 3.5m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Trace Gravel and Clay	1	55	44

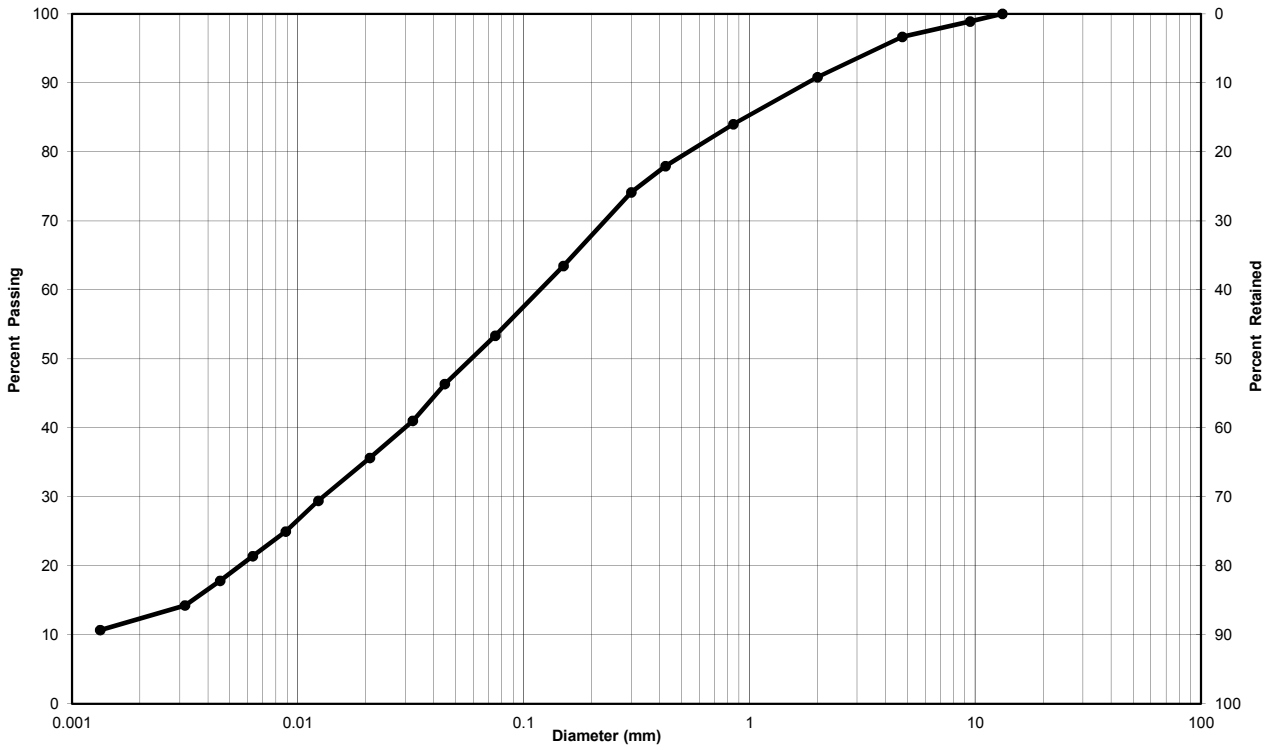
Remarks: Silt-size particles (0.074 to 0.002 mm): 34%, Clay-size particles (<0.002 mm): 10%

Gravel 1%, Sand 55%, Silt 34%, Clay 10%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1294
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH06-16	Sample No.:	SS5
Depth:	3.2m - 3.5m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Clay/Clayey Silt, Sandy, Trace Gravel	3	44	53

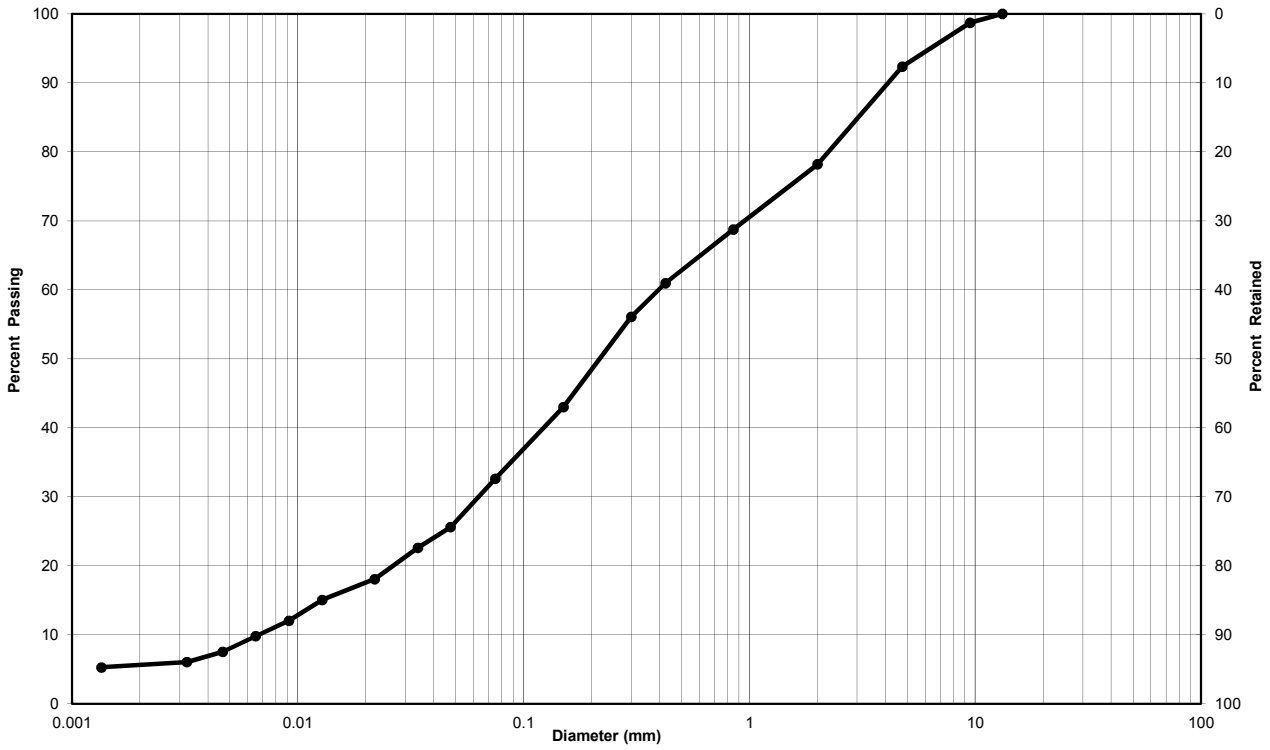
Remarks: Silt-size particles (0.074 to 0.002 mm): 41%, Clay-size particles (<0.002 mm): 12%

Gravel 3%, Sand 44%, Silt 41%, Clay 12%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH7-16	Sample No.:	SS5A
Depth:	3.2m - 3.3m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Trace Clay and Gravel	8	59	33

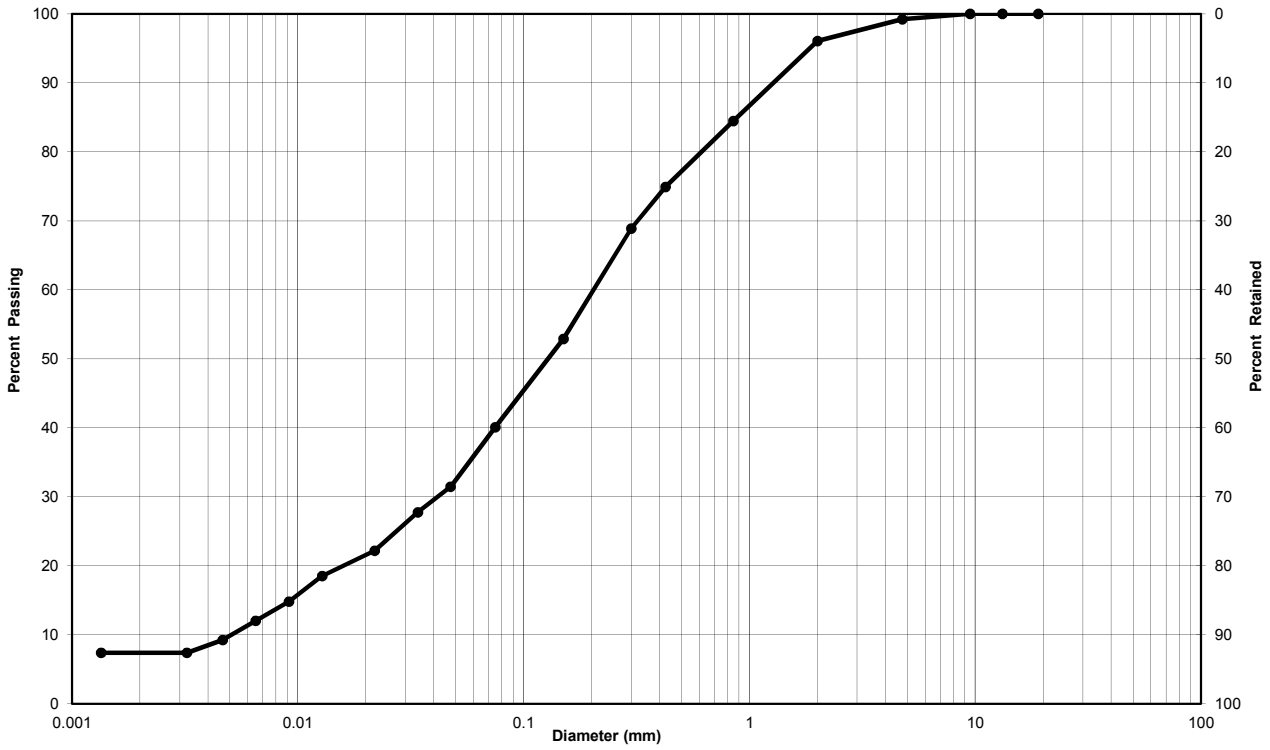
Remarks: Silt-size particles (0.074 to 0.002 mm): 27%, Clay-size particles (<0.002 mm): 6%

Gravel 8%, Sand 59%, Silt 27%, Clay 6%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH07-16	Sample No.:	SS5B
Depth:	3.3m - 3.4m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Trace Gravel and Clay	1	59	40

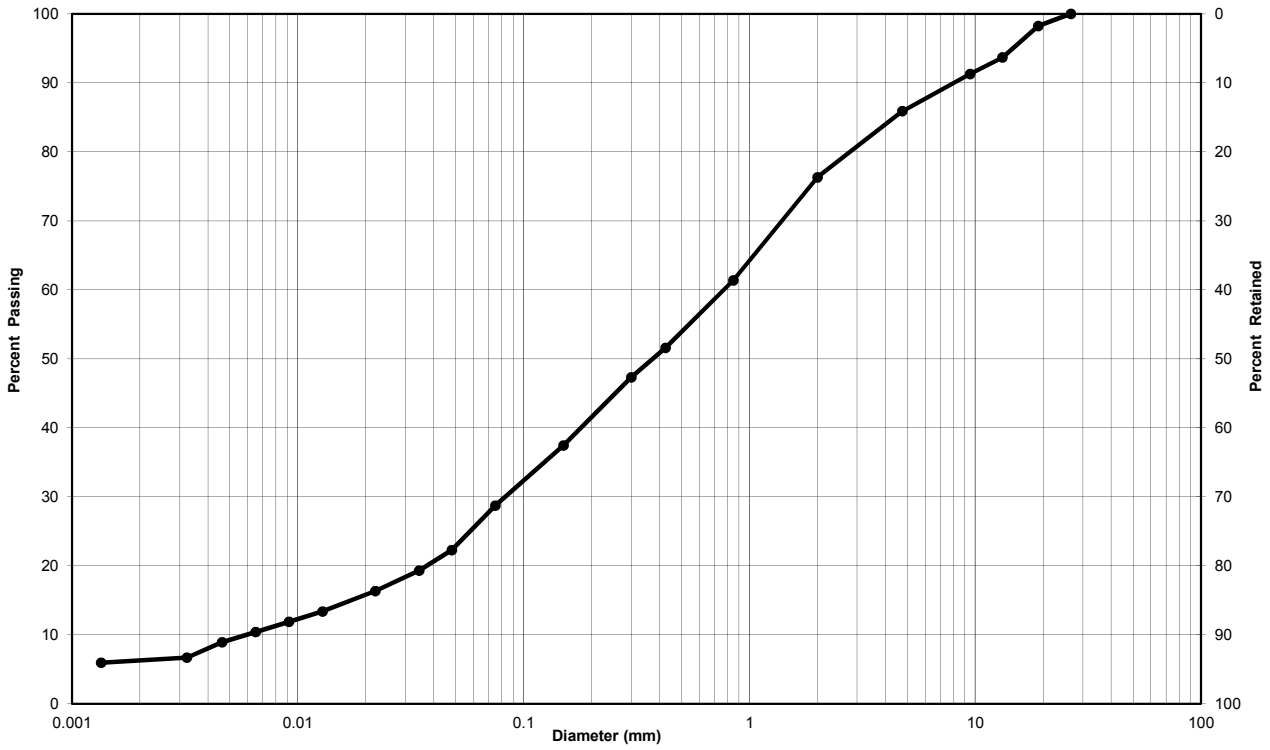
Remarks: Silt-size particles (0.074 to 0.002 mm): 33%, Clay-size particles (<0.002 mm): 7%

Gravel 1%, Sand 59%, Silt 33%, Clay 7%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1294
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH08-16	Sample No.:	SS6
Depth:	4.7m - 5.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Gravel, Trace Clay	14	57	29

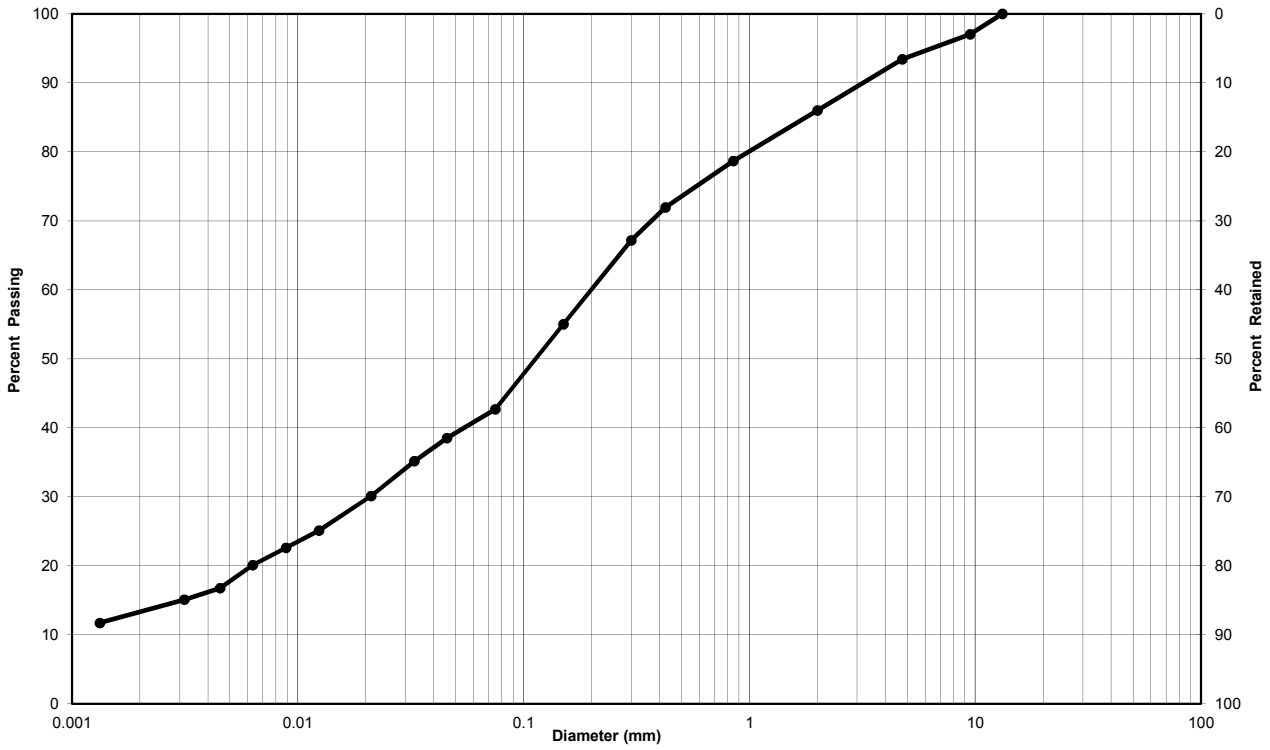
Remarks: Silt-size particles (0.074 to 0.002 mm): 23%, Clay-size particles (<0.002 mm): 6%

Gravel 14%, Sand 57%, Silt 23%, Clay 6%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH09-16	Sample No.:	SS3
Depth:	1.7m - 2.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	7	50	43

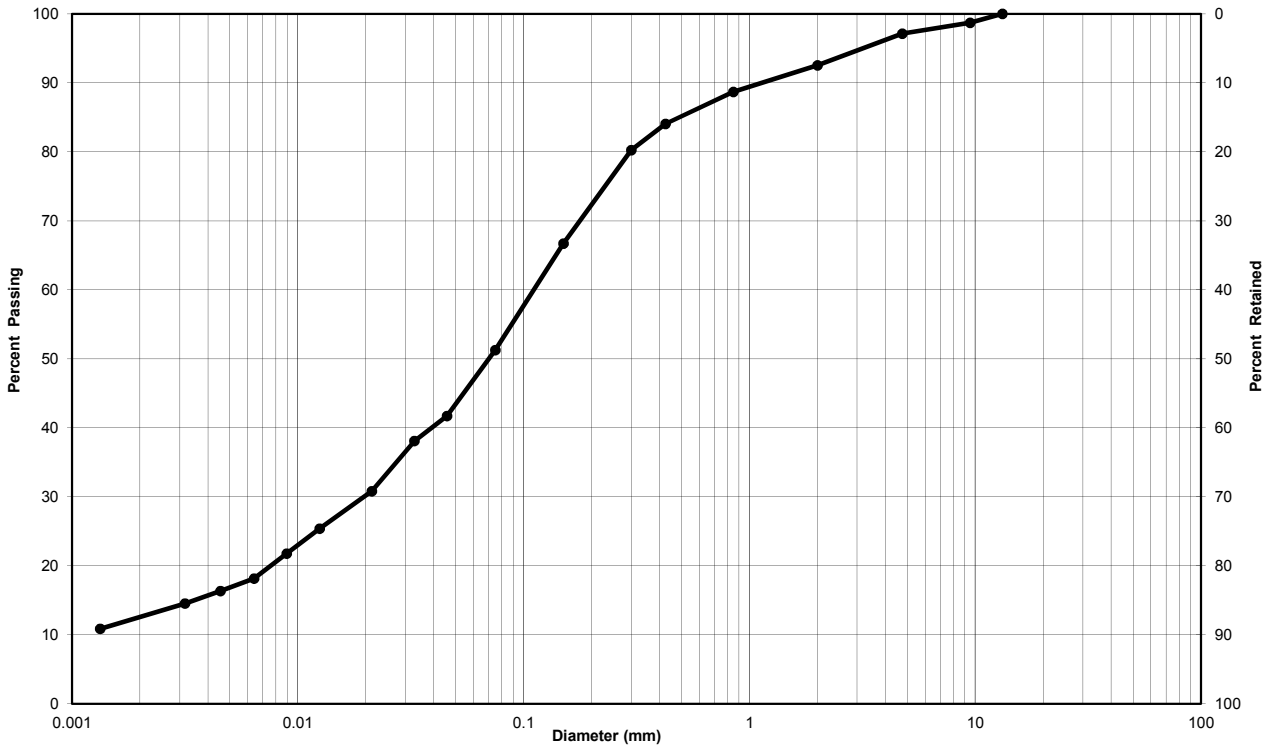
Remarks: Silt-size particles (0.074 to 0.002 mm): 30%, Clay-size particles (<0.002 mm): 13%

Gravel 7%, Sand 50%, Silt 30%, Clay 13%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH09-16	Sample No.:	SS6
Depth:	4.7m - 5.0m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Clay/Clayey Silt, Sandy, Trace Gravel	3	46	51

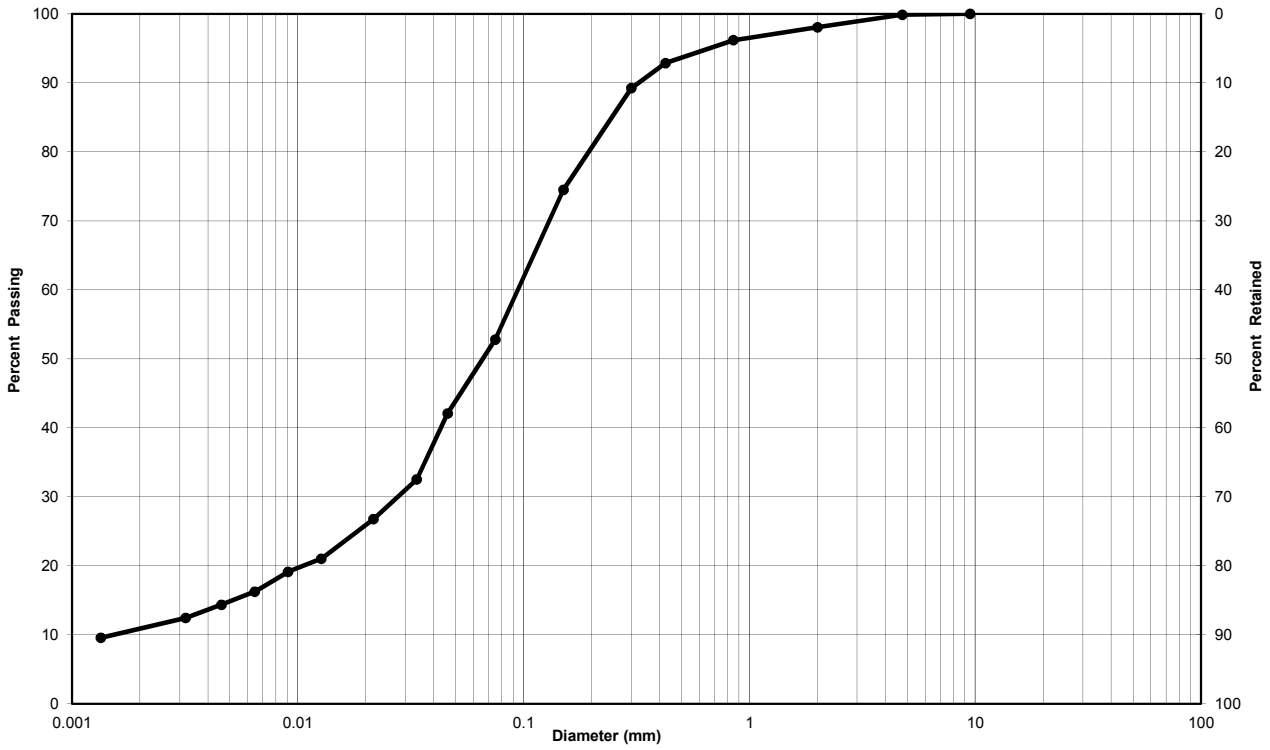
Remarks: Silt-size particles (0.074 to 0.002 mm): 38%, Clay-size particles (<0.002 mm): 13%

Gravel 3%, Sand 46%, Silt 38%, Clay 13%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1280
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH09-16	Sample No.:	SS9
Depth:	9.3m - 9.6m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Clay/Clayey Silt, Sandy	0	47	53

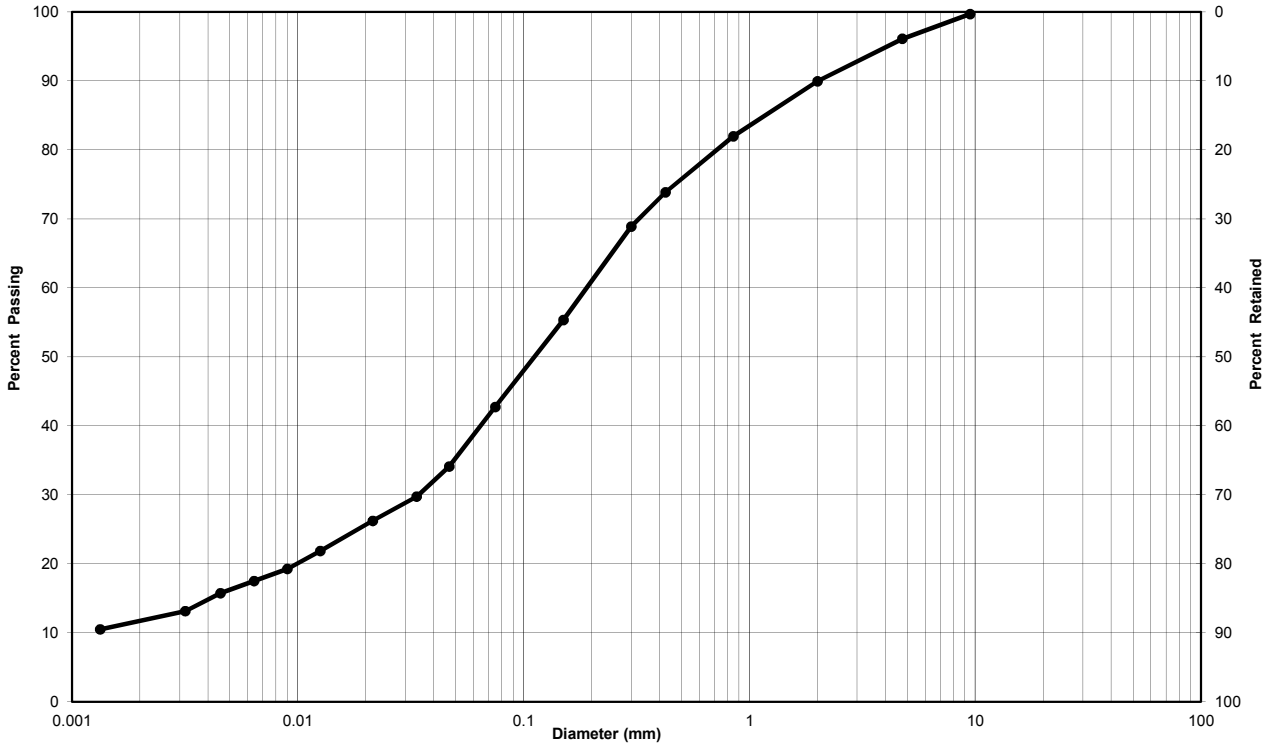
Remarks: Silt-size particles (0.074 to 0.002 mm): 42%, Clay-size particles (<0.002 mm): 11%

Gravel 0%, Sand 47%, Silt 42%, Clay 11%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1305
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH11-16	Sample No.:	SS5
Depth:	3.2m - 3.5m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	4	53	43

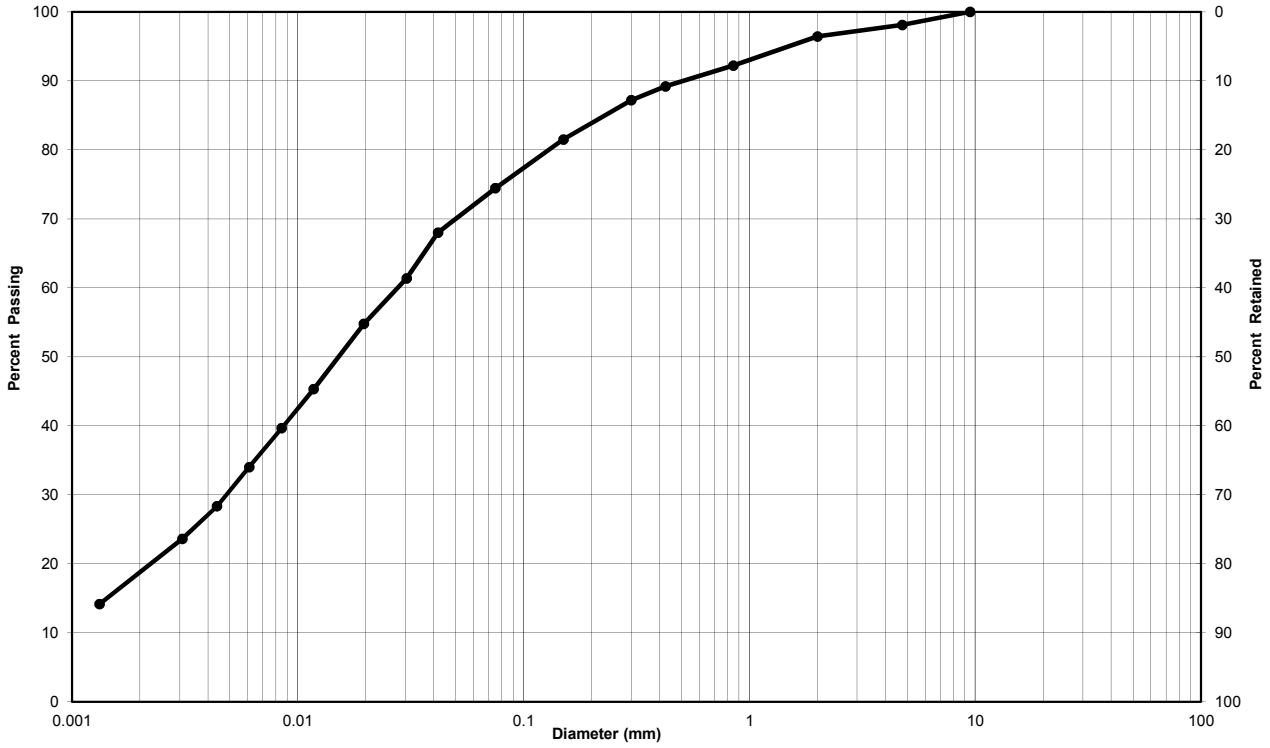
Remarks: Silt-size particles (0.074 to 0.002 mm): 31%, Clay-size particles (<0.002 mm): 12%

Gravel 4%, Sand 53%, Silt 31%, Clay 12%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1286
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	MW12D-16	Sample No.:	SS11
Depth:	12.3m - 12.6m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Clay, Sandy, Trace Gravel	2	24	74

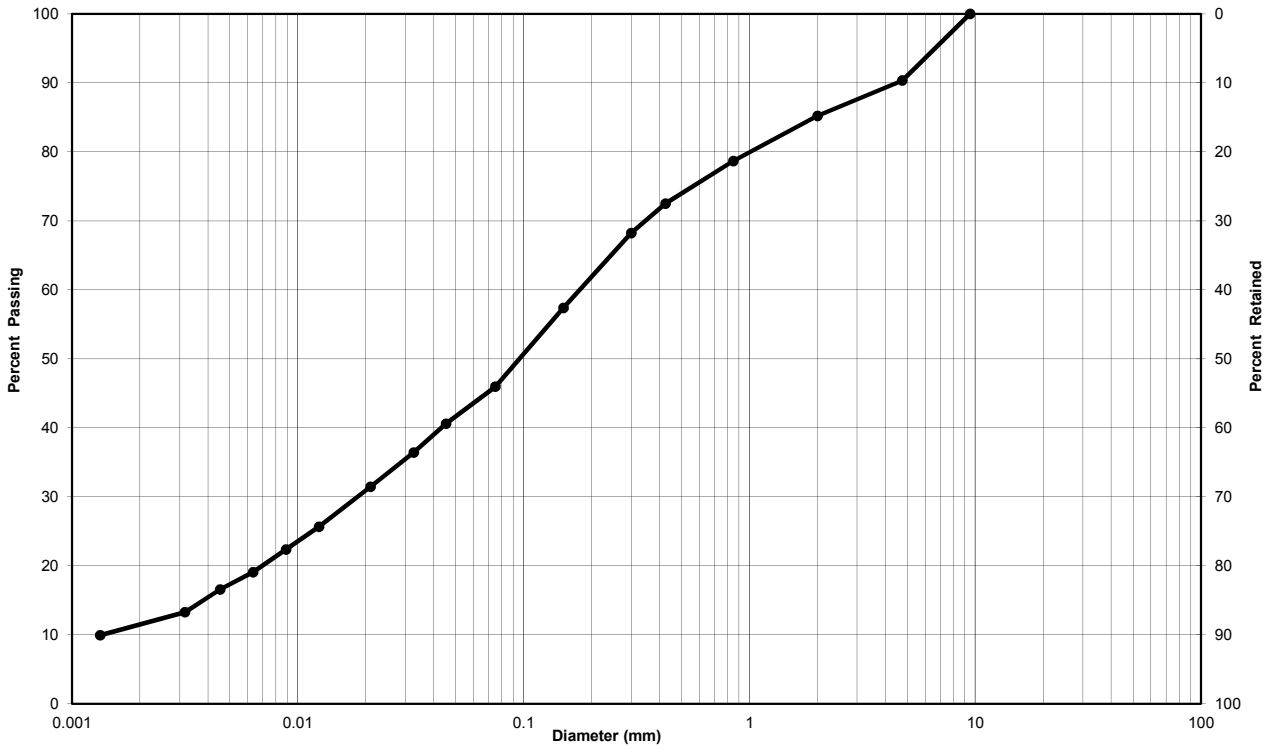
Remarks: Silt-size particles (0.074 to 0.002 mm): 55%, Clay-size particles (<0.002 mm): 19%

Gravel 2%, Sand 24%, Silt 55%, Clay 19%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1286
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH13-16	Sample No.:	SS5
Depth:	3.0m - 3.2m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	10	44	46

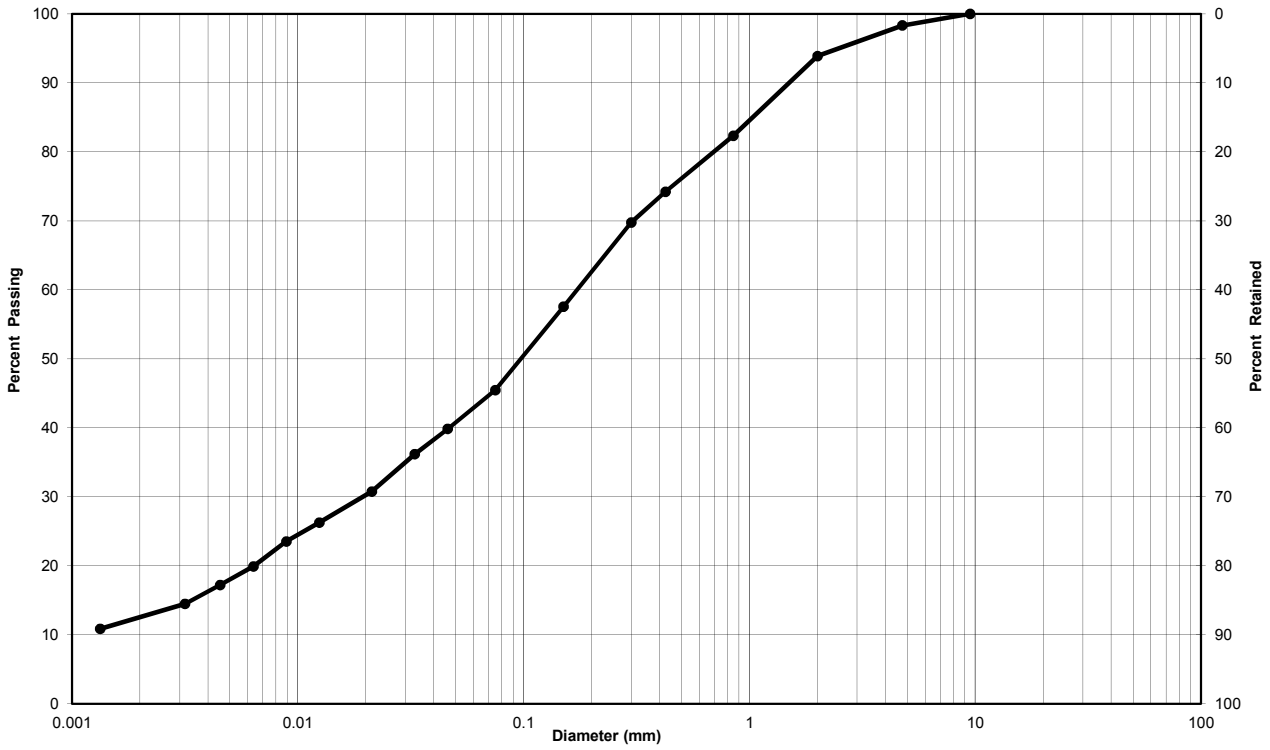
Remarks: Silt-size particles (0.074 to 0.002 mm): 35%, Clay-size particles (<0.002 mm): 11%

Gravel 10%, Sand 44%, Silt 35%, Clay 11%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	July 27, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 3, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1286
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH13-16	Sample No.:	SS6
Depth:	4.6m - 4.8m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty Sand, Some Clay, Trace Gravel	2	53	45

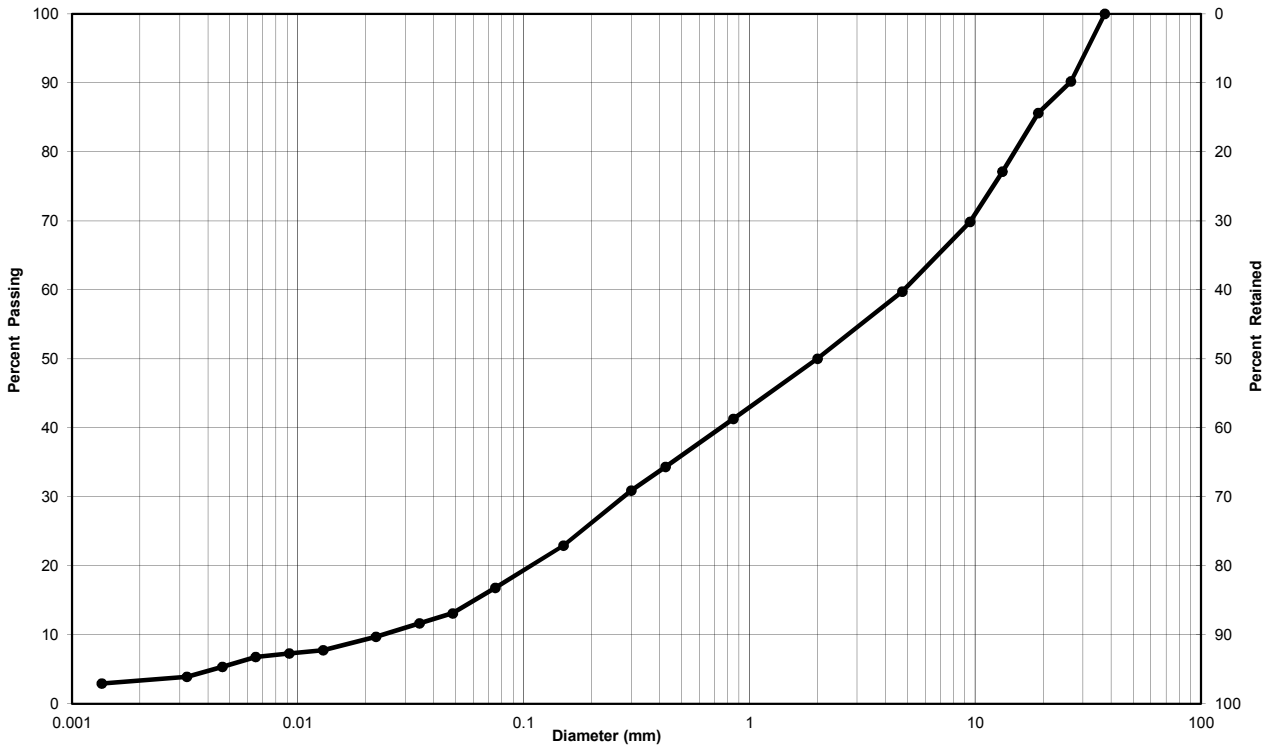
Remarks: Silt-size particles (0.074 to 0.002 mm): 32%, Clay-size particles (<0.002 mm): 13%

Gravel 2%, Sand 53%, Silt 32%, Clay 13%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 10, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Particle-Size Analysis of Soils
ASTM D422 (Geotechnical)

Client:	Ontario Infrastructure & Lands Corporation	**Lab No.:**	G1286
Project, Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, Ontario	**Project No.:**	076896
Borehole No.:	BH13-16	Sample No.:	SS8
Depth:	7.0m - 7.3m	Enclosure:	



Silty Clay	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Gravel, Some Silt, Trace Clay	40	43	17

Remarks: Silt-size particles (0.074 to 0.002 mm): 14%, Clay-size particles (<0.002 mm): 3%

Gravel 40%, Sand 43%, Silt 14%, Clay 3%

Performed by:	Anwar Rehani / Riddhee Panchal	**Date:**	August 15, 2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	August 17, 2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1294
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH02-16	Sample no.:	SS6	Depth:	4.7m - 5.0m
Soil description:	Low Plasticity Inorganic Clay (CL)			Date sampled:	28-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	7
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	30	24
Water Content:			
Tare no.	AT41	AT29	AT38
Wet soil+tare, g	25.99	27.75	27.12
Dry soil+tare, g	23.44	24.78	24.26
Mass of water, g	2.55	2.97	2.86
Tare, g	14.86	14.93	14.91
Mass of soil, g	8.58	9.85	9.35
Water content %	29.7%	30.2%	30.6%

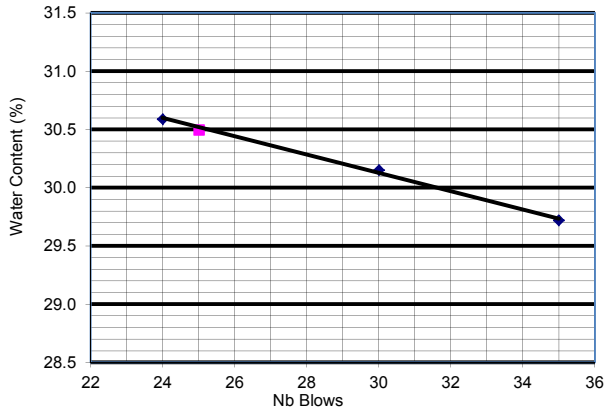
Plastic Limit (PL) - Water Content:		
Tare no.	AT15	AT33
Wet soil+tare, g	19.03	20.34
Dry soil+tare, g	18.51	19.62
Mass of water, g	0.52	0.72
Tare, g	15.04	14.86
Mass of soil, g	3.47	4.76
Water content %	15.0%	15.1%
Average water content %	15.1%	

Natural Water Content (W^n):		
Tare no.	C31	
Wet soil+tare, g	48.6	
Dry soil+tare, g	42.6	
Mass of water, g	6.00	
Tare, g	1.30	
Mass of soil, g	41.30	
Water content %	14.5%	

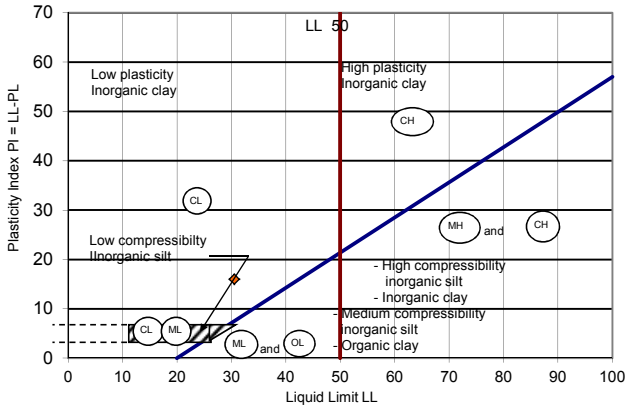
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
31	15	16	15

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/12/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1280
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	MW03-16	Sample no.:	SS3	Depth:	1.7m - 2.0m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	18-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	2
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	33	28	25
Water Content:			
Tare no.	AT-44	AT-42	AT-11
Wet soil+tare, g	26.68	24.87	26.59
Dry soil+tare, g	25.01	23.42	24.85
Mass of water, g	1.67	1.45	1.74
Tare, g	14.83	14.91	14.83
Mass of soil, g	10.18	8.51	10.02
Water content %	16.4%	17.0%	17.4%

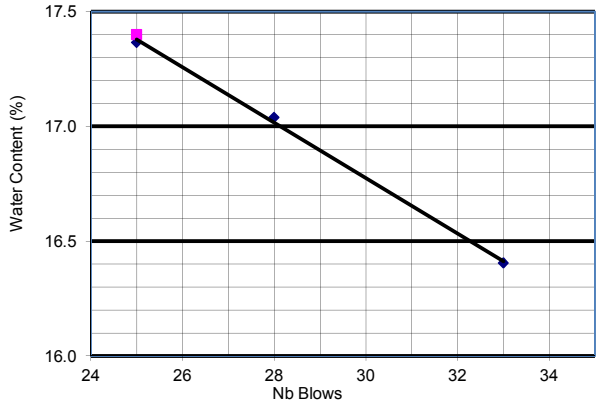
Plastic Limit (PL) - Water Content:		
Tare no.	AT46	AT3
Wet soil+tare, g	18.58	19.15
Dry soil+tare, g	18.22	18.72
Mass of water, g	0.36	0.43
Tare, g	14.98	14.93
Mass of soil, g	3.24	3.79
Water content %	11.1%	11.3%
Average water content %	11.2%	

Natural Water Content (W^n):		
Tare no.	C7	
Wet soil+tare, g	63.4	
Dry soil+tare, g	60.1	
Mass of water, g	3.30	
Tare, g	1.30	
Mass of soil, g	58.80	
Water content %	5.6%	

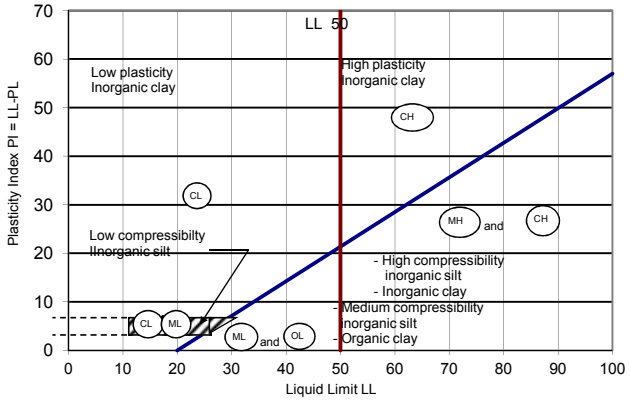
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
17	11	6	6

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/2/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/3/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1294
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH04-16	Sample no.:	SS4	Depth:	2.4m - 2.7m
Soil description:	Non-Plastic (np)			Date sampled:	29-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	2
Liquid limit device no.:	-	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

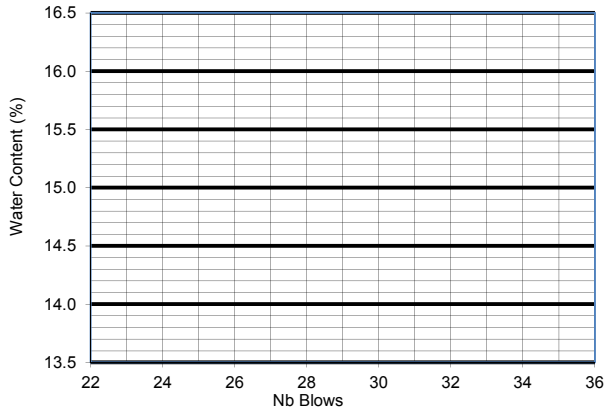
Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Plastic Limit (PL) - Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Average water content %			
Natural Water Content (W^n):			
Tare no.	A12		
Wet soil+tare, g	35.0		
Dry soil+tare, g	33.9		
Mass of water, g	1.10		
Tare, g	1.30		
Mass of soil, g	32.60		
Water content %	3.4%		

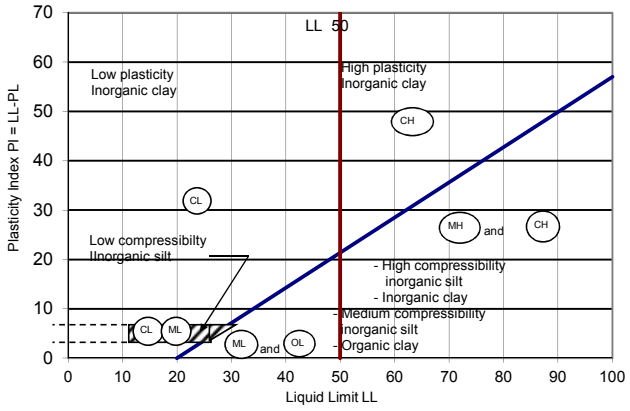
Soil Preparation:

- ☐ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☑ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
Non-Plastic (np)			3

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/15/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1305
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	MW5-16	Sample no.:	SS5	Depth:	3.2m - 3.5m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	26-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	10
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	30	26	22
Water Content:			
Tare no.	AT13	AT16	AT46
Wet soil+tare, g	24.31	25.04	26.79
Dry soil+tare, g	23.08	23.68	25.14
Mass of water, g	1.23	1.36	1.65
Tare, g	14.95	14.99	15.00
Mass of soil, g	8.13	8.69	10.14
Water content %	15.1%	15.7%	16.3%

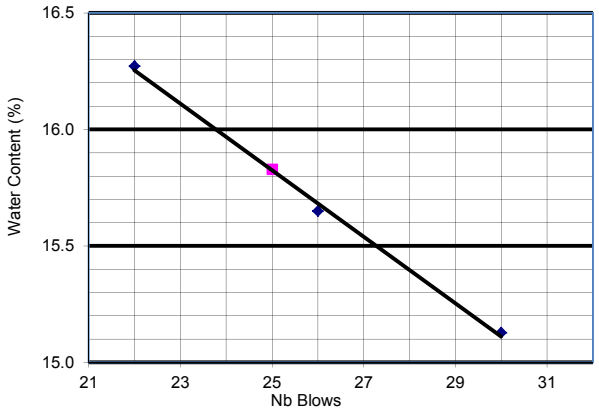
Plastic Limit (PL) - Water Content:		
Tare no.	AT22	AT23
Wet soil+tare, g	22.13	20.65
Dry soil+tare, g	21.45	20.09
Mass of water, g	0.68	0.56
Tare, g	14.81	14.79
Mass of soil, g	6.64	5.30
Water content %	10.2%	10.6%
Average water content %	10.4%	

Natural Water Content (W^n):		
Tare no.	HY15	
Wet soil+tare, g	356.7	
Dry soil+tare, g	339.2	
Mass of water, g	17.49	
Tare, g	13.69	
Mass of soil, g	325.51	
Water content %	5.4%	

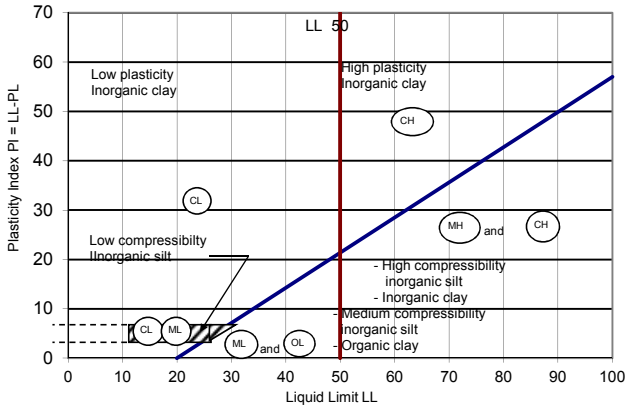
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
16	10	6	5

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/15/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1294
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH06-16	Sample no.:	SS5	Depth:	3.2m - 3.5m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	27-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	8
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	31	27	22
Water Content:			
Tare no.	AT3	AT9	AT21
Wet soil+tare, g	25.80	27.00	26.42
Dry soil+tare, g	24.29	25.31	24.76
Mass of water, g	1.51	1.69	1.66
Tare, g	14.94	15.06	15.06
Mass of soil, g	9.35	10.25	9.70
Water content %	16.1%	16.5%	17.1%

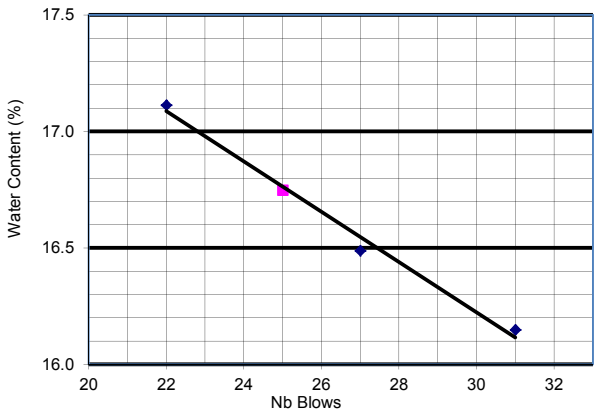
Plastic Limit (PL) - Water Content:		
Tare no.	AT44	AT46
Wet soil+tare, g	20.24	19.70
Dry soil+tare, g	19.74	19.24
Mass of water, g	0.50	0.46
Tare, g	14.87	15.00
Mass of soil, g	4.87	4.24
Water content %	10.3%	10.8%
Average water content %	10.6%	

Natural Water Content (W^n):		
Tare no.	C10	
Wet soil+tare, g	31.1	
Dry soil+tare, g	29.0	
Mass of water, g	2.10	
Tare, g	1.30	
Mass of soil, g	27.70	
Water content %	7.6%	

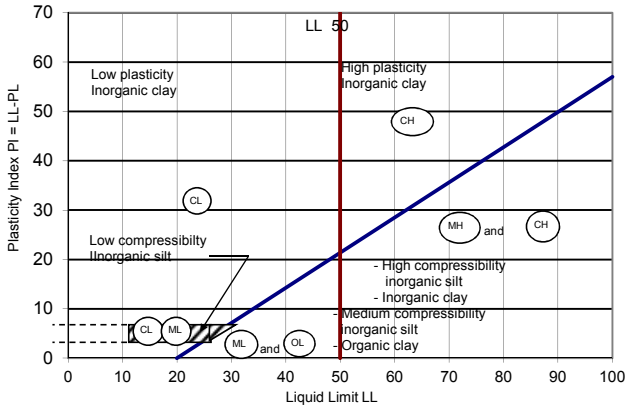
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
17	11	6	8

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/12/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1280
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH07-16	Sample no.:	SS5A	Depth:	3.2m - 3.3m
Soil description:	Non-Plastic (np)			Date sampled:	21-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	2
Liquid limit device no.:	-	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			

Plastic Limit (PL) - Water Content:

Tare no.		
Wet soil+tare, g		
Dry soil+tare, g		
Mass of water, g		
Tare, g		
Mass of soil, g		
Water content %		
Average water content %		

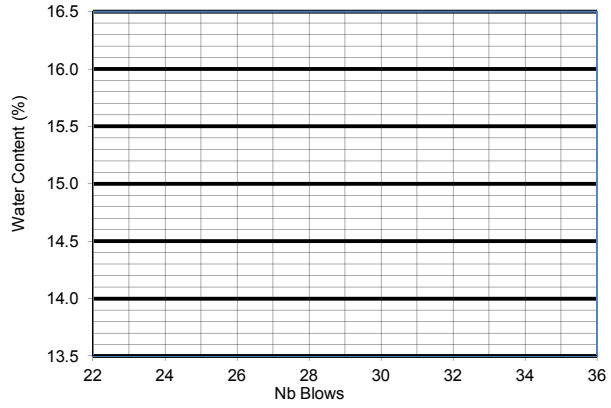
Natural Water Content (W^n):

Tare no.	A27	
Wet soil+tare, g	27.3	
Dry soil+tare, g	25.8	
Mass of water, g	1.50	
Tare, g	1.30	
Mass of soil, g	24.50	
Water content %	6.1%	

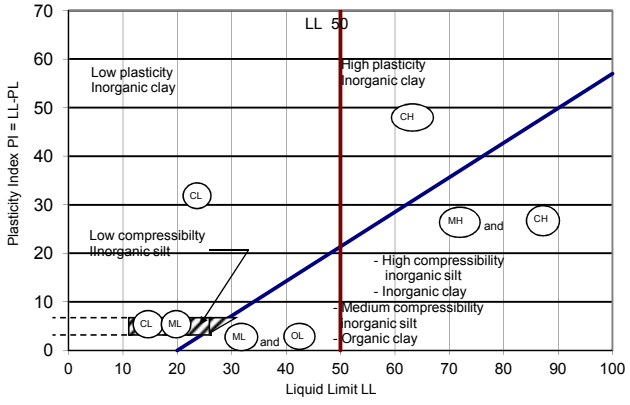
Soil Preparation:

- ☐ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☑ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
Non-Plastic (np)			6

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/15/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1294
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH08-16	Sample no.:	SS6	Depth:	4.7m - 5.0m
Soil description:	Non-Plastic (np)			Date sampled:	29-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	2
Liquid limit device no.:	-	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

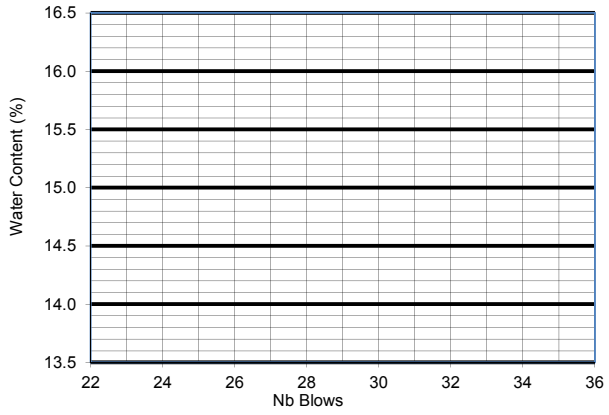
Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows			
Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Plastic Limit (PL) - Water Content:			
Tare no.			
Wet soil+tare, g			
Dry soil+tare, g			
Mass of water, g			
Tare, g			
Mass of soil, g			
Water content %			
Average water content %			
Natural Water Content (W^n):			
Tare no.	C7		
Wet soil+tare, g	32.9		
Dry soil+tare, g	32.2		
Mass of water, g	0.70		
Tare, g	1.30		
Mass of soil, g	30.90		
Water content %	2.3%		

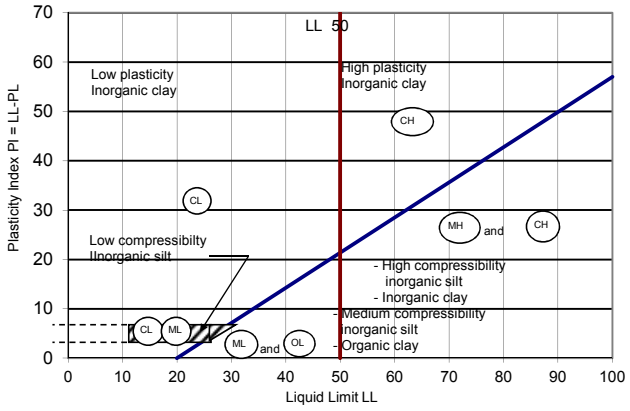
Soil Preparation:

- ☐ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☑ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
Non-Plastic (np)			2

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/15/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1280
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH09-16	Sample no.:	SS3	Depth:	1.7m - 2.0m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	1
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	28	22	19
Water Content:			
Tare no.	AT-9	AT-31	AT38
Wet soil+tare, g	26.30	30.58	29.67
Dry soil+tare, g	24.64	28.23	27.36
Mass of water, g	1.66	2.35	2.31
Tare, g	15.05	15.06	14.86
Mass of soil, g	9.59	13.17	12.50
Water content %	17.3%	17.8%	18.5%

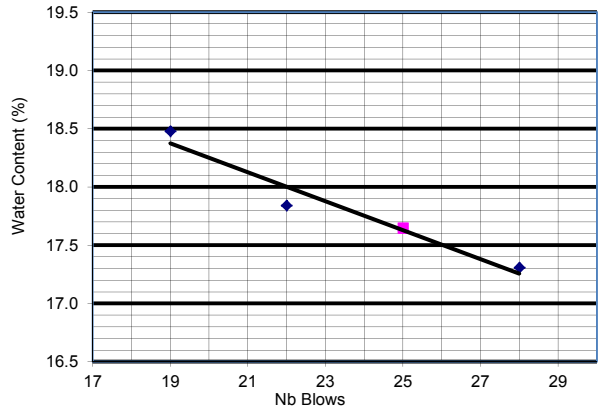
Plastic Limit (PL) - Water Content:		
Tare no.	AT22	AT23
Wet soil+tare, g	22.27	20.95
Dry soil+tare, g	21.52	20.33
Mass of water, g	0.75	0.62
Tare, g	14.76	14.76
Mass of soil, g	6.76	5.57
Water content %	11.1%	11.1%
Average water content %	11.1%	

Natural Water Content (W^n):		
Tare no.	E37	
Wet soil+tare, g	38.3	
Dry soil+tare, g	36.2	
Mass of water, g	2.10	
Tare, g	1.30	
Mass of soil, g	34.90	
Water content %	6.0%	

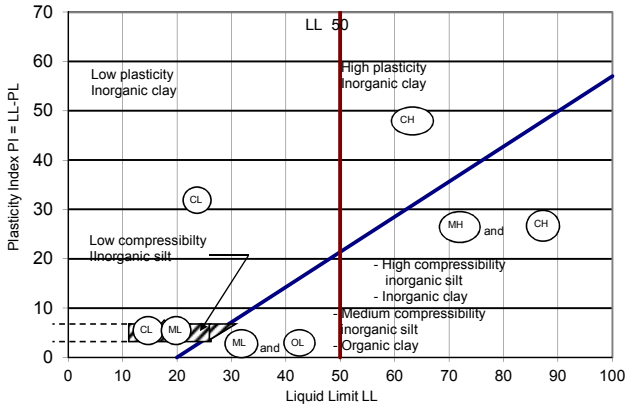
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
18	11	7	6

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/2/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/3/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1280
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH09-16	Sample no.:	SS6	Depth:	4.7m - 5.0m
Soil description:	Low Compressibility Inorganic Silt (ML)			Date sampled:	21-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	9
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	27	21	15
Water Content:			
Tare no.	AT33	AT11	AT44
Wet soil+tare, g	26.18	27.05	27.40
Dry soil+tare, g	24.93	25.60	25.85
Mass of water, g	1.25	1.45	1.55
Tare, g	14.86	14.89	14.87
Mass of soil, g	10.07	10.71	10.98
Water content %	12.4%	13.5%	14.1%

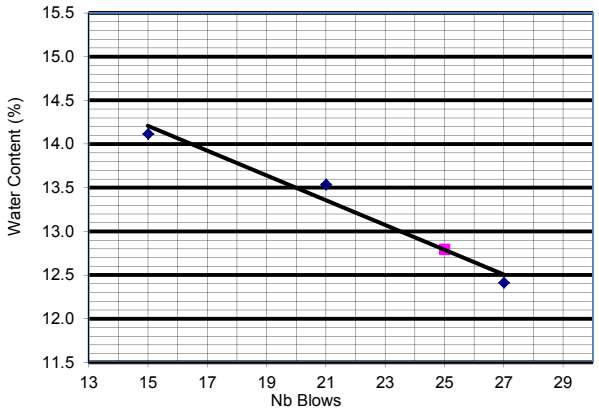
Plastic Limit (PL) - Water Content:		
Tare no.	AT15	AT45
Wet soil+tare, g	22.73	21.40
Dry soil+tare, g	22.05	20.83
Mass of water, g	0.68	0.57
Tare, g	15.02	14.94
Mass of soil, g	7.03	5.89
Water content %	9.7%	9.7%
Average water content %	9.7%	

Natural Water Content (W^n):		
Tare no.	S2	
Wet soil+tare, g	46.7	
Dry soil+tare, g	40.9	
Mass of water, g	5.80	
Tare, g	1.30	
Mass of soil, g	39.60	
Water content %	14.6%	

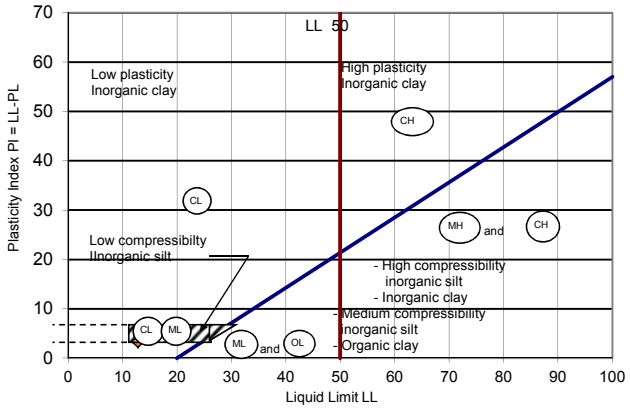
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
13	10	3	15

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/16/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1305
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH11-16	Sample no.:	SS5	Depth:	3.2m - 3.5m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	8-Aug-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	9
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	31	27	23
Water Content:			
Tare no.	AT20	AT43	AT28
Wet soil+tare, g	28.94	28.13	30.57
Dry soil+tare, g	27.09	26.38	28.44
Mass of water, g	1.85	1.75	2.13
Tare, g	14.65	14.91	14.94
Mass of soil, g	12.44	11.47	13.50
Water content %	14.9%	15.3%	15.8%

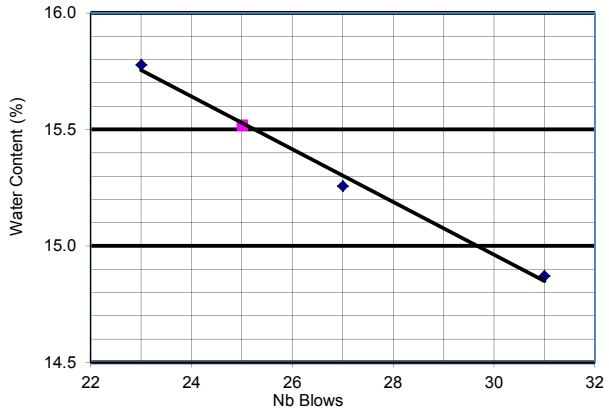
Plastic Limit (PL) - Water Content:		
Tare no.	AT13	AT45
Wet soil+tare, g	21.91	22.51
Dry soil+tare, g	21.29	21.83
Mass of water, g	0.62	0.68
Tare, g	14.94	14.94
Mass of soil, g	6.35	6.89
Water content %	9.8%	9.9%
Average water content %	9.8%	

Natural Water Content (W^n):		
Tare no.	C31	
Wet soil+tare, g		
Dry soil+tare, g		
Mass of water, g	0.00	
Tare, g		
Mass of soil, g	0.00	
Water content %	#DIV/0!	

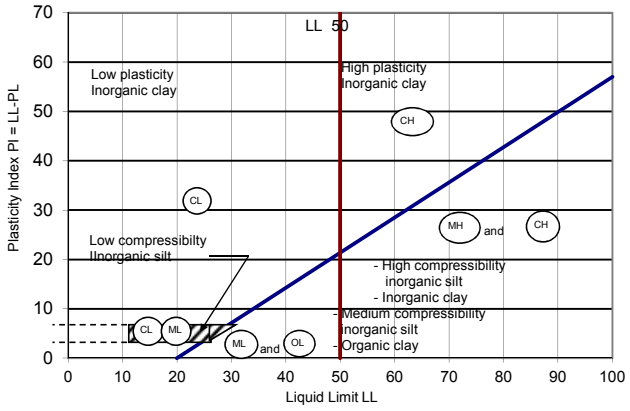
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
16	10	6	#DIV/0!

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/12/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1286
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH12D-16	Sample no.:	SS5	Depth:	12.3m - 12.6m
Soil description:	Low Plasticity Inorganic Clay (CL)			Date sampled:	26-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	1
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	30	24	17
Water Content:			
Tare no.	AT20	AT3	AT41
Wet soil+tare, g	25.62	23.22	21.59
Dry soil+tare, g	23.90	21.91	20.50
Mass of water, g	1.72	1.31	1.09
Tare, g	14.66	14.97	14.88
Mass of soil, g	9.24	6.94	5.62
Water content %	18.6%	18.9%	19.4%

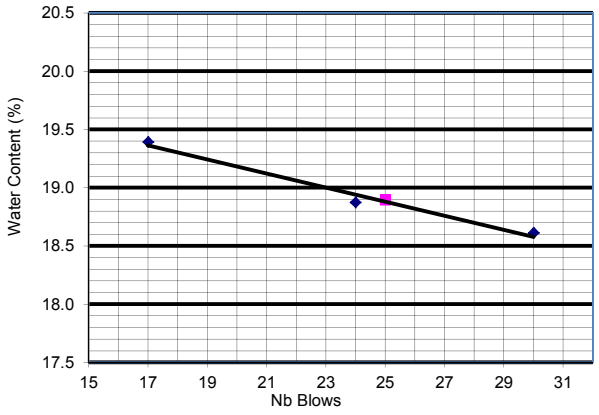
Plastic Limit (PL) - Water Content:		
Tare no.	AT28	AT43
Wet soil+tare, g	20.65	21.58
Dry soil+tare, g	20.09	20.92
Mass of water, g	0.56	0.66
Tare, g	14.92	14.95
Mass of soil, g	5.17	5.97
Water content %	10.8%	11.1%
Average water content %	10.9%	

Natural Water Content (W^n):		
Tare no.	B10	
Wet soil+tare, g	40.2	
Dry soil+tare, g	35.5	
Mass of water, g	4.70	
Tare, g	1.30	
Mass of soil, g	34.20	
Water content %	13.7%	

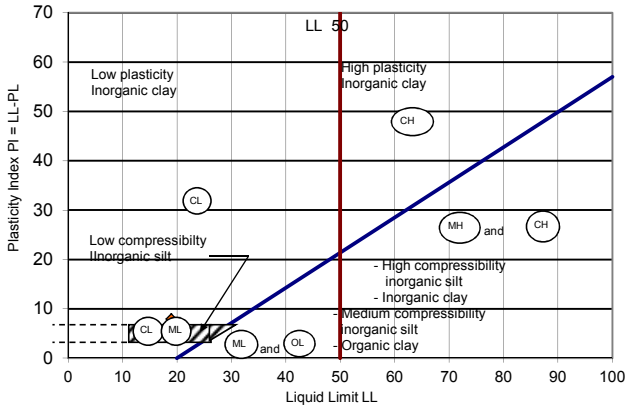
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
19	11	8	14

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/16/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Ontario Infrastructure & Lands Corporation	**Lab no.:**	G1286
Project/Site:	Preliminary Geotechnical Investigation 700 Gordon Street, Whitby, ON	**Project no.:**	076896

Borehole no.:	BH13-16	Sample no.:	SS6	Depth:	4.6m - 4.8m
Soil description:	Low Compressibility Inorganic Clay/Silt (CL-ML)			Date sampled:	20-Jul-16

Apparatus:	Hand Crank	Balance no.:	1	Porcelain bowl no.:	2
Liquid limit device no.:	2	Oven no.:	1	Spatula no.:	2
Sieve no.:	40	Glass plate no.:	2		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	28	24	21
Water Content:			
Tare no.	AT9	AT29	AT42
Wet soil+tare, g	23.81	23.85	24.83
Dry soil+tare, g	22.64	22.62	23.43
Mass of water, g	1.17	1.23	1.40
Tare, g	15.05	14.93	14.98
Mass of soil, g	7.59	7.69	8.45
Water content %	15.4%	16.0%	16.6%

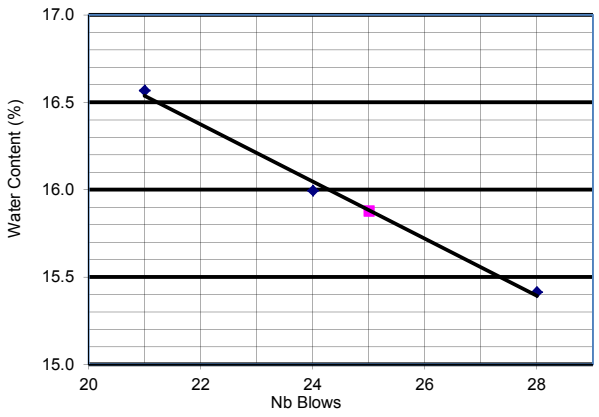
Plastic Limit (PL) - Water Content:		
Tare no.	AT21	AT38
Wet soil+tare, g	20.34	19.93
Dry soil+tare, g	19.86	19.48
Mass of water, g	0.48	0.45
Tare, g	15.06	14.92
Mass of soil, g	4.80	4.56
Water content %	10.0%	9.9%
Average water content %	9.9%	

Natural Water Content (W^n):		
Tare no.	C25	
Wet soil+tare, g	59.1	
Dry soil+tare, g	55.8	
Mass of water, g	3.30	
Tare, g	1.30	
Mass of soil, g	54.50	
Water content %	6.1%	

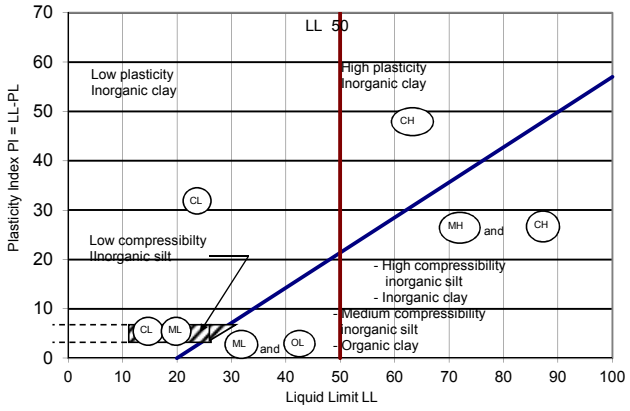
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
16	10	6	6

Remarks:

Performed by:	Riddhi Panchal	**Date:**	8/12/2016
Verified by:	Raj Kadia, C.E.T.	**Date:**	8/17/2016

DENSITY OF SOIL

(ASTM # D 2937- 83)

CLIENT:	Ontario Infrastructure & Lands Corporation	**LAB No.:**	G1294
PROJECT/SITE:	Preliminary Geotechnical Investigation, 700 Gordon Street, Whitby, Ontario	**PROJECT No.:**	076896

Source: *Sampled Borehole* Date Sampled: 11-Aug-16

Material: *Different soil types* Date Received:

Sample Location: *BH06-16*

SAMPLE No.	Moisture content %	Bulk Density(wet) (kg/m^3)	Unit Weight (wet) (kN/m^3)	Bulk Density(dry) (kg/m^3)	Unit Weight (dry) (kN/m^3)
BH06-16 / SS2	10.1	2367.0	23.2	2149.5	21.1
BH06-16 / SS3	7.8	2276.6	22.3	2111.6	20.7
BH06-16 / SS6	7.1	2664.4	26.1	2488.2	24.4
BH06-16 / SS8	7.2	2207.1	21.7	2059.3	20.2
BH06-16 / SS9	9.9	2340.7	23.0	2129.4	20.9
BH06-16 / SS10	12.8	2444.1	24.0	2167.0	21.3

REMARKS:

PERFORMED BY: Anwar Rehani **DATE:** 16-Aug-16

VERIFIED BY: Raj Kadia, C.E.T. **DATE:** 17-Aug-16

Appendix C
Soil Corrosivity Test Results

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GHD LIMITED
651 COLBY DRIVE
WATERLOO, ON N2V1C2
(519) 884-0510

ATTENTION TO: Jennifer Balkwill

PROJECT: 076896 (PO# 73504349-1)

AGAT WORK ORDER: 16T123663

SOIL ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

DATE REPORTED: Aug 12, 2016

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil SAMPLE ID: 7755817 DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: MW1-16 SS3 (5'-7')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	<0.05		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	4		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	5		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.39		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.086		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	11600		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	283		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil SAMPLE ID: 7755822 DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: MW2-16 SS3 (5'-7')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	<0.05		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	4		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	8		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.68		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.082		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	12200		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	327		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil SAMPLE ID: 7755823 DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: BH6-16 SS5 (10'-12')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	0.50		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	18		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	210		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.25		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.316		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	3160		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	249		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil | SAMPLE ID: 7755824 | DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 | DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: BH7-16 SS3 (5'-7')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	<0.05		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	8		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	24		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.96		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.151		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	6620		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	267		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil SAMPLE ID: 7755825 DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: MW12B-16 SS3 (5'-7')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	<0.05		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	3		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	7		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.55		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.098		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	10200		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	263		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

SAMPLE TYPE: Soil SAMPLE ID: 7755826 DATE RECEIVED: Aug 05, 2016

DATE SAMPLED: Aug 05, 2016 DATE REPORTED: Aug 12, 2016

SAMPLE DESCRIPTION: BH13-16 SS3 (5'-7')

PARAMETER	UNIT	RESULT	G / S	RDL	DATE ANALYZED	INITIAL	DATE PREPARED
Sulphide	%	<0.05		0.05	Aug 11, 2016	BW	Aug 11, 2016
Chloride (2:1)	µg/g	5		2	Aug 11, 2016	JC	Aug 11, 2016
Sulphate (2:1)	µg/g	28		2	Aug 11, 2016	JC	Aug 11, 2016
pH (2:1)	pH Units	8.28		NA	Aug 11, 2016	MM	Aug 11, 2016
Electrical Conductivity (2:1)	mS/cm	0.198		0.005	Aug 11, 2016	AR	Aug 11, 2016
Resistivity (2:1)	ohm.cm	5050		1	Aug 11, 2016	SYS	Aug 11, 2016
Redox Potential (2:1)	mV	265		5		AR	

COMMENTS:

RDL - Reported Detection Limit; G / S - Guideline / Standard
EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Aug 12, 2016			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulphide	7755817	7755817	< 0.05	< 0.05	NA	< 0.05	100%	80%	120%	NA			NA		
Chloride (2:1)	7755817	7755817	4	4	NA	< 2	101%	80%	120%	110%	80%	120%	107%	70%	130%
Sulphate (2:1)	7755817	7755817	5	5	NA	< 2	105%	80%	120%	108%	80%	120%	109%	70%	130%
pH (2:1)	7755817	7755817	8.39	8.48	1.1%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	7755817	7755817	0.086	0.086	0.0%	< 0.005	99%	90%	110%	NA			NA		
Redox Potential (2:1)	7755817	7755817	283	283	0.0%	< 5	103%	70%	130%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GHD LIMITED

AGAT WORK ORDER: 16T123663

PROJECT: 076896 (PO# 73504349-1)

ATTENTION TO: Jennifer Balkwill

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulphide	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 16T123663

Cooler Quantity:

Arrival Temperatures: 20.4 | 21.9 | 20.7 (20.1)

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Report Information:

Company: GHD
Contact: Shahkar Shahangian
Address: 111 Brunel Rd. Suit 200
Mississauga ON. L4Z1X3
Phone: 905 712 0510 Fax: 905 712 0515
Reports to be sent to:
1. Email: Shahkar.Shahangian@ghd.Com
2. Email: Jennifer.Balhwill@ghd.Com

Regulatory Requirements:

☐ No Regulatory Requirement
(Please check all applicable boxes)

☐ Regulation 153/04
Table ____ (Indicate One)
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture (Check One)
☐ Coarse
☐ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region ____ (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
____ (Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☐ No

Report Guideline on Certificate of Analysis ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: 076896 Preliminary Geotechnical Investigation
Site Location: 700 Gordon Street, Whitby, Ontario
Sampled By: Anwar Rehan
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company: GHD
Contact: Jennifer Balhwille
Address: As above
Email: Jennifer.balhwill@ghd.Com

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Please Circle) Y / N	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	(Check Applicable) ORPs: ☐B-HWS ☐Cl⁻ ☐CN⁻ ☐C_r^{6+} ☐EC ☐FOC ☐NO_3/NO_2 ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH_3 ☐TKN ☐NO_3 ☐NO_2 ☐NO_3/NO_2	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	Corrosivity
MW1-16 SS3(5-7')	Aug5	11:00	1	Soil	1.7 - 2.0m																	✓
MW2-16 SS3(5-7')	"	"	1	Soil	1.7 - 2.0m																	✓
BH6-16 SS5(10-12')	"	"	1	Soil	3.0 - 3.6m																	✓
BH7-16 SS3(5-7')	"	"	1	Soil	1.7 - 2.0m																	✓
MW12B-16 SS3(5-7')	"	"	1	Soil	1.7 - 2.0m																	✓
BH13-16 SS3(5-7')	"	"	1	Soil	1.7 - 2.0m																	✓

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
MOHAMMAD ANWAR REHAN	Aug 05,16	12:00pm	Shannon	Aug 5/16	1:20pm
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page 1 of 1

N°: T 031973

www.ghd.com