



February 1, 2018

Reference No. 086822

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Dear Sirs:

**Re: County of Simcoe Environmental Resource Recovery Centre  
Geotechnical Investigation  
2976 Horseshoe Valley Road West, Springwater**

The County of Simcoe (County) continues to pursue the development of the proposed Environmental Resource Recovery Centre (ERRC) located at 2976 Horseshoe Valley Road West (Site) in the Township of Springwater (Township). In support of the ERRC, applications for Amendments to the Official Plan and Zoning By-Law were submitted to Township Planning staff on November 18, 2016.

Geotechnical investigations have also been carried out at the Site in support of the continued development of the ERRC. GHD are pleased to provide the enclosed Geotechnical Investigation Report, which provides details of the subsurface conditions as well as discussion and recommendations regarding design and construction of the ERRC.

Should you require any additional information or clarification please do not hesitate to contact the undersigned.

Sincerely,

GHD

A handwritten signature in black ink, appearing to read 'Brian Dermody', with a stylized flourish at the end.

Brian Dermody, P. Eng.

BD/jlm/3



# Geotechnical Investigation

Environmental Resource Recovery Centre (ERRC)

2976 Horseshoe Valley Road West

Springwater, Ontario

County of Simcoe

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

086822 | Report No 15 | November 30, 2017



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# 1. Introduction

GHD Limited (GHD) was retained by County of Simcoe to conduct a geotechnical investigation for the proposed Environmental Resource Recovery Centre (ERRC) to be located on a vacant parcel of forested land at 2976 Horseshoe Valley Road West, in Springwater, Ontario. A Site Location Map is provided as Figure 1.

The Site is situated on the north side of Horseshoe Valley Road West, approximately 2,800 m west of Highway 400. It is rectangular in shape and is described as Lot 2, Concession 1 in the Township of Springwater, County of Simcoe. The property is approximately 84 hectares (ha) in size and the land-use designation is rural and agricultural in the County of Simcoe Official Plan (County of Simcoe Official Plan, Schedule 5.1). The Site is identified as the Freele County Forest Tract and is covered by a forest with the exception of existing access roads/trails that traverse across the property.

The Site has been selected for the proposed ERRC based on a study and evaluation of more than 500 sites in the County of Simcoe. The 2976 Horseshoe Valley Road West property was selected as the preferred Site using a comprehensive list of criteria. The proposed ERRC is anticipated to consist of an Organics Processing Facility (OPF), Materials Management Facility (MMF), and ancillary facilities (e.g., truck servicing facility, Materials Recovery Facility, administrative facility and public education space, access roads, as well as a stormwater management pond). The ERRC footprint is anticipated to be relatively small, covering an area of 4.5 ha of the total 84 ha Site.

The geotechnical investigation at the Site has been completed by GHD in two (2) stages. Stage one included a preliminary investigation to assess the shallow soil and groundwater conditions as part of Site evaluation to assess suitability to support the proposed development. Subsequent to the first stage of geotechnical investigation, the footprint of the proposed development was relocated in response to other Site limitations and as a result a supplementary geotechnical investigation (Stage two) was carried out for the proposed development.

The purpose of the geotechnical investigations were to assess the subsurface soil and groundwater conditions within the area of the proposed development and to provide geotechnical engineering comments and recommendations for the design and construction of building foundations, floor slabs, pavements, stormwater management, and site servicing for the proposed development. The anticipated construction conditions pertaining to excavation, backfilling and groundwater control are discussed also, but only with regard to how these might influence the design.

This report presents the results of a completed geotechnical investigation for the Site and contains the findings of the two stages of geotechnical investigation, together with engineering recommendations and comments. These recommendations and comments are based on factual information and are intended only for use of County of Simcoe design engineers and 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 geotechnical 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 recommendations in this report are applicable and/or correctly interpreted and implemented.

The recommendations and opinions in this report are applicable only to the proposed development as described above and the attached 'Limitations of the Investigation' is an integral part of this report

## 2. Investigation Methodology

### 2.1 Safety Planning

Upon project initiation, a Site-specific Health and Safety Plan (HASP) was prepared for implementation during the field investigation programs. 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. 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.

### 2.2 Borehole Location Clearance

Prior to initiating the Stage one and Stage two 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 public 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 field investigation of the first stage of geotechnical investigation was completed during the period of August 2 and August 12, 2016 and consisted of the following tasks:

- Advancement of five (5) boreholes identified as BH1-16 to BH5-16 within the proposed footprint areas of the structures to a depth of 7.9 to 8.2 mBGS.
- Advancement of three (3) boreholes identified as BH6-16 to BH8-16 along the proposed access road to a depth of 5.2 mBGS.
- Drilling and installation of four (4) monitoring well (MW1-16 to MW4-16) within the central portion of the Site for groundwater level measurements as part of a hydrogeological assessment to a depth of 14.9 to 30.2 mBGS (the hydrogeological assessment report submitted under a separate cover).

The fieldwork of the second stage of geotechnical investigation was completed during the period of December 19, 2016 and January 6, 2017 and consisted of the following tasks:

- Advancement of five (5) boreholes, identified as BH13-16, BH14-16, BH16-16, BH17-16, BH18-16, to 8 mBGS within the proposed OPF footprint.
- Advancement of four (4) boreholes, identified as BH10-16, BH11-16, BH12-16, BH15-16, to 8 mBGS within the proposed footprint of the MMF and materials recovery facility.
- Drilling one (1) borehole to 5 mBGS within the proposed multi-storey administrative facility footprint (BH15-16) and two (2) boreholes to 5 mBGS within the proposed stormwater management facility footprint (BH19-16, BH20-16).
- Drilling three (3) boreholes to 5 mBGS, identified as BH9-16, BH21-16 and BH 22-16, along the proposed access roads.
- Installation of one monitoring well (MW15-16) to 18.9 mBGS on the east side of the Site for long-term monitoring of the groundwater level in the area (the hydrogeological assessment report submitted under a separate cover).

The location of the drilled boreholes and installed monitoring wells are shown on Figure 2.

The service facilities/features to be constructed in the property and their associated boreholes are tabulated in the following table.

### Service Facilities/Features to be Constructed in the Property and their Associated Boreholes

Service Facility/Feature	Borehole
Organic Processing Facility	BH5-16, BH13-16, BH14-16, BH16-16, BH17-16, BH18-16, MW02-16
Scale Facility	BH8-16
Stormwater Management Facility	BH19-16, BH20-16
Materials Management Facility and Truck Servicing Facility	BH11-16, BH12-16, BH15-16
Material Recovery Facility	BH10-16, BH11-16



## Service Facilities/Features to be Constructed in the Property and their Associated Boreholes

Service Facility/Feature	Borehole
Multi-Storey Administration Facility	BH15-16
Access Roads	BH6-16 to BH9-16, BH21-16, BH22-16

Borehole drilling was conducted by a GHD specialist drilling sub-contractor Profile Drilling, under the full-time supervision of GHD experienced technical personnel. The drilling work was carried out utilizing a track mounted power auger drilling rig (Deidrich D-50), supplied and operated by Profile Drilling equipped with conventional soil testing and sampling tools. These boreholes were advanced using a 204 mm O.D. (nominal) hollow stem continuous flight augers and soil samples were collected every 0.75 metres to 4 mBGS, and every 1.5 metres interval thereafter to the termination depth of drilling.

The GHD representative logged the overburden material encountered in the boreholes 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<sup>1</sup> 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.

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, boreholes MW1-16 to MW4-16 as well as MW15-16 were equipped with 50 mm O.D. monitoring well (Schedule 40 PVC riser pipe and screen) to permit measurement of the groundwater level. The well screen were 1.5 m or 3.0 m long (nominal) and pre-slotted (No. 10 slot). The screen was surrounded with silica sand that was placed around the screen and was extended to 0.6 m above the top of the screen. The monitoring well was sealed with bentonite that extended from the top of the filter sand as shown on the attached borehole log (Appendix A1). It is noted that when the monitoring well is no longer needed, the well is to be decommissioned in accordance with O. Reg. 903.

Groundwater observations were made in the boreholes during and upon completion of drilling. Groundwater levels were also measured in the completed monitoring wells on several occasions following drilling. The groundwater level monitoring results are presented on borehole logs in Appendix A and the summary of the obtained values are tabulated in Section 3.2.

Boreholes were backfilled upon completion and sealed in accordance with Ontario Regulation 903. Excess cuttings (spoils) from the borings were distributed evenly on the ground surface at the borehole location upon completion of drilling.

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. The detailed description of the individual soil units and groundwater conditions and ground stratigraphy as

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<sup>1</sup> as indicated in the Canadian Foundation Engineering Manual (CFEM).





encountered at the borehole locations are recorded on the accompanying borehole logs presented in Appendix A1.

The UTM coordinates of the ground surface at each borehole and monitoring well location (Northing and Easting) were surveyed by GHD experienced survey team, using UTM NAD 83 coordinate system with geodetic elevations obtained using a geodetic benchmark<sup>2</sup>. The table below presents a summary of the UTM coordinates, geodetic elevation, and depth of the boreholes and monitoring wells.

#### UTM Coordinates of the Boreholes and Monitoring Wells

Borehole Number	Borehole Depth (m)	Location – UTM Coordinates		Ground Surface Elevation (m)
		Northing	Easting	
BH1-16	7.9	4929729.62	597159.66	260.655
BH2-16	8.1	4929893.00	597107.30	255.979
BH3-16	7.9	4929929.03	597135.45	254.462
BH4-16	8.2	4929991.01	597196.61	246.733
BH5-16	8.2	4929801.17	597274.13	253.570
BH6-16	5.2	4929368.99	597757.18	243.438
BH7-16	5.2	4929694.34	597524.70	247.113
BH8-16	5.2	4929840.30	597419.18	252.710
MW1-16	30.5	4929846.46	597082.23	259.097
NW2-16	22.0	4929735.62	597356.93	252.448
MW3-16	14.9	4929954.27	597335.09	246.143
MW4-16	15.1	4930076.70	597126.21	242.864
BH9-16	5.18	4929758.00	597200.00	261.827
BH10-16	8.23	4929805.09	597208.11	258.919
BH11-16	8.23	4929777.13	597238.41	258.259
BH12-16	8.23	4929703.50	597269.87	255.994
BH13-16	8.23	4929862.94	597263.60	252.152
BH14-16	8.23	4929733.40	597377.93	251.832
BH15-16	8.23	4929731.88	597321.04	253.467
BH16-16	8.23	4929874.52	597304.91	251.434
BH17-16	8.23	4929816.27	597338.05	252.812
BH18-16	8.23	4929754.37	597369.08	252.257
BH19-16	5.18	4929887.64	597332.23	249.994
BH20-16	5.18	4929795.20	597393.39	253.228
BH21-16	5.18	4929778.56	597466.71	249.754
BH22-16	5.18	4929573.13	597606.16	244.889
MW15-16	18.90	4929830.86	597664.91	247.330

<sup>2</sup> Benchmark - Station 00819798284 (Orthometric Elevation 244.394 m (steel rod with brass cap on east side of Hwy 27, 8.6 km south of the JCT of Hwys 27 and 92 in Elmvale, 9.0 km north of the JCT of Hwys 26 and 27 at Midhurst, 0.4 km south of FLOS TWP CON 3 Road and 18.1 m east of centerline of Hwy 27. Bench mark is set 39.2 m north of the south end of east right-of-way fence at the north side of a forestation area on the east side of Hwy 27, 45 cm west of east right-of-way fence and is marked by a steel marker set 40 cm north of bench mark) was used as a reference point for surveying purposes.



It is noted that even though the boreholes/monitoring well coordinates are accurate to  $\pm 20$  mm, these should not be used for construction purposes.

## 2.4 Geotechnical Laboratory Testing

Geotechnical laboratory testing was conducted on representative samples of the subsoils in accordance with ASTM applicable standards. The purpose of the laboratory tests was to determine the engineering properties of the subsoils for use in analysis. Geotechnical laboratory testing consisted of moisture content tests on all recovered samples. Grain-size distribution analysis was carried out on eleven (11) selected samples, and Atterberg limit testing on four (4) selected fine-grained soil 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 SoilsII (Hydrometer Analysis)

ASTM D4318 —Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of SoilsII

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 the moisture content determinations are recorded on the borehole logs at their corresponding depths. A summary of the grain-size test results as well as the Atterberg Limit test results are discussed in Section 3.1. The gradation analysis results (sieve and hydrometer testing) as well as the plasticity charts are provided in Appendix B.

## 3. Subsurface Conditions

Details of the subsurface conditions encountered at the site are summarized below. The logs of the individual boreholes advanced as part of the investigation are presented in Appendix A1. It should be noted that the subsurface conditions are confirmed at the borehole locations only, and may vary at other locations.

The general stratigraphy below the ground cover at the borehole locations consists of surficial topsoil and earth fill (reworked native) overlying native silty clay to sand deposits that extended to the termination depth of the boreholes. A brief description of each soil stratum is summarized below.

It is noted that because of the similarity and granular texture of the fill and native soils, a thorough assessment of the extent of fill could not be performed.

### 3.1 Stratigraphy

#### 3.1.1 Proposed Environmental Resource Recovery Centre Buildings

The soil conditions obtained from the boreholes drilled in the footprint of the ERRC major structures (BH5-16, BH8-16, BH10-16 to B18-16 and MW2-16) are described in the following sections:



### ***Ground Cover: Topsoil and Fill***

All boreholes encountered a relatively thin surficial layer of fill and reworked native soil containing topsoil at the ground surface with an approximate thickness values ranging between 0.5 to 0.8 m overlying native deposits. Borehole BH5-16 and MW2-16 encountered 25 mm and 35 mm topsoil on the ground surface and no topsoil/fill was present in BH9-16. Due to the presence frozen ground conditions at the time of drilling (Stage two), it was not possible to distinguish the topsoil layer thickness from the underlying fill/disturbed native soils. It is noted that the topsoil thickness across the Site will vary between boreholes particularly in areas where more vegetation and shrubs are present. The Standard Penetration Test (SPT) 'N' values within the fill/re-worked native soil (the first 'N' value in each borehole log) ranged between 0 and 7 indicating a very loose to loose condition. The moisture content values of the extracted samples of fill deposits varied between 5 and 28 percent associated with damp to very moist condition.

### ***Native Granular (Silt and Sand) Deposits***

The predominant native soil types in the area consists of granular silt and sandy silt to sand that were generally encountered below the surficial topsoil/fill layer and extended to the termination depth of the boreholes drilled in the area (i.e. 8.2 mBGS).

The penetration resistance 'N' values measured in the native granular deposit by standard sampling procedure yielded results ranging between 3 blows to greater than 50 blows per 0.3 m of penetration, indicating a very loose to very dense condition. It is noted that the shallow soils in the boreholes immediately beneath the surficial topsoil/fill and locally up to a depth of 2.0 to 4.0 mBGS were in a very loose to loose condition before becoming compact to dense with 'N' values increasing with depth.

Grain size distribution and hydrometer analyses were carried out on select samples of the native granular soils (BH8-16 SS2 at 0.0-1.4 mBGS and BH15-16 SS5 at 3.2-3.5 mBGS) and the results indicated the samples contained 0 and 7 percent gravel, 96 and 66 percent sand, respectively. The fine content the tested samples were 4 and 27 percent in the noted order. The values are tabulated in Section 3.2.1.

### ***Native Fine-Grained (Silty Clay to Clayey Silt) Soils***

Fine-grained silty clay to clayey silt deposits have been encountered embedded within the granular soils in BH8-16, BH10-16, BH17-16 and BH18-16 at depths ranging between 0.8 to 4.6 mBGS. The SPT 'N' values of the clayey stratum varied between 6 and 28 blows per 0.3 m of penetration, indicating a firm to very stiff consistency.

Grain size distribution and hydrometer analyses were carried out on select samples of the native fine-grained soils (BH5-16 SS3 at 1.7-2.0 mBGS and BH10-16 SS4 at 2.4-2.7 mBGS) and the results of the tested samples contained 17 and 25 percent sand, 51 and 47 percent silt as well as 32 and 28 percent clay size particles (soil particles smaller than  $2\mu$ ), respectively. The fine-content of the tested samples were 83 and 75 percent in the noted order. A summary of the obtained results is presented in the Section 3.2.1.

Atterberg limit tests were conducted on the above-noted soil samples and the tested samples had liquid limit values of 33 and 22, plastic limit of 17 and 16, plasticity indices of 16 and 8. The natural



moisture content of the samples were 22 and 11 percent in the order as noted above. The obtained Atterberg limit values are tabulated in Section 3.2.2 and the plasticity charts related to the conducted Tests are provided in Appendix B.

The moisture contents of soil samples extracted from the native fine-grained stratum varied between 11 and 26 percent by weight, indicating a moist condition.

### 3.1.2 Stormwater Management Facility

Boreholes BH19-16 and BH20-16 have been drilled at the location of a proposed stormwater management facility. The encountered subsurface conditions are described in the following sections.

#### **Ground Cover: Topsoil and Fill**

At the location of the above-noted boreholes, earth fill consisting of sand with trace silt to sand-and-silt, with trace topsoil, rootlets and organics was encountered at the ground surface and extended in both investigated locations to 0.8 mBGS.

The fill deposit had SPT 'N' values of 2 and 3, recorded within the layer indicating a very loose relative density of the fill soil. The moisture content of select samples of the fill were 5 and 19 percent by weight indicating a moist condition.

#### **Native Sandy Silt to Sand Soil**

Deposits of sandy silt to sand were encountered underlying the fill in BH20-16 or a relatively thin layer of fine-grained native soil in BH19-16 and extended to the termination depth of the boreholes (i.e. 5.2 mBGS).

The penetration numbers (SPT 'N' values) recorded within the granular soil ranged between 3 and 68 indicated a very loose to very dense relative density of the native granular soil.

The water contents of soil samples extracted from the granular stratum ranged between 1 and 7 percent by weight, indicating a damp to moist condition.

#### **Native Silty Clay to Clayey Silt**

Silty clay to clayey silt fine-grained soils were encountered underlying the fill in BH19-16 at 0.8 mBGS, and at 2.3 mBGS embedded within the granular soil in BH20-16. The fine-grained soil was grey and extended to the approximate depths of 1.5 m in BH19-16 and 4.0 mBGS in BH20-16.

The SPT 'N' values that ranged between 6 to 20 have been recorded within the fine-grained soil and indicated a firm to very stiff consistency of the silty clay/clayey silt deposits.

Gradation analyses, consisting of sieve and hydrometer testing, have been carried out on a select and representative sample of the native soil extracted from BH20-16 at a depth of 1.7 to 2.0 mBGS. The tested soil sample contained 10 percent sand, 47 percent silt (soil fine particles larger than  $2\mu$ ) and 43 percent clay size particle ( $d < 2\mu$ ). The fine content of the tested sample was 90 percent.

Atterberg limit classification tests have been conducted on the above-noted soil sample. The tested soil sample had a liquid limit of 41 percent, a plastic limit of 27 percent, and a plasticity index of 14



percent. The natural moisture content of the tested sample was 7 percent by weight, below its plastic limit.

Based on the obtained results, and considering the Unified Soil Classification System (USCS), the tested soil sample has been classified as silty clay with trace to some sand.

### 3.1.3 Proposed Access Roads

#### ***Earth Fill/Re-worked Native soil***

Boreholes BH6-16, to BH9-16, BH21-16 and BH22-16 have been drilled on the proposed access roads and generally encountered a surficial earth fill or reworked native layer comprising of silty sand to sand with trace to some gravel and intermixed with organic materials that extended to a maximum depth of 2.3 mBGS in the above noted boreholes. No fill was encountered in BH09-16. The penetration resistance ‘N’ values measured in the fill/ re-worked native soil range between 2 to 20 blows per 0.3 m of penetration indicating a very loose to compact relative density.

The moisture content of the fill samples extracted from the boring varied between 4 and 9 percent by weight, indicating a damp to moist condition.

#### ***Native Sand / Silt and Sand / Silt Till***

Undisturbed native deposits of sand with trace to some silt to sandy silt, with trace to some gravel as glacial till with similar composition were encountered below the earth fill layer and extended to the termination depth of investigation, i.e. 5.2 mBGS. The penetration resistance ‘N’ values measured in the native granular deposits by standard sampling procedure yielded results ranging between 3 to in excess of 50 blows per 0.3 m of penetration, indicating a very loose to very dense condition. The relatively low SPT ‘N’ value were locally encountered beneath the surficial fill layer and extended up to 4.0 m below grade in some of the boreholes (i.e. BH7-16 and BH9-16).

Grain size distribution analysis was carried out on a representative sample of the native granular soil extracted from BH22-16 at a depth of 1.7-2.0 mBGS. The composition of the tested soil sample is summarized below and the gradation analysis curve is presented in Appendix B.

#### Results of Grain Size Analysis

Borehole No./ Sample No.	Sample Depth (mBGS)	% Gravel	% Sand	Silt	Clay	% Clay &Silt
BH22-16 / SS3	1.7 - 2.0	0	88	NA	NA	12

The moisture contents of soil samples extracted from the granular stratum varied between 2 and 13 percent by weight, indicating a damp to moist condition. The more elevated moisture content values were associated with samples containing more fine-grained materials.

#### ***Native Clayey Silt***

At the location of BH8-16 a deposit of clayey silt with some sand and trace gravel was encountered at 2.9 m and extended to 4.7 mBGS. The deposit is grey and a SPT‘N’ value, recorded within the soil unit was 13, indicating a stiff consistency of the material.



The water content of a representative sample of the fine-grained soil measured in the laboratory was 21 percent associated with its moist condition.

### 3.2 Geotechnical Laboratory Test Results

Geotechnical laboratory testing included moisture content determination on all recovered samples, eleven (11) particle size distribution (gradation), using sieve analysis and hydrometer as well as Atterberg limit tests, and four (4) select and representative soil samples. The test results are described below.

#### 3.2.1 Grain Size Distribution

Grain size analysis consisting of sieve and hydrometer testing was carried out on eleven (11) select samples extracted from the deposits at depths ranging between 0.9 m to 3.5 mBGS. The results of these tests are summarized in the following table and the grain-size distribution test curves are presented in Appendix B.

##### Results of Grain Size Analysis (Sieve and Hydrometer Testing)

Borehole Identification Number	Sample Number	Depth m	Gravel %	Sand %	Silt %	Clay *	Fines Silt & Clay %
BH1-16	SS2	0.8-1.4	0	84	NA	NA	16
BH2-16	SS3	1.5-2.1	1	54	35	10	45
BH3-16	SS3	1.5-2.1	0	69	26	5	31
BH4-16	SS2	0.8-1.4	0	85	NA	NA	15
BH5-15	SS3	1.5-2.1	0	17	51	32	83
BH7-16	SS2	0.8-1.6	0	85	NA	NA	15
BH8-16	SS2	0.8-1.4	0	96	NA	NA	4
BH10-16	SS4	2.4-2.7	0	25	47	28	75
BH20-16	SS4	2.4-2.7	0	10	47	43	90
BH22-16	SS3	1.7-2.0	0	88	NA	NA	12
MW15-16	SS5	3.2-3.5	7	66	19	8	27

\* Soil particles <2 $\mu$   
 NA- Not Available

The results of the grain-size analysis tests (sieve and hydrometer) are reported on the respective borehole logs at the corresponding depths and the corresponding gradation curves are provided in Appendix B.

#### 3.2.2 Atterberg Limit Tests

Atterberg limit classification tests have been conducted on the four (4) select and representative soil samples. The results are reported on the soil plasticity charts provided in Appendix B and a summary of the obtained results are tabulated in the table below.



### Results of Atterberg Limits Analysis

Borehole ID	Sample	Depth (m)	WL	WP	IP	W	Soil Sample Description
BH3-16	SS3	1.5-2.1	Non Plastic			8	Silty Sand, Trace Clay
BH5-16	SS3	1.5-2.1	33	17	16	22	Silty Clay, Some Sand
BH10-16	SS4	2.4-2.7	22	14	8	11	Silty Clay, Sandy
BH20-16	SS4	2.4-2.7	41	27	14	7	Silty Clay, Trace to Some Sand

Notes: W - Natural Water Content  
 WL - Liquid Limit  
 WP - Plastic Limit  
 IP - Plasticity Index

Soil classification has been conducted in accordance to the Unified Soil Classification System (ASTM D2487).

### 3.3 Groundwater

Groundwater observations were made in each of the boreholes as they were advanced and after completion of fieldwork. Additionally, boreholes MW1-16 to MW4-16, as well as MW15-16 were equipped with 50 mm O.D. monitoring well (Schedule 40 PVC riser pipe and screen) to permit measurement of the groundwater level. The well screen were 1.5 m or 3.0 m long (nominal) and pre-slotted (No. 10 slot). The screen was surrounded with silica sand that was placed around the screen and was extended to 0.6 m above the top of the screen. The monitoring well was sealed with bentonite that extended from the top of the filter sand as shown on the attached borehole log (Appendix A1).

The groundwater observations were made in the installed monitoring wells upon their completion and also on several occasions following their installation. A summary of the groundwater level measurements within the installed monitoring wells is provided in the table below:

#### Summary of Groundwater Level Measurements within the Monitoring Wells

Borehole No.	MW01-16	MW02-16	MW03-16	MW04-16	MW15-16
Monitoring Well Installation Date	Aug 4, 2016	Aug 10, 2016	Aug 11, 2016	Aug 11, 2016	Dec 23, 2016
Depth of the Well (m)	30.49	21.95	14.88	15.00	18.30
GW Depth Upon Completion of Drilling (mBGS/mAMSL*)	-	17.38 / 235.07	10.52 / 235.62	-	16.60 / 230.70
GW Depth Aug 19, 2016 (mBGS/mAMSL*)	-	16.29 / 236.16	10.45 / 235.69	-	-
GW Depth Aug 22, 2016 (mBGS/mAMSL*)	-	16.20 / 235.65	-	9.27 / 233.60	-
GW Depth Aug 23, 2016 (mBGS/mAMSL*)	25.9 / 233.20	16.16 / 236.29	-	9.26 / 233.61	-





#### Summary of Groundwater Level Measurements within the Monitoring Wells

Borehole No.	MW01-16	MW02-16	MW03-16	MW04-16	MW15-16
GW Depth Jan 30, 2017 (mBGS/mAMSL*)	26.17 / 232.93	16.90 / 235.55	11.14 / 235.00	9.65 / 233.21	11.85 / 235.48

mAMSL\*: meters Above Mean Sea Level  
mBGS: meters Below Ground Surface

The depth of groundwater level in the installed monitoring wells on January 30, 2017 ranged between 9.65 and 26.17 mBGS (Elevations 232.93 and 235.55 m).

It should be noted that groundwater levels are transient, have seasonal fluctuations, and could rise in response to major weather events.

## 4. Discussion and Recommendations

The proposed ERRC is anticipated to consist of an Organics Processing Facility (OPF), Materials Management Facility (MMF), and ancillary facilities (e.g., truck servicing facility, Materials Recovery Facility, administrative building and public education space, access roads, stormwater management pond). The ERRC footprint is anticipated to be relatively small, covering an area of 4.5 ha of the total 84 ha Site.

It is understood that the proposed buildings will be slab-on-grade structures. The information on the details of the structures and the loads on their foundations were not available to GHD at the time of preparation of the present report.

Based upon our understanding of the proposed development and on the borehole results, and assuming them to be representative of the subsurface conditions across the study area, the following comments and recommendations are offered:

Based on the results of the conducted geotechnical investigation, the subsurface soil stratigraphy at the Site can generally be described as follows:

- Ground cover comprising of topsoil and fill that could extend to 2.3 mBGS. The fill thickness across the Site could vary between the drilled boreholes. Due to frozen ground condition at the time of our investigation, it was not possible to distinguish the topsoil layer thickness from the underlying fill/distributed native soils. If required, further investigations such as test pits should be carried out to better assess and determine the topsoil/fill layer thickness across the Site. It is noted that soil descriptions and assessments were made based on tactile examination.
- Below the topsoil and earth fill layers, native deposits, generally consisting of granular silt/sand were encountered that extended to the termination depth of the boreholes. Fine-grained silty clay/clayey silt soils were also encountered locally embedded within the granular soils. The relative densities of the deposits were variable ranging from very loose to very dense or consistencies with firm to very stiff. The zone of loose native soils was encountered at depths generally ranging between 2.0 to 4.0 mBGS.





- The groundwater level has been measured to be at 11.85 mBGS (Elevation 235.48 m) in the monitoring well MW15-16 several days following drilling.

#### 4.1 Site Preparation and Grading

The boreholes advanced across the study area encountered surficial vegetation, topsoil and fill at the ground surface overlying native soils. The surficial soils containing rootlets, organics, and vegetation and any earth fill materials found to contain significant amounts of organics should be removed from the footprint of the proposed structures prior to site grading activities and should not be used as backfill in settlement sensitive areas. Care will be required during excavation to separate any fill materials that appears to contain significant topsoil from the clean earth fill. Prior to any filling the exposed subgrade should be visually inspected, heavily proof-rolled, and compacted.

The earth fill and the native soils are generally suitable for reuse as backfill to raise site grades where required, provided the materials are free of organic material and are within the optimum moisture content. Based on laboratory water content measurements and visual examination of soil samples extracted from the borings, the soils are generally within acceptable limits for effective compaction, while, locally, materials with elevated moisture content values have also been noted. Materials found to be wet may be left aside to dry, or mixed with drier material.

All fill placed as part of Site grading activity should be laid in thin lifts not exceeding 150 mm and thoroughly compacted with heavy rollers to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD).

#### 4.2 Foundation Design Parameters

Based on the findings of the conducted geotechnical investigation and depending on the design loads associated with the proposed buildings, the following options can be considered for design:

##### 4.2.1 Conventional Spread/Strip Footings

The proposed buildings can consist of conventional spread/strip footings placed on the compact to dense native granular stratum or very stiff fine-grained soil using a maximum net allowable bearing pressure of 200 kPa for a Service Limit State (SLS) design and 300 kPa for an Ultimate Limit State (ULS) design.

Conventional spread/strip footings must be founded at least 0.3 meters into the native soil for the allowable bearing capacity values provided. The minimum founding depth at each of the borehole located near or within the footprint of the proposed structures is summarized in the table below.

##### Minimum Depth and Maximum Elevation of Footing for Geotechnical Bearing Pressure of 200 kPa (SLS) and 300 (ULS) Design

Service Facility/Feature	Borehole No.	Ground Surface Elevation (m)	Minimum Depth Below Existing Grade (m) / Geodetic Elevation
Multi-Storey Administration Facility	BH15-16	253.5	2.3 / 251.2



Minimum Depth and Maximum Elevation of Footing for Geotechnical Bearing Pressure of 200 kPa (SLS) and 300 (ULS) Design

Service Facility/Feature	Borehole No.	Ground Surface Elevation (m)	Minimum Depth Below Existing Grade (m) / Geodetic Elevation
Organic Processing Facility	BH5-16	253.6	2.0 / 251.4
	BH13-16	252.1	2.0 / 250.1
	BH14-16	251.8	4.5 / 247.3
	BH16-16	251.4	3.0 / 248.4
	BH17-16	252.8	3.0 / 249.8
	BH18-16	252.3	1.5 / 250.7
	MW2-16	252.4	3.0 / 249.4
Scale Facility	BH8-16	252.7	4.6 / 248.1
Materials Management Facility and Truck Servicing Facility	BH5-16	253.6	2.0 / 251.4
	BH11-16	258.3	3.0 / 255.3
	BH12-16	256.0	1.5 / 254.5
	BH15-16	253.5	2.3 / 251.2
Material Recovery Facility	BH5-16	253.6	2.0 / 251.4
	BH10-16	258.9	4.6 / 254.3
	BH11-16	258.3	3.0 / 255.3

The total and differential settlements of spread footings established in the compact to very dense sand deposit native at the above design bearing pressures are expected to be limited to 25 and 19 mm respectively.

It is recommended that the minimum footing width for strip footings be 0.6 m, and the minimum width for square or pad footings be 1.0 m.

It is recommended that structures subject to frost action have a minimum soil cover of at least 1.5 m according to OPSD 3090.101 or equivalent insulation.

#### 4.2.2 Shallow Foundations on Engineered Fill

If the existing grades are raised using engineered fill as part of Site grading activity, the proposed buildings can be supported on shallow/surficial conventional spread/strip footings placed on engineered fill material and proportioned to an allowable bearing pressure of 150 kPa for a Service Limit State (SLS) design and 225 kPa for an Ultimate Limit State (ULS) design.

Prior to placing engineered fill, it will be necessary to remove the surficial topsoil and any upper loose native soils and the exposed subgrade surfaces should be visually inspected, and proof rolled



to confirm the presence of competent native soils. The engineered fill should consist on-site native soils free of organics or imported granular fill and placed in layers (150 mm thick or less) and compacted to a minimum 100% Standard Proctor Maximum Dry Density (SPMDD).

#### 4.2.3 Caissons/Augured Piers

Higher bearing pressures, if required, will be available at deeper depths. Building foundations at the Site can consist of short caissons/augured piers founded in the underlying dense to very dense native sand. Caissons/augured piers installed at a minimum depth of approximately 5 to 6 mBGS at the borehole locations can be designed for an allowable bearing resistance of 500 KPa for Service Limit State (SLS) design and 750 KPa for Ultimate Limit State (ULS). The founding depth at each of the borehole locations is summarized in the table below.

Minimum Depth and Maximum Elevation of Caissons/Augured Piers for Geotechnical Bearing Pressure of 500 kPa (SLS) and 750 (ULS) Design

Service Facility/Feature	Borehole No.	Ground Surface Elevation (m)	Depth Below Existing Grade (m) / Geodetic Elevation (m)
Multi-Storey Administration Facility	BH15-16	253.5	6.0 / 247.5
Organic Processing Facility	BH5-16	253.6	4.5 / 248.9
	BH13-16	252.1	6.0 / 246.1
	BH14-16	251.8	6.2 / 245.6
	BH16-16	251.4	6.2 / 245.2
	BH17-16	252.8	5.6 / 247.0
	BH18-16	252.3	5.0 / 247.3
	MW2-16	252.4	4.5 / 247.9
Scale Facility	BH8-16	252.7	4.6 / 248.1
Materials Management Facility and Truck Servicing Facility	BH5-16	253.6	4.5 / 248.9
	BH11-16	258.3	6.0 / 252.3
	BH12-16	256.0	6.0 / 250.0
	BH15-16	253.5	6.0 / 247.5
Material Recovery Facility	BH5-16	253.6	4.5 / 248.9
	BH10-16	258.9	6.0 / 252.2
	BH11-16	258.3	6.0 / 252.3

The minimum diameter of the caissons is 760 mm diameter to allow for adequate access for workmen to enter and hand clean the caisson base, prior to placing concrete. The drilled shaft construction will require the use of a temporary liner so that workmen and inspection personnel can safely enter the drilled shaft.



Total settlement of the building foundations designed to the bearing values given above are not expected to exceed 25 mm for the service load conditions.

### 4.3 Floor Slab Design Parameters

The proposed floor slab for the buildings can be constructed using a standard slab on grade technique, provided that the surficial topsoil, existing fill or loose native soils are removed prior to slab construction. The subgrade for the slab construction can consist of engineered fill materials placed as part of the site grading operations on the compact native soil. These materials are generally suitable to support the slab.

It is recommended that the existing loose native soil layer beneath the proposed floor slab be subexcavated to the underlay compact native soil and the exposed surface be inspected and heavily proof rolled. Any area observed to be soft should be subexcavated and replaced with engineered fill in accordance with Section 4.1. Prior to fill placement, any organic or unacceptable areas should be removed as directed by the Engineer. The area should be backfilled using suitable fill materials compacted to a minimum of 98% Standard Proctor Maximum Dry Density (SPMDD). A qualified geotechnical engineer should review the condition of the subgrade beneath the proposed slab-on-grade.

The proposed slab on grade can be placed on the existing fill provided it is suitability compacted and proof-rolled, engineered fill, or competent native soils. A modulus of subgrade reaction of 40 MPa/m can be used for the slab design; provided all existing fill is removed and replaced with engineered fill compacted to 98% SPMDD.

The floor slab should be founded on a 200 mm thick layer of well-graded granular base material consisting of 19 mm crusher run limestone (or equivalent).

No groundwater was observed during and upon the completion of the drilling at the borehole locations. In such condition, a subfloor drainage system is not required.

Perimeter drainage of the structure is recommended where there is pavement adjacent to the building face or finished floor level in the structure is not at least 200 mm above the prevailing exterior grade level. Surface drainage should be directed away from the building.

Exposed concrete slab subjected to solid waste, should be designed for the following parameters:

- Concrete exposed to freezing and thawing or deicing chemicals shall be air entrained with air content between 4.5% and 7.5% in accordance to CSA A 23.1 and ACI 350 Environmental Structure Code.
- Concrete exposed to solid waste should be protected against sulphate attack by using cement that provides sulfate resistance in accordance to CSA A 23.3 and ACI 350 table 4.3.1.
- Steel reinforcement in the slab shall be protected against corrosion. The maximum water soluble chloride ion (Cl) concentration in hardened concrete at ages from 28 days shall not exceed the limit of 0.1% by weight as derived by ACI 350 Table 4.4.1.
- Jointing materials including water-stops, expansion joints, and sealants, shall be resistant to chemical attack for the design life of the facility.



- Where a structure will be subjected to abrasion erosion, aggregate shall meet requirement of CSA A 23.3 and ASTM C33.

#### 4.4 Foundation Wall Drainage

A perimeter drainage system will need to be installed around the building foundation to collect perched groundwater from within the earth fill and sandy seams in the native deposit interface. The perimeter drainage system should be provided with a collector pipe at the base of the wall that adequately sloped to a sump pit and discharges to the municipal/private storm sewer (upon approval of the Municipal Authorities) or to the stormwater management pond.

#### 4.5 Lateral Earth Pressure

Structures subject to unbalanced earth pressures such as foundation walls, 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**
  - h** = Depth below top of the wall (m)
  - K** = **K<sub>o</sub>** “at rest” the earth pressure coefficient- non yielding foundation wall, or
  - K** = **K<sub>a</sub>** “active” the earth pressure coefficient- yielding foundation wall
  - h<sub>w</sub>** = the depth below the groundwater level (m)
  - γ** = the bulk unit weight of retained soil, ( use 21 kN/m<sup>3</sup> )
  - γ'** = the submerged unit weight of the exterior soil, ( γ - 9.8 kN/m<sup>3</sup> )
  - q** = the complete surcharge loading (not less than 15 kPa)

Where the perimeter drainage system to eliminate hydrostatic pressures on the wall, acting in conjunction with the earth pressure, this equation can be simplified to:

$$P = K[\gamma h + q]$$

This equation assumes that the perimeter drainage systems and appropriate piping is placed at an elevation below the base of the wall.

Based on the subsurface conditions encountered at the Site, the following design parameters may be used at this Site:

Soil	Bulk Unit Weight γ (kN/m <sup>3</sup> )	Angle of Internal Friction	Coefficients of Lateral Earth Pressure		
			K <sub>a</sub>	K <sub>o</sub>	K <sub>p</sub>
Compacted OPSS Granular 'B'	22	32	0.31	0.47	3.25
Existing Fill or Very Loose to Loose Native Soil	20	26	0.39	0.56	2.56



Soil	Bulk Unit Weight $\gamma$ (kN/m <sup>3</sup> )	Angle of Internal Friction	Coefficients of Lateral Earth Pressure		
			K <sub>a</sub>	K <sub>o</sub>	K <sub>p</sub>
Compact to Very Dense Native Sand/Silt	22	32	0.31	0.47	3.25

If ground movements are to be limited around these structures, we recommend the use of the K<sub>o</sub> earth pressure coefficients instead of the K<sub>a</sub> values.

#### 4.6 Earthquake Consideration

The Ontario Building Code (OBC) 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 OBC, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 30 m below the ground surface. The 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); or
- Average undrained shear strength.

Based on the results of the conducted geotechnical investigation, the depths of the boreholes and our knowledge of the regional geology, and based on the criteria listed in Table 4.1.8.4.A. of the OBC for design purposes on Seismic Classification for Seismic Site Response, a Seismic Site Class 'D' (Stiff Soil) can be used for the design of the proposed structures.

#### 4.7 Pavement Design for Access Roads

The boreholes advanced in the area of the proposed access roads (BH06-16 to BH9-16, BH21-16 and BH22-16) encountered topsoil intermixed with fill or reworked native soil underlying the ground surface. The fill containing topsoil and any loose fill materials should be removed from the proposed pavement areas prior to placing new fill soil. It is anticipated that the pavement subgrade will consist of existing earth fill materials, undisturbed native soils, or compacted earth fill that had been placed during the site servicing/grading operations. These materials are considered suitable to support the pavement structure provided they found to be completed and stable by proof rolling.

Where undisturbed soil or competent fill materials are encountered at the design subgrade level, it is recommended that the soil be cut neatly to grade. The area should be proof rolled using large axially loaded equipment and any soft/loose or unacceptable areas be subexcavated and removed, as directed by the Engineer and replaced with suitable fill materials compacted to a minimum of 98 percent SPMDD.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as is practically possible.



The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of subbase fills, restricted construction lanes, and half-loads during paving may be required, especially if construction is carried out during wet weather conditions.

The following asphaltic concrete and granular pavement thicknesses may be used for the new light duty and heavy duty roads and driveway areas for a 20 year design life.

#### Asphaltic Concrete and Granular Pavement Thicknesses

Pavement Layers	Compaction Requirements	Light Duty Parking Areas	Heavy Duty Fire Route/Road/Driveway
Surface Course Asphaltic Concrete HL3 (OPSS 1150)	92% to 96.5% Maximum Relative Density	40 mm	40 mm
Base Course Asphaltic Concrete HL8 (OPSS 1150)	92% to 96.5% Maximum Relative Density	40 mm	60 mm
Base Course: Granular 'A' or 19mm Crusher Run	100% Standard Proctor	150 mm	150 mm
Subbase Course: Granular B or 50mm Crusher Run	98% Standard Proctor	150 mm	400 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 subbase.

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 the pavement and toward catchbasins.

Subsurface drains should be installed in the upgradient direction of all catchbasins. The drains should be a minimum length of 3 m and consist of 100 mm diameter perforated PVC pipe. The pipes are to be placed in a narrow trench that extends 0.3 m below subgrade and backfilled with 19 mm clear crushed limestone. Also, the catchbasin structures should be patched or repaired as required to prevent the washing in of any fines to avoid loss of ground into the structure.

## 5. Construction Recommendations

### 5.1 Excavation

Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects*. These regulations designate four broad classifications of soils to stipulate appropriate measures for excavation safety. The earth fill and loose native soils encountered at the site is considered to be a Type 3 soil. The undisturbed compact to very dense



native soils encountered at the Site are also considered to be as Type 3 soils when not impacted by water and Type 4 if water seepage or surface water is encountered.

Where workmen must enter a trench or excavation carried deeper than 1.2 meters the trench or excavation must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates maximum slopes of excavation by soil type as follows:

#### Maximum Slope Inclination for Excavation Side-Walls

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

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.

Seepage is anticipated in localized excavated areas during excavation activity from surface drainage and seepage from perched water within any preferentially permeable features in the earth fill or glacial till, such as sand seams or layers. Since the earth fill and native soils are, in general, of low permeability, the volume of water to be anticipated is such that temporary pumping from the excavations should suffice to control groundwater.

The deposits to be penetrated for excavations at this site will be found to contain larger particle sizes than are indicated on the Borehole Logs. It should be anticipated that cobbles and boulders will be encountered that are intrinsic to the native deposits. The frequency and distribution of these fragments within the till matrices is unpredictable.

It is expected that shallow excavations, which extend into the compact to dense native materials can be handled by conventional mechanical excavation equipment.

## 5.2 Site Services and Pipe Bedding

Underground storm and sanitary sewer lines can be founded on the undisturbed native soils, or suitably compacted fill materials. These materials will provide adequate support of buried services on conventional well-graded granular bedding. Where disturbance of the trench base has occurred, due to groundwater seepage or construction traffic, the disturbed soils should be sub-excavated and replaced with suitable compacted granular fill.

Structures such as catchbasins and manholes founded within the existing fill layer should be supported on a granular pad extending at least 0.3 m beyond the footprint of these structures in order to distribute their loads evenly.

The bedding for trenched (open-cut) services should consist of materials meeting County of Simcoe specifications. The bedding should have a minimum thickness of 150 mm below the pipe and 300 mm above and adjacent to the pipe and should comply with the County of Simcoe Standards. The bedding and cover materials should be compacted to a minimum of 95 percent of their





standard Proctor maximum dry density (SPMDD) to provide support and protection to the service pipes.

Where wet conditions are encountered, the use of 'clear stone' bedding (such as 19 mm clear stone, OPSS 1004) may be considered, only in conjunction with a suitable geotextile filter. Without proper filtering, there may be entry of fines from native soils and trench backfill into the bedding. This loss of fine soil particles could result in loss of support to the pipes and possible surface settlements.

### 5.3 Trench Backfill

The trench backfill operations should be conducted with the following minimum requirements:

- Adequate heavy vibratory compaction equipment is used to compact the material.
- Loose lift thickness should not exceed 200 mm.
- Soils should be at suitable moisture contents to achieve compaction of 95 percent Standard Proctor Maximum Dry Density (SPMDD) up to a depth of 1 m below the pavement subgrade level and 98 percent SPMDD within 1 m of the pavement subgrade level.
- General backfill materials used to raise grades up to design subgrade levels may consist of on site or imported granular fill comprised of well-graded soils, with no material in size greater than 150 mm, and no topsoil or other deleterious materials.

The excavated fill and the native soils encountered at the Site are considered suitable as trench backfill provided the moisture content of the backfill soils is within 2 percent of the optimum moisture content of the soil as determined by Standard Proctor (ASTM D 698) test method. Some of the native soils contained slightly high water contents and these soils may need to be dried prior to reuse. Care will be required to ensure that any excavated soils that are too wet for adequate compaction are separated from the Site stockpiles. Materials found to be wet may be left aside to dry, or mixed with drier material. Also, some of the samples extracted from the boreholes contained intermixed topsoil and rootlets. Fill materials containing excessive amounts of organics will need to be separated and not used as backfill in settlement sensitive areas.

Oversized material should be removed. All backfill operations and materials should be inspected and tested by qualified geotechnical personnel to confirm that proper material is utilized and that adequate compaction is attained.

The depth to the groundwater table at the site exceeded 9.65 mBGS in the installed monitoring wells in the area. Based on this information, groundwater level at this Site is anticipated to be relatively deep and will not be encountered during excavation activity.

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 be prepared to remove any surface water or precipitation runoff from within the excavations. This should be possible in most instances by the strategic placement of sumps.



## 5.4 Construction Monitoring

The foundation installations must be monitored and evaluated by qualified personnel to ensure that the founding achieved is consistent with the design bearing intended by the geotechnical 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 2012 Ontario Building Code.

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.

# 6. Stormwater Management Facility

As noted in the Facility Characteristics Report prepared by GHD, dated November 2016, the proposed stormwater management system will consist of vegetated filter strips, an enhanced vegetated swale, a sediment forebay, a settling pond, an infiltration basin, and a drainage ditch. The detailed design of the stormwater management system will be completed in the future, and as such, the following guidelines and comments are general in nature and are provided with consideration of the limited information available at this time.

Boreholes BH19-16 and BH20-16 have been drilled at the location of the proposed stormwater management pond and provide the geotechnical information for the design and construction of the proposed pond. Based on the condition encountered in the boreholes, various types of soil would be encountered at the base and walls of the pond. The soil would range from sand and silt, silty clay to clayey silt, and sandy silt to silty sand.

The long-term global stability of the pond slopes excavated into the existing or constructed with the existing soils was not conducted. However, it is anticipated that the pond side slopes will be constructed with a gradient not steeper than 4H:1V (4 horizontal to 1 vertical). Furthermore, if an access road is to be located on the top of the pond side berms a minimum of 2 m setback must be provided between the concrete curb and the top of the pond slope (minimum 2 m shoulder).

Due to the silty/sandy nature of the deposits, the hydraulic design should incorporate provisions to account for high erosion susceptibility (high scourability) of existing soils. We recommend consideration be given to establish vegetation cover on the slopes to minimize surface erosion due to weather. Also, all surface water run-off from the area surrounding the pond should be directed away from the pond.

Based on the information obtained from the monitoring wells installed in the area (MW2-16 and MW3-16), the groundwater table in the area will be lying below the base of the pond but the actual operation regime will depend on the hydraulic design, the general site drainage, and the prevailing weather patterns.

The foundation design of the associated pond structures should be completed on a case-by-case basis, when details of the pond design are available.



Grain size distribution tests (sieve and hydrometer testing) have been conducted on a representative sample of the silty clay soils in the area of the proposed pond and the results have been summarized in the following table:

#### Results of Grain Size Analysis of a Silty Clay Soil Sample

Borehole No./ Sample No.	Sample Depth (mBGS)	% Gravel	% Sand	Silt	Clay	% Clay & Silt
BH20-16 / SS4	2.4 – 2.7	0	10	47	43	90

The tested soil sample contained 43 percent clay size particles (particles smaller than  $2\mu$ ) while the fine content of the tested sample was 90%.

Atterberg limit classification tests have been conducted on the above-noted soil sample. The results are reported on the soil plasticity charts provided in Appendix B and a summary of the obtained results are tabulated in the table below:

#### Results of Atterberg Limits Analysis

Borehole ID	Sample	Depth (m)	WL	WP	IP	W	Soil Sample Description
BH20-16	SS4	2.4-2.7	41	27	14	7	Silty Clay, Trace to Some Sand

Based on the selected elevation for the base of the pond, the above noted fine-grained layer is probably not present at the base of the pond and as such, if a wet pond with lower permeability is considered as the preferred alternative, installation of a clay liner could be adopted by extracting clayey soils from other areas of the Site.

The use of a clay layer (membrane material) inside the pond will limit water seepage through the underlying soils. Suitable impervious clay material (Kaolinite, Illite, Montmorillonite) with a total thickness of about 300 mm should be placed and compacted inside the pond. On the slopes (berms) the material has to be protected by a layer of sand to provide overall stability. The locally available native clayey soil could be used for the liner. The information obtained in our investigation indicates the clayey soils are available in limited quantities. In our opinion, if the pond base design is conducted in a way to preserve the existing fine-grained soils in place, the site would be suitable for the construction of an effective stormwater management pond (a water retention pond). The clay soils should be placed in thin lifts not exceeding 200 mm and compacted using a heavy sheep foot roller to 98% of its Standard Proctor maximum dry density (SPMDD). As an alternative, if clayey soils are not available the use of a synthetic clay liner could be used.

## 7. Limitations of the Investigation

This report is intended solely for County of Simcoe (Client) and other parties explicitly identified in the report 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. Client shall defend, indemnify and hold GHD harmless from any



liability arising from or related to Client's unauthorized distribution of the report. 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. 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

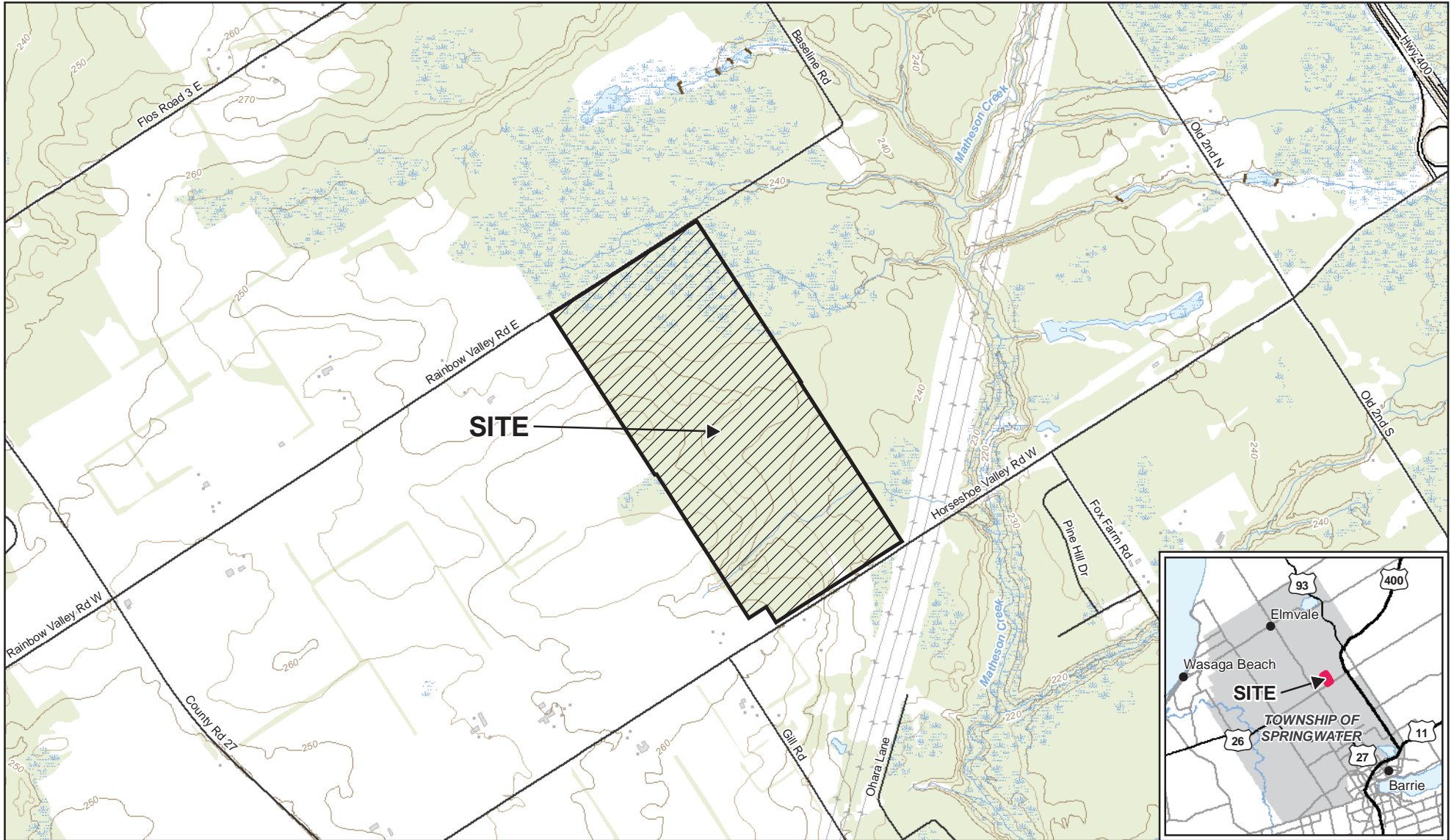


Shahkar Shahangian, Ph. D, CHEBAP, P. Eng.



Karl Roechner, P. Eng.

# Figures



Source: MNRF NRVIS, 2015. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017

0 200 400 600  
Meters

Coordinate System:  
NAD 1983 UTM Zone 17N



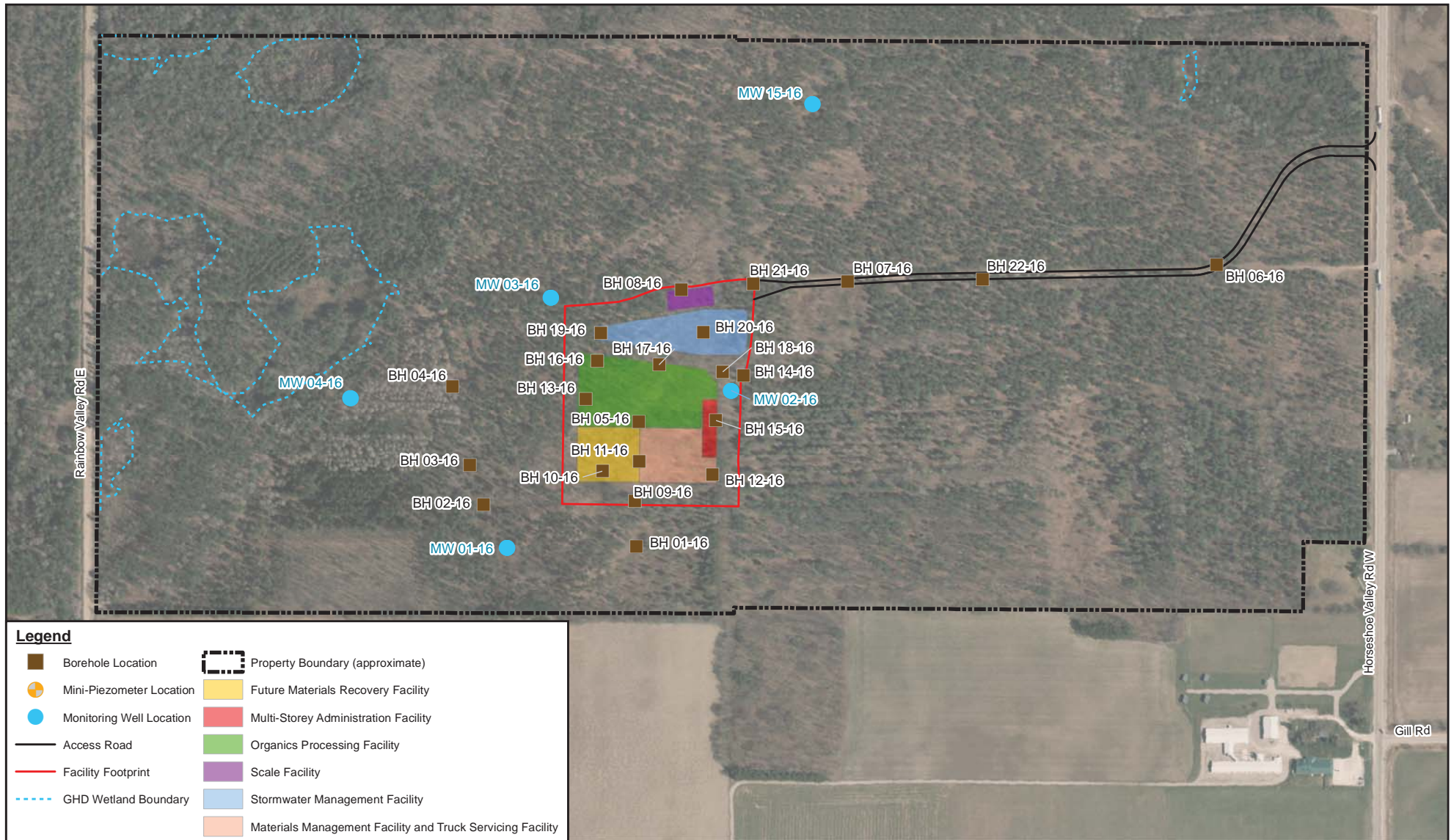
COUNTY OF SIMCOE  
GEOTECHNICAL INVESTIGATION  
ENVIRONMENTAL RESOURCE RECOVERY CENTRE (ERRC)  
2976 HORESHOE VALLEY ROAD WEST, SPRINGWATER, ONTARIO

SITE LOCATION MAP

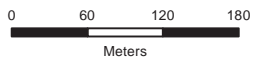
086822-00  
Nov 24, 2017

FIGURE 1

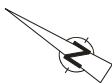




Source: MNRF NRVIS, 2015. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2017;  
 NOTE: Location coordinates are Easting & Northing values projected in NAD83 UTM Zone 17 North in metres.



Coordinate System:  
 NAD 1983 UTM Zone 17N



COUNTY OF SIMCOE  
 GEOTECHNICAL INVESTIGATION  
 ENVIRONMENTAL RESOURCE RECOVERY CENTRE (ERRC)  
 2976 HORESHOE VALLEY ROAD WEST, SPRINGWATER, ONTARIO  
 INVESTIGATIVE LOCATION PLAN

086822-00  
 Nov 24, 2017

FIGURE 2



# Appendices

# Appendix A Borehole Logs



**BOREHOLE No.:** BH01-16  
**ELEVATION:** 260.66 m

**BOREHOLE REPORT**

Page: 1 of 1

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 5 August 2016 **DATE (FINISH):** 5 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N		
0	260.66		GROUND SURFACE			%			N	10	20	30	40	50	60	70	80	90
0.03	260.63		TOPSOIL : 25 mm															
1			NATIVE : SAND, some silt, fine grained, well graded, trace gravel, rootlets, brown, moist, very loose		SS-1	50	3	1-0-1-1	1									
0.76	259.90		SANDY SILT, trace to some clay and gravel, grey, moist, compact to dense		SS-2	50	3	1-4-6-8	10									
2																		
3																		
4																		
5																		
6	2.0																	
7																		
8	2.29		SAND, fine grained, well graded, trace gravel, trace granitic cobbles, brown, moist, dense		SS-4	83	3	7-14-15-14	29									
9																		
10	3.0																	
11																		
12																		
13	4.0																	
14																		
15			becoming very dense															
16	5.0																	
17																		
18																		
19																		
20	6.0																	
21	6.10		SILT, some sand, trace gravel, brown, moist, very dense		SS-7	100	5	16-50	50									
22																		
23	7.0																	
24																		
25																		
26	7.90		granitic cobbles		SS-8	100	9	16-50/125mm	100									
27	8.0																	
28			<b>END OF BOREHOLE:</b>															
29			NOTE :															
30	9.0		End of Borehole at 7.90 m bgs															
31			Borehole was dry upon completion															
32			Borehole backfilled with enviroplug medium to the top															
33	10.0		bgs denotes 'below ground surface'															
34																		
35																		
36	11.0																	
37																		
38																		
39																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH02-16

**ELEVATION:** 255.98 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe

Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 5 August 2016 DATE (FINISH): 5 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	10	20	30
0	255.98		GROUND SURFACE			%			N									
0.03	255.95		TOPSOIL : 25 mm															
1			NATIVE : SAND and SILT, trace to some gravel, rootlets, grey, moist, compact		SS-1	75	3	1-6-6-8	12									
2																		
3	255.22		SILTY SAND, trace gravel, brown, moist, dense to compact		SS-2	83	10	3-14-21-23	35									
4	1.0																	
5																		
6	2.0		dense		SS-3	42	10	9-12-13-19	25									
7																		
8																		
9																		
10	3.0																	
11	3.35	252.63	SAND, trace silt and gravel, layered, brown, moist, dense		SS-5	75	7	10-19-28-33	47									
12	4.0																	
13																		
14																		
15	4.57	251.41	SANDY SILT/SILTY SAND, brown, moist, very dense		SS-6	83	4	12-27-36-50	63									
16	5.0																	
17																		
18																		
19																		
20	6.0																	
21																		
22																		
23	7.0																	
24																		
25																		
26	8.0		silty sand layer		SS-7	83	2	7-22-32-42	54									
27	8.08	247.90			SS-8	94	14	22-32-50	82									
28			<b>END OF BOREHOLE:</b>															
29			NOTE :															
30	9.0		End of Borehole at 8.08 m bgs															
31			Borehole was dry upon completion															
32			Borehole backfilled with enviroplug															
33	10.0		medium to the top															
34			bgs denotes 'below ground surface'															
35																		
36	11.0																	
37																		
38																		
39																		

SOIL LOG WITH GRAPH+WELL\_066822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH03-16

**ELEVATION:** 254.46 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 8 August 2016 DATE (FINISH): 8 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N	Field	Lab
0	254.46		GROUND SURFACE			%			N	10	20	30	40	50	60	70	80	90
0.04	254.42		TOPSOIL with organics : 35 mm		SS-1	62	9	1-2-3-7	5									
1			NATIVE : SAND and SILT, trace to some gravel, rootlets, grey, moist, loose		SS-2	50	10	5-6-6-8	12									
0.76	253.70		SAND, trace silt, occasional sand and silt layers, brown, moist, compact to dense		SS-3	58	8	4-5-10-15	15									
1.0					SS-4	71	3	6-18-21-25	39									
2.0					SS-5	100	9	8-19-25-30	44									
4.0					SS-6	87	13	10-20-28-32	48									
5.0			becoming very dense		SS-7	75	12	11-25-27-33	52									
6.0					SS-8	50	9	17-50	50									
7.0																		
7.93	246.53		<b>END OF BOREHOLE:</b>															
8.0			NOTE : End of Borehole at 7.93 m bgs Borehole was dry upon completion Borehole backfilled with enviroplug medium to the top bgs denotes 'below ground surface'															
9.0																		
10.0																		
11.0																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH04-16

**ELEVATION:** 246.73 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 8 August 2016 DATE (FINISH): 8 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		△ Field	□ Lab	
										w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	10	20	30	40	50	60	70
0	246.73		GROUND SURFACE			%			N											
0.03	246.70		TOPSOIL with organics : 25 mm																	
1			NATIVE : SAND, some silt, trace to some gravel, brown, damp, loose		SS-1	50	5	2-3-4-4	7											
2																				
3																				
4	1.0																			
5			occasional sand and silt layers, moist		SS-2	50	1	1-3-2-3	5											
6																				
7	2.0																			
8			becoming dense																	
9																				
10	3.0																			
11																				
12	4.0																			
13																				
14	5.0																			
15																				
16	6.0																			
17																				
18	7.0																			
19																				
20	8.0		trace clay and gravel, occasional sand and silt layers, brown, moist, very dense		SS-3	71	3	2-4-5-6	9											
21																				
22	8.23																			
23																				
24	9.0																			
25																				
26	10.0																			
27																				
28	11.0																			
29																				
30																				
31																				
32																				
33																				
34																				
35																				
36																				
37																				
38																				
39																				

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17

**END OF BOREHOLE:**  
NOTE :  
End of Borehole at 8.23 m bgs  
Borehole was dry upon completion  
Borehole backfilled with enviroplug medium to the top  
bgs denotes 'below ground surface'





**BOREHOLE No.:** BH06-16

**ELEVATION:** 243.44 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	10	20	30
0	243.44		GROUND SURFACE			%			N									
1			REWORKED NATIVE : SILTY SAND, some gravel, trace topsoil and rootlets, brown, damp to moist, compact	SS-1	62	6	7-11-9-9	20										
2				SS-2	67	8	3-6-8-7	14										
3	1.0																	
4																		
5	1.52	241.92	NATIVE : SILTY SAND TILL, some gravel, brown, moist, compact	SS-3	62	5	7-13-14-12	27										
6			becoming dense	SS-4	75	6	10-19-20-24	39										
7	2.0																	
8																		
9			auger refusal, very dense	SS-5	100	6	50/75mm	100										
10	3.0																	
11																		
12																		
13	4.0																	
14																		
15																		
16	5.0																	
17	5.18	238.26	<b>END OF BOREHOLE:</b>															
18			NOTE :															
19			End of Borehole at 5.18 m bgs															
20	6.0		Borehole was dry upon completion															
21			Borehole backfilled with enviroplug															
22			medium to the top															
23	7.0		bgs denotes 'below ground surface'															
24																		
25																		
26	8.0																	
27																		
28																		
29	9.0																	
30																		
31																		
32																		
33	10.0																	
34																		
35																		
36	11.0																	
37																		
38																		
39																		

SOIL LOG WITH GRAPH+WELL\_066822-12.GPJ INSPEC\_SOL.GDT 8/11/17





**BOREHOLE No.:** BH07-16

**ELEVATION:** 247.11 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	247.11		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
0																
1	0.46	246.65	▨	RE-WORKED NATIVE : SAND and SILT, trace gravel, trace to some topsoil, brown, damp to moist, compact	▨	SS-1	67	4	2-6-4-6	10	○	●				
2			▨	NATIVE : SAND, some silt, trace gravel, reddish brown to greyish brown, loose	▨	SS-2	71	8	1-3-4-5	7	●					
3	1.0		▨		▨	SS-3	71	9	2-4-6-7	10	●					
4			▨	becoming brown, compact	▨	SS-4	67	6	2-4-4-6	8	●					
5			▨		▨	SS-5	92	10	1-3-5-7	8	●					
6	2.0		▨		▨	SS-6	79	3	1-4-11-14	15	○	●				
7			▨	<b>END OF BOREHOLE:</b>  NOTE : End of Borehole at 5.18 m bgs Borehole was dry upon completion Borehole backfilled with enviroplug medium to the top bgs denotes 'below ground surface'	▨	SS-7		8	7-12-15-18	27	○	●				
8			▨		▨											
9																
10	3.0															
11																
12																
13	4.0															
14																
15																
16	5.0															
17	5.18	241.93														
18																
19																
20	6.0															
21																
22																
23	7.0															
24																
25																
26	8.0															
27																
28																
29	9.0															
30																
31																
32																
33	10.0															
34																
35																
36	11.0															
37																
38																
39																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH08-16

**ELEVATION:** 252.71 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: S. Andreou CHECKED BY: F. Gergis

DATE (START): 12 August 2016 DATE (FINISH): 12 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	252.71		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
0																
1				RE-WORKED NATIVE : SAND, some silt, trace gravel, some topsoil, light brown, moist, loose		SS-1	62	5	2-2-4-3	7	●					
2																
3	0.76	251.95		NATIVE : SAND, some silt, trace gravel, light brown, moist, loose		SS-2	42	5	2-2-2-2	4	●					
4	1.0															
5																
6	2.0					SS-3	58	5	1-1-2-2	3	●					
7																
8																
9						SS-4	67	4	2-2-1-2	3	●					
10	2.90	249.81		CLAYEY SILT, some sand, trace gravel, grey, moist, stiff		SS-5	54	21	3-6-7-10	13	●	○				
11	3.0															
12																
13	4.0															
14																
15	4.57	248.14		SANDY SILT TILL, some clay, trace gravel, grey, moist, compact		SS-6	96	8	8-9-11-13	20	○	●				
16	5.0															
17	5.18	247.53														
18				<b>END OF BOREHOLE:</b>												
19				NOTE :												
20	6.0			End of Borehole at 5.18 m bgs												
21				Borehole was dry upon completion												
22				Borehole backfilled with enviroplug												
23	7.0			medium to the top												
24				bgs denotes 'below ground surface'												
25																
26	8.0															
27																
28																
29	9.0															
30																
31																
32																
33	10.0															
34																
35																
36	11.0															
37																
38																
39																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH09-16

**ELEVATION:** 261.83 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe

Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 5 January 2017 DATE (FINISH): 5 January 2017

**LEGEND**

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

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N	Field	Lab
0	261.83		GROUND SURFACE						N									
1			NATIVE : SAND, some silt, rootlets, dark brown, moist, very loose		SS-1	33	12	1-1-2-3	3									
2	0.76	261.07																
3	1.0		SAND, trace silt, brown, moist, loose		SS-2	50	7	1-4-4-5	8									
4																		
5			very loose		SS-3	58	3	1-3-4-5	7									
6																		
7	2.0																	
8																		
9			sandy silt, loose		SS-4	63	3	1-1-2-3	3									
10	3.0																	
11																		
12																		
13	3.96	257.87																
14	4.0		SANDY SILT TILL, trace gravel, grey, moist, very dense															
15																		
16	5.0																	
17	5.18	256.65			SS-6	75	6	6-14-36-50/76mm	50									
18			<b>END OF BOREHOLE:</b>															
19																		
20	6.0																	
21			NOTE :															
22			End of Borehole at 5.18 m bgs															
23			Borehole was dry upon completion															
24	7.0		Borehole backfilled with enviroplug medium to the top															
25			bgs denotes 'below ground surface'															
26	8.0																	
27																		
28																		
29	9.0																	
30																		
31																		
32																		
33	10.0																	
34																		
35																		
36	11.0																	
37																		
38																		
39	12.0																	
40																		
41																		
42																		
43	13.0																	
44																		
45																		
46	14.0																	
47																		
48																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH10-16

**ELEVATION:** 258.92 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 5 January 2017 DATE (FINISH): 5 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	258.92		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
1				FILL: SAND, trace to some silt, topsoil with rootlets, dark brown to brown, loose	SS-1	33	11	2-3-3-2	6							
2	0.76	258.16		NATIVE: SILTY CLAY, sandy, brown, moist, firm to stiff	SS-2	50	8	1-2-3-4	5							
3	1.0				SS-3	63	9	3-3-5-4	8							
4					SS-4	75	11	3-8-8-6	16							
5	2.0	256.63		CLAYEY SILT, trace gravel, trace to some sand, rootlets, grey, moist, very stiff becoming firm	SS-5	67	13	3-3-3-4	6							
6	2.29															
7																
8																
9	3.0															
10																
11	4.0															
12																
13	4.57	254.35		SANDY SILT TILL, trace gravel, grey, moist, dense	SS-6	75	7	7-16-27-41	43							
14				damp to moist, very dense												
15	5.0															
16																
17	6.0															
18																
19	6.0															
20																
21	7.00	251.92		SAND, some silt to silty, grey, damp, dense	SS-7	83	11	10-27-31-34	58							
22																
23	8.0															
24																
25	8.0	250.69														
26	8.23															
27																
28	9.0			<b>END OF BOREHOLE:</b>												
29				NOTE :												
30				End of Borehole at 8.23 m bgs												
31				Borehole was dry upon completion												
32				Borehole backfilled with enviroplug medium to the top												
33	10.0			bgs denotes 'below ground surface'												
34																
35																
36	11.0															
37																
38																
39	12.0															
40																
41																
42	13.0															
43																
44																
45	14.0															
46																
47																
48																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH11-16

**ELEVATION:** 258.26 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 6 January 2017 DATE (FINISH): 6 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	258.26		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
0																
1			▨	FILL : SAND, trace silt and rootlets, dark brown, moist, loose	☒	SS-1	33	9	1-3-2-2	5						
2	0.76	257.50														
3	1.0															
4				NATIVE: SAND, trace silt, brown, moist, loose	☒	SS-2	67	6	2-3-4-3	7						
5				very loose												
6																
7	2.0															
8				silty, loose												
9																
10	3.0															
11				some clay and silt, trace gravel, grey, moist, very stiff												
12																
13	4.0															
14																
15	4.57	253.69														
16	5.0			SAND to SANDY SILT, trace silt, brown, damp, dense	☒	SS-6	83	4	9-17-31-42	48						
17																
18																
19	6.0															
20				grey, moist, very dense												
21																
22																
23	7.0															
24																
25																
26	8.0															
27	8.23	250.03														
28				<b>END OF BOREHOLE:</b>												
29				NOTE :												
30	9.0			End of Borehole at 8.23 m bgs												
31				Borehole was dry upon completion												
32				Borehole backfilled with enviroplug												
33	10.0			medium to the top												
34				bgs denotes 'below ground surface'												
35																
36	11.0															
37																
38																
39	12.0															
40																
41																
42																
43	13.0															
44																
45																
46	14.0															
47																
48																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH12-16

**ELEVATION:** 255.99 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe

Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 21 December 2016 DATE (FINISH): 21 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N	10	20
0	255.99		GROUND SURFACE			%			N									
1		☒	FILL : SAND, some silt, trace topsoil and rootlets, trace organics, dark brown to brown, very moist, very loose	☒	SS-1	0	13	0-0-0-1	0									
2	0.76																	
3	1.0	▨	NATIVE : SANDY SILT, trace clay, dark brown, moist, loose	☒	SS-2	50	24	1-3-5-8	8									
4	1.52																	
5	2.0	▨	SILTY SAND, trace gravel, grey, moist, compact	☒	SS-3	83	9	5-7-6-8	13									
6	2.29																	
7																		
8			SAND, trace silt, brown, damp, very dense	☒	SS-4	83	--	10-24-33-50	57									
9																		
10	3.0																	
11																		
12	4.0																	
13																		
14																		
15			very dense															
16	5.0																	
17																		
18																		
19	6.0																	
20																		
21																		
22	7.0																	
23																		
24																		
25																		
26	8.0																	
27	8.23	247.76																
28			<b>END OF BOREHOLE:</b>															
29	9.0																	
30			NOTE :															
31			End of Borehole at 8.23 m bgs															
32			Borehole was dry upon completion															
33	10.0		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																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH13-16

**ELEVATION:** 252.15 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

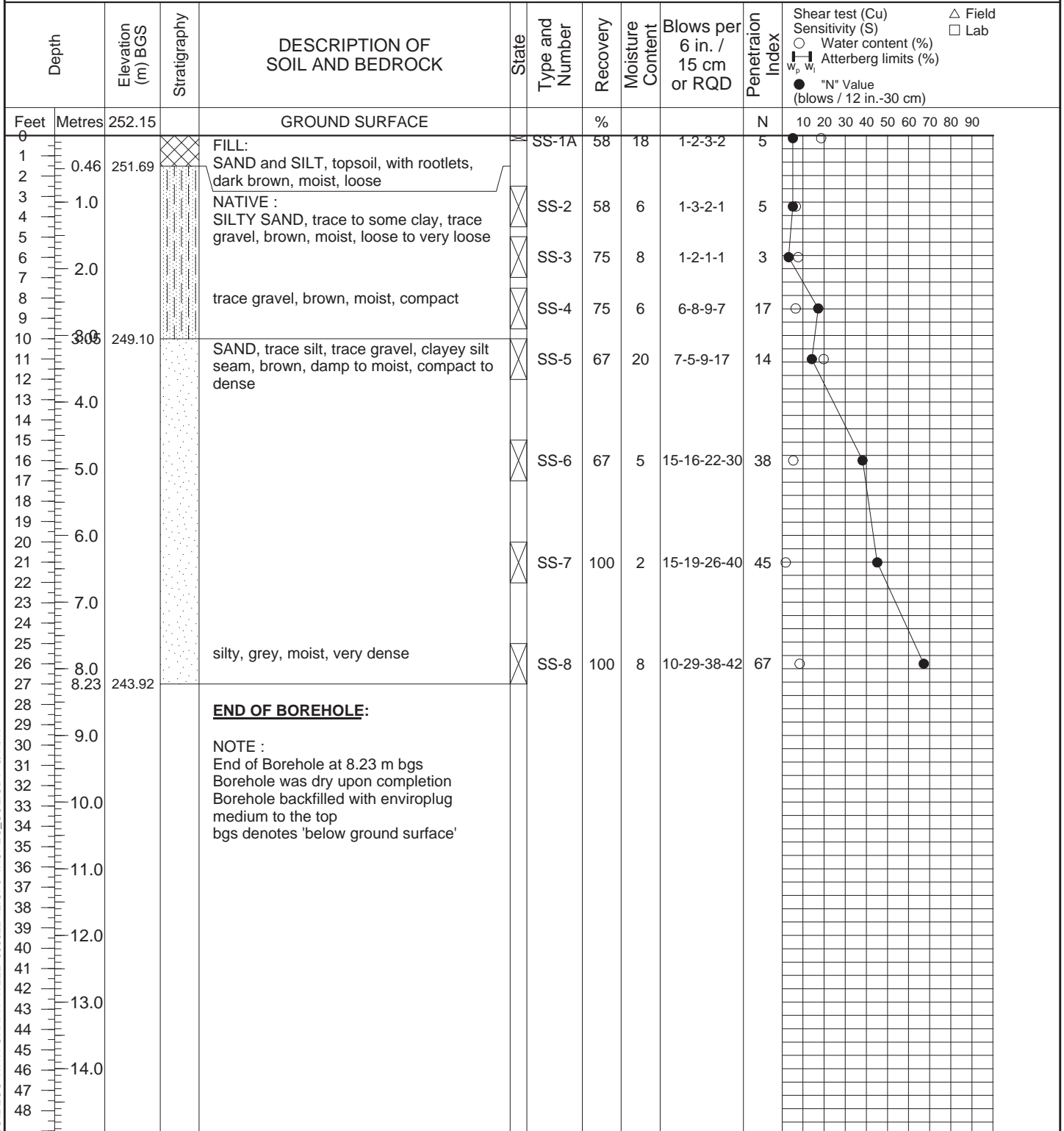
LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 3 January 2017 DATE (FINISH): 3 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17

**END OF BOREHOLE:**  
NOTE :  
End of Borehole at 8.23 m bgs  
Borehole was dry upon completion  
Borehole backfilled with enviroplug medium to the top  
bgs denotes 'below ground surface'



**BOREHOLE No.:** BH14-16

**ELEVATION:** 251.83 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe

Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 21 December 2016 DATE (FINISH): 22 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N	10	20
0	251.83		GROUND SURFACE			%			N									
1	251.07	☒	FILL : SAND, trace to some silt, trace topsoil and rootlets, trace organics, dark brown to reddish brown, very moist, very loose	☒	SS-1	75	12	1-1-1-2	2									
2				☒	SS-2	92	7	2-3-3-3	6									
3				☒	SS-3	92	8	1-2-1-2	3									
4			NATIVE : SAND, trace silt, dark brown, moist, loose	☒	SS-4	83	5	2-2-3-3	5									
5			loose	☒	SS-5	100	3	1-2-4-3	6									
6			brown to grey	☒	SS-6	100	11	3-6-9-17	15									
7				☒	SS-7	75	4	11-22-28-29	50									
8			SANDY SILT, trace gravel, grey, moist, compact	☒	SS-8	100	3	11-20-29-30	49									
9																		
10																		
11																		
12																		
13																		
14																		
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45																		
46																		
47																		
48																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17

**END OF BOREHOLE:**

NOTE :  
End of Borehole at 8.23 m bgs  
Borehole was dry upon completion  
bgs denotes 'below ground surface'





**BOREHOLE No.:** BH15-16

**ELEVATION:** 253.47 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

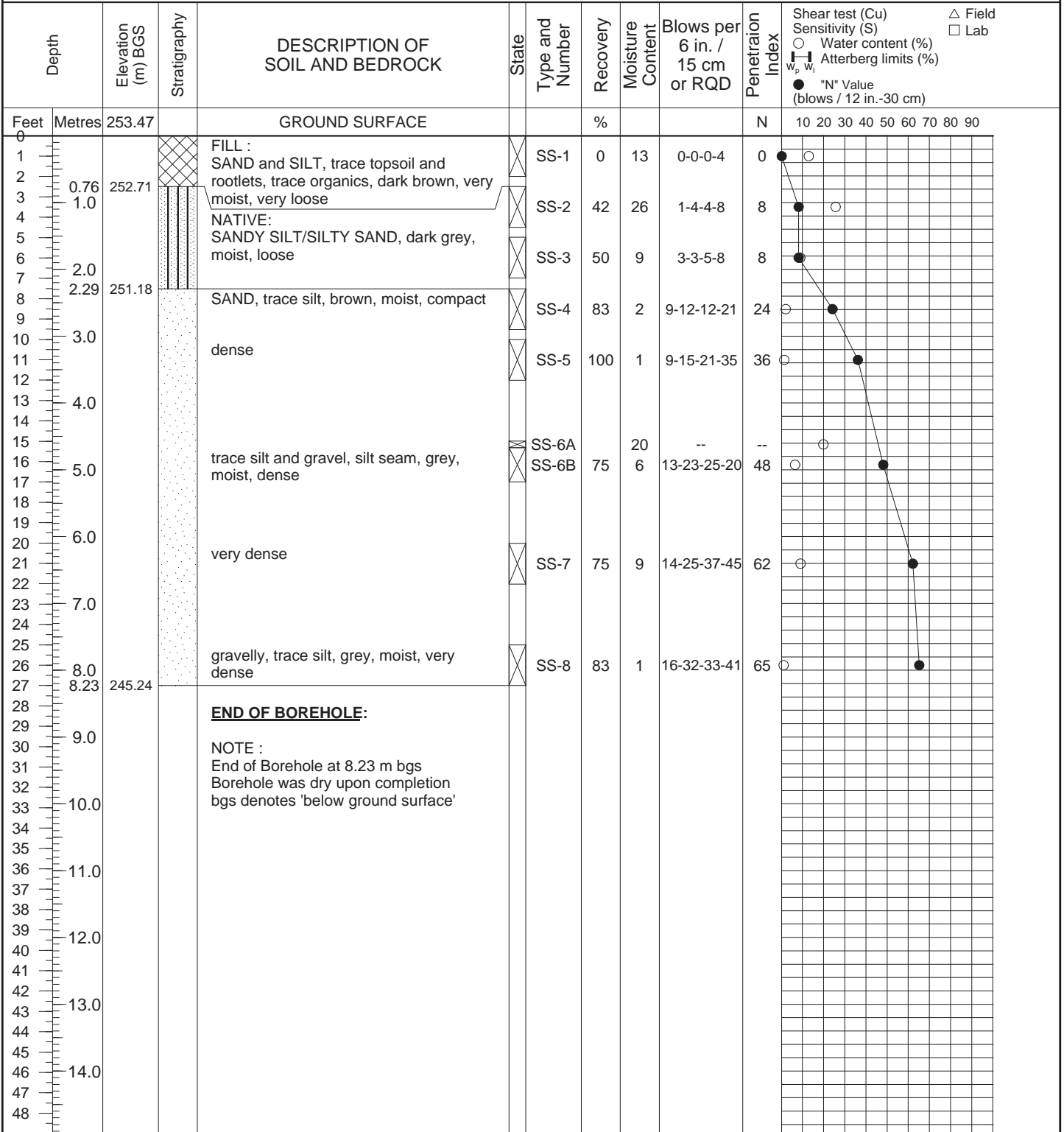
LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 19 December 2016 DATE (FINISH): 19 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH16-16

**ELEVATION:** 251.43 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe

Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

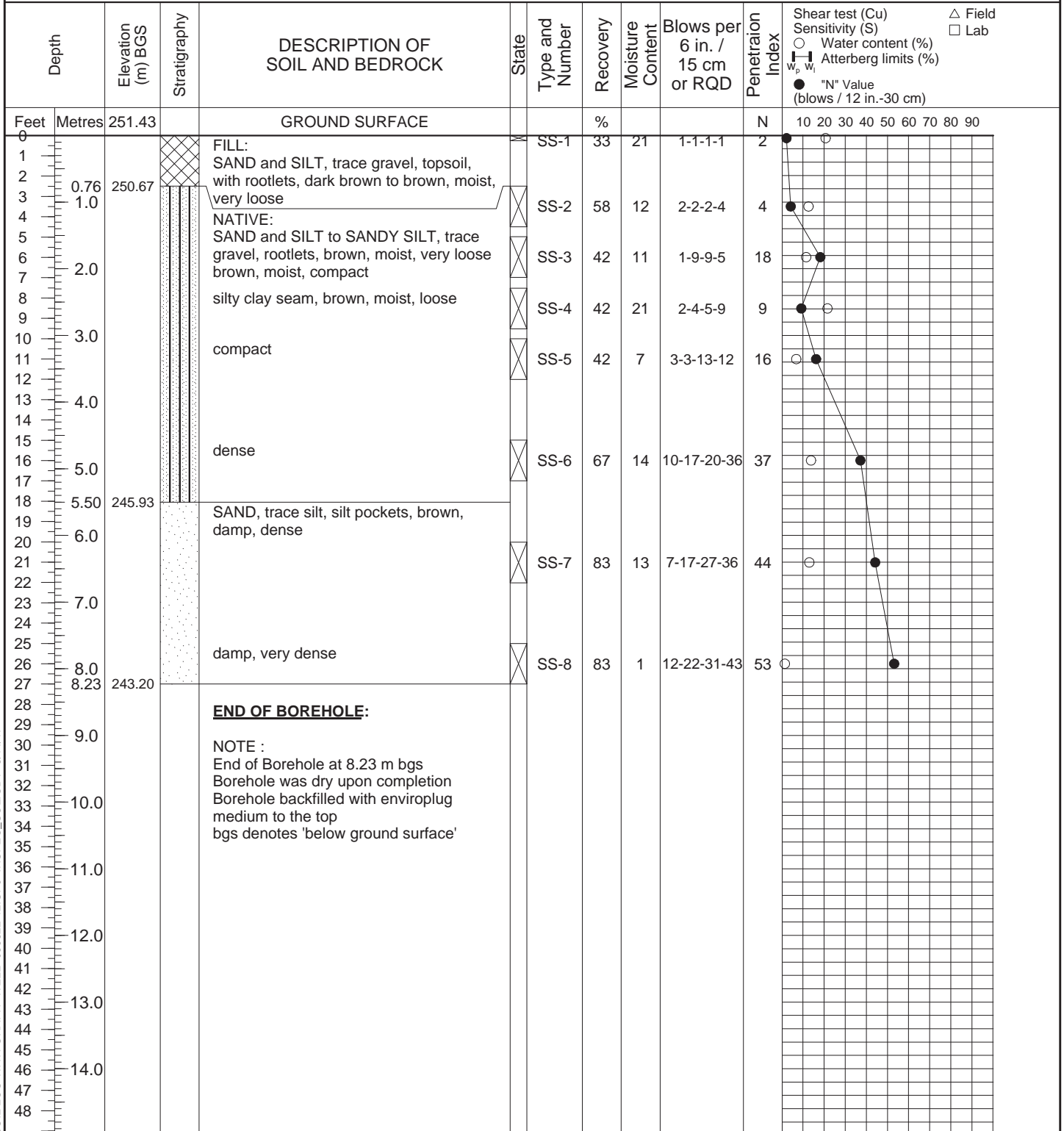
LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 3 January 2017 DATE (FINISH): 3 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH17-16

**ELEVATION:** 252.81 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 4 January 2017 DATE (FINISH): 4 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	Field	Lab	
0	252.81		GROUND SURFACE			%			N									
1		▨	FILL: SAND, trace silt, topsoil, with rootlets, dark brown to brown, moist, very loose	SS-1	67	7	1-2-1-2	3										
2	0.76		NATIVE: SAND, trace silt, brown, damp, loose	SS-2	75	7	2-2-2-3	4										
3	1.0		sandy silt, with rootlets, grey	SS-3	75	13	2-2-4-4	6										
4				SS-4	67	17	2-6-6-9	12										
5	2.0		SANDY CLAYEY SILT, grey, moist, stiff	SS-5	79	26	5-7-9-13	16										
6	2.29			SS-6	25	5	6-50/203mm	50										
7	2.52		SILT, grey, very moist, very stiff	SS-7	67	18	5-22-45-50/127mm	58										
8	2.76			SS-8	83	2	8-21-19-33	40										
9	3.0		SANDY SILT, trace gravel, grey, moist, very dense															
10	3.26																	
11	3.51																	
12	3.76																	
13	4.0																	
14																		
15	5.0																	
16																		
17	6.0																	
18	6.25																	
19																		
20	7.0																	
21																		
22	8.0																	
23	8.23																	
24																		
25	9.0																	
26																		
27	10.0																	
28																		
29	11.0																	
30																		
31	12.0																	
32																		
33	13.0																	
34																		
35	14.0																	
36																		
37	15.0																	
38																		
39	16.0																	
40																		
41	17.0																	
42																		
43	18.0																	
44																		
45	19.0																	
46																		
47	20.0																	
48																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17

**END OF BOREHOLE:**

NOTE :  
End of Borehole at 8.23 m bgs  
Borehole was damp upon completion  
Borehole backfilled with enviroplug medium to the top  
bgs denotes 'below ground surface'



**BOREHOLE No.:** BH18-16  
**ELEVATION:** 252.26 m

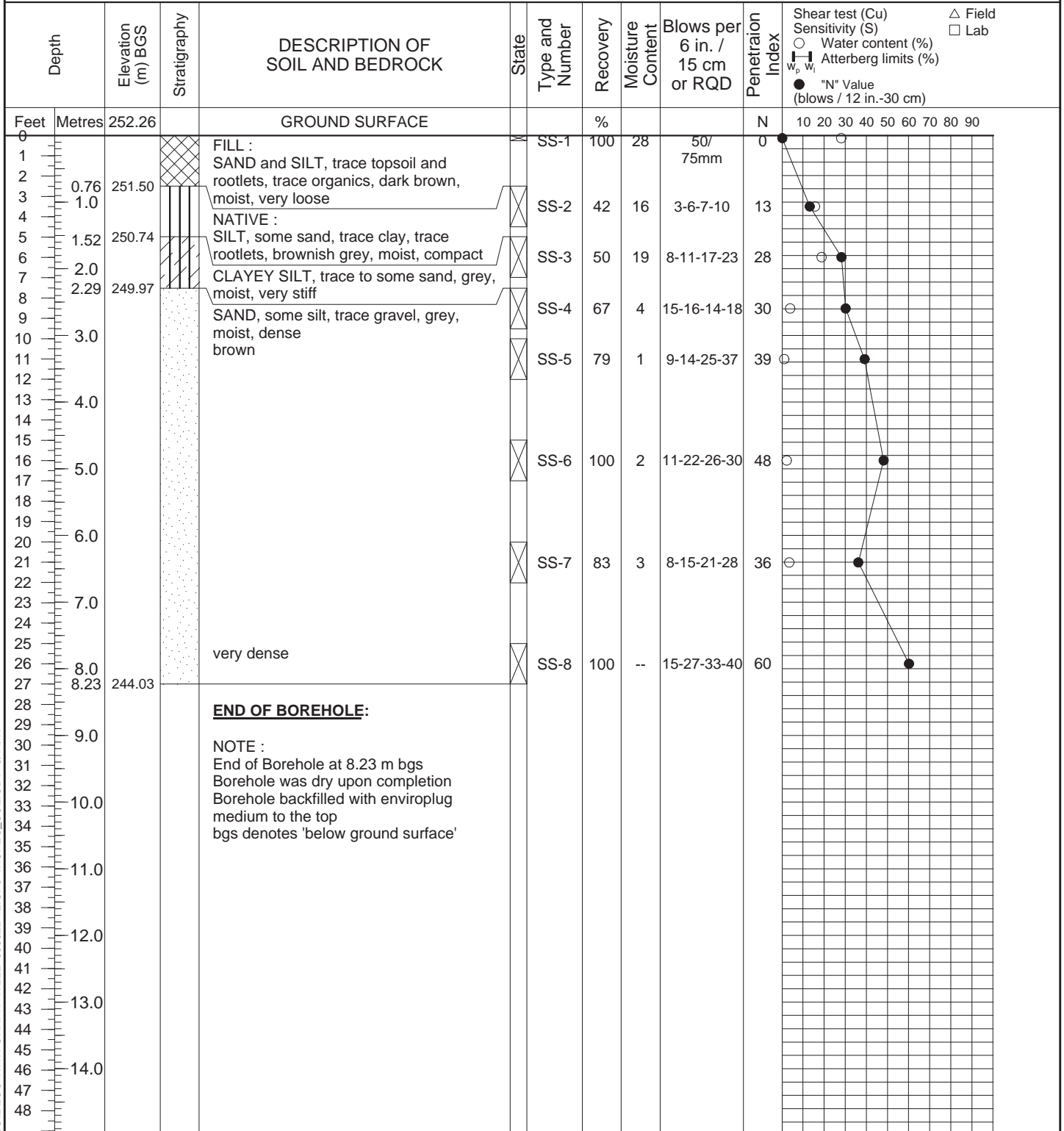
**BOREHOLE REPORT**

Page: 1 of 1

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** O. Sabeeh **CHECKED BY:** S. Shahangian  
**DATE (START):** 19 December 2016 **DATE (FINISH):** 19 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH19-16

**ELEVATION:** 249.99 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 3 January 2017 DATE (FINISH): 3 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	Field	Lab			
0	249.99		GROUND SURFACE						N	10	20	30	40	50	60	70	80	90
1		▨	FILL: SAND and SILT, topsoil, with rootlets, dark brown, moist, very loose	SS-1	75	19	1-2-1-2	3										
2	0.76																	
3	1.0	▨	NATIVE: SILTY CLAY to CLAYEY SILT, trace gravel, trace sand, grey, moist, very stiff	SS-2	33	25	24-15-5-6	20										
4	1.52																	
5		▨	SANDY SILT to SILTY SAND, trace gravel, brown, moist, compact	SS-3	33	7	9-8-8-6	16										
6	2.0																	
7																		
8																		
9	3.0																	
10																		
11																		
12	3.96																	
13	4.0		SAND, trace silt, brown, damp, very dense															
14																		
15																		
16	5.0																	
17	5.18																	
18			<b>END OF BOREHOLE:</b>															
19	6.0																	
20			NOTE : End of Borehole at 5.18 m bgs Borehole was dry upon completion Borehole backfilled with enviroplug medium to the top bgs denotes 'below ground surface'															
21																		
22																		
23	7.0																	
24																		
25																		
26	8.0																	
27																		
28																		
29	9.0																	
30																		
31																		
32																		
33	10.0																	
34																		
35																		
36	11.0																	
37																		
38																		
39	12.0																	
40																		
41																		
42																		
43	13.0																	
44																		
45																		
46	14.0																	
47																		
48																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH20-16

**ELEVATION:** 253.23 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 4 January 2017 DATE (FINISH): 4 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	Field	Lab			
0	253.23		GROUND SURFACE						N									
1		☒	FILL: SAND, trace silt, trace topsoil with rootlets, dark brown to brown, moist, very loose	SS-1	83	5	1-1-1-1	2										
2	0.76		NATIVE: SAND, trace silt, dark brown to brown, damp to moist, very loose	SS-2	58	7	1-2-1-2	3										
3	1.0			SS-3	75	7	1-1-3-2	4										
4	2.0			SS-4	67	26	2-3-3-5	6										
5	2.29	▨	SILTY CLAY, trace to some sand, grey, moist, firm	SS-5	75	33	3-3-5-6	8										
6	2.50		SANDY SILT, trace to some gravel, grey, moist, very dense	SS-6	67	7	11-25-28-30	53										
7	2.96																	
8	3.96																	
9	4.0																	
10	5.0																	
11	5.18																	
12			<b>END OF BOREHOLE:</b>															
13			NOTE :															
14			End of Borehole at 5.18 m bgs															
15			Borehole was dry upon completion															
16			Borehole backfilled with enviroplug medium to the top															
17			bgs denotes 'below ground surface'															

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH21-16

**ELEVATION:** 249.75 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 22 December 2016 DATE (FINISH): 22 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		
										Field	Lab	w <sub>p</sub>	w <sub>L</sub>	U <sub>c</sub>	U <sub>L</sub>	N	Field	Lab
0	249.75		GROUND SURFACE			%			N	10	20	30	40	50	60	70	80	90
1		▨	FILL : SAND, trace to some silt, trace topsoil and rootlets, trace organics, dark brown to brown, moist, very loose	▨	SS-1	83	7	1-2-1-1	3									
2		▨	trace rootlets, dark brown, very moist	▨	SS-2	75	9	1-1-1-1	2									
3	1.0																	
4	1.52	▨	POSSIBLE NATIVE: SANDY SILT/SILTY SAND, trace gravel, trace rootlets, dark brown, moist, loose	▨	SS-3	50	13	1-2-4-4	6									
5	2.0																	
6	2.29	▨	NATIVE : SAND, trace silt, brown, damp, compact dense	▨	SS-4	83	3	2-3-7-10	10									
7																		
8																		
9																		
10	3.0																	
11																		
12	4.0																	
13																		
14																		
15																		
16	5.0																	
17	5.18				SS-6	100	7	8-13-17-19	30									
18			<b>END OF BOREHOLE:</b>															
19			NOTE :															
20	6.0		End of Borehole at 5.18 m bgs															
21			Borehole was dry upon completion															
22			Borehole backfilled with enviroplug medium to the top															
23	7.0		bgs denotes 'below ground surface'															
24																		
25																		
26	8.0																	
27																		
28																		
29	9.0																	
30																		
31																		
32	10.0																	
33																		
34																		
35	11.0																	
36																		
37																		
38																		
39	12.0																	
40																		
41																		
42	13.0																	
43																		
44																		
45	14.0																	
46																		
47																		
48																		

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** BH22-16

**ELEVATION:** 244.89 m

**BOREHOLE REPORT**

Page: 1 of 1

CLIENT: County of Simcoe  
Geotechnical Investigation

PROJECT: Environmental Resource Recovery Centre (ERRC)

LOCATION: 2976 Horseshoe Valley Road West, Springwater

DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian

DATE (START): 4 January 2017 DATE (FINISH): 4 January 2017

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	244.89		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
0																
1				FILL: SAND and GRAVEL, trace to some silt, dark brown to brown, moist, loose		SS-1	58	7	4-5-4-4	9						
2	0.76	244.13														
3	1.0			NATIVE: SAND, trace silt, brown, moist, loose		SS-2	83	6	3-3-4-5	7						
4																
5																
6																
7	2.0															
8																
9																
10	3.0															
11				some silt to silts, trace gravel, brown, moist, very dense												
12																
13	4.0															
14																
15																
16																
17	5.0	239.71														
18	5.18			<b>END OF BOREHOLE:</b>												
19																
20	6.0			NOTE :												
21				End of Borehole at 5.18 m bgs												
22				Borehole was dry upon completion												
23	7.0			Borehole backfilled with enviroplug medium to the top												
24				bgs denotes 'below ground surface'												
25																
26	8.0															
27																
28																
29	9.0															
30																
31																
32																
33	10.0															
34																
35																
36	11.0															
37																
38																
39	12.0															
40																
41																
42	13.0															
43																
44																
45	14.0															
46																
47																
48																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17





**BOREHOLE No.:** MW01-16  
**ELEVATION:** 259.10 m

**BOREHOLE REPORT**

Page: 1 of 3

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 2 August 2016 **DATE (FINISH):** 4 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	259.10		GROUND SURFACE			%			N						
0	0.03	259.07		TOPSOIL with organics : 25 mm	☒	SS-1	62	6	1-2-2-3	4	●					
1				NATIVE : SAND, some silt, trace gravel, rootlets, light reddish brown, dry to damp, loose	☒	SS-2	21	10	1-2-4-5	6	●					
2				compact	☒	SS-3	46	6	5-6-5-5	11	●					
3	1.0				☒	SS-4	79	13	2-3-4-3	7	●					
4				fine grained, grey, loose	☒	SS-5	100	4	9-12-16-18	28	○					
5				some silt, trace to some gravel, moist, compact	☒	SS-6	92	5	3-16-22-23	38	○					
6	2.0			becoming dense	☒	SS-7	96	4	14-21-35-43	56	○					
7					☒	SS-8	100	3	19-34-39-44	73	○					
8				very dense	☒	SS-9	92	2	14-28-44-50/75mm	72	○					
9					☒	SS-10	87	3	18-35-50/125mm	100	○					
10	3.0			thin dark bands, layered	☒	SS-11	83	6	14-33-50/125mm	100	○					
11					☒	SS-12	75	7	15-40-50/125mm	100	○					
12	4.0															
13																
14																
15	5.0															
16																
17																
18	6.0															
19																
20																
21	7.0															
22																
23																
24	8.0															
25																
26																
27	9.0															
28																
29																
30	10.0															
31																
32																
33	11.0															
34																
35																
36	12.0															
37																
38																
39	13.0															
40																
41																
42	14.0															
43																
44																
45																
46																
47																
48																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17

Bentonite Grout

0.3 m



**BOREHOLE No.:** MW01-16  
**ELEVATION:** 259.10 m

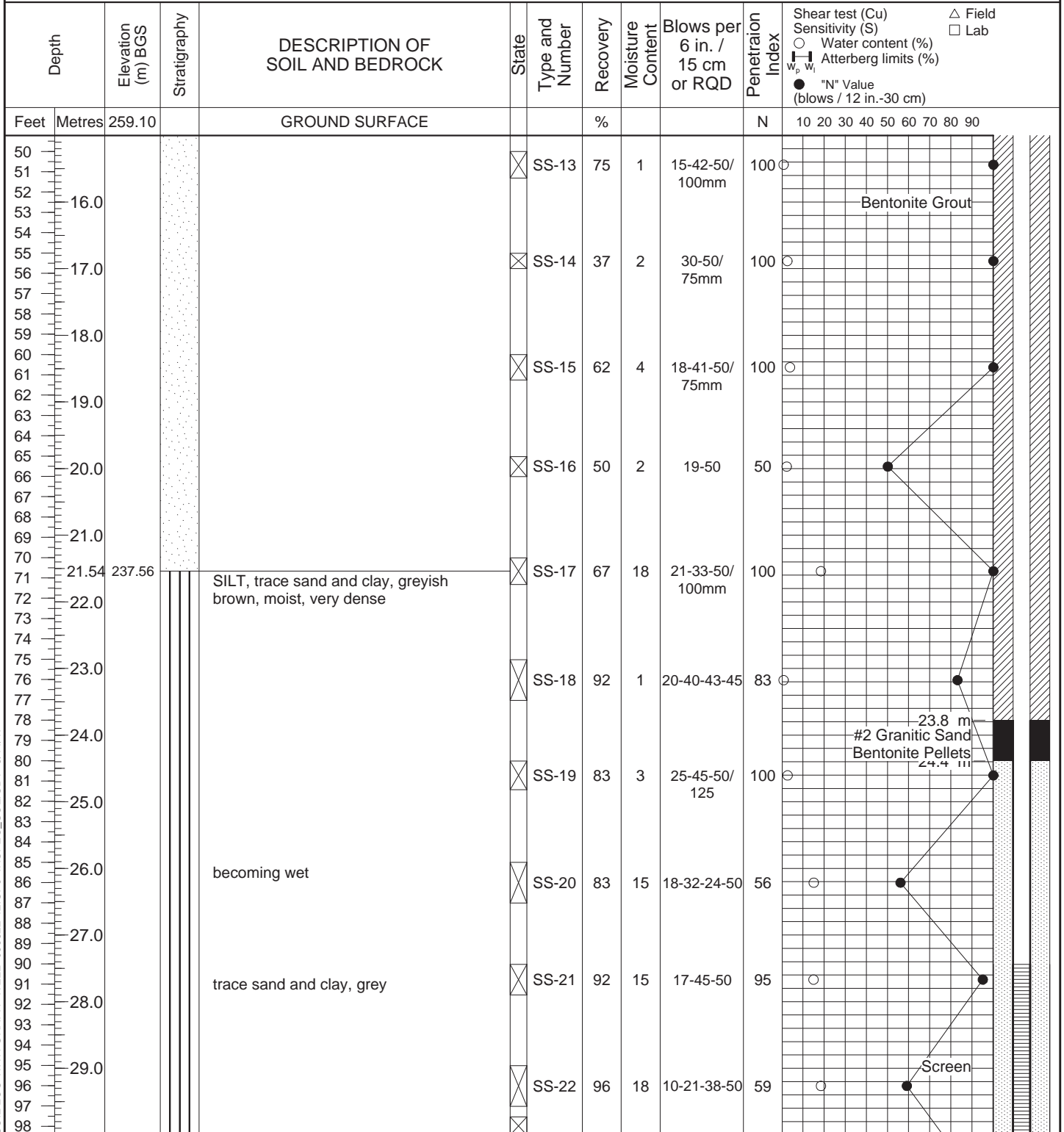
**BOREHOLE REPORT**

Page: 2 of 3

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 2 August 2016 **DATE (FINISH):** 4 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▮ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ\_INSPEC\_SOL.GDT\_8/11/17

Bentonite Grout

23.8 m  
#2 Granitic Sand  
Bentonite Pellets  
44.4

Screen



**BOREHOLE No.:** MW01-16  
**ELEVATION:** 259.10 m

**BOREHOLE REPORT**

Page: 3 of 3

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 2 August 2016 **DATE (FINISH):** 4 August 2016

**LEGEND**

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

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	259.10		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
99						SS-23	100	15	13-27-50-0	77						
100	30.49	228.61														
101	31.0															
102																
103																
104																
105	32.0															
106																
107																
108																
109																
110																
111	34.0															
112																
113																
114																
115	35.0															
116																
117																
118	36.0															
119																
120																
121	37.0															
122																
123																
124																
125	38.0															
126																
127																
128	39.0															
129																
130																
131	40.0															
132																
133																
134	41.0															
135																
136																
137	42.0															
138																
139																
140	43.0															
141																
142																
143	44.0															
144																
145																
146																
147																

**END OF BOREHOLE:**

**NOTE :**  
 End of Borehole at 30.18 m bgs  
 Borehole was dry upon completion  
 50 mm diameter monitoring well installed  
 at 30.49 m bgs  
 bgs denotes 'below ground surface'

SOIL LOG WITH GRAPH+WELL\_066822-12.GPJ\_INSPEC\_SOL.GDT\_8/11/17



**BOREHOLE No.:** MW02-16  
**ELEVATION:** 252.45 m

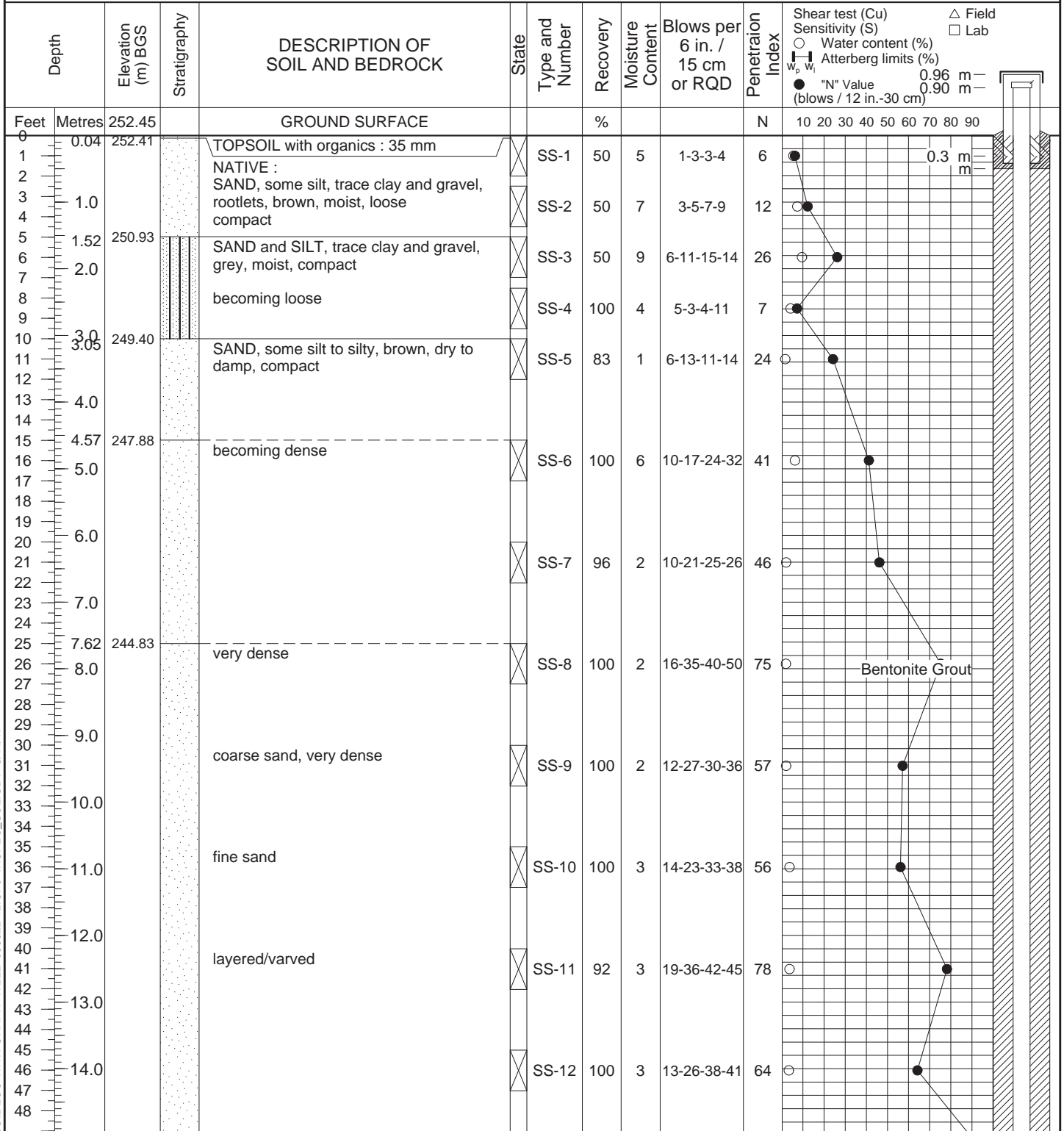
**BOREHOLE REPORT**

Page: 1 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 9 August 2016 **DATE (FINISH):** 9 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** MW02-16  
**ELEVATION:** 252.45 m

**BOREHOLE REPORT**

Page: 2 of 2

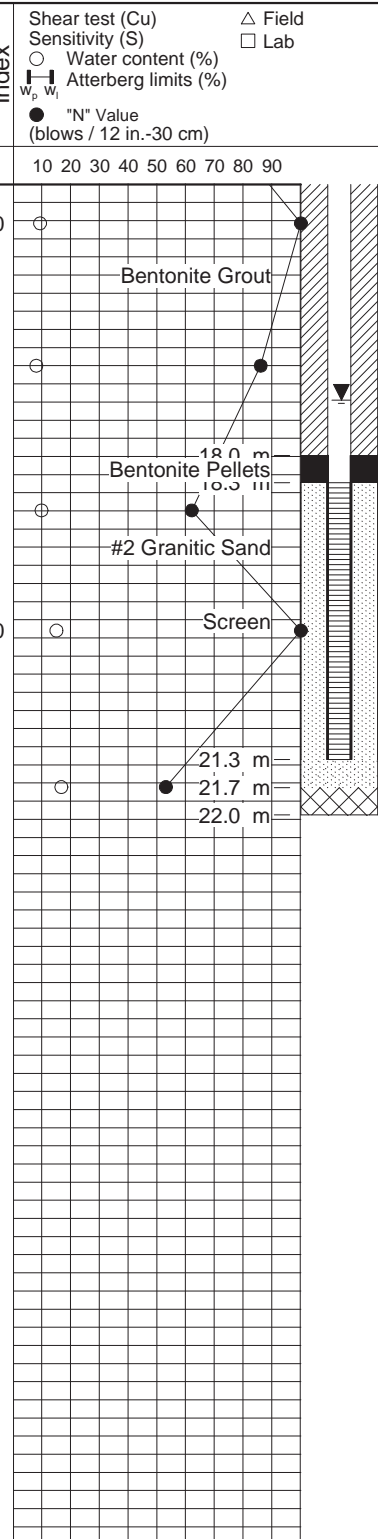
**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 9 August 2016 **DATE (FINISH):** 9 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS		Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		△ Field
	Feet	Metres								W <sub>p</sub>	W <sub>L</sub>	Atterberg limits (%)
		252.45		GROUND SURFACE		%			N	10 20 30 40 50 60 70 80 90		
50					SS-13	79	9	15-39-50/75mm	100			
51												
52	16.0											
53												
54												
55		235.53			SS-14	92	8	25-36-50	86			
56	17.0			SILTY SAND TILL, gravelly, brown, moist, very dense								
57												
58												
59	18.0											
60												
61		233.85			SS-15	100	10	8-28-34-50	62			
62	19.0			SILTY SAND, trace clay and gravel, brown, wet, very dense sand heaving observed								
63												
64												
65	19.82				SS-16	100	15	22-50/50mm	100			
66	20.0			SAND, trace silt, brown, wet, very dense								
67												
68												
69	21.0											
70												
71	21.65				SS-17	50	17	10-23-30-50	53			
72	21.95	230.50		BOULDER/COBBLES, very dense								
73	22.0											
74				<b>END OF BOREHOLE:</b>								
75				NOTE :								
76	23.0			End of Borehole at 21.95 m bgs								
77				Groundwater measured at 17.38 m bgs upon completion								
78				50 mm diameter monitoring well installed at 21.34 m bgs								
79	24.0			Sand heaving encountered at 18.60 m bgs								
80				bgs denotes 'below ground surface'								
81												
82	25.0											
83												
84												
85	26.0											
86												
87												
88	27.0											
89												
90												
91	28.0											
92												
93												
94	29.0											
95												
96												
97												
98												

SOIL LOG WITH GRAPH+WELL\_066822-12.GPJ INSPEC\_SOL.GDT 8/11/17





**BOREHOLE No.:** MW03-16  
**ELEVATION:** 246.14 m

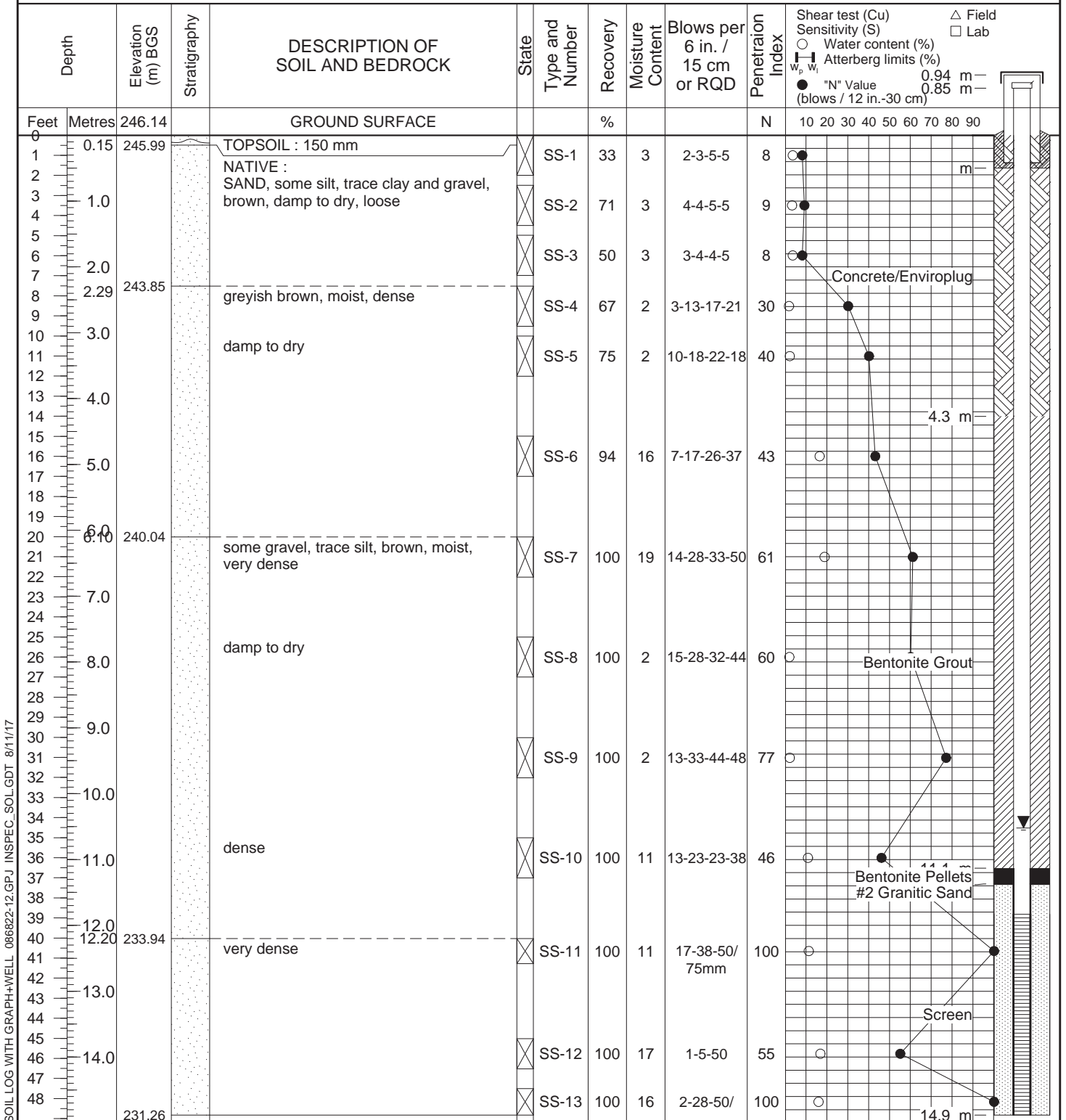
**BOREHOLE REPORT**

Page: 1 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 10 August 2016 **DATE (FINISH):** 10 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ\_INSPEC\_SOL.GDT\_8/11/17



**BOREHOLE No.:** MW03-16  
**ELEVATION:** 246.14 m

**BOREHOLE REPORT**

Page: 2 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** S. Andreou **CHECKED BY:** F. Gergis  
**DATE (START):** 10 August 2016 **DATE (FINISH):** 10 August 2016

**LEGEND**

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

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	246.14		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
50	14.88			<b>END OF BOREHOLE:</b>					100mm							
51				<b>NOTE :</b>												
52				End of Borehole at 14.88 m bgs												
53	16.0			Groundwater measured at 10.52 m bgs upon completion												
54				50 mm diameter monitoring well installed at 14.88 m bgs												
55				bgs denotes 'below ground surface'												
56	17.0															
57																
58																
59	18.0															
60																
61																
62	19.0															
63																
64																
65	20.0															
66																
67																
68	21.0															
69																
70																
71	22.0															
72																
73																
74	23.0															
75																
76																
77	24.0															
78																
79																
80	25.0															
81																
82																
83	26.0															
84																
85																
86	27.0															
87																
88																
89	28.0															
90																
91																
92	29.0															
93																
94																
95																
96																
97																
98																

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17





**BOREHOLE No.:** MW04-16  
**ELEVATION:** 242.86 m

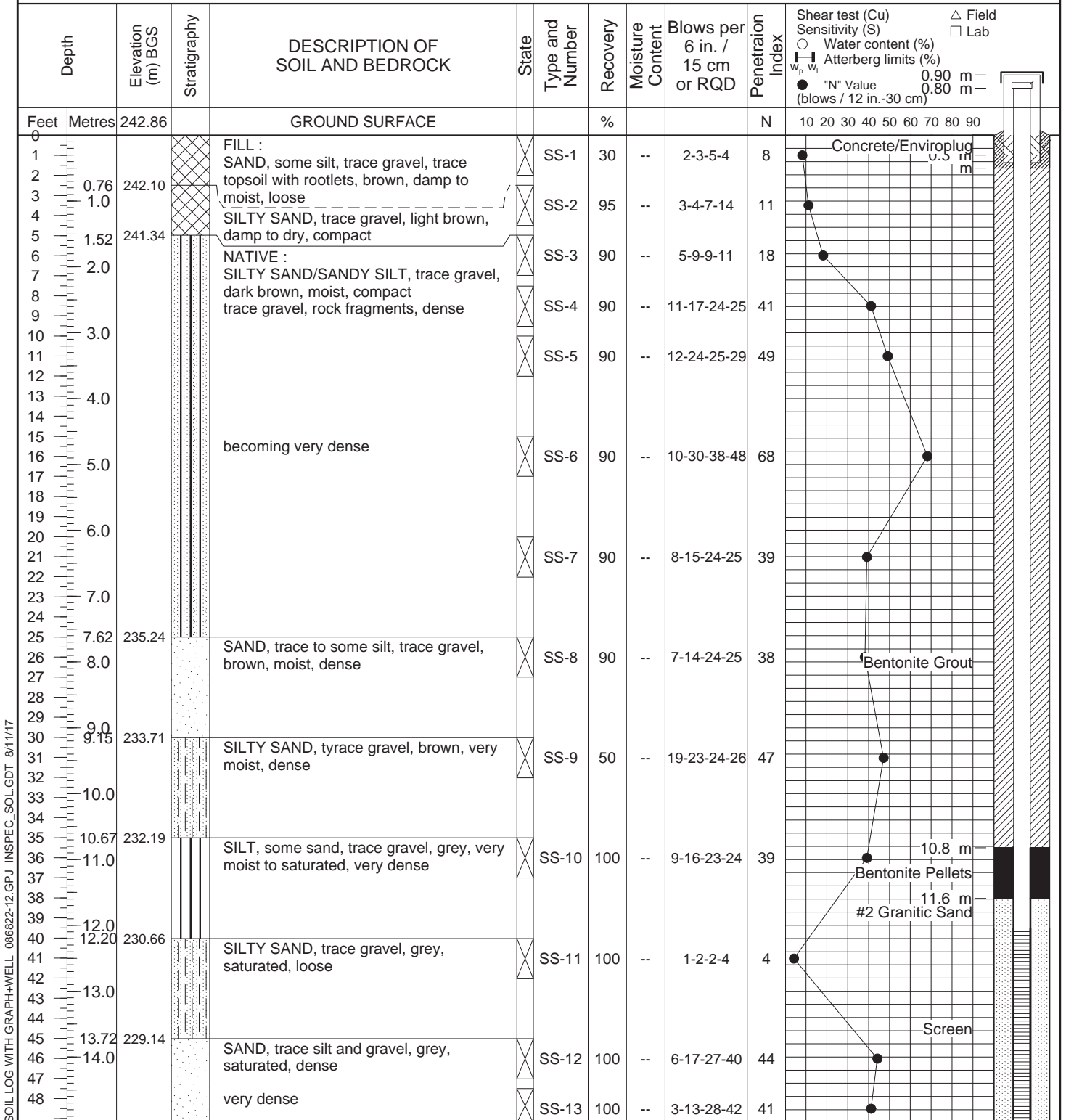
**BOREHOLE REPORT**

Page: 1 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** O. Sabeeh **CHECKED BY:** F. Gergis  
**DATE (START):** 11 August 2016 **DATE (FINISH):** 11 August 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ\_INSPC\_SOL.GDT\_8/11/17





**BOREHOLE No.:** MW04-16  
**ELEVATION:** 242.86 m

**BOREHOLE REPORT**

Page: 2 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** O. Sabeeh **CHECKED BY:** F. Gergis  
**DATE (START):** 11 August 2016 **DATE (FINISH):** 11 August 2016

**LEGEND**

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

Depth	Elevation (m) BGS		Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		△ Field	□ Lab	
	Feet	Metres									242.86	227.77	%	%	N	10	20	30	40	50	60
50	15.09	227.77		<b>GROUND SURFACE</b>																	
51				<b>END OF BOREHOLE:</b>																	
52				<b>NOTE :</b>																	
53	16.0			End of Borehole at 15.09 m bgs																	
54				Borehole dry upon completion																	
55				50 mm diameter monitoring well installed																	
56	17.0			at 15.09 m bgs																	
57				bgs denotes 'below ground surface'																	
58																					
59	18.0																				
60																					
61																					
62	19.0																				
63																					
64																					
65	20.0																				
66																					
67																					
68	21.0																				
69																					
70																					
71	22.0																				
72																					
73																					
74	23.0																				
75																					
76																					
77	24.0																				
78																					
79																					
80	25.0																				
81																					
82																					
83	26.0																				
84																					
85																					
86	27.0																				
87																					
88																					
89	28.0																				
90																					
91																					
92	29.0																				
93																					
94																					
95																					
96																					
97																					
98																					

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** MW15-16  
**ELEVATION:** 247.33 m

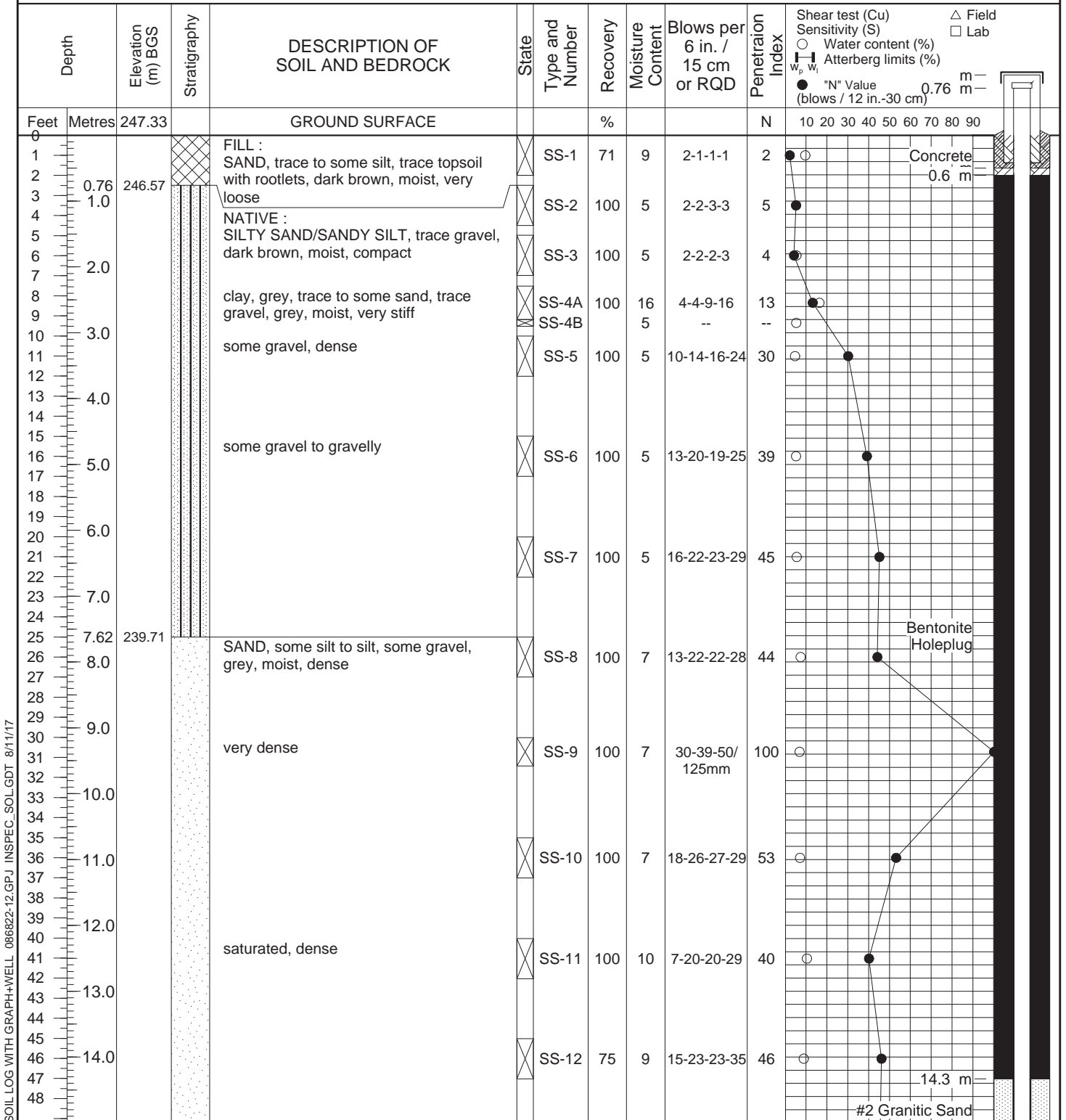
**BOREHOLE REPORT**

Page: 1 of 2

**CLIENT:** County of Simcoe  
 Geotechnical Investigation  
**PROJECT:** Environmental Resource Recovery Centre (ERRC)  
**LOCATION:** 2976 Horseshoe Valley Road West, Springwater  
**DESCRIBED BY:** O. Sabeeh **CHECKED BY:** S. Shahangian  
**DATE (START):** 22 December 2016 **DATE (FINISH):** 23 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



**BOREHOLE No.:** MW15-16  
**ELEVATION:** 247.33 m

**BOREHOLE REPORT**

Page: 2 of 2

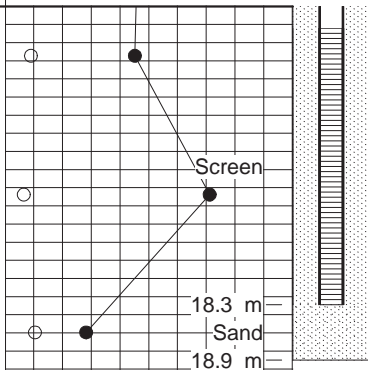
CLIENT: County of Simcoe  
 Geotechnical Investigation  
 PROJECT: Environmental Resource Recovery Centre (ERRC)  
 LOCATION: 2976 Horseshoe Valley Road West, Springwater  
 DESCRIBED BY: O. Sabeeh CHECKED BY: S. Shahangian  
 DATE (START): 22 December 2016 DATE (FINISH): 23 December 2016

**LEGEND**

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ☐ GS - GRAB SAMPLE
- ▬ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS		Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		Water content (%)		Atterberg limits (%)		"N" Value (blows / 12 in.-30 cm)		△ Field	□ Lab
	Feet	Metres									247.33	%	N	w <sub>p</sub>	w <sub>L</sub>	10	20	30	40	50
		247.33		GROUND SURFACE			%			N										
50				dense	☒	SS-13	100	9	15-24-21-29	45										
51																				
52	16.0																			
53																				
54																				
55																				
56	17.0			very dense	☒	SS-14	50	6	10-26-45-43	71										
57																				
58																				
59	18.0																			
60	18.29	229.04																		
61				SILTY SAND, some gravel, grey, saturated, compact	☒	SS-15	100	10	13-12-16-20	28										
62	18.90	228.43																		
63	19.0																			
64				<b>END OF BOREHOLE:</b>																
65				NOTE :																
66	20.0			End of Borehole at 18.90 m bgs																
67				Waterlevel at 16.6 m bgs upon completion																
68				50 mm diameter monitoring well installed at 18.29 m bgs																
69	21.0			Water level at 11.8 m bgs after well installation																
70				bgs denotes 'below ground surface'																
71																				
72	22.0																			
73																				
74																				
75	23.0																			
76																				
77																				
78	24.0																			
79																				
80																				
81	25.0																			
82																				
83																				
84	26.0																			
85																				
86																				
87	27.0																			
88																				
89																				
90	28.0																			
91																				
92																				
93	29.0																			
94																				
95																				
96																				
97																				
98																				

SOIL LOG WITH GRAPH+WELL\_086822-12.GPJ INSPEC\_SOL.GDT 8/11/17



# Appendix B

## Laboratory Test Results



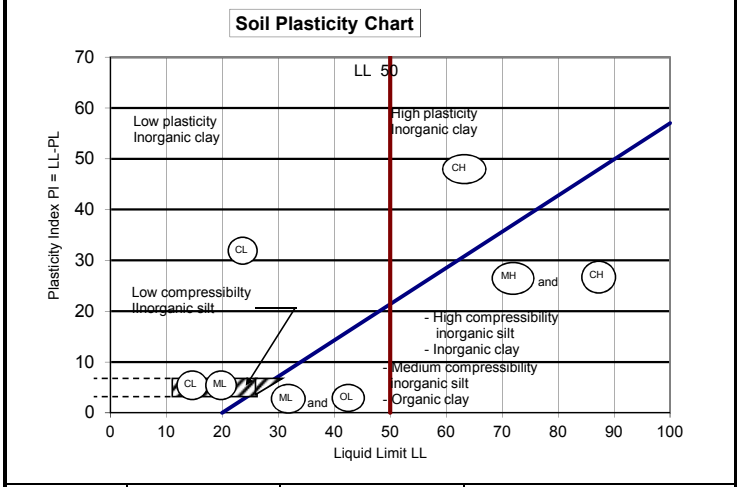
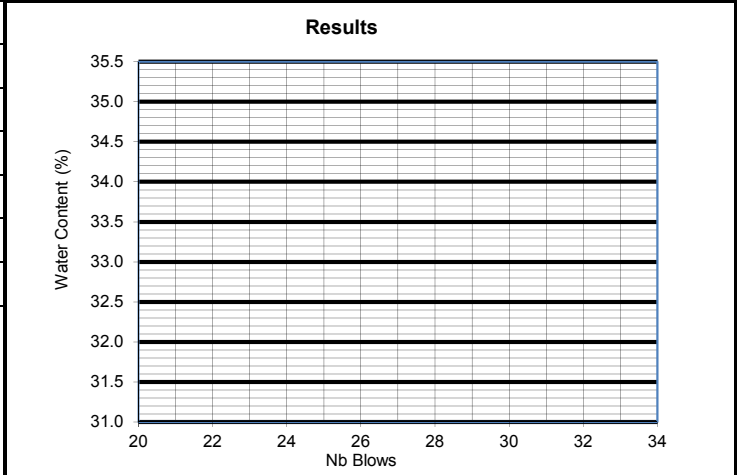
## Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

<b>Client:</b>	County of Simcoe Geotechnical Investigation	<b>Lab no.:</b>	G1310
<b>Project/Site:</b>	Environmental Resource Recovery Centre (ERRC) Horseshoe Valley Road West, Springwater, Ontario	2976	<b>Project no.:</b> 086822
Borehole no.:	BH03-16	Sample no.:	SS3
Soil description:	Non-Plastic (np)	Depth:	1.5m-2.1m
		Date sampled:	11-Aug-16
Apparatus:	Hand Crank	Balance no.:	2
Liquid limit device no.:	-	Porcelain bowl no.:	1
Sieve no.:	40	Oven no.:	1
		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 <sup>n</sup> ):			
Tare no.	B36		
Wet soil+tare, g	14.1		
Dry soil+tare, g	13.2		
Mass of water, g	0.90		
Tare, g	1.30		
Mass of soil, g	11.90		
Water content %	7.6%		

**Soil Preparation:**

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



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W <sup>n</sup>
Non-Plastic (np)			8

**Remarks:**

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<b>Performed by:</b>	Riddhee Panchal	<b>Date:</b>	8/23/2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	8/25/2016



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

<b>Client:</b>	County of Simcoe Geotechnical Investigation	<b>Lab no.:</b>	G1310
<b>Project/Site:</b>	Environmental Resource Recovery Centre (ERRC) Horseshoe Valley Road West, Springwater, Ontario	2976	<b>Project no.:</b> 086822
Borehole no.:	BH05-16	Sample no.:	SS3
Soil description:	Low Plasticity Inorganic Clay (CL)		Depth: 1.5m-2.1m Date sampled: 11-Aug-16
Apparatus:	Hand Crank	Balance no.:	1
Liquid limit device no.:	2	Porcelain bowl no.:	7
Sieve no.:	40	Oven no.:	1
		Glass plate no.:	2

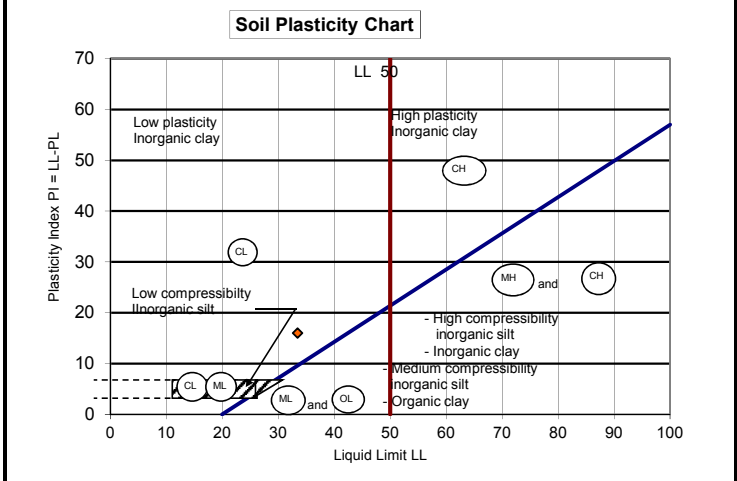
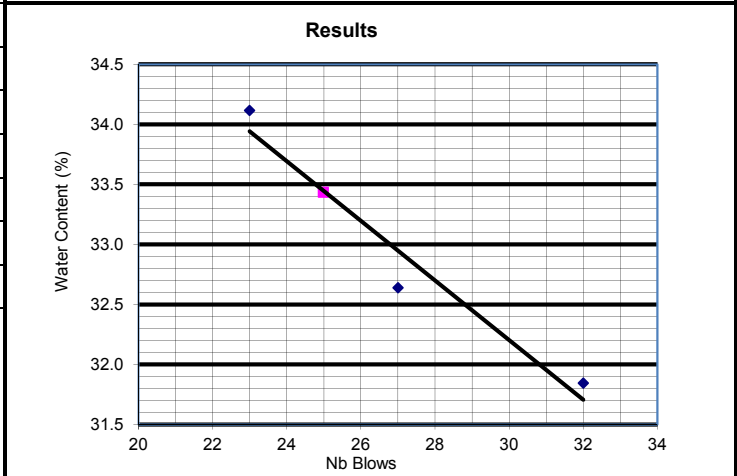
Liquid Limit (LL):			
	Test No. 1	Test No. 2	Test No. 3
Number of blows	32	27	23
Water Content:			
Tare no.	AT40	AT44	AT46
Wet soil+tare, g	19.35	20.53	22.43
Dry soil+tare, g	18.28	19.12	20.54
Mass of water, g	1.07	1.41	1.89
Tare, g	14.92	14.80	15.00
Mass of soil, g	3.36	4.32	5.54
Water content %	31.8%	32.6%	34.1%
Plastic Limit (PL) - Water Content:			
Tare no.	AT42	AT33	
Wet soil+tare, g	19.17	19.05	
Dry soil+tare, g	18.57	18.43	
Mass of water, g	0.60	0.62	
Tare, g	14.98	14.77	
Mass of soil, g	3.59	3.66	
Water content %	16.7%	16.9%	
Average water content %	16.8%		
Natural Water Content ( W <sup>n</sup> ):			
Tare no.	E37		
Wet soil+tare, g	36.5		
Dry soil+tare, g	30.1		
Mass of water, g	6.40		
Tare, g	1.30		
Mass of soil, g	28.80		
Water content %	22.2%		

**Soil Preparation:**

Cohesive <425 µm       Dry preparation

Cohesive >425 µm       Wet preparation

Non-cohesive



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W <sup>n</sup>
33	17	16	22

**Remarks:**

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<b>Performed by:</b>	Riddhee Panchal	<b>Date:</b>	8/23/2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	8/25/2016



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

<b>Client:</b>	County of Simcoe	<b>Lab no.:</b>	S1447
<b>Project/Site:</b>	Geotechnical Investigation	2976	<b>Project no.:</b>
	Supplementary Geotechnical Investigation- (ERRC) Horseshoe Valley Road West, Springwater, Ontario		

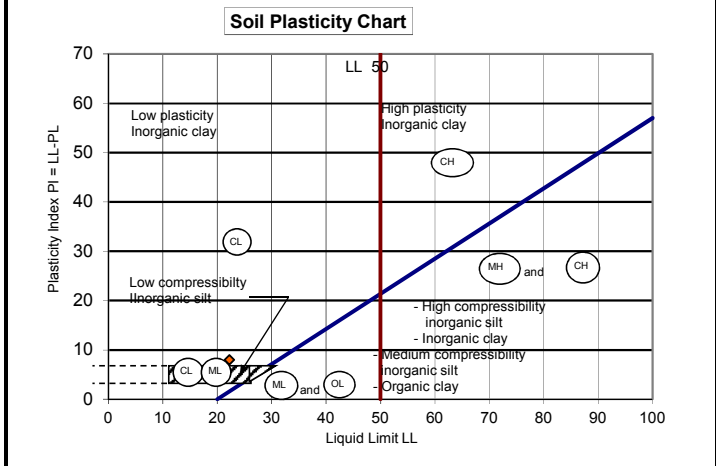
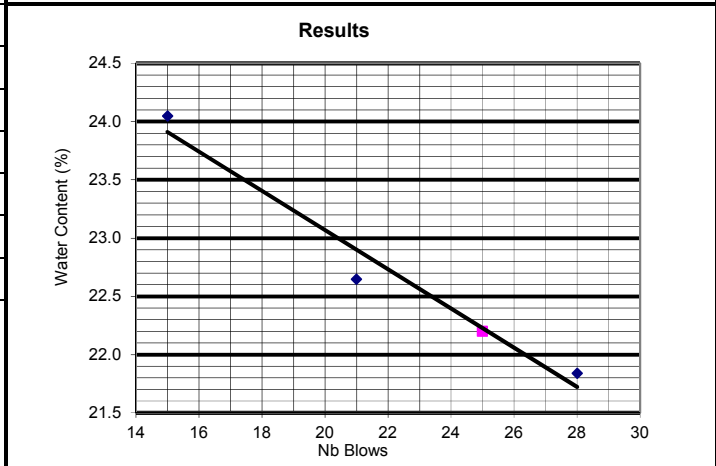
Borehole no.:	BH10-16	Sample no.:	SS4	Depth:	2.4m - 2.7m
Soil description:	Low Plasticity Inorganic Clay (CL)			Date sampled:	6-Jan-17

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

Liquid Limit (LL):			
	Test No. 1	Test No. 2	Test No. 3
Number of blows	28	21	15
Water Content:			
Tare no.	AT8	AT17	AT45
Wet soil+tare, g	20.32	19.14	20.07
Dry soil+tare, g	19.37	18.37	19.06
Mass of water, g	0.95	0.77	1.01
Tare, g	15.02	14.97	14.86
Mass of soil, g	4.35	3.40	4.20
Water content %	21.8%	22.6%	24.0%
Plastic Limit (PL) - Water Content:			
Tare no.	AT20	AT42	
Wet soil+tare, g	18.04	18.17	
Dry soil+tare, g	17.62	17.76	
Mass of water, g	0.42	0.41	
Tare, g	14.64	14.89	
Mass of soil, g	2.98	2.87	
Water content %	14.1%	14.3%	
Average water content %	14.2%		
Natural Water Content ( W <sup>n</sup> ):			
Tare no.	B8		
Wet soil+tare, g	46.8		
Dry soil+tare, g	42.4		
Mass of water, g	4.40		
Tare, g	1.30		
Mass of soil, g	41.10		
Water content %	10.7%		

**Soil Preparation:**

<input checked="" type="checkbox"/> Cohesive <425 µm	<input checked="" type="checkbox"/> Dry preparation
<input type="checkbox"/> Cohesive >425 µm	<input type="checkbox"/> Wet preparation
<input type="checkbox"/> Non-cohesive	



**Remarks:**

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<b>Performed by:</b>	Anwar Rehani	<b>Date:</b>	January 12, 2017
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	January 16, 2017





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

<b>Client:</b>	County of Simcoe Geotechnical Investigation	<b>Lab no.:</b>	S1446
<b>Project/Site:</b>	Supplementary Geotechnical Investigation- (ERRC) Horseshoe Valley Road West, Springwater, Ontario	2976	<b>Project no.:</b> 086822
Borehole no.:	BH20-16	Sample no.:	SS4
Soil description:	Low Plasticity Inorganic Clay (CL)	Depth:	2.4m - 2.7m
		Date sampled:	4-Jan-17
Apparatus:	Hand Crank	Balance no.:	1
Liquid limit device no.:	2	Porcelain bowl no.:	2
Sieve no.:	40	Oven no.:	1
		Spatula no.:	1
		Glass plate no.:	2

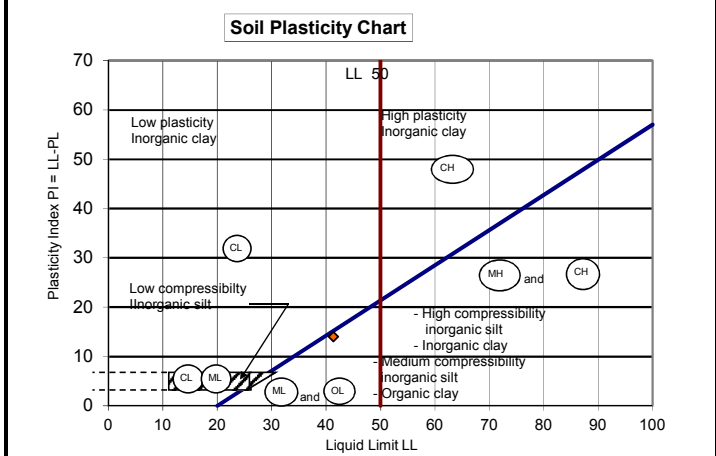
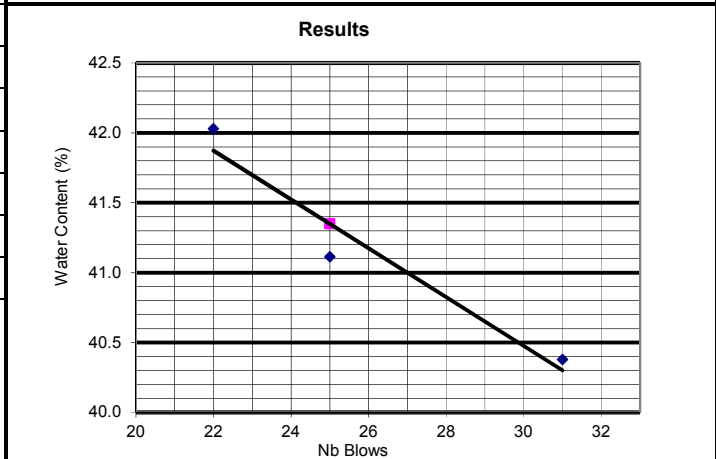
Liquid Limit (LL):			
	Test No. 1	Test No. 2	Test No. 3
Number of blows	31	25	22
Water Content:			
Tare no.	AT38	AT9	AT41
Wet soil+tare, g	19.32	20.29	19.76
Dry soil+tare, g	18.04	18.74	18.31
Mass of water, g	1.28	1.55	1.45
Tare, g	14.87	14.97	14.86
Mass of soil, g	3.17	3.77	3.45
Water content %	40.4%	41.1%	42.0%
Plastic Limit (PL) - Water Content:			
Tare no.	AT39	AT15	
Wet soil+tare, g	17.01	17.07	
Dry soil+tare, g	16.57	16.61	
Mass of water, g	0.44	0.46	
Tare, g	14.91	14.90	
Mass of soil, g	1.66	1.71	
Water content %	26.5%	26.9%	
Average water content %	26.7%		
Natural Water Content ( W <sup>n</sup> ):			
Tare no.	A29		
Wet soil+tare, g	45.8		
Dry soil+tare, g	42.8		
Mass of water, g	3.00		
Tare, g	1.30		
Mass of soil, g	41.50		
Water content %	7.2%		

**Soil Preparation:**

Cohesive <425 µm                       Dry preparation

Cohesive >425 µm                       Wet preparation

Non-cohesive



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W <sup>n</sup>
41	27	14	7

**Remarks:**

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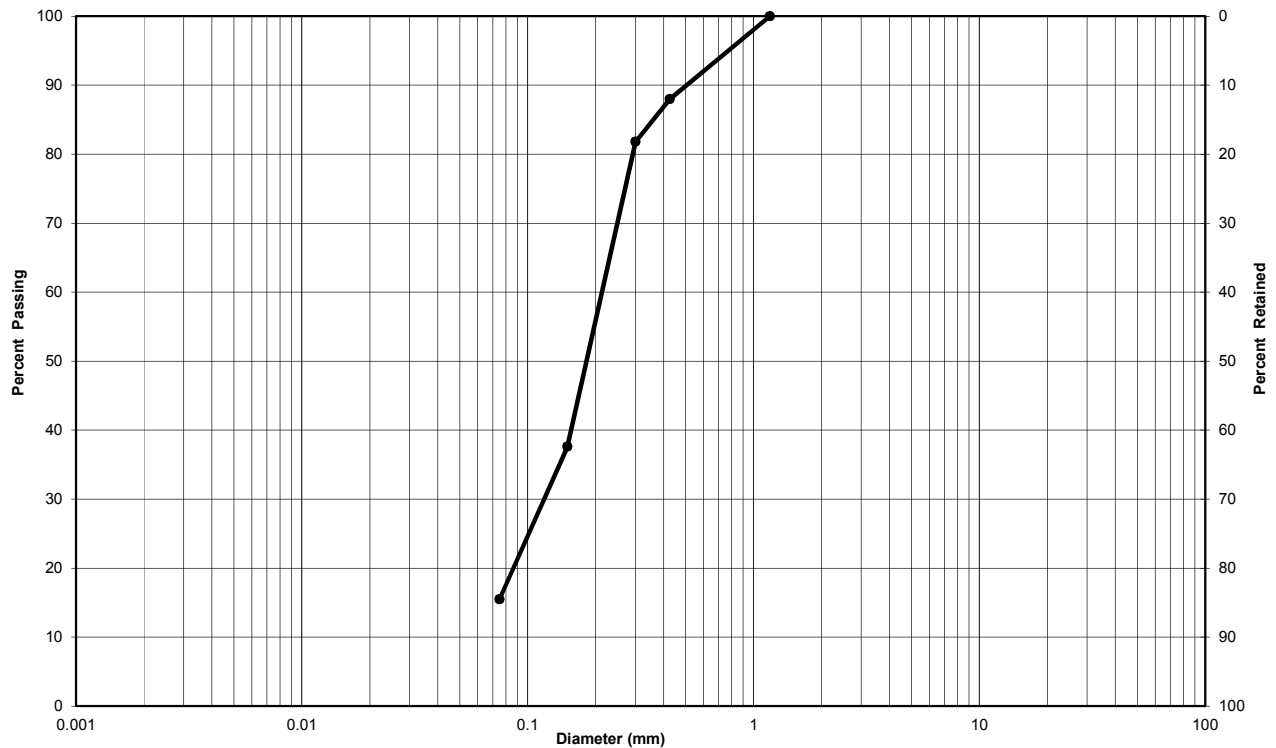
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<b>Performed by:</b>	Anwar Rehani	<b>Date:</b>	January 12, 2017
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	January 16, 2017



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH01-16	<b>Sample No.:</b>	SS2
<b>Depth:</b>	0.8m-1.4m	<b>Enclosure:</b>	



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, Some Silt	0	84	16

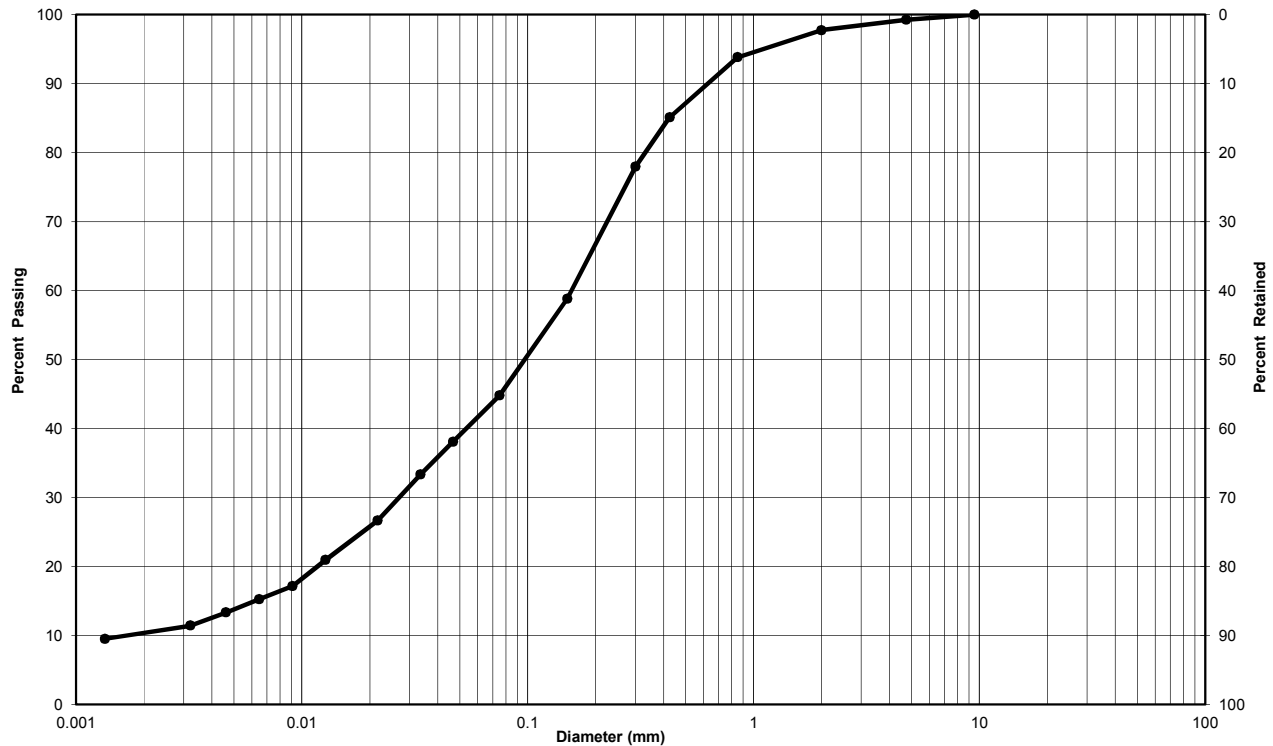
**Remarks:** \_\_\_\_\_  
 \_\_\_\_\_  
 Gravel 0%, Sand 84%, Silt 16%

<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils**  
**ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH02-16	<b>Sample No.:</b>	SS3
<b>Depth:</b>	1.5m-2.1m	<b>Enclosure:</b>	



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	1	54	45

**Remarks:** Silt-size particles (0.074 to 0.002 mm): 35%, Clay-size particles (<0.002 mm): 10%  
Gravel 1%, Sand 54%, Silt 35%, Clay 10%

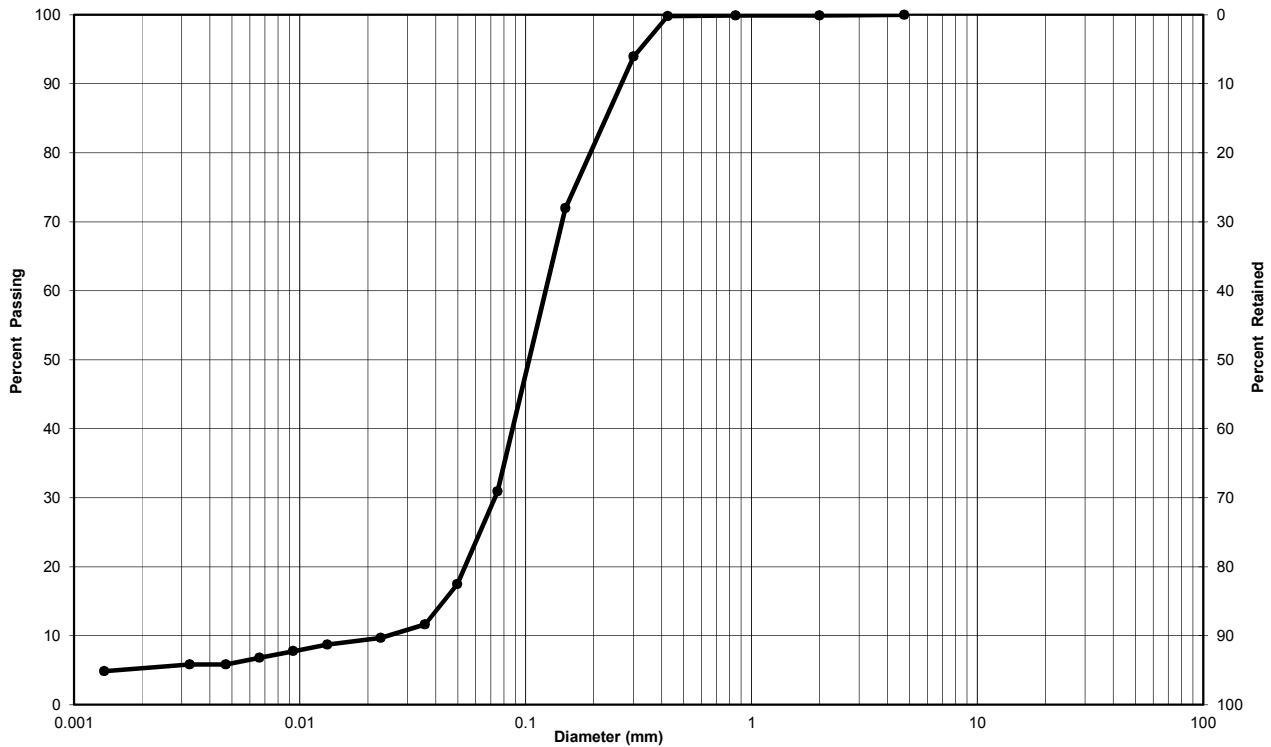
<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822

Borehole No.:	BH03-16	Sample No.:	SS3
Depth:	1.5m-2.1m	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	0	69	31

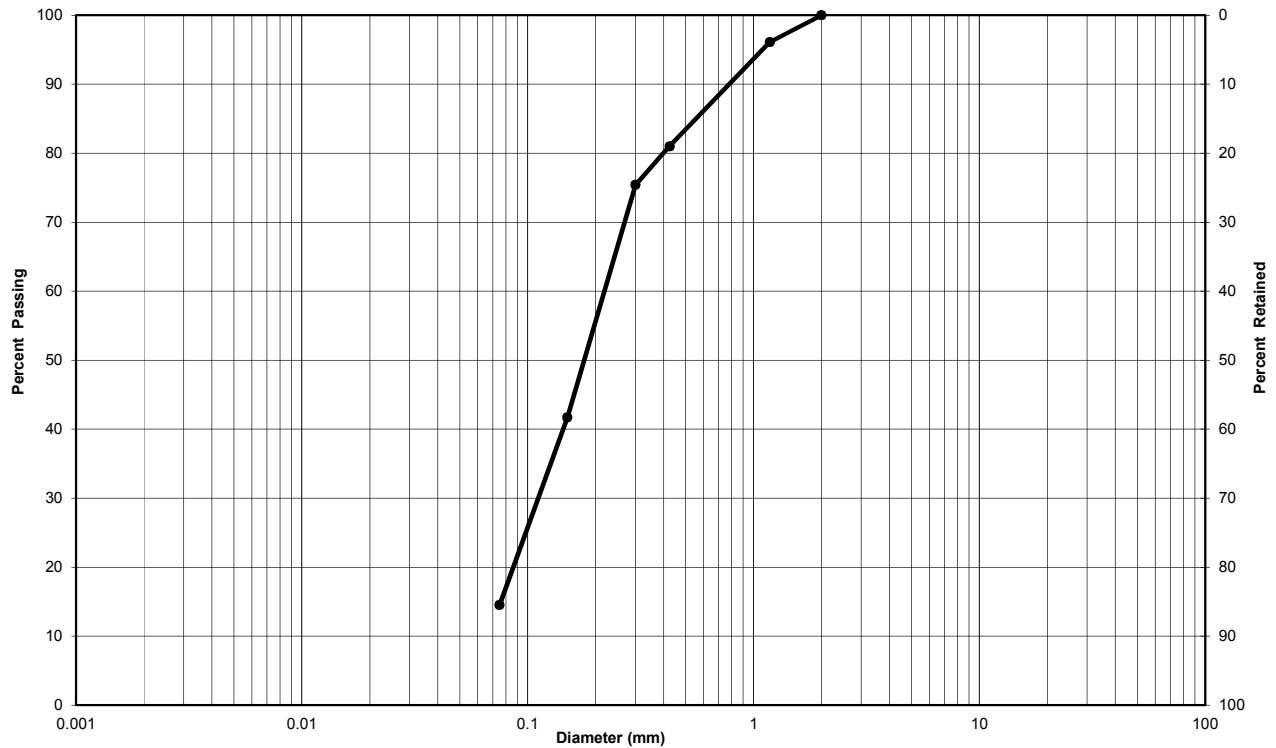
**Remarks:** Silt-size particles (0.074 to 0.002 mm): 26%, Clay-size particles (<0.002 mm): 5%  
Gravel 0%, Sand 69%, Silt 26%, Clay 5%

<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
Borehole No.:	BH04-16	Sample No.:	SS2
Depth:	0.8m-1.4m	Enclosure:	



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, Some Silt	0	85	15

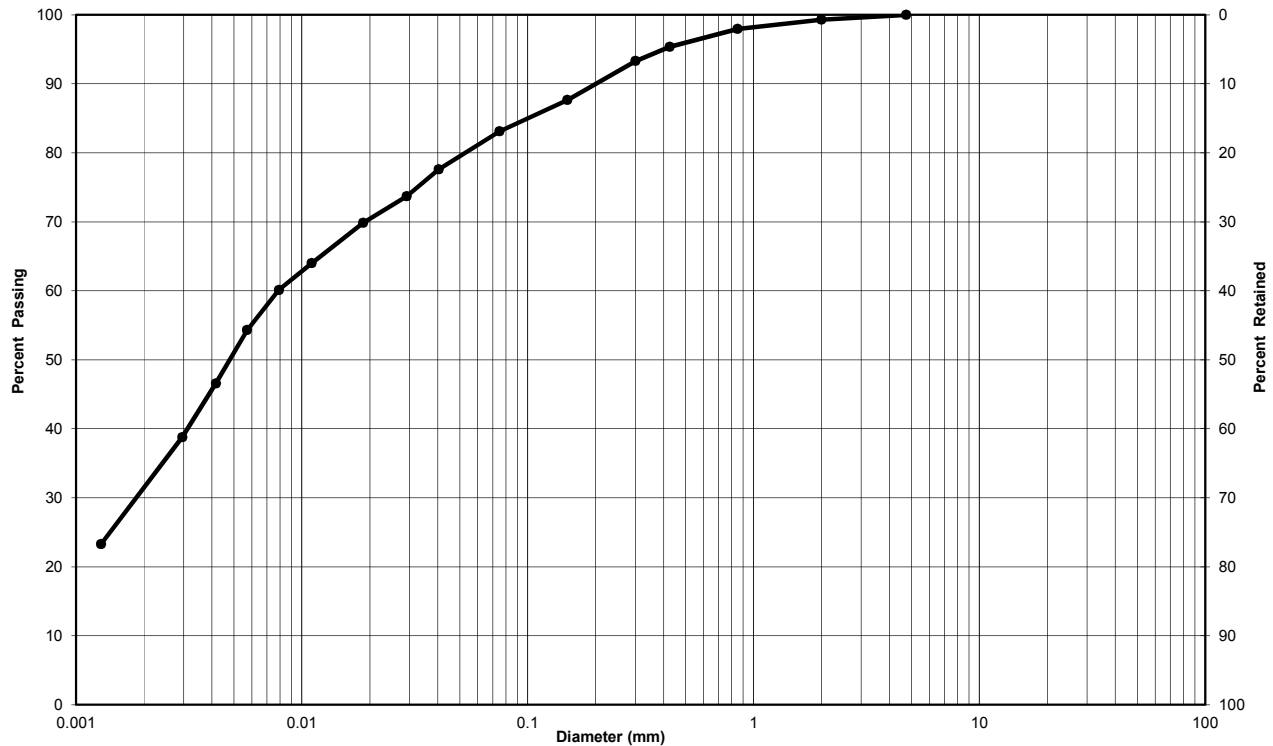
**Remarks:**  
 \_\_\_\_\_  
 Gravel 0%, Sand 85%, Silt 15%

<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH05-16	<b>Sample No.:</b>	SS3
<b>Depth:</b>	1.5m-2.1m	<b>Enclosure:</b>	



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, Some Sand	0	17	83

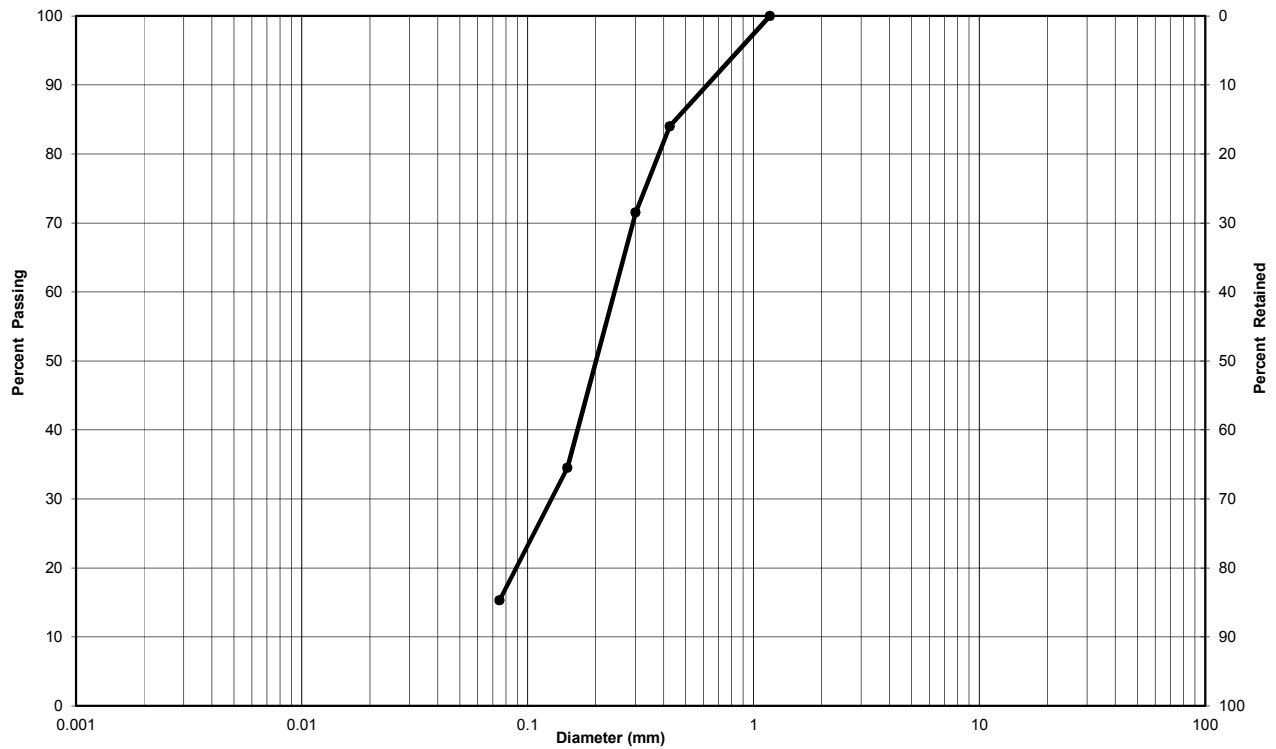
**Remarks:** Silt-size particles (0.074 to 0.002 mm): 51%, Clay-size particles (<0.002 mm): 32%  
Gravel 0%, Sand 17%, Silt 51%, Clay 32%

<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe Geotechnical Investigation Environmental Resource Recovery Centre (ERRC)	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH07-16	<b>Sample No.:</b>	SS2
<b>Depth:</b>	0.8m-1.4m	<b>Enclosure:</b>	



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, Some Silt	0	85	15

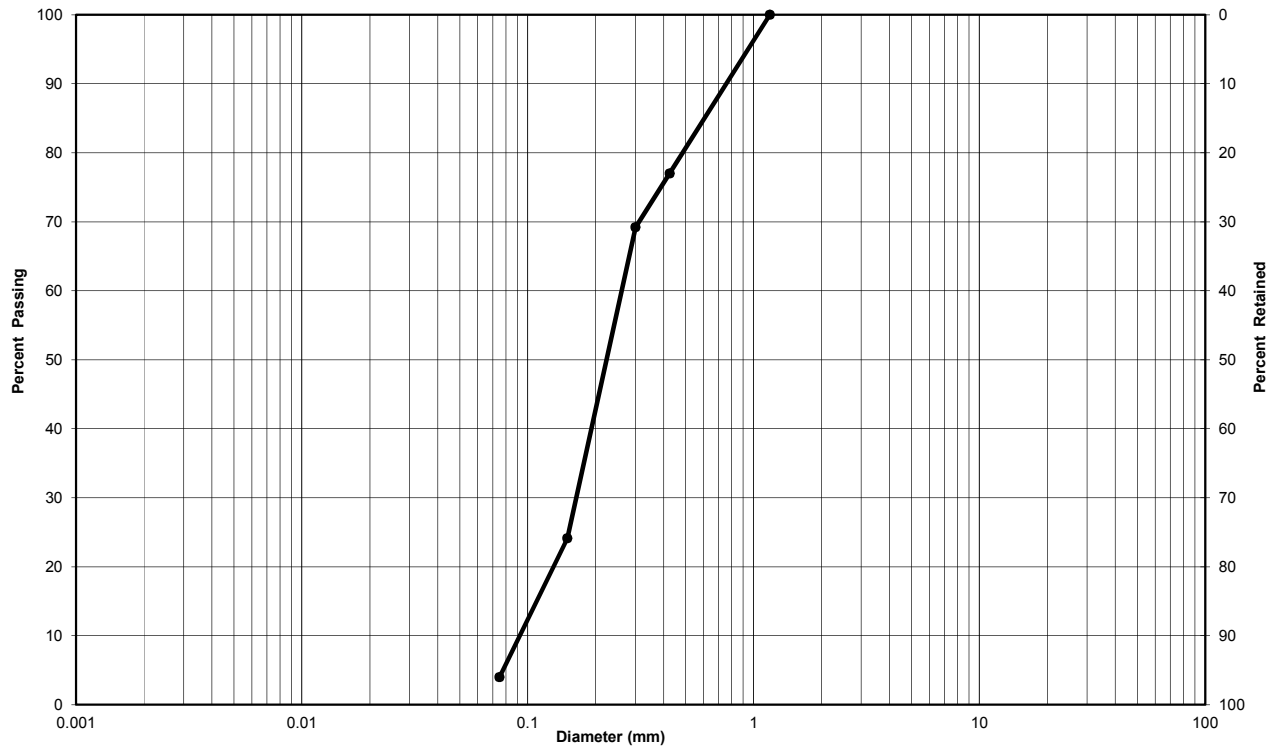
**Remarks:**  
 \_\_\_\_\_  
 Gravel 0%, Sand 85%, Silt 15%

<b>Performed by:</b>	Anwar Rehani / Riddhee Panchal	<b>Date:</b>	August 22, 2016
<b>Verified by:</b>	Raj Kadia, C.E.T.	<b>Date:</b>	August 25, 2016



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe Geotechnical Investigation Environmental Resource Recovery Centre (ERRC)	<b>Lab No.:</b>	G1310
<b>Project, Site:</b>	2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
Borehole No.:	BH08-16	Sample No.:	SS2
Depth:	0.8m-1.4m	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 (%)
Sand, Trace Silt	0	96	4

**Remarks:**  
 \_\_\_\_\_  
 Gravel 0%, Sand 96%, Silt 4%

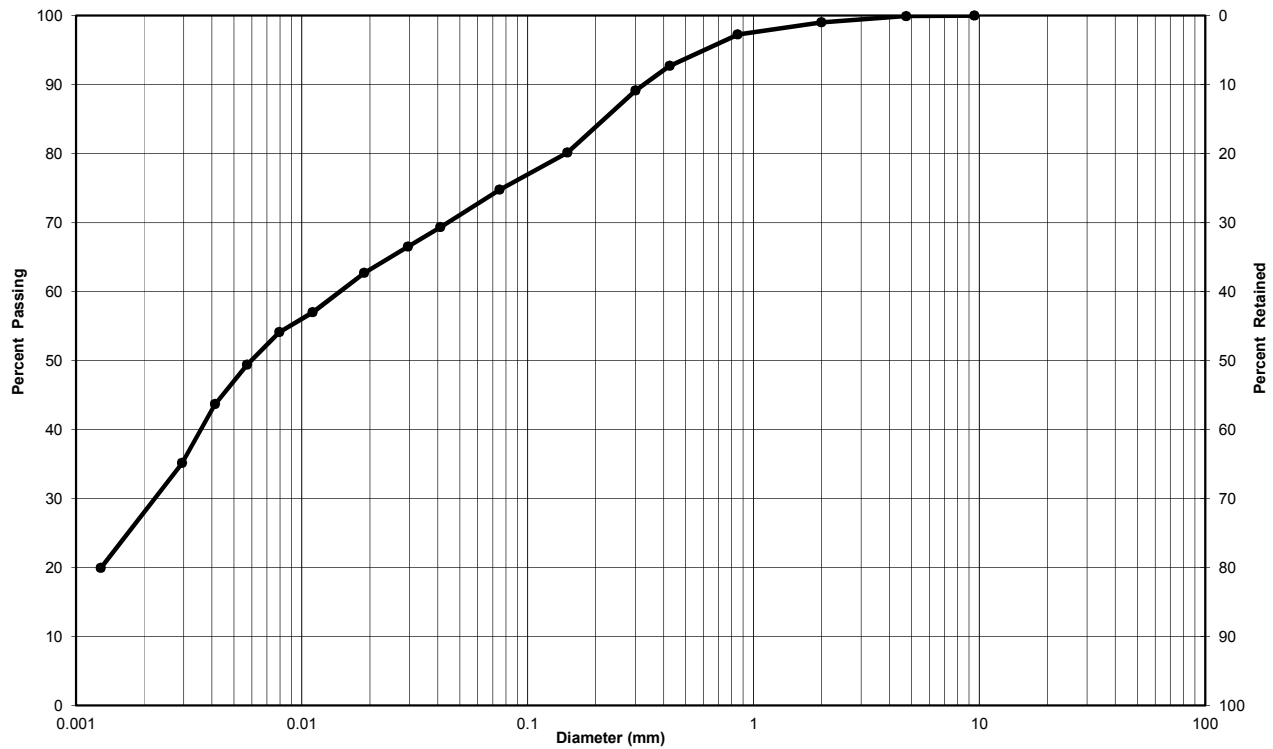
**Performed by:** \_\_\_\_\_ Anwar Rehani / Riddhee Panchal      **Date:** \_\_\_\_\_ August 22, 2016  
**Verified by:** \_\_\_\_\_ Raj Kadia, C.E.T.      **Date:** \_\_\_\_\_ August 25, 2016





**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe Geotechnical Investigation Environmental Resource Recovery Centre (ERRC)	<b>Lab No.:</b>	G1447
<b>Project, Site:</b>	2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH10-16	<b>Sample No.:</b>	SS4
<b>Depth:</b>	2.4m - 2.7m	<b>Enclosure:</b>	



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	0	25	75

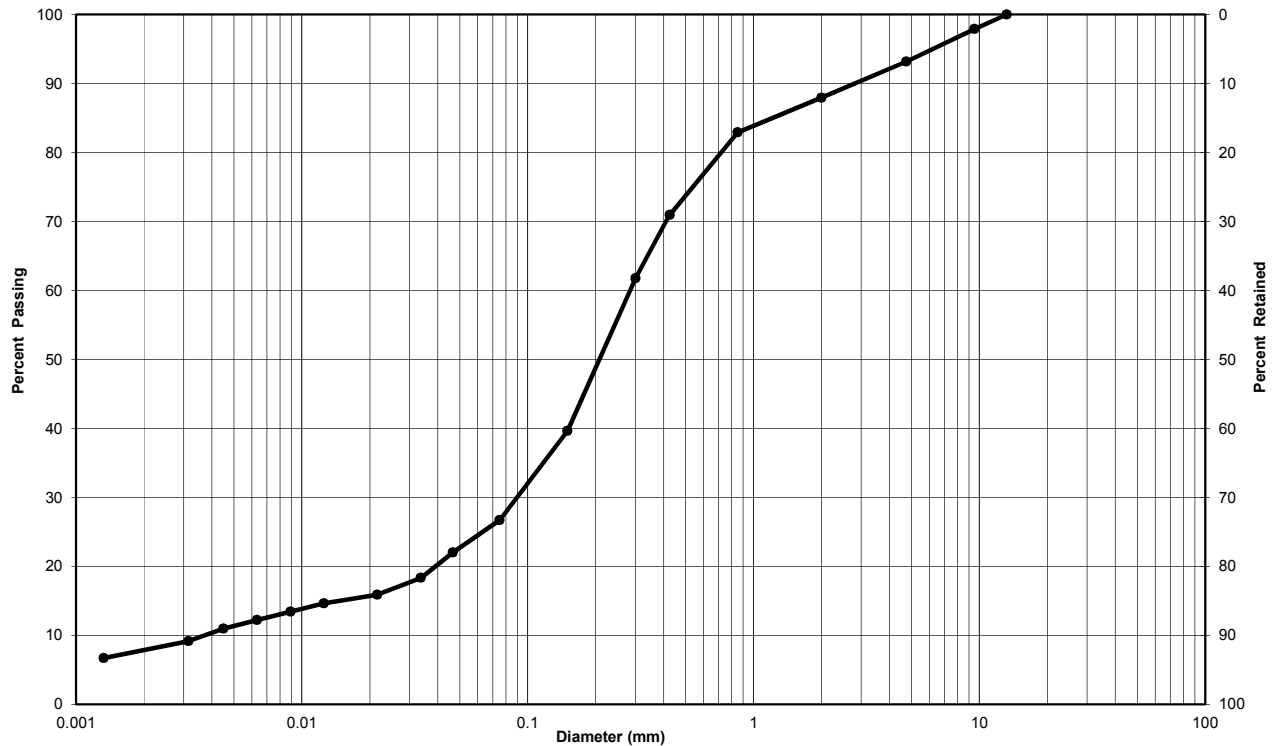
**Remarks:** Silt-size particles (0.074 to 0.002 mm): 47%, Clay-size particles (<0.002 mm): 28%  
Gravel 0%, Sand 25%, Silt 47%, Clay 28%

**Performed by:** Anwar Rehani      **Date:** January 11, 2017  
**Verified by:** Raj Kadia C.E.T      **Date:** January 17, 2017



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1444
<b>Project, Site:</b>	Geotechnical Investigation	<b>Project No.:</b>	086822
	Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario		
<b>Borehole No.:</b>	MW15-16	<b>Sample No.:</b>	SS5
<b>Depth:</b>	3.2m - 3.5m	<b>Enclosure:</b>	



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, Some Silt, Trace Clay and Gravel	7	66	27

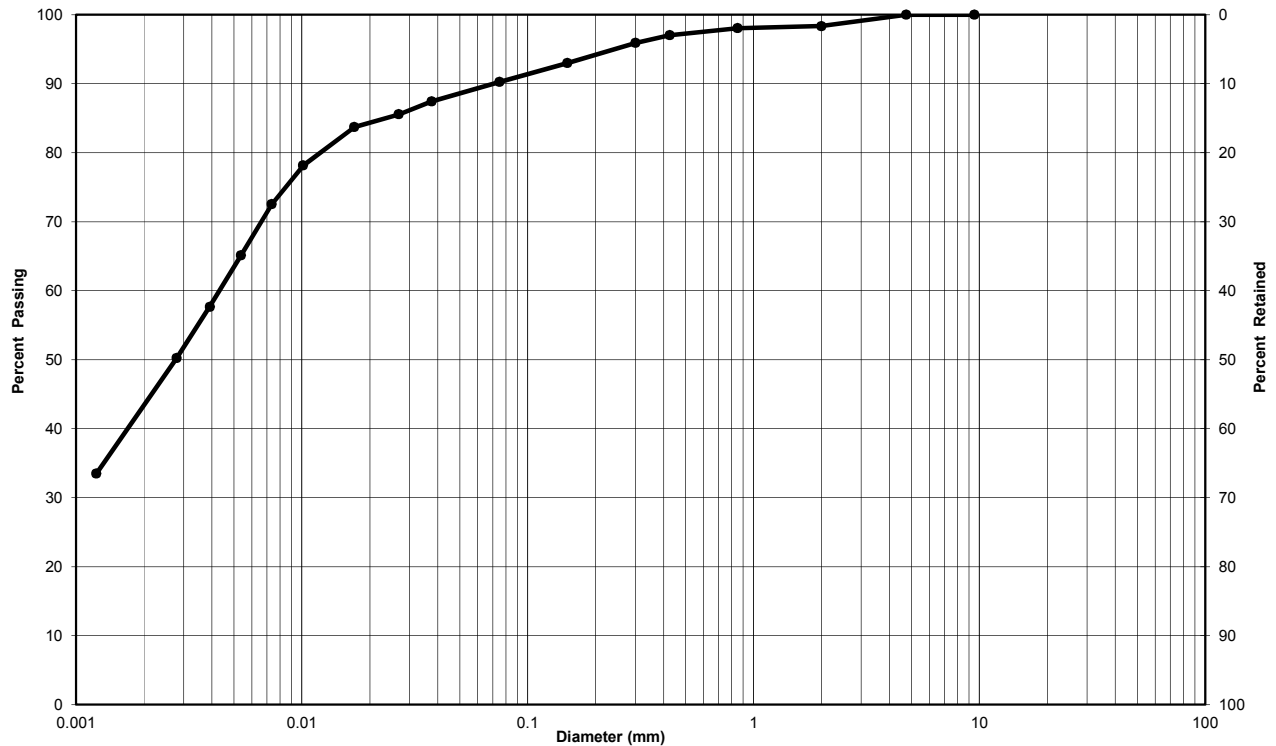
**Remarks:** Silt-size particles (0.074 to 0.002 mm): 19%, Clay-size particles (<0.002 mm): 8%  
 Gravel 7%, Sand 66%, Silt 19%, Clay 8%

<b>Performed by:</b>	Anwar Rehani	<b>Date:</b>	January 11, 2017
<b>Verified by:</b>	Raj Kadia C.E.T	<b>Date:</b>	January 16, 2017



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1446
<b>Project, Site:</b>	Geotechnical Investigation Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario	<b>Project No.:</b>	086822
<b>Borehole No.:</b>	BH20-16	<b>Sample No.:</b>	SS4
<b>Depth:</b>	2.4m - 2.7m	<b>Enclosure:</b>	



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 to Some Sand	0	10	90

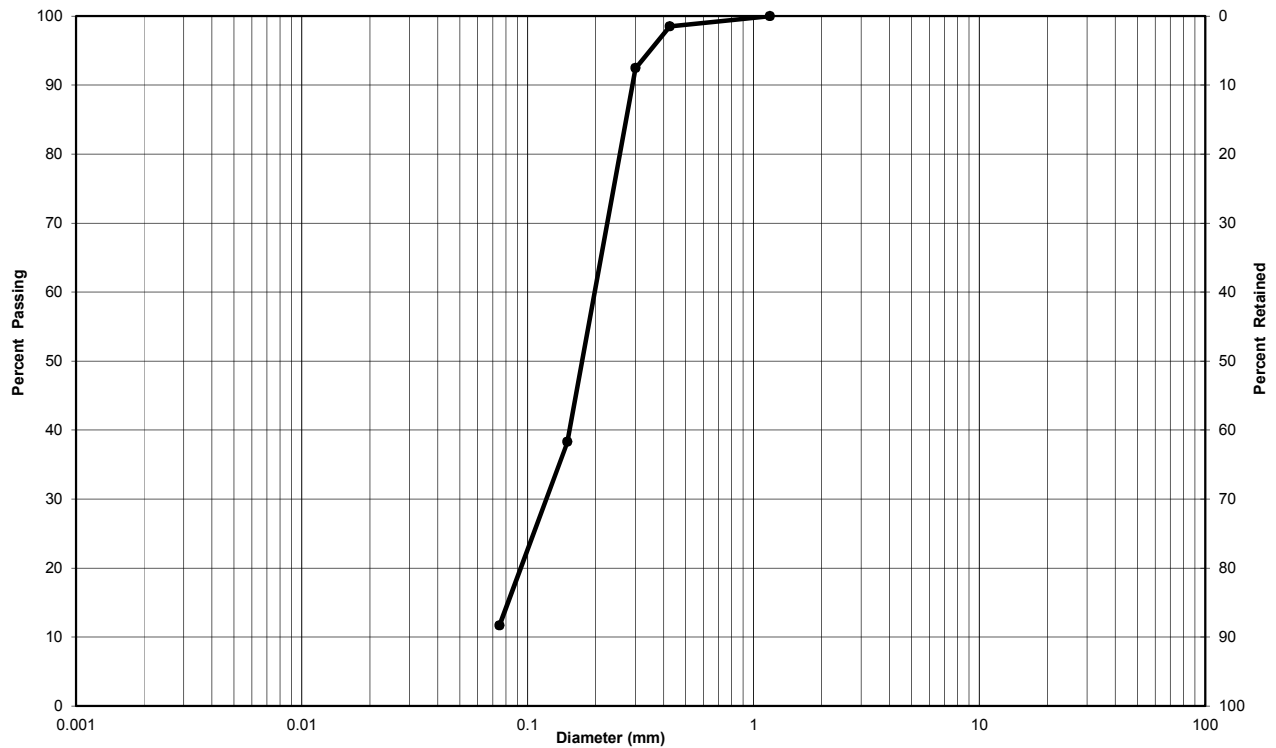
**Remarks:** Silt-size particles (0.074 to 0.002 mm): 47%, Clay-size particles (<0.002 mm): 43%  
Gravel 0%, Sand 10%, Silt 47%, Clay 43%

<b>Performed by:</b>	Anwar Rehani	<b>Date:</b>	January 11, 2017
<b>Verified by:</b>	Raj Kadia C.E.T	<b>Date:</b>	



**Particle-Size Analysis of Soils  
ASTM D422 (Geotechnical)**

<b>Client:</b>	County of Simcoe	<b>Lab No.:</b>	G1446
<b>Project, Site:</b>	Geotechnical Investigation	<b>Project No.:</b>	086822
	Environmental Resource Recovery Centre (ERRC) 2976 Horseshoe Valley Road West Springwater, Ontario		
<b>Borehole No.:</b>	BH22-16	<b>Sample No.:</b>	SS3
<b>Depth:</b>	1.7m - 2.0m	<b>Enclosure:</b>	



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand, Some Silt	0	88	12

**Remarks:** \_\_\_\_\_  
 \_\_\_\_\_  
 Gravel 0%, Sand 88%, Silt 12%

**Performed by:** \_\_\_\_\_ Anwar Rehani **Date:** \_\_\_\_\_ January 11, 2017  
**Verified by:** \_\_\_\_\_ Raj Kadia C.E.T **Date:** \_\_\_\_\_ January 16, 2017

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