TOWN OF CALEDON
PLANNING
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DRAFT REPORT
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
MOUNT HOPE ROAD, CALEDON, ONTARIO

PREPARED FOR:

PALGRAVE ESTATES

PREPARED BY:

SIRATI & PARTNERS CONSULTANTS LIMITED

SIRATI & PARTNERS
Geotechnical Hydrogeological & Environmental Solutions

Project: SP18-334-10
December 06, 2018

12700 Keele Street, King City
Ontario L7B 1H5
Tel: 905.833.1582
Fax: 905.833.4488

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1. INTRODUCTION

Sirati & Partners Consultants Limited (SIRATI) was retained by Palgrave Estates (the Client) to undertake a preliminary geotechnical investigation for the proposed development of a parcel of land located along Mount Hope Road in Caledon, Ontario.

It is understood that the proposed development consists of a series of residential lots, green space and community park.

The site is bounded by Mount Hope Road to the west and wooded area to the north, south and west. The site is relatively flat with a maximum elevation difference of 7.08 m between the borehole locations that were drilled by SIRATI.

The geotechnical investigation is preliminary and a separate complementary investigation may be required for detailed design and construction of the proposed new development. This report is geotechnical in nature. The environmental and hydrogeological investigations of the property were also undertaken by SIRATI and are reported under separate report covers.

The purpose of this preliminary geotechnical investigation was to obtain information about the subsurface conditions at borehole locations and from the findings in the boreholes to make preliminary recommendations pertaining to the geotechnical design of underground utilities, subdivision roads and to comment on the foundation conditions for general house construction.

This report is provided based on the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for the Client and its architects and designers. Third party use of this report without Sirati & Partners Consultants Limited (SIRATI) consent is prohibited. The limitation conditions presented in **Appendix B** form an integral part of the report and they must be considered in conjunction with this report.

2. FIELD AND LABORATORY WORK

A total of ten (10) boreholes (BH1 through BH10B, see Drawing 1 for location plan) were drilled to depths ranging from 9.2 m to 9.7 m below the existing ground surface (mbgs). The boreholes were drilled with solid stem, continuous flight augers. The drilling of all boreholes was conducted by a drilling sub-contractor under the direction and supervision of SIRATI's senior staff.

The field work was carried out in accordance with ASTM D 1586-11 test method. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to SIRATI's laboratory for detailed examination by the project engineer and for laboratory testing.

In addition to visual examination in the laboratory, all soil samples were tested for moisture content. The results of the natural moisture contents are presented in the respective borehole logs. Seven (7) representative soil samples were subjected to grain size and plasticity index analyses. The results of the laboratory tests are presented in the respective logs and in Figures12, 13, and 14.

Water level observations were made during drilling in the open boreholes, upon completion of the drilling operations and on a subsequent visit on November 1, 2018. Monitoring wells were installed in five (5) boreholes (BH1, BH3, BH6, BH9 and BH10B) for long-term (stabilized) groundwater level monitoring.

The elevations at the borehole locations were surveyed by SIRATI personnel using differential GPS system and varied from 295.67 m to 302.75 m.

3. SITE AND SUBSURFACE CONDITIONS

The borehole location plan is shown on Drawing 1. Notes on soil descriptions are presented on Drawing 1A. The subsurface conditions in the boreholes are presented in the individual borehole logs (Encl. 2 to 11 inclusive). The subsurface conditions in the boreholes are summarized in the following paragraphs.

3.1 SOIL CONDITIONS:

Topsoil: A 300 mm to 450 mm thick surficial layer of topsoil was found at all borehole locations except BH4. The thickness of the topsoil in each borehole is shown in the respective borehole logs. It should be noted that the thickness of the topsoil observed at the borehole locations may not be representative for the entire site and should not be relied on to calculate the amount of topsoil that need to be stripped from the site.

Fill Material: Below the topsoil, where present, a zone of earth fill/disturbed native material was encountered in all boreholes. The fill layer was found extending to depths varying between 0.8 m (BH7) and 3 m (BH6) below the existing ground surface. The fill material mainly consisted of silty sand, sandy silt and sand, with trace to some topsoil inclusion at some borehole locations. The

composition of the weathered/disturbed sand was generally similar to that of the underlying undisturbed native soils (sand). The measured SPT 'N' values in the fill material ranged from 0 to 32 blows, but more commonly between 4 and 8 indicating a very loose to loose compaction state.

Cohesive Layer: A thin cohesive layer of clayey silt was observed locally in BH5, extending from 1.5 m to 2.3 m depth. The measured SPT 'N' values in the clayey silt layer was measured to be 7 blows per 300 mm penetration, indicating a firm consistency. The natural moisture content of the cohesive soil was measured at 20.0%, indicating a very moist condition.

Grain size analysis and Atterberg limits tests of a representative sample from this stratum (B5/SS3) was conducted and the results are presented in Figures 12 and 14, with the following fractions:

Clay: 27%
Silt: 54%
Sand: 17%
Gravel: 2%

Cohesionless Layers: Cohesionless layers of silt, sandy silt, silty sand, sand, and gravelly sand were encountered in all borehole locations. The native cohesionless layers were encountered at different depths ranging from 0.8 m to 3.0 m below the existing ground surface and extended to the termination depth at all borehole locations.

The SPT "N" values were found to range between 7 to more than 50 blows per 300 mm penetration, indicating a loose to very dense state.

The natural moisture content of the cohesionless soil varied between 2.0% to 20.0%, indicating a moist to wet condition.

Grain size analysis of six (6) representative samples from sand, silt, sandy silt and silty sand (B14/SS5, BH10B/SS8, BH2/SS6, BH3/SS4, BH5/SS8/SS9) were conducted and the results are presented in Figure 12 and 13, with the following fractions:

Clay: 4% to 9%
Silt: 1% to 80%
Sand: 10% to 93%
Gravel: 1% to 7 %

3.2 GROUNDWATER CONDITIONS

During drilling (short-term) all boreholes were observed to be dry. The groundwater level in the monitoring wells was observed to be dry on November 1, 2018 and November 27, 2018.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

Recommendations in this report regarding the groundwater condition must be read in conjunction with the Hydrogeological Study conducted by SIRATI.

4. DISCUSSION AND RECOMMENDATIONS

It is understood that the subject site will be developed to a residential sub-division. The following recommendation should be considered as preliminary and will need to be re-assessed by SIRATI once the drawings regarding architectural, structural design and services are provided. Further confirmatory geotechnical investigation may be required.

4.1 ROADS

The investigation has shown that the predominant subgrade soil at the site, after stripping the topsoil and any other organic, loose, wet and otherwise unsuitable material, is capable to support the pavement structure.

Based on the above and assuming that traffic usage will be residential minor local or local, the following minimum pavement thickness is recommended:

40 mm HL3 Asphaltic Concrete
50 mm HL8 Asphaltic Concrete
150 mm Granular 'A'
300 mm Granular 'B'

The above values may need to be adjusted according to the Town of Caledon design specifications. The pavement structure recommended above assumes that the subgrade has sufficient bearing capacity to accommodate the applied pavement structure and local traffic. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.1.1 Stripping, Sub-excavation and Grading

The site should be stripped of all topsoil, weathered/disturbed soils and any organic or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 10 tons. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be recompacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be

cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate. Proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material must be used.

Any fill required for the site or backfill should be selected, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, as per Town Standards. The compaction of the new fill should be checked by frequent field density tests.

4.1.2 Construction

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.1.3 Drainage

The Town of Caledon requires the installation of full-length subdrains on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch basins. As discussed in Section 4.1.1, by means of good planning. Any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.2 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed.

4.2.1 Trenching

It is expected that the trenches will be dug through native soil deposit. All monitoring wells on November 1, 2018 were observed to be dry. For any information regarding the long-term groundwater table and dewatering requirements, reference should be made to the hydrogeological report by SIRATI.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill material can be classified as Type 4 and the native soils can be classified as Type 3.

4.2.2 Bedding

The boreholes show that, in their undisturbed state, native soils will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter. The bedding material should consist of well-graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly-graded bedding material.

4.2.3 Backfilling of Trenches

Based on visual and tactile examination, and the measured moisture contents of the soil samples, the onsite excavated soils from above the groundwater table will generally need to be brought to ±2% of the optimum moisture content whether by adding water or aerating. Soils excavated from below the groundwater table will be too wet to compact and will require significant aeration prior to their use as backfill material.

Unless the materials are properly pulverized and compacted in sufficiently thin lifts, post-construction settlements could occur. The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at last 95% SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, as per City Standards. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling. Otherwise imported selected inorganic fill will be required for backfilling at this site.

The onsite excavated soils should not be used in confined areas (e.g. around catch basins, manholes and laterals under roadways) where heavy compaction equipment cannot be operated. The use of

imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch basins and manholes.

4.3 SITE GRADING AND ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill may be constructed below house/building foundations, roads, boulevards, etc.

Prior to the construction of engineered fill, all topsoil, fill material, weak weathered / disturbed and any other unsuitable materials must be removed in this area. After the removal of all unsuitable materials, the excavation base consisting of native soil deposits must be inspected and approved by a qualified geotechnical engineer prior to placement of engineered fill. The base of the excavation should be compacted, and proof rolled with heavy compactors (minimum 10,000 kg). During proof rolling, spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with approved soil, compatible with subgrade conditions, as directed by the geotechnical engineer.

The material for engineered fill should consist of approved inorganic soil, compacted to 100 percent of Standard Proctor Maximum Dry Density (SPMDD). Recommendations regarding engineered fill placement are provided in **Appendix A** of this report.

To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential by SIRATI to certify the engineered fill. Despite full time supervision, it has been found that contractors frequently bulldoze loose fill into areas and compact only the surface. The inspector, either busy on other portions of the site or absent during "off hours" will be unaware of this condition. This potential problem must be recognized and discussed at a pre-construction meeting.

Depending upon the amount of grade raise, there will be consolidation settlement of the underlying soils. Additionally, there will be settlement of the engineered fill under its own weight, approximately 0.5% of the fill height. A waiting period of 3 to 6 months may be required prior to the construction of any structures on engineered fill. This should be confirmed during the detail design stage, once the grading plans for the proposed development are available.

4.4 FOUNDATION CONDITIONS

Based on the information provided by the client, the proposed development consists of a series of residential lots with a basement approximately 3 m below the existing grade.

The boreholes show that, provided the foundation soil is undisturbed during the construction, in general, allowable soil bearing values of 90 kPa to 150 kPa at serviceability limit state and 135 kPa to 225 kPa at ultimate limit state are feasible in the undisturbed inorganic natural soils, at or below the depths provided in **Table 1**. The bearing value would be suitable for the use of normal spread footings to support the proposed development.

Where the grade needs to be raised, the proposed structures can be supported by spread and strip footings founded on engineered fill for an allowable bearing pressure of 150 kPa. The engineered fill supporting footings should be constructed in accordance with the guidelines presented in **Appendix A**. Other requirements of engineered fill are given in Section 4.4.

All footings must have at least 1.5 m of frost cover.

Table 2: Bearing Values and Founding Levels of Spread Footings

BH No.	Material	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth Below Existing Ground (m)	Founding Level at or Below Elevation (m)
BH1	Sand	110 150	165 225	2.3 3.0	296.6 295.9
BH2	Sand	150	225	2.3	296.8
BH3	Sandy Silt to Silty Sand	150	225	2.3	295.5
BH4	Sand	150	225	1.5	297.0
BH5	Sand	120	180	2.3	291.8
BH6	Sand	110	165	3	296.9
BH7	Sand	110 150	165 225	0.8 1.5	298.1 297.4
BH8	Sand	150	225	2.3	300.5
BH9	Sand	150	225	2.3	295.9
BH10B*	Sand	90	135	4.6	291.1

*** The ground was observed to be loose at shallow depth at BH10B location. Further investigation is required to delineate the lateral extent of the soft strata at this location. The type of foundation must be revisited by SIRATI once the architectural drawings and FFE elevations become available to the client.**

Consideration may need to be given to other types of foundation subject to the final layout, type and founding depths of the proposed development.

5. FLOOR SLAB AND PERMANENT DRAINAGE

With one level of basement, the basement floor slab can be supported on grade provided the base is thoroughly proof rolled to detect any soft or unstable areas, which must be removed and replaced with suitably compacted soils, as defined in **Section 4** of this report. Once the required subgrade has been developed, SIRATI recommends that the exposed subgrade be inspected and approved by the Geotechnical Engineer prior to the placement of any granular fill or concrete. A granular layer consisting of at least 200 mm of 19 mm Crusher Run Limestone (CRL) or OPSS Granular A should

be installed under the floor slab as a bedding layer. The CRL or the OPSS Granular A should be compacted to 100% of its SPMDD.

The completed excavations for floor slabs should not be left open before pouring concrete for any period longer than 24 hours. Particularly, if the floor construction works are being completed during the winter months or wet weather periods. The base of any floor slab excavation that is left exposed longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

The floor slab should be structurally independent of any load bearing structural elements and should tolerate expected foundation settlements as indicated above.

The perimeter drainage system shown on **Drawing 15** is recommended for the basement walls with open cut excavation. Weeping tile systems on the exterior and underfloor drainage systems, should be appropriately designed to effectively discharge water and eliminate hydrostatic pressure build-ups.

6. EARTH PRESSURES

The lateral earth and water pressure acting at any depth on the basement walls can be calculated by the following formula:

In soils above the groundwater table ($z < d_w$):

$$p = K (\gamma z + q)$$

In soils below the groundwater table ($z \geq d_w$):

$$p = K \{\gamma d_w + \gamma_1 (z - d_w) + q\} + p_w$$

In which, $p_w = \gamma_w (z - d_w)$

Where,

p	=	lateral earth and water pressure in kPa acting at a depth of z below ground surface
K	=	earth pressure coefficient = 0.33
γ	=	unit weight of soil above groundwater table, assuming γ = 21.0 kN/m^3
γ_1	=	submerged unit weight of soil below groundwater table, assuming γ_1 = 11.2 kN/m^3
γ_w	=	unit weight of water, assuming γ_w = 9.8 kN/m^3
z	=	depth below ground surface to point of interest, in meters
d_w	=	depth of groundwater table below ground surface, in meters
q	=	value of surcharge in kPa
p_w	=	hydrostatic water pressure in kPa

7. EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed buildings with one level of basement with spread footings bearing on sand deposit, can be classified as "Class D" for seismic site response.

8. GENERAL COMMENTS ON REPORT

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

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

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

SIRATI & PARTNERS CONSULTANTS LIMITED

Meysam Najari, Ph.D.

Archie Sirati, Ph.D., P. Eng.

Drawings

SIRATI & PARTNERS

Geotechnical Hydrogeological & Environmental Solutions

12700– Keele Street
King City, ON. L7B 1H5
Phone# 905 833 1582, Fax# 905 833 5360

North:

Legend:

Property Boundary

Borehole

Monitoring Well

Project Title:

Geotechnical Investigation

Site Location:

17791 Mount Hope Road, Caledon, ON

Figure Title:

Proposed Borehole Location Plan

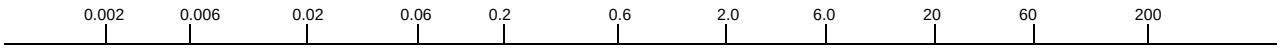
Scale:	Project Number:
0m 50m 100m	SP18-334-10
Date:	**Figure Number:**
December 2018	1

Drawing 1A: Notes on Sample Descriptions

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

ISSMFE SOIL CLASSIFICATION

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



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

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

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

LOG OF BOREHOLE BH 1

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/19/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.9								2 4 6 8 10	10 20 30			
0.0 / 298.6	**TOPSOIL:**350 mm		1	SS	5							
0.4	**SAND (REWORKED):** trace gravel, brown, moist, loose											
1	possibly reworked, becoming light brown		2	SS	5		298					
297.4												
1.5	**SAND:** light brown, moist, compact		3	SS	7		297					
2	trace gravel		4	SS	11							
3	becoming brown		5	SS	15		296					2 93 1 4
4							295					
	some gravel		6	SS	23		294					
6 / 292.8							293					
6.1	**GRAVELLY SAND:** trace cobbles, brown, moist, compact		7	SS	19							
7 / 291.3							292					
7.6	**SILT:** greyish brown, trace gravel, very moist to wet, very dense		8	SS	74		291					
9 / 289.7			9	SS	50/ 75 mm		290					
9.2	**END OF BOREHOLE:**											

Notes:
1. Borehole was open and dry upon completion of drilling.
2. Monitoring well was installed in the borehole upon completion of drilling.
3. Monitoring well was dry on November 1, 2018 and November 28, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 6=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 2

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/19/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
299.1								2 4 6 8 10	10 20 30			
0.0 / 298.8	**TOPSOIL:** 300 mm		1	SS	4		299					IBL in ppm
0.3	**FILL:** topsoil mixed with silty sand to sand, brown, moist											
1	**SAND (REWORKED):** trace silt, light brown, moist		2	SS	4		298					
2			3	SS	8		297					
296.8												
2.3	**SAND:** light brown, moist, compact to dense		4	SS	15							
3			5	SS	21		296					
4							295					
5	some gravel, trace cobbles, becoming brown		6	SS	21		294					7 85 3 5
6	trace gravel		7	SS	25		293					
7							292					
8	trace cobbles		8	SS	21		291					
9	some gravel		9	SS	31		290					
289.4												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was open and dry upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 3

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/18/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
297.8								2 4 6 8 10	10 20 30			
0.0 / 297.3	**TOPSOIL:** 450 mm		1	SS	5				○			IBL in ppm
0.5 / 296.3	**FILL:** silty sand, trace gravel, dark brown, very moist to moist becomig sandy silt, trace clay, brown, moist		2	SS	6		297		○			
1.5 / 294.8	**SANDY SILT TO SILTY SAND:** trace clay, brown, moist, loose to compact		3	SS	7		296		○			
			4	SS	18		295		○			1 61 30 8
3.0	**SAND:** trace gravel, trace silt, light brown, very moist, compact to very dense		5	SS	16		294		○			
	trace to some gravel, trace cobbles		6	SS	29		293		○			
			7	SS	40		292		○			
			8	SS	31		291		○			
288.5			9	SS	50/ 75 mm		290		○			
9.3	**END OF BOREHOLE:**						289					

Notes:
1. Borehole was open and dry upon completion of drilling.
2. Monitoring well was installed in the borehole upon completion of drilling.
3. Monitoring well was dry on November 1, 2018 and November 28, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 3=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 4

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/18/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.5								2 4 6 8 10	10 20 30			
0.0	**FILL:** sandy silt, trace gravel, trace topsoil, brown, moist		1	SS	7		298					IBL in ppm
1	**POSSIBLE FILL:** silty sand, trace cobbles, trace gravel, brown		2	SS	32							
297.0							297					
1.5	**SAND:** light brown, moist, compact to dense		3	SS	27							
2			4	SS	32		296					
3	trace gravel		5	SS	17		295					
4												
5			6	SS	12		294					
6	some gravel		7	SS	31		293					
7							292					
8			8	SS	40		291					
9	trace gravel						290					
288.8			9	SS	26		289					
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was open and dry upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 5

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/18/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
294.1							294	2 4 6 8 10	10 20 30			
0.0 / 293.8	**TOPSOIL:** 300 mm		1	SS	5							
0.3	**FILL:** silty sand, yellowish brown, moist											
1	sandy silt, trace clay, light brown, very moist to wet		2	SS	5		293					
292.6												
1.5	**CLAYEY SILT** some sand, trace cobbles, trace gravel, light brown, very moist, firm		3	SS	7							2 17 54 27
2 / 291.8							292					
2.3	**SAND:** light brown, moist, compact		4	SS	13							
3			5	SS	11		291					
4							290					
	trace gravel		6	SS	16							
5							289					
6			7	SS	28		288					
7							287					
286.5												
7.6	**SANDY SILT:** brown, moist, dense		8	SS	32							1 28 65 6
8							286					
9 / 285.0												
9.1	**SILT:** trace sand, brown, very moist, very dense		9	SS	52		285					1 10 80 9
284.4												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 6

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/18/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
299.9								2 4 6 8 10	10 20 30			
0.0 / 299.6	**TOPSOIL:** 300 mm		1	SS	5							IBL in ppm
0.3	**SAND (REWORKED):** trace gravel, trace silt, dark brown, moist											
1	becoming brown		2	SS	2		299					
	becoming light brown		3	SS	0		298					
2 / 297.6												
2.3 / 296.9	**FILL:** silty sand, light brown, moist		4	SS	2		297					
3	**SAND:** some silt, light brown, moist, compact to very dense		5	SS	11							
4							296					
5			6	SS	19		295					
6							294					
			7	SS	36							
7							293					
8			8	SS	59		292					
9	beoming greyish brown, very moist						291					
			9	SS	52							
290.2												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.
2. Monitoring well was installed in the borehole upon completion of drilling.
3. Borehole was dry on November 1, 2018 and November 27, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 7

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/19/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.9								2 4 6 8 10	10 20 30			
0.0 / 298.6	**TOPSOIL:** 300 mm											
0.3 / 298.1	**SAND (REWORKED):** trace silt, brown, moist, loose		1	SS	5							
0.8	**SAND:** trace silt, light brown, moist		2	SS	11		298					
			3	SS	16		297					
			4	SS	24							
	some silt, wet		5	SS	32		296					
294.3							295					
4.6	**SANDY SILT:** brown, wet, compact		6	SS	30		294					
			7	SS	18		293					
291.3							292					
7.6	**SAND:** brown, wet to moist, compact		8	SS	23		291					
289.8							290					
9.1	**GRAVELLY SAND:** brown, moist, very dense		9	SS	60							
289.2												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 8

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/18/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT (w_P w w_L) WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
302.8								2 4 6 8 10	10 20 30			
0.0 / 302.3	**TOPSOIL:** 450 mm		1	SS	6							
0.5	**FILL:** silty sand, trace topsoil, dark brown, moist		2	SS	2		302					
1												
			3	SS	2		301					
2 / 300.5												
2.3	**SAND:** trace cobbbles, trace gravel, light brown, moist, compact		4	SS	16		300					
299.8												
3.0	**SILTY SAND:** light brown, very moist, compact		5	SS	14							
4							299					
298.2												
4.6	**SAND:** light brown, moist, compact to dense		6	SS	12		298					
5												
6							297					
			7	SS	9							
7							296					
			8	SS	42		295					
8												
9							294					
			9	SS	31							
293.1												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 9

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/19/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.2								2 4 6 8 10	10 20 30			
0.0 / 297.9	**TOPSOIL:** 300 mm		1	SS	6		298					
0.3	**FILL:** sandy silt to silty sand, trace topsoil, dark brown, wet		2	SS	3		297					
1			3	SS	4							
2 / 295.9							296					
2.3	**SAND:** light brown, moist, compact		4	SS	15							
3			5	SS	29		295					
4 / 293.6							294					
4.6	**GRAVELLY SAND :** trace cobbles, light brown, moist, dense		6	SS	35		293					
5												
6			7	SS	25		292					
7 / 290.6							291					
7.6	**SAND:** trace silt, light brown, moist, dense		8	SS	41							
8							290					
9	trace gravel		9	SS	43		289					
288.5												
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.
2. Monitoring well was installed in the borehole upon completion of drilling.
3. Monitoring well was dry on November 1, 2018, and November 27, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +³, ×³: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

LOG OF BOREHOLE BH 10B

PROJECT: Proposed Residential Development
CLIENT: Palgrave Estate
PROJECT LOCATION: Mount Hope Rd., Caledon, Ontario
DATUM: Geodetic
BH LOCATION: See Drawing 1

DRILLING DATA
Method: Solid Stem Augers
Diameter: 150 mm
Date: Oct/19/2018
Drilling Contractor:

REF. NO.: SP18-334-10
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
295.7								2 4 6 8 10	10 20 30			
0.0 / 295.4	**TOPSOIL:** 300 MM		1	SS	6		295					
0.3	**FILL:** topsoil mixed with silty sand, reddish brown, very moist, loose											
1	**SAND (REWORKED):** brown, very moist, very loose		2	SS	0							
2 / 293.4			3	SS	0		294					
2.3	**SAND:** brown, moist to very moist, very loose to very dense		4	SS	4		293					
3	trace cobbles		5	SS	5							
4							292					
	trace gravel		6	SS	9		291					
5												
6							290					
			7	SS	18							
7							289					
	some gravel, trace clay, light brown		8	SS	50/125 mm		288					3 88 2 7
8												
							287					
9	some silt (pockets)		9	SS	38							
286.0							286					
9.7	**END OF BOREHOLE:**											

Notes:
1. Borehole was dry and open upon completion of drilling.
2. Monitoring well was installed in the borehole upon completion of drilling.
3. Borehole was dry on November 1, 2018 and November 27, 2018.

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

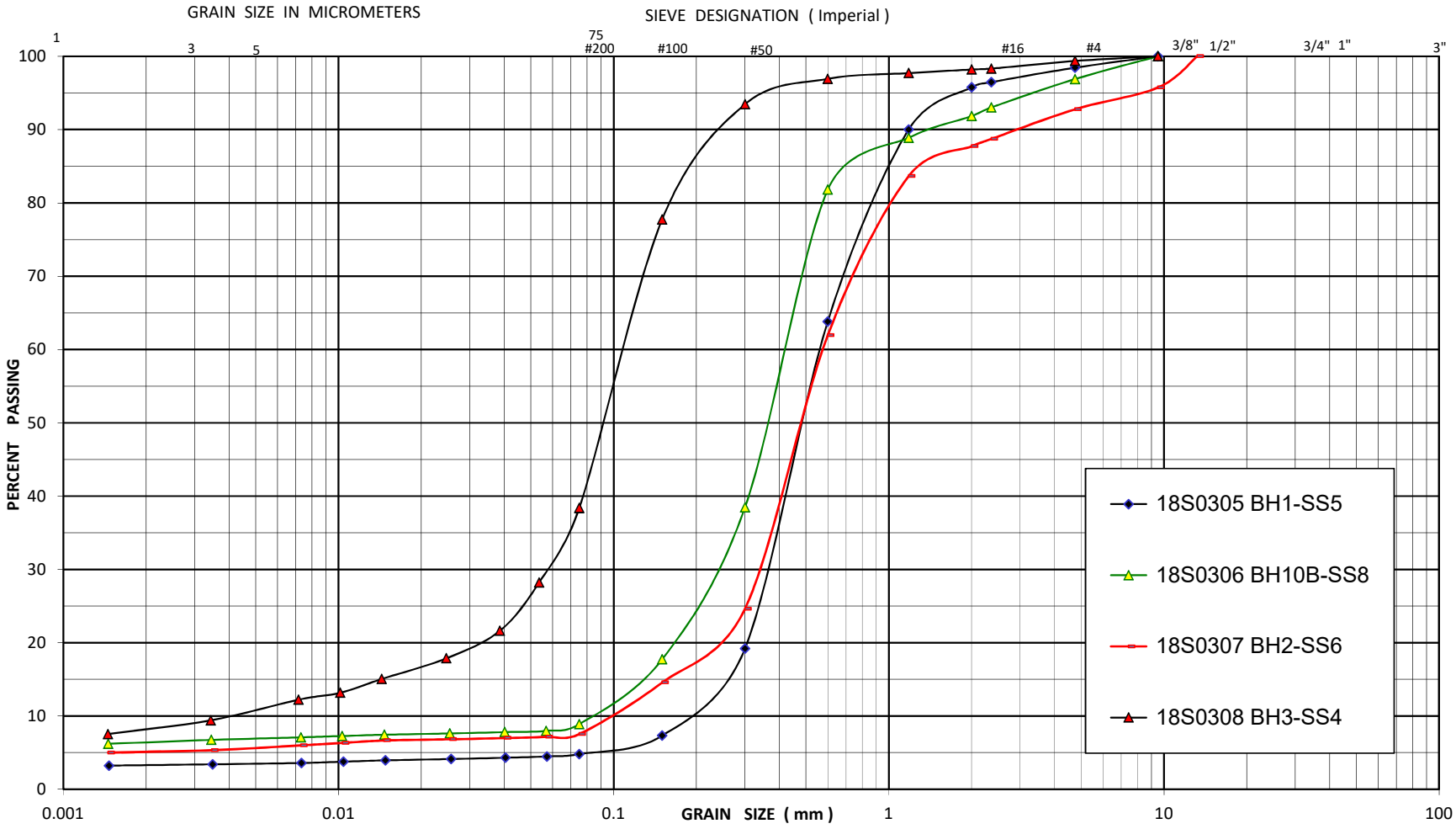
SPCL SOIL LOG /W VOC 0-12 PPM-2016 SP18-334-10.GPJ SPCL.GDT 12/5/18

SIRATI & PARTNERS

GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



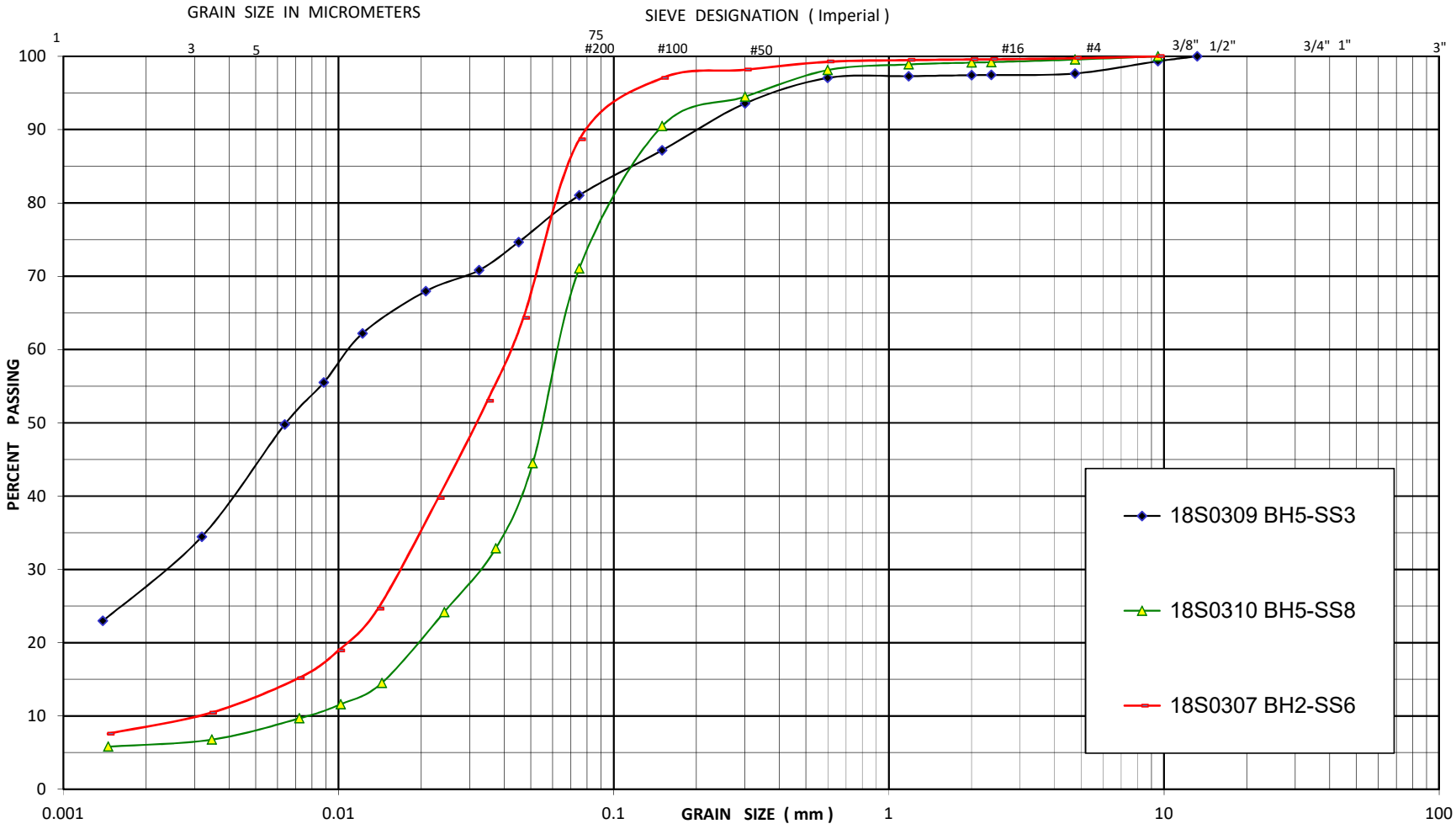
Project No.	:	SP18-334-10
Figure No.	:	12
Date	:	November 2018

SIRATI & PARTNERS

GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM

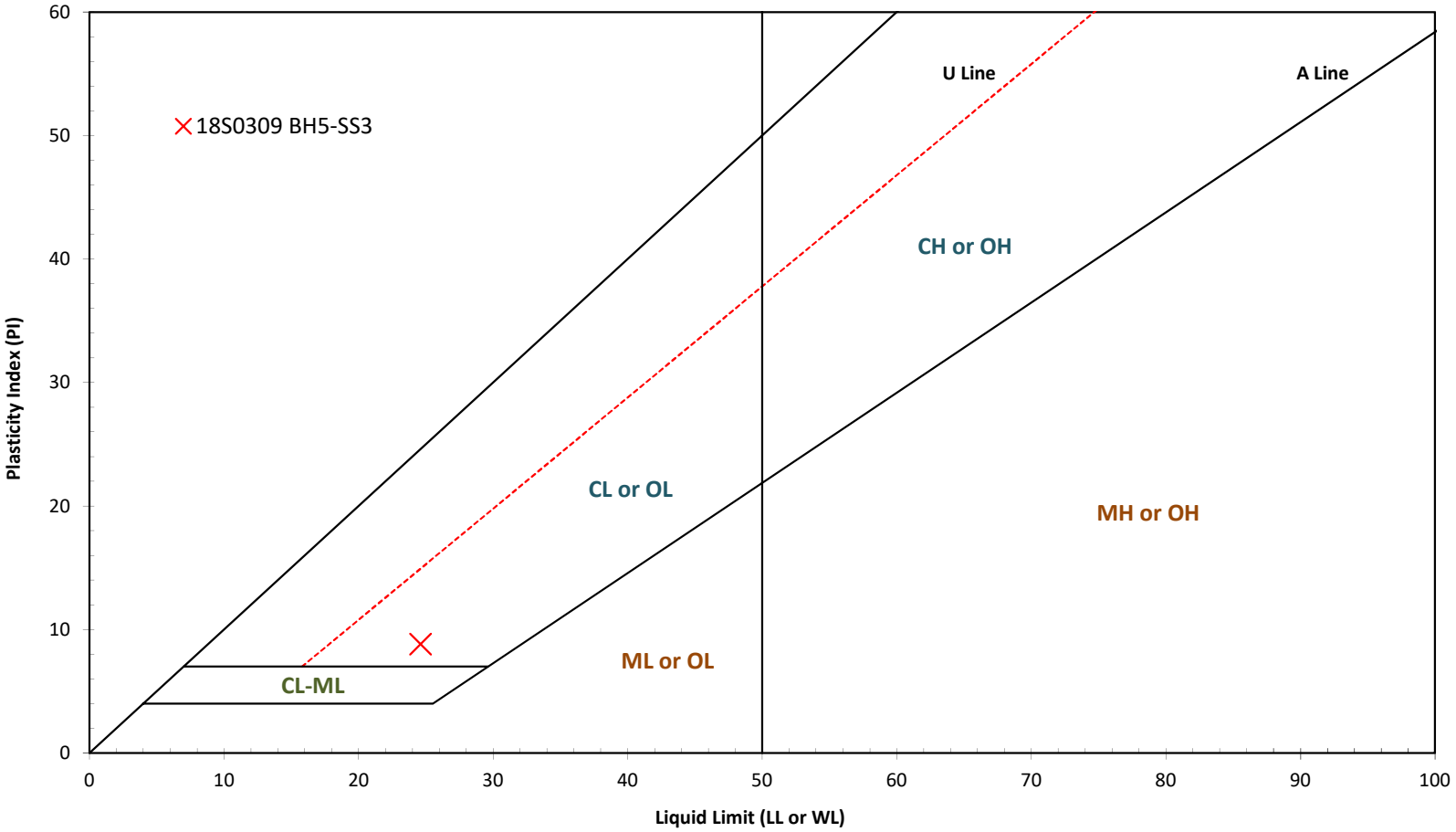
CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Project No.	:	SP18-334-10
Figure No.	:	13
Date	:	November 2018

Atterberg's Limits Test Report

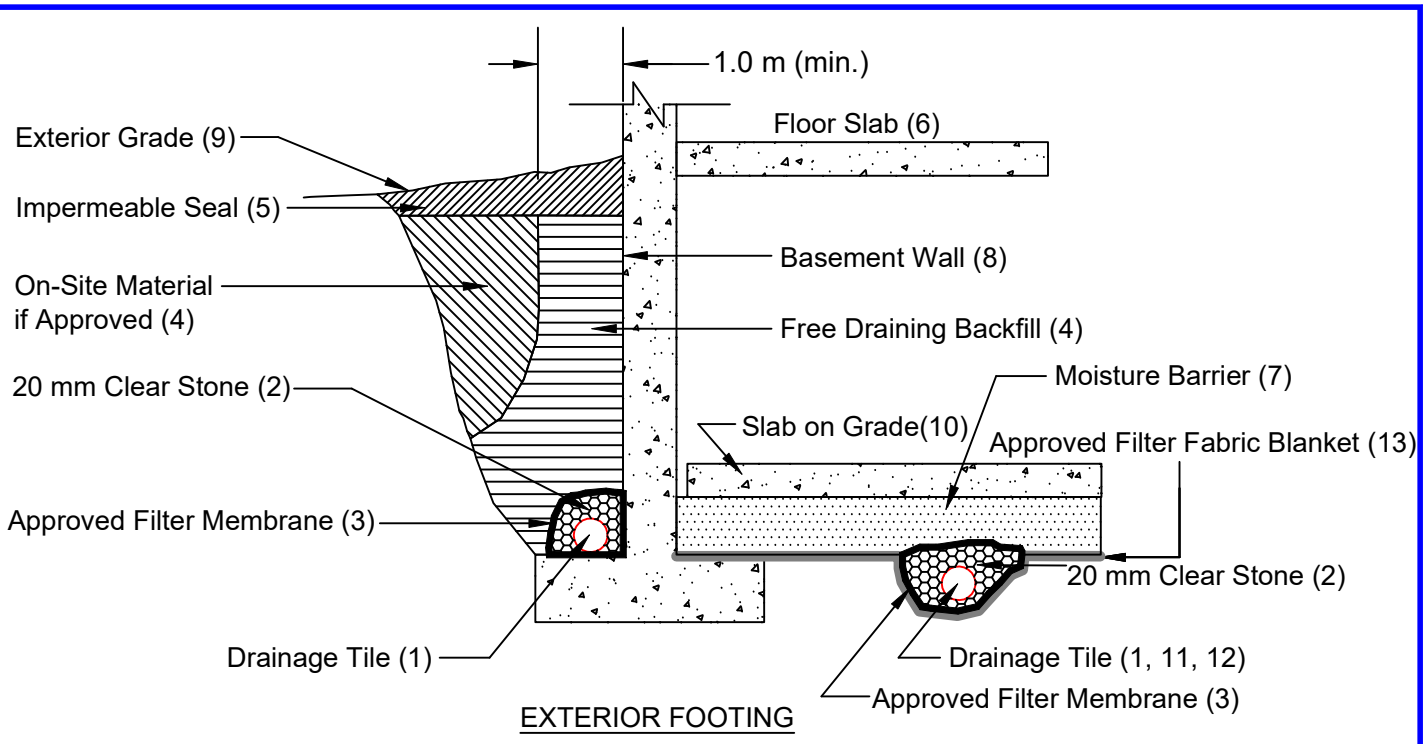
ASTM D4318-10



SIRATI & PARTNERS

Geotechnical Hydrogeological & Environmental Solutions

Date	:	13 November 2018
Project No.	:	SP18-334-10
Figure No.	:	14



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

APPENDIX A

GUIDELINES FOR ENGINEERED FILL

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and Sirati & Partners Consultants Limited. Without this confirmation, no responsibility for the performance of the structure can be accepted by Sirati & Partners Consultants Limited (SPCL). Survey drawing of the pre-and post-fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a SPCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by SPCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the SPCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

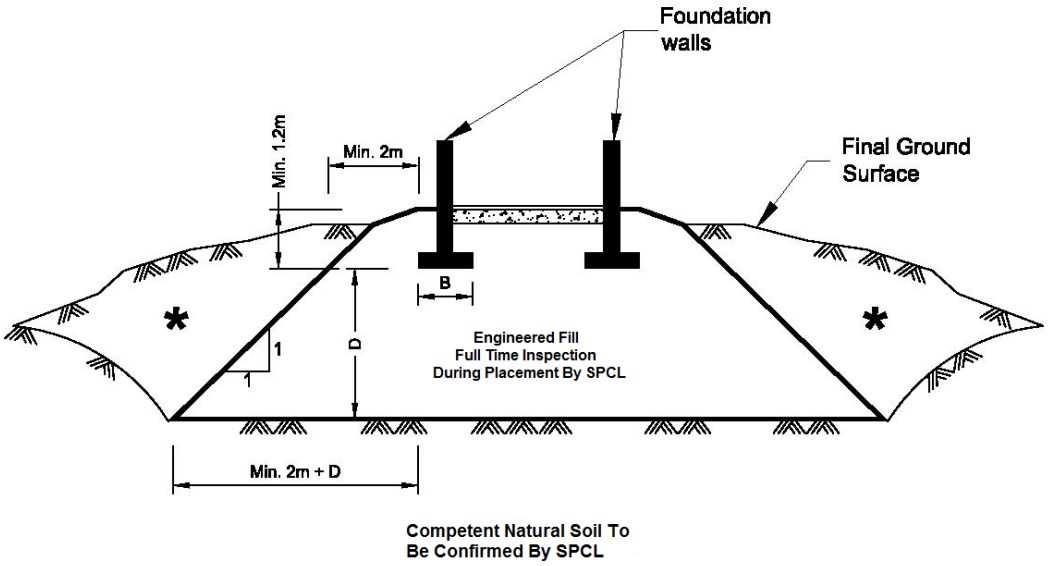
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from SPCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by SPCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of SPCL.

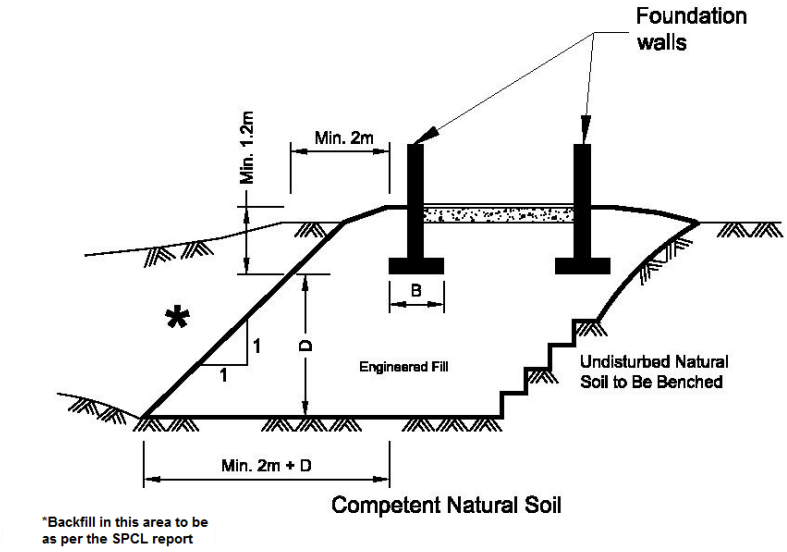
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with Sirati & Partners Consultants Limited (SPCL) report attached.


Foundation walls
Min. 1.2m
Min. 2m
Final Ground Surface
B
D
1
1
Engineered Fill
Full Time Inspection
During Placement By SPCL
*
*
Min. 2m + D
Competent Natural Soil To
Be Confirmed By SPCL


Foundation walls
Min. 1.2m
Min. 2m
B
D
1
1
*
Engineered Fill
Undisturbed Natural Soil to Be Benched
Min. 2m + D
Competent Natural Soil
*Backfill in this area to be as per the SPCL report

Appendix B: Limitation and Use of the Report

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to Sirati & Partners Consultants Limited (SIRATI) at the time of preparation. Unless otherwise agreed in writing by SIRATI, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the borehole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc. Professional judgement was exercised in gathering and analyzing data and formulation of recommendations using current industry guidelines and standards. Similar to all professional persons rendering advice, SIRATI cannot act as absolute insurer of the conclusion we have reached. No additional warranty or representation, expressed or implied, is included or intended in this report other than stated herein the report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

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. SIRATI accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time. Any user of this report specifically denies any right to claims against the Consultant, Sub-Consultants, their officers, agents and employees in excess of the fee paid for professional services.

SIRATI engagement hereunder is subject to and condition upon, that SIRATI not being required by the Client, or any other third party to provide evidence or testimony in any legal proceedings pertaining to this finding of this report or providing litigations support services which may arise to be required in respect of the work produced herein by SIRATI. It is prohibited to publish, release or disclose to any third party the report produced by SIRATI pursuant to this engagement and such report is produced solely for the Client own internal purposes and which shall remain the confidential proprietary property of SIRATI for use by the Client, within the context of the work agreement. The Client will and does hereby remise and forever absolutely release SIRATI, its directors, officers, agents and shareholders of and from any and all claims, obligations, liabilities, expenses, costs, charges or other demands or requirements of any nature pertaining to the report produced by SIRATI hereunder. The Client will not commence any claims against any Person who may make a claim against SIRATI in respect of work produced under this engagement.