Amarico Properties Inc.

Geotechnical Investigation

Project Name
Westwinds Lands, Bostwick Road, London, Ontario

Project Number
LON-00015718-GB

Prepared By:
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15701 Robin's Hill Road
London, Ontario, N5V 0A5

Date Submitted
January, 2019

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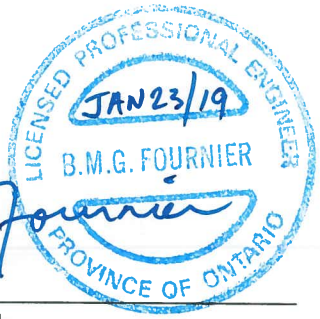

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January, 2019

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1. Introduction

EXP Services Inc. (EXP) was retained by Amiraco Properties Inc. to conduct a Geotechnical Investigation relating to the proposed development at the Site known as Westwinds Lands, located west of Bostwick Road and south of Pack Road, in London, Ontario, hereinafter referred to as the 'Site'. Authorization for EXP to proceed with the Geotechnical Investigation was given by York Developments. In preparing this report, the information provided from the client has been used.

The Site is currently open agricultural land with a treed area at the southwest corner. It is understood that a residential subdivision is proposed for this 16 hectare site. The objective of the Geotechnical Report is to summarize the results of the investigation and to provide geotechnical engineering guidelines to assist with the design and construction of the proposed development.

1.1 Terms of Reference

The current investigation was carried out in general accordance with our Proposal P18-278, dated August 2, 2018. The investigation was authorized by David Ailles on behalf of York Developments.

The purpose of the investigation was to examine the subsoil and groundwater conditions at the site by advancing four (4) boreholes and nine (9) test pits at the approximate locations shown on the attached Borehole Location Plan, Drawing 1.

Based on an interpretation of the factual borehole data, and a review of soil and groundwater information from test holes advanced at the site, EXP has provided engineering guidelines to assist with the geotechnical design and construction of the proposed structure. More specifically, this report provides comments on site preparation, basements and foundations, excavations, dewatering, backfill, site servicing, and pavement design.

This report is provided based on the Terms of Reference presented above, and on the assumption that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The information in this report in no way reflects on the environmental aspects of the soil. Should specific information in this regard be needed, additional testing may be required.

Reference is made to Appendix C of this report, which contains further information necessary for the proper interpretation and use of this report.

2. Methodology

The drilling fieldwork was conducted on November 14 and 15, 2018 and consisted of advancing four (4) boreholes at three approximate locations as shown on Drawing 1. The boreholes within the Site are designated as BH101 to BH103. The boreholes were advanced using a locally subcontracted track-mounted drill rig equipped with continuous flight solid stem augers, soil sampling and soil testing equipment. Boreholes were terminated at depths of about 7.6 to 15.7 m below existing grades.

Within the boreholes, Standard Penetration Tests (SPTs) were performed to assess the compactness of the underlying soils and to obtain representative samples. In cohesive soils, pocket penetrometer readings were taken to assess the undrained shear strength. During the drilling, the stratigraphy in the boreholes was examined and logged in the field by EXP geotechnical personnel. Short-term groundwater level observations within the open boreholes and the natural moisture contents of recovered soil samples were recorded on the borehole logs.

Following the drilling of Borehole BH101A/MW, BH101B/MW, BH102-MW, and BH103-MW, 50 mm diameter PVC monitoring wells were installed. Details of the monitoring well construction, are provided on the Borehole Logs found in Appendix A. Groundwater was measured in the monitoring wells on November 26 and December 19, 2018 and January 15, 2019.

Test Pits, designated as TP101 to TP109 were excavated with a rubber-tire backhoe, under the direction of EXP.

Representative samples of the various soil strata encountered at the borehole locations were taken to our laboratory in London for further examination by a Geotechnical Engineer and laboratory classification testing. Laboratory testing for this investigation consisted of routine moisture content determinations and grain size analyses on two selected samples of the native soil.

Samples remaining after the classification testing will be stored for a period of three months following the issuance of the report (i.e., until February 2019). After this time, they will be discarded unless prior arrangements have been made for longer storage.

The location of each test hole was established in the field. The Elevations at the test hole locations were interpreted from topographic contours available on the City of London Interactive mapping website.

3. Site and Subsurface Conditions

3.1 Site Description

The Site is roughly rectangular in shape and consists of about 16 hectares. The Site is open agricultural field with a meadowmarsh feature at the southwest corner. It is our understanding that proposed development will be a residential subdivision with single family residences, with associated access roads and site services.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in each test hole and the results of routine laboratory tests carried out on representative samples of the subsoils are presented on the test hole logs found in Appendix A. It must be noted that boundaries of soil indicated on the logs are inferred from non-continuous sampling and observations during excavating. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

The subsurface soil conditions encountered in the test holes were consistent with past findings in the area and are summarized as follows.

3.2.1 Topsoil

All boreholes and test pits had a layer of topsoil that varied in thickness from about 200 to 410 mm.

Topsoil quantities should not be established from the information provided at the borehole and test pit locations only. If required, a more detailed analysis (involving more shallow test pits) is recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

3.2.2 Sandy Silt

Beneath the topsoil at all test pits and Borehole 102/MW, sandy silt was encountered to depths ranging from 0.6 to 1.4 m below existing grade. In general, the sandy silt was noted to be brown and fine-grained. The compactness condition of the sandy silt is loose to compact, based on a Standard Penetration Test (SPT) N value of 16 blows/300 mm.

3.2.3 Clayey Silt Till

At all test locations, clayey silt till was encountered below the topsoil and/or sandy silt, to depths from at least 4.6 to 12.5 m below existing grade. All the test pits were terminated within the clayey silt till at around 4.6 m below existing grade. Clayey silt till

was also encountered beneath the sand, to termination depth at Borehole 102/MW. In general, the clayey silt till was noted to be brown in the upper zone and becoming grey with depth. The clayey silt till contains traces of gravel and sand as well as localized seams of wet sandy silt. The results of a grain size analysis on a sample of the till indicated a composition of 2% gravel, 8% sand, 41% silt, and 48% clay. The grain size analysis is included in Appendix B.

At Boreholes 101A/MW and 101B/MW, the clayey silt till contains a layered sequence of compact sandy silt, very stiff clayey silt, and compact silt. The consistency of the clayey silt till is generally stiff to very stiff. The *in situ* moisture contents ranged between 12 and 16 percent.

3.2.4 Silt

Beneath the clayey silt till at Boreholes 101A/MW and 103/MW a layer of silt was encountered to depths from at least 12.6 m to 14.0 m below existing grade, Elevation 260.0 to 264.0 m. In general, the silt was noted to be grey with trace to some sand and traces of gravel and clay. The silt was also noted to be wet and dilatant. The compactness condition of the silt is compact to very dense, based on SPT N values of 17 to greater than 50. The *in situ* moisture content of the silt was found to be about 17 percent, indicating wet conditions.

3.2.5 Sand

At Borehole 102/MW, a layer of sand was encountered below the clayey silt till, to a depth of about 13.1 m below existing grade, Elevation 260.9. Sand was also encountered below the silt and to termination depth at Borehole 101A/MW. The sand was noted to be grey, fine to medium-grained, and contain trace to some silt. The compactness condition of the sand is compact, based on SPT N values of 14 to 22. The *in situ* moisture content of the sand is 16 to 22 percent, generally indicating wet conditions.

3.3 Shallow Groundwater

Upon completion of excavation, wet conditions were not observed within any of the test pits. Detailed observations of the groundwater in the boreholes are provided on the attached borehole logs. Measurement of water levels in the monitoring wells and moisture contents of selected samples are recorded on the attached Borehole Logs and summarized in the table below.

Table 1 – Summary of Groundwater Levels/Elevations

Borehole/MW	Geodetic Surface Elevation (m)	Groundwater Elevation (m)		
		Nov 26/18	Dec 19/18	Jan 15/19
BH101A/MW	274.00	258.51	258.63	258.61
BH101B/MW	274.15	269.39	269.76	270.06
BH102/MW	274.10	263.32	263.79	263.94
BH103/MW	276.60	Not measured	265.15	265.81

Based on observations during drilling and on the measured water levels in the monitoring wells, the shallow groundwater at the site is generally located in the sand or silt deposits located below the clayey silt till, at Elevations of about 258.6 to 270.0 m. Trapped/confined groundwater is typical in this type of soil stratigraphy and may impact the progress of construction depending on the required excavation depths. It is also noted that the depth to the groundwater table may vary in response to climatic or seasonal conditions, and, as such, may differ at the time of construction, with high levels in wet seasons. Capillary rise effects should also be anticipated in fine-grained soil deposits.

3.4 Methane Gas Testing

An RKI Gx-2003 Gas Detector was used in the upper levels of the open boreholes. The unit measures LEL combustibles, oxygen content, Carbon Monoxide and Hydrogen Sulfide in standard confined space gases. No methane was detected in any of the boreholes.

4. Discussion and Recommendations

4.1 General

It is our understanding that proposed development will be a residential subdivision consisting of single-family residences, with associated access roads and site services. The following sections of this report provide geotechnical recommendations regarding site preparation, excavations, dewatering, basements and foundations, bedding, backfill, and pavement design.

4.2 Site Preparation

Prior to placement of foundations and/or engineered fill, any existing loose soils, topsoil and/or otherwise deleterious materials should be stripped from the footing areas of the proposed buildings as well as parking and roadway areas.

Following the removal of any unsuitable material, the exposed native subgrade surfaces at subgrade design level should be thoroughly proof-rolled with a heavy roller and examined by a Geotechnical Engineer. Any loose areas detected during the proof-rolling process should be sub-excavated and replaced with approved material. Where the exposed subgrade requires re-construction to achieve the design elevations, structural fill should be used. The fill should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100 percent Standard Proctor Maximum Dry Density (SPMDD). The geometric requirements for engineered fill are provided on Drawing 2. In the parking areas, access roads, and within floor slab areas, fill placed to raise the grade should be placed and compacted to a minimum of 98 percent SPMDD. For best compaction results, the *in-situ* moisture content of the fill should be within about three percent of optimum, as determined by a standard Proctor test. *In-situ* compaction testing should be carried out during any fill placement to ensure that the specified compaction is being achieved.

If imported fill material is used at the Site, verification of the suitability of the fill may be required from an environmental standpoint. Conventional geotechnical testing will not determine the suitability of the material in this regard. Analytical testing and environmental site assessment may be required at the source. This will best be assessed prior to the selection of the material source. A quality assurance program should be implemented to ensure that the fill material will comply with the current Ministry of Environment, Conservation and Parks (MECP) standards for placement and transportation.

The disposal of any excess excavated materials must also conform to the MECP Guidelines and requirements. EXP can be of assistance if an assessment of the materials is required.

4.3 Excavation and Construction Dewatering

4.3.1 General

Side slopes of temporary excavations must conform to Regulation 213/91 of the Occupational Health and Safety Act of Ontario (OHSA). The native soils at the Site are all classified as Type 3 soils above the groundwater table and Type 4 soils below the groundwater table. It is expected that most of the excavations will terminate in Type 3 soils and therefore, the walls must be sloped at a minimum inclination of 1H:1V from the base of the excavation. Should groundwater egress loosen the excavation side slopes, flatter slopes may be required. Temporary excavations that terminate within Type 4 soils must be have side slopes that are 3H:1V or flatter from the base of the excavation.

It should be noted that the presence of cobbles and boulders in glacial deposits or debris within the fill may influence the progress of excavation and construction.

4.3.3 Construction Dewatering

Based on the results of the field investigation, groundwater infiltration may be encountered within excavations depths near or below 4 to 15 m below existing grade, Elevations of about 258.6 to 270.0 m. This trapped/confined groundwater at the Site is typical in this type of soil stratigraphy and may impact the progress of construction depending on the required excavation depths and final grades. If minor groundwater infiltration is encountered above these levels, it can likely be accommodated using conventional sump pumping techniques. Where groundwater infiltration persists, more extensive dewatering measures may be required. It is therefore recommended that contractors bidding on the work conduct further investigation including test pits to further determine groundwater conditions and how it will affect their work.

Any collected water should be discharged a sufficient distance away from the excavated area to prevent the discharge water from returning to the excavation. Sediment control measures should be provided at the discharge point of the dewatering system. Caution should also be taken to avoid any adverse impacts to the environment.

Although not anticipated at this site, it should be noted that any projects requiring positive groundwater control with a removal rate more than 50,000 litres and up to 400,000 litres per day an Environmental Activity and Sector Registry (EASR) will be required. For volumes over 400,000 litres per day, a Permit to Take Water (PTTW - Groundwater) will be required. PTTW applications will need to be approved by the MECP according to Sections 34 and 98 of the Ontario Water Resources Act R.S.O. 1990 and the Water Taking and Transfer Regulation O. Reg. 387/04. It is noted that a standard geotechnical investigation will not determine all the groundwater parameters that may be required to support the application.

4.4 Building Foundations

The proposed site development includes the construction of a residential subdivision with houses. The design finished floor or finished surface elevations were not known at time of report preparation but based on our understanding, with basement levels, the lowest underground floor level would be a maximum of about 3 to 4 m below existing grade. The houses can be supported by conventional strip and spread footings founded at relatively shallow depth in the native soils.

Table 2 – Highest Elevation at Borehole Locations Where Recommended Bearing Values Can Be Applied

Borehole No.	Approximate Surface Elevation (m)	Depth to Competent Soils (m)	Approximate Elevation at Competent Soils (m)
BH101A/MW	274.0	1.0	273.0
BH101B/MW	274.2	1.0	273.2
BH102/MW	274.1	1.5	272.6
BH103/MW	276.6	1.0	275.6
TP101	276.6	1.0	275.6
TP102	274.7	1.0	273.7
TP103	275.1	1.0	274.1
TP104	276.5	1.0	275.5
TP105	274.9	1.0	273.9
TP106	274.4	1.0	273.4
TP107	274.0	1.0	273.0
TP108	274.5	1.0	273.5
TP109	276.4	1.0	275.4

4.4.2 Conventional Strip and Spread Footings

For design of footings on the native clayey silt till at the Elevations shown in Table 1, the following allowable bearing pressures (net stress increase) can be used for design of footings:

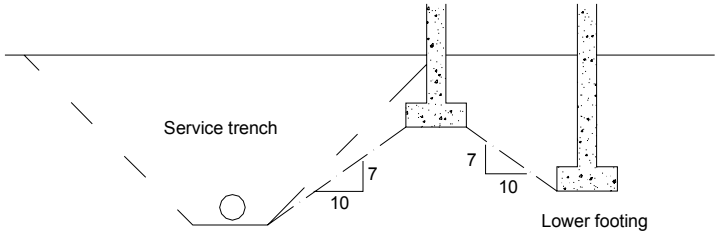
Serviceability Limit States (SLS) 200 kPa (4,100 psf)

Ultimate Limit States (ULS) 300 kPa (6,200 psf)

Verification of the founding base conditions should be undertaken by a Geotechnical Engineer at the time of excavation.

4.4.4 Foundations - General

Footings at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing. This concept should also be applied to service excavations, etc. to ensure that undermining is not a problem.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

Provided that the footing bases are not disturbed due to construction activity, precipitation, freezing and thawing action, etc., and the aforementioned bearing pressures are not exceeded, the total and differential settlements of footings designed in accordance with the recommendations of this report and with careful attention to construction detail are expected to be less than 25 mm and 20 mm (1 and ¾ inch), respectively.

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m (4 ft) of soil cover or equivalent insulation.

It should be noted that the recommended bearing capacities have been calculated by EXP from the test hole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available (i.e., where more specific information becomes available with respect to conditions between test locations when foundation construction is underway). The interpretation between the test holes and the recommendations of this report must therefore be checked through field inspections provided by EXP to validate the information for use during the construction stage.

4.5 Basement Construction

The basement slabs of the proposed houses may be constructed using conventional concrete slab-on-grade techniques. The floor subgrade area should be stripped of any fill or any loose/soft soil. The exposed area should be thoroughly proof-rolled with a heavy roller and any soft areas detected by this, or any other means, should be dug out and made good with compactable fill, following the guidelines set out in Section 4.2.

Care should be taken to protect the subgrades below the floor slabs during construction, by limiting construction traffic on the prepared subgrade soils. In addition, if the exposed subgrade soils are exposed to inclement weather conditions (i.e. rain, snow,

freezing conditions), some remedial works may be required to remove wet, soft, or disturbed soils prior to stone and concrete placement.

A moisture barrier, consisting of a 200 mm (8 in.) thick, compacted layer of 19 mm (3/4 in.) clear, crushed stone, should be placed between the prepared subgrade and the floor slab. For design, the modulus of subgrade reaction (*k*) can be taken as 20 MPa/m for the compacted stone layer over the natural subgrade soils.

The installation and requirement of a vapour barrier under the slabs should conform to the flooring manufacturer's and designer's requirements, if needed. Moisture emission and/or relative humidity testing of the slab will be required to determine the concrete condition prior to flooring installation. To minimize the potential for excess moisture in the floor slab at the time of the flooring installation, a concrete mixture with a low water-to-cement ratio (i.e., 0.5 to 0.55) should be used. Chemical additives may be required at the time of placement to make the concrete workable, and should be used in place of additional water at the point of placement. Ongoing liaison from this office will be required.

The water-to-cement ratio and slump of concrete used in the floor slab should be strictly controlled to minimize shrinkage of the slab. Adequate joints should be provided in the floor slab to further control cracking. During placement of concrete at the construction site, testing should be performed on the concrete.

All basement walls should be damp-proofed and must be designed to resist a horizontal earth pressure 'P' at any depth 'h' below the surface as given by the following expression: $P = K(\gamma h+q)$

where, P = lateral earth pressure in kPa acting at depth h;

γ = natural unit weight, a value of 20.4 kN/m^3 may be assumed;

h = depth of point of interest in m;

q = equivalent value of any surcharge on the ground surface in kPa.

K = earth pressure coefficient, assumed to be 0.4

Installation of perimeter drains is required for basements at the Site. The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. Suggestions for permanent perimeter drainage are given on Drawing 3.

4.6 Pipe Bedding and Trench Backfill

The subgrade soils beneath the water and sewer pipes (installed at conventional depths) which will service the Site are generally expected to generally consist of clayey silt till. No bearing problems area anticipated for flexible or rigid pipes founded on the

natural deposits or on compacted on-site soils. Localized improvement may be required if work is carried out in wet weather.

Consideration should be given to placing the bedding in accordance with the OPSS specifications. The bedding course may be thickened if portions of the subgrade become wet during excavation. The bedding aggregate should be placed around the pipe to at least 300 mm (12 inch) above the pipe. The bedding aggregate should be compacted to a minimum 95 percent SPMDD. Water and sewer lines installed outside of heated areas should be provided with a minimum 1.2 m (4 ft) of soil cover for frost protection.

Requirements for backfill in service trenches, etc. should also have regard for City of London requirements. A summary of the general recommendations for trench backfill is presented on Drawings 4 and 5. A program of *in situ* density testing should be established to ensure that satisfactory levels of compaction are achieved.

Based on the results of this investigation, much of the native soils may be used for construction backfill, provided that reasonable care is exercised in handling and that the material is at appropriate moisture content levels as discussed in Section 4.3. Any excavated soils proposed for re-use as backfill should be examined by a Geotechnical Engineer. The material should be within 3 percent of the optimum moisture as determined in the Standard Proctor density test. Stockpiling of material for prolonged periods of time should be avoided. This is particularly important if construction is carried out in wet, adverse weather. As well, materials should be stockpiled according to composition, (i.e., clayey silt soils should be stockpiled separately from sand soils).

Soils excavated from below the stabilized groundwater table may be too wet for re-use as backfill unless adequate time is allowed for drying, or if the material is blended with approved dry fill; otherwise, it may be stockpiled on the Site for re-use as landscape fill. The use of any imported material is subject to review and approval by the contract administrator and geotechnical consultant.

Disposal of excavated materials off site should conform to current MECP guidelines.

4.7 Earthquake Design Considerations

The recommendations for the geotechnical aspects to determine the earthquake loading for design using the OBC 2012 are presented below.

The subsoil and groundwater information at this Site have been examined in relation to Section 4.1.8.4 of the OBC 2012. It is expected that the proposed structures will be founded on the shallow, competent native soils, below any loose or soft zones.

Table 4.1.8.4.A. Site Classification for Seismic Site Response in OBC 2012 indicated that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. The test holes advanced at this Site were to

a maximum of 15.7 m depth. Therefore, the Site Classification recommendation would be based on the available information as well as our interpretation of conditions below the test holes based on our knowledge of the soil conditions in the area.

Based on the above assumptions, interpretations in combination with the known local geological conditions, the Site Class for the proposed development is "D" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012. Additional depth drilling or geophysical surveying may be advised to determine if the soil conditions below the current depth of exploration can support a higher Site Classification.

4.8 Methane Gas Testing

An RKI Gx-2003 Gas Detector was used in the upper levels of the open boreholes. The unit measures LEL combustibles, oxygen content, Carbon Monoxide and Hydrogen Sulfide in standard confined space gases. No methane was detected in any of the boreholes.

Based on the present information, no special methane gas abatement measures are indicated at this site.

4.9 Pavement Design

Areas to be paved should be stripped of all topsoil, fill, and other obviously unsuitable material. The exposed subgrade must then be thoroughly proof-rolled. Any soft zones revealed by this or any other observations must be over-excavated and backfilled with approved material. All fill required to backfill service trenches or to raise the subgrade to design levels must conform to requirements outlined previously. Preferably, the natural inorganic excavated soils should be used to maintain uniform subgrade conditions, provided adequate compaction can be achieved.

Provided the preceding recommendations are followed, the pavement thickness design requirements given in the following table are recommended for the anticipated loading and subgrade conditions.

Table 3 – Recommended Pavement Structure Thicknessess

Recommended Pavement Structure Thicknesses				
Pavement Layer	Compaction Requirements	Light Duty Pavement Structure (Cars Only)	Heavy Duty Pavement Structure (Cars & Trucks)	Arterial Road
Asphaltic Concrete	97% Marshall Density	40 mm HL-3 40 mm HL-8	50 mm HL-3 60 mm HL-8	50 mm HL-1 130 mm (2x65) HL8
Granular 'A' (Base)	100% SPMDD[1]	150 mm	150 mm	150 mm
Granular 'B' (Sub-base)	100% SPMDD[1]	300 mm	450 mm	450 mm

Notes: 1) SPMDD denotes Standard Proctor Maximum Dry Density.
2) The subgrade must be compacted to 98% SPMDD.
3) The above recommendations are minimum requirements.

The recommended pavement structures provided in the above table are based on the natural subgrade soil properties determined from visual examination and textural classification of the soil samples. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. Other granular configurations may also be possible provided the granular base equivalency (GBE) thickness is maintained. These recommendations on thickness design are not intended to support heavy and concentrated construction traffic, particularly where only a portion of the pavement section is installed.

If construction is undertaken under adverse weather conditions (i.e., wet or freezing conditions) subgrade preparation and granular sub-base requirements should be reviewed by the Geotechnical Engineer.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 and City of London standards prior to use on Site, and during construction. The Granular 'B' subbase and the Granular 'A' base courses must be compacted to 100 percent SPMDD.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150 and City of London standards. The asphalt should be placed in accordance with OPSS 310 and compacted to at least 97 percent of the Marshall mix design bulk density.

Good drainage provisions will optimize pavement performance. The finished pavement surface should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catchbasins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. In low areas, subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening, as shown on Drawing 6. This is particularly important in heavier traffic areas at the site entrances. The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading.

A program of *in situ* density testing must be carried out to verify that satisfactory levels of compaction are being achieved.

4.10 Curbs and Sidewalks

The concrete for the curbs and gutters should be proportioned, mixed placed and cured in accordance with the requirements of OPSS 353, OPSS 1350 and City of London requirements.

During cold weather, the freshly placed concrete should be covered with insulating blankets to protect against freezing.

The subgrade for the sidewalks should consist of undisturbed natural soil or well-compacted fill. A minimum 150 mm thick layer of compacted (minimum 98 percent SPMDD) Granular 'A' should be placed below the sidewalk slabs.

4.11 Inspection and Testing Recommendations

An effective inspection and testing program is an essential part of construction monitoring. The Inspection and Testing Program for residential developments typically include the following items:

- Inspection and Materials testing during site servicing works, including soil sampling, laboratory testing (moisture contents and Standard Proctor density test on the pipe bedding, trench backfill and engineered fill material), monitoring of fill placement, and *in situ* density testing;

- Inspection and Materials testing during the road construction, including subgrade examination of the road subgrade soils following site servicing, laboratory testing (grain size analyses and Standard Proctor density tests on the Granular 'A' and 'B' material placed on site roadways), *in situ* density testing, and concrete sampling and testing for curbs.

- Inspection and Materials testing for base and surface asphalt, including laboratory testing on asphalt sampling to confirm conformance to project specifications and standards;

- Footing Base Examinations to confirm the soils suitability to support the design bearing pressures;

- Concrete testing for footings, walls, floor slabs, curbs, and sidewalks

5. General Limitations

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current geotechnical conditions within the subject property. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, EXP Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance regarding any future geotechnical and environmental issues related to this property.

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

The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes 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.

EXP Services Inc. 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 afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

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

Drawings

-NOTES-

1. The boundaries and soil types have been established only at test hole locations. Between test holes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for 3 months and then destroyed unless client advises that an extended time period is required.
3. Topsoil quantities should not be established from the information provided at the test hole locations.
4. The site plan reproduced from Google Earth Pro and City of London Digital Mapping and should be read in conjunction with EXP Geotechnical Report LON-00015718-GB.

Geotechnical Investigation

Westwinds Lands

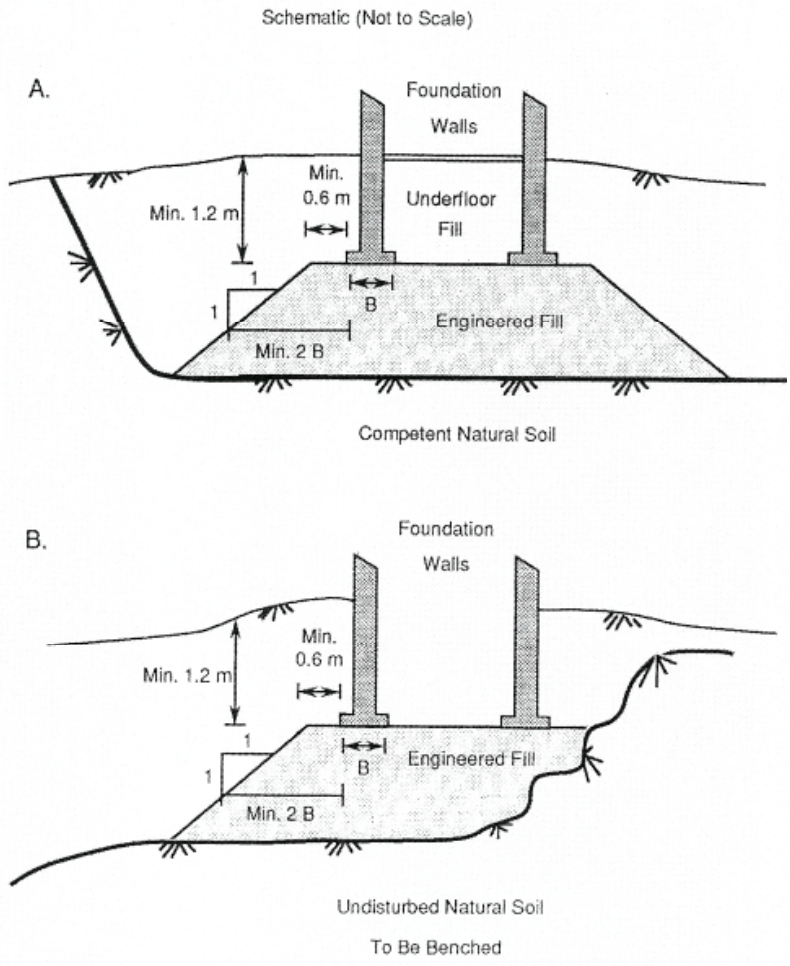
3563 Bostwick Road, London, Ontario

CLIENT	Amarico Properties Inc.
TITLE	Borehole and Test Pit Location Plan
Prepared By: E.B.	Reviewed By: G.F.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	SCALE	PROJECT NO.	DWG.
JANUARY 2019	NTS	LON-00015718-GB	1

GEOMETRIC REQUIREMENTS FOR FOUNDATIONS ON ENGINEERED FILL

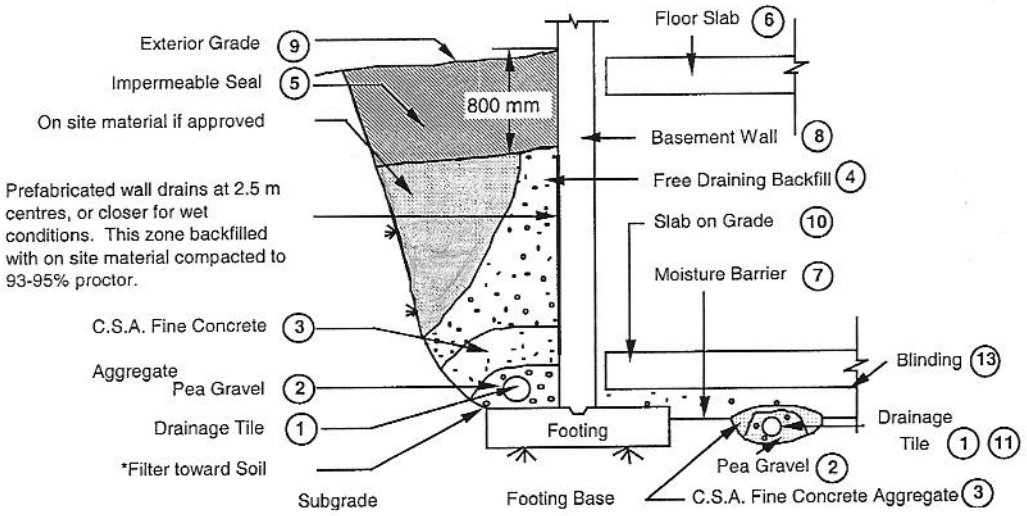


SECTION VIEW

NOTES:

1. The area must be stripped of all topsoil contaminated fill material and proof rolled. Soft areas must be dug out. The stripped native subgrade must be examined and approved by an EXP Engineer prior to placement of fill.
2. The approved engineered fill must be compacted to 100% Standard Proctor dry density throughout. Granular fill is required.
3. Full-time geotechnical inspection by EXP is required during placement of the engineered fill.
4. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements.
5. An allowable SLS bearing pressure of 150 kPa (3,000 psf) may be used provided that all conditions outlined above, are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and as a precautionary measure, footings should be provided with nominal steel reinforcement.
6. All excavations must be done in accordance with the Occupational Health and Safety Regulation of Ontario (Construction Projects - O. Reg. 213.91)
7. These guidelines are to be read in conjunction with the attached EXP Report for Project Number LON-00015718-GB.

DRAWING NO. 3 – BACKFILL AND BASEMENT DRAINAGE DETAIL, (NOT TO SCALE)

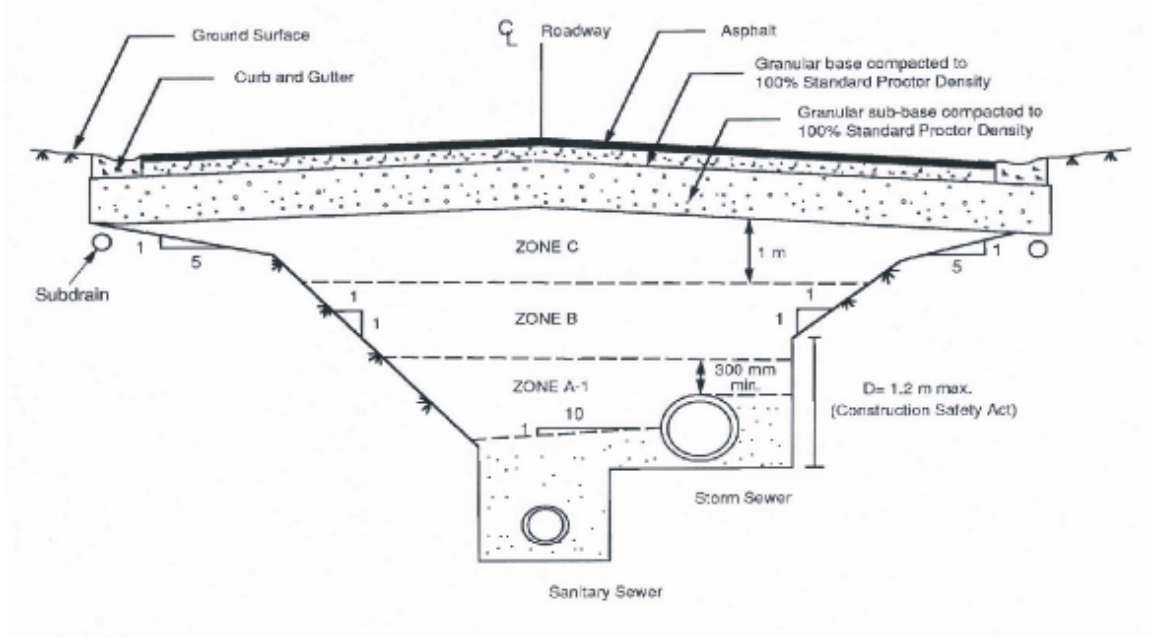


NOTES:

1. Drainage tile to consist of 100 mm (4 in.) diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be minimum of 150 mm (6 in.) below underside of floor slab.
2. Pea gravel 150 mm (6 in.) top and sides of drain. If drain is not on footing, place 100 mm (4 in.) of pea gravel below drain. 20 mm (3/4 in.) clear stone may be used provided if it is covered by an approved porous geotextile fabric membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm (12 in.) top and side of drain. This may be replaced by an approved porous geotextile membrane (Terrafix 270R or equivalent).
4. Free-draining backfill - OPSS Granular B or equivalent compacted to 93 to 95 (maximum) percent Standard Proctor density. Do not compact closer than l.8 m (6 ft) from wall with heavy equipment. Use hand controlled light compaction equipment within 1.8 m (6 ft) of wall.
5. Impermeable backfill seal of compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to consist of compacted 20 mm (3/4 in.) clear, crushed stone or equivalent free-draining material. Layer to be 200 mm (8 in.) minimum thickness.
8. Basement walls to be damp-proofed.
9. Exterior grade to slope away from wall.
10. Slab on grade should not be structurally connected to wall or footing.
11. Underfloor drain invert to be at least 300 mm (12 in.) below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25 ft.) centres one way. Place drain on 100 mm (4 in.) of pea gravel with 150 mm (6 in.) of pea gravel top and sides. CSA fine concrete aggregate to be provided as filter material or an approved porous geotextile membrane (as in 2 above) may be used.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm (3/4 in.) clear stone requires surface binding, use 6 mm (1/4 in.) clear stone chips.

Note: a) Underfloor drainage can be deleted where not required (see report).
b) Free draining backfill, item 4 may be replaced by wall drains, as indicated, if more economical.

DRAWING NO. 4 – TYPICAL BACKFILL DETAIL STORM AND SANITARY SEWER (COMMON TRENCH)



SECTION VIEW

NOTES:

ZONE A
Granular bedding satisfying current City of London Standards compacted to 95% Standard Proctor maximum dry density.

ZONE A-I

To be compacted to 95% Standard Proctor maximum dry density.

ZONE B
To be compacted to 95% Standard Proctor maximum dry density.

ZONE C
To be compacted to 98% Standard Proctor maximum dry density.
The excavations shown above are for Type 1 or 2 soils. Where excavations extend through Type 3 soils, the side walls should be sloped back at a maximum inclination of 1 horizontal to 1 vertical from the base (Reference O.Reg 219/31).

DRAWING NO. 5 – TRENCH BACKFILL REQUIREMENTS

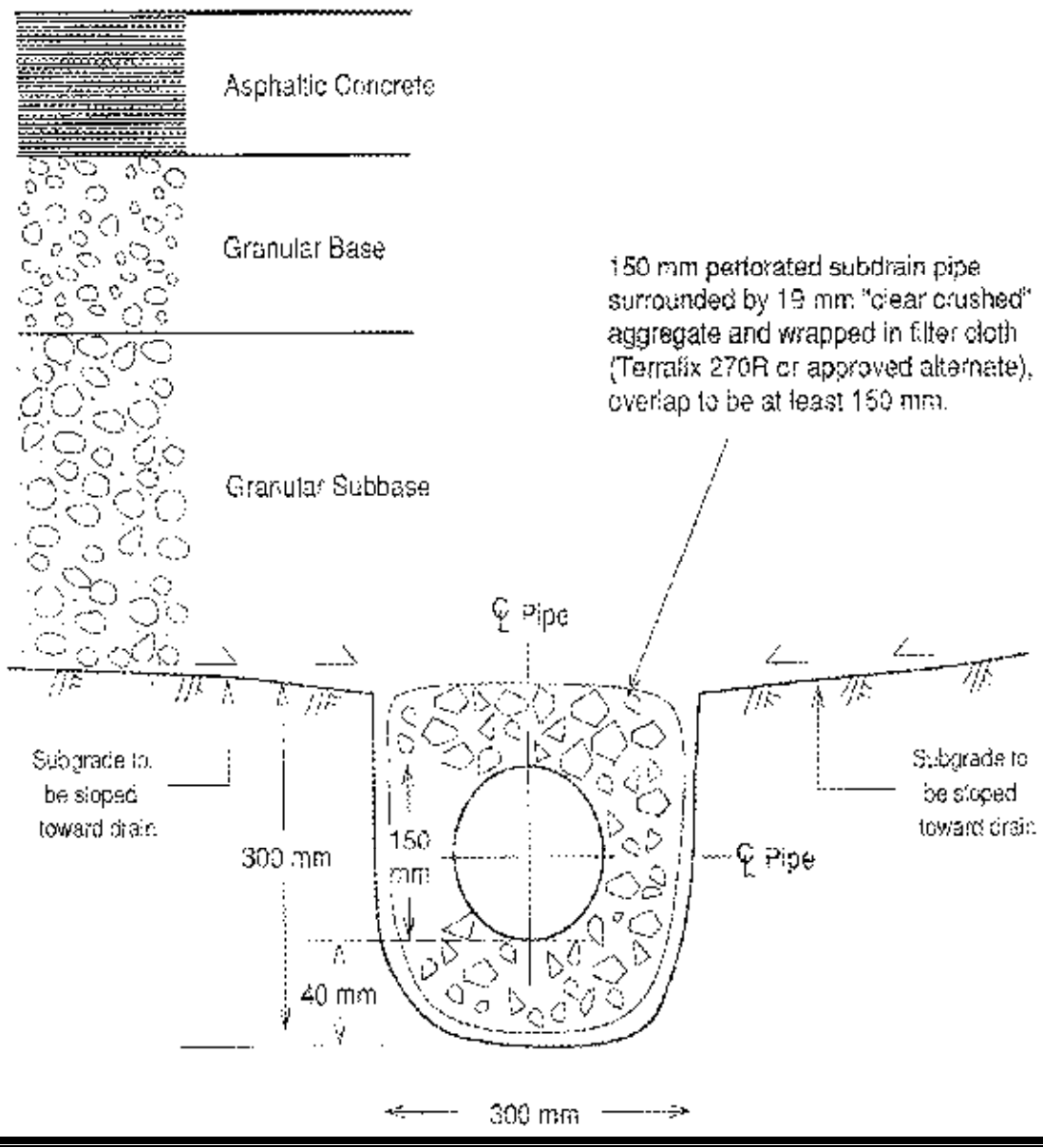
Requirements for backfill in service trenches, etc. should conform to current City of London and OPS requirements. A summary of the general recommendations for trench backfill is presented on Drawing No. 3.

The bedding materials for the services designated as Zone A on the attached drawings should consist of approved granular material satisfying the current City of London minimum standards and specifications. (Class B bedding should provide adequate support for the pipes). These materials should be uniformly compacted to 95 percent of standard Proctor dry density. Some problems may be encountered in maintaining alignment when bedding pipes in wet sandy soil. If Granular 'A' or other sandy material is used for bedding, they may become 'spongy' when saturated. If significant amounts of clear stone are used to stabilize the base, a geotextile should be incorporated to avoid problems with migration of fine grained materials and differential settlement under the pipes as the groundwater rises after backfilling. For minor local use of crushed stone without a geotextile filter, a graded HL3 stone is preferable.

The backfill in Zone B will consist of the native material. This material should be placed in loose lifts not exceeding 300 mm (12 inches) and be uniformly compacted to 95 percent of the standard Proctor maximum dry density. Material wetter than 5 percent above optimum must be allowed to dry sufficiently or should be discarded or used in landscaped areas.

The upper 1 meter of the general backfill (i.e. Zone C) should be placed in loose lifts not exceeding 300 mm (12 inches) and be uniformly compacted to at least 98 percent of the standard Proctor maximum dry density. To achieve satisfactory compaction, the fill material should be within 3 percent of standard Proctor optimum moisture content at placement.

DRAWING NO. 6 – PAVEMENT SUBDRAIN DETAIL



NOTES:

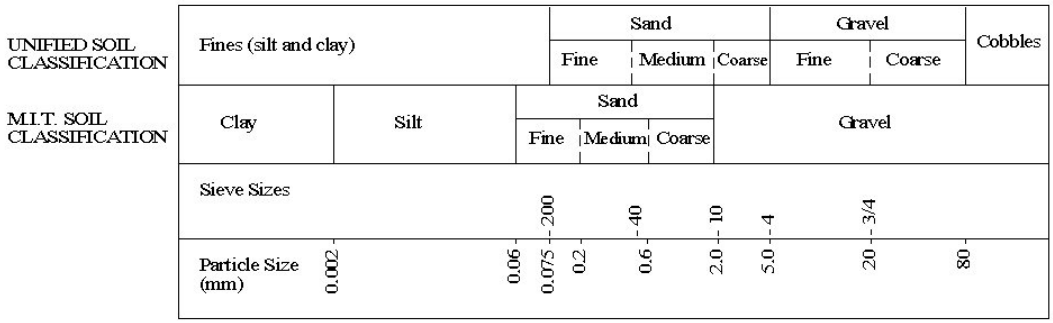
1. All dimensions in millimetres.
2. All subdrains to be set on at least 1% grade draining to a positive outlet.
3. Subgrade soil conditions should be verified onsite, during subgrade preparation works, following site servicing installations.

Scale: NTS

Appendix A - Borehole and Test Pit Logs

NOTES ON SAMPLE DESCRIPTIONS

1. All descriptions included in this report follow the 'modified' Massachusetts Institute of Technology (M.I.T.) soil classification system. The laboratory grain-size analysis also follows this classification system. Others may designate the Unified Classification System as their source; a comparison of the two is shown for your information. Please note that, with the exception of those samples where the grain size analysis has been carried out, all samples are classified visually and the accuracy of the visual examination is not sufficient to differentiate between the classification systems or exact grain sizing. The M.I.T. system has been modified and the EXP classification includes a designation for cobbles above the 75 mm size and boulders above the 200 mm size.



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 therefore, may not be applicable as a general description of the site fill material. All fills should be expected to contain obstructions such as large concrete pieces or subsurface basements, floors, tanks, even though none of these obstructions may have been encountered in the borehole. 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 and correct 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. The fill at this site has been monitored for the presence of methane gas and the results are recorded on the borehole logs. The monitoring process neither indicates the volume of gas that can be potentially generated or pinpoints the source of the gas. These readings are to advise of a potential or existing problem (if they exist) and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic waste that renders the material unacceptable for deposition in any but designated land fill sites; unless specifically stated, the fill on the site has not been tested for contaminants that may be considered hazardous. This testing and a potential hazard study can be carried out if you so request. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common, but not detectable using conventional geotechnical procedures.

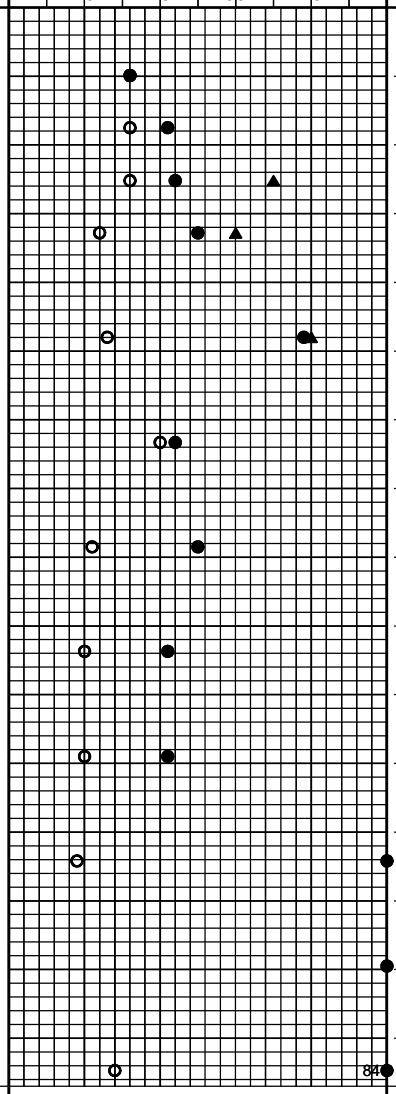
3. **Glacial Till**: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process, the till must be considered heterogeneous in composition and as such, may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (75 to 200 mm in diameter) or boulders (greater than 200 mm diameter) and therefore, contractors may encounter them during excavation, even if they are not indicated on the borehole logs. It should be appreciated that normal sampling equipment can not differentiate the size or type of obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited area; therefore, caution is essential when dealing with sensitive excavations or dewatering programs in till material.

BOREHOLE LOG

BH101A/MW
Sheet 1 of 1

CLIENT **Amarico Properties Inc.** PROJECT NO. **LON-00015718-GB**
PROJECT **Westwinds Lands** DATUM **Geodetic**
LOCATION **3563 Bostwick Road, London, Ontario** DATES: Boring **November 14, 2018** Water Level **Jan 15/19**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	274.0						
0	273.7	**TOPSOIL** - 300 mm					
1		**CLAYEY SILT TILL** - brown, trace gravel, trace sand, very stiff, moist	SS	S1	400	16	16
2			SS	S2	450	21	16
3			SS	S3	450	22	16
4			SS	S4	450	25	12
		- becoming grey near 4.0 m bgs					
5	269.0		SS	S5	400	39	13
	268.2	**SANDY SILT** - brown, dilatant, dense, very moist					
6		**CLAYEY SILT** - grey, trace sand, ocasional dilatant wet silt seams, very stiff, moist	SS	S6	400	22	20
7	266.7						
	266.2	**SILT** - brown, some sand, dilatant, compact, wet					
8		**CLAYEY SILT TILL** - grey, trace gravel, trace sand, very stiff to hard, moist	SS	S7	450	25	11
9			SS	S8	450	21	10
10							
11			SS	S9	450	21	10
12	261.5		SS	S10	250	50 *	9
		SILT - grey, some sand, trace gravel, dilatant, very dense, wet					
13	260.0						
14		**SAND** - grey, trace to some silt, very dense, moist	SS	S11	250	50 *	
15		- wet silt layer encountered near 15.2 m bgs					
	258.3		SS	S12	200	84	14
16		**End of Borehole at 15.7 m bgs.**					



NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON00015718-GB.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) * denotes 50 blows per less than 150 mm split spoon sampler penetration.
5) Water Level Readings:
November 26, 2018 - dry
December 19, 2018 - dry
January 15, 2019 - dry

SAMPLE LEGEND
AS Auger Sample | SS Split Spoon | ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) | VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent | Measured | Artesian (see Notes)

BOREHOLE LOG

BH101B/MW
Sheet 1 of 1

CLIENT **Amarico Properties Inc.** PROJECT NO. **LON-00015718-GB**
PROJECT **Westwinds Lands** DATUM **Geodetic**
LOCATION **3563 Bostwick Road, London, Ontario** DATES: Boring **November 15, 2018** Water Level **Jan 15/19**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)	SHEAR STRENGTH / Atterberg Limits and Moisture
	274.2									S Field Vane Test (#=Sensitivity); Penetrometer; Torvane; 100 200 kPa; W_P W W_L; SPT N Value; Dynamic Cone; 10 20 30 40
0	273.9	**TOPSOIL** - 300 mm								
1		**CLAYEY SILT TILL** - brown, trace gravel, trace sand, very stiff, moist								
2										
3										
4		- becoming grey near 4.0 m bgs								
5	269.1									
	268.4	**SANDY SILT** - brown, dilatant, dense, very moist								
6		**CLAYEY SILT** - grey, trace sand, ocasional dilatant wet silt seams, very stiff, moist								
7	266.8									
	266.5	**SILT** - brown, some sand, dilatant, compact, wet								
8		**End of Borehole at 7.6 m bgs.**								
9										
10										
11										
12										
13										
14										
15										
16										

NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON00015718-GB.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
   November 26, 2018 - 4.76 m bgs, Elevation 269.39 m
   December 19, 2018 - 4.39 m bgs, Elevation 269.76 m
   January 15, 2019 - 4.10 m bgs, Elevation 270.06 m

SAMPLE LEGEND
AS Auger Sample; SS Split Spoon; ST Shelby Tube; Rock Core (eg. BQ, NQ, etc.); VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

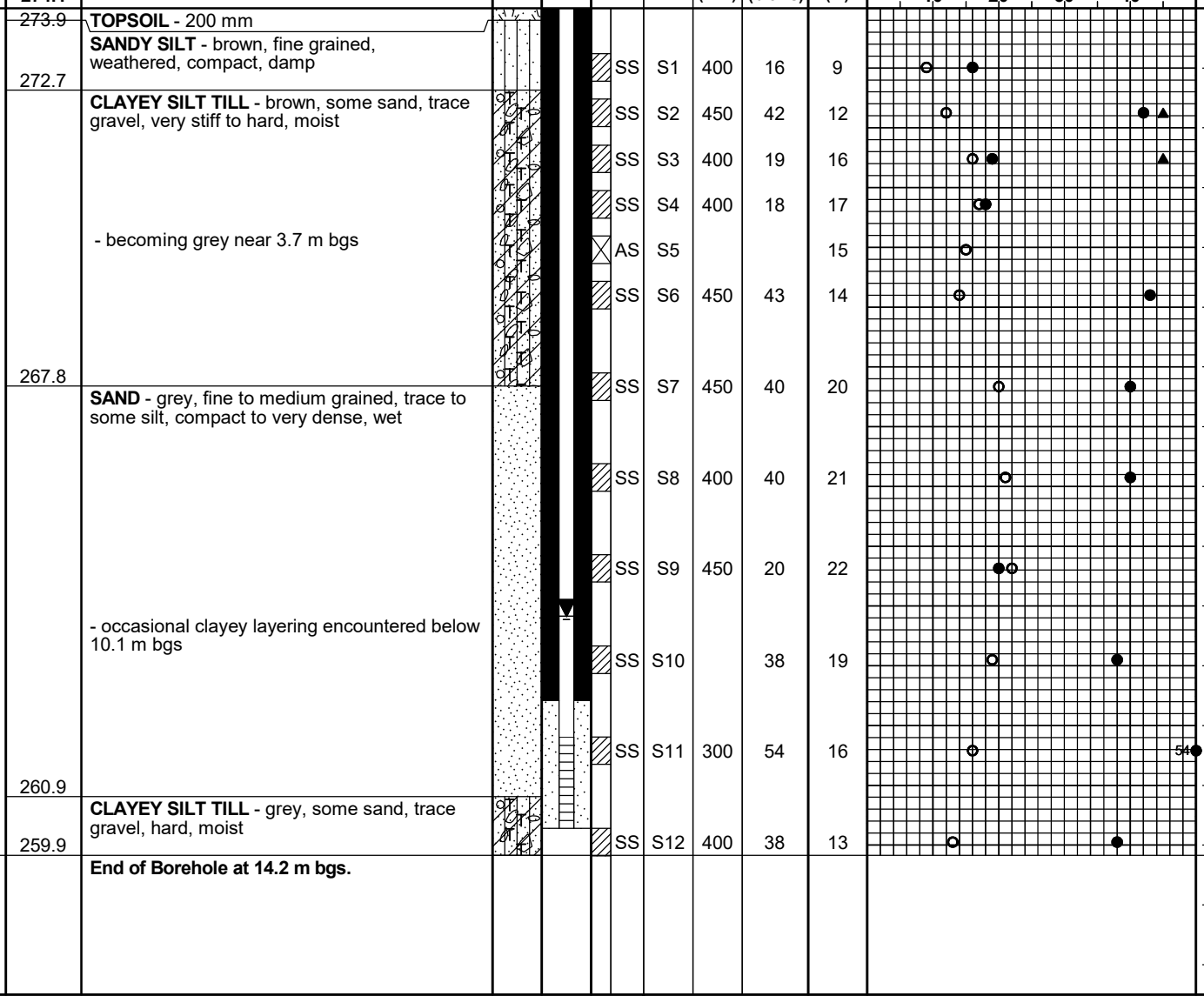
WATER LEVELS
Apparent; Measured; Artesian (see Notes)

BOREHOLE LOG

BH102/MW
Sheet 1 of 1

CLIENT **Amarico Properties Inc.** PROJECT NO. **LON-00015718-GB**
PROJECT **Westwinds Lands** DATUM **Geodetic**
LOCATION **3563 Bostwick Road, London, Ontario** DATES: Boring **November 15, 2018** Water Level **Jan 15/19**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	274.1						
	273.9	**TOPSOIL** - 200 mm					
1	272.7	**SANDY SILT** - brown, fine grained, weathered, compact, damp	SS	S1	400	16	9
2		**CLAYEY SILT TILL** - brown, some sand, trace gravel, very stiff to hard, moist	SS	S2	450	42	12
3			SS	S3	400	19	16
4			SS	S4	400	18	17
		- becoming grey near 3.7 m bgs	AS	S5			15
5			SS	S6	450	43	14
6	267.8						
7		**SAND** - grey, fine to medium grained, trace to some silt, compact to very dense, wet	SS	S7	450	40	20
8			SS	S8	400	40	21
9			SS	S9	450	20	22
10							
11		- occasional clayey layering encountered below 10.1 m bgs	SS	S10		38	19
12			SS	S11	300	54	16
13	260.9						
		CLAYEY SILT TILL - grey, some sand, trace gravel, hard, moist					
14	259.9		SS	S12	400	38	13
		End of Borehole at 14.2 m bgs.					
15							
16							



NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON00015718-GB.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
   November 26, 2018 - 10.48 m bgs, Elevation 263.62 m
   December 19, 2018 - 10.31 m bgs, Elevation 263.79 m
   January 15, 2019 - 10.17 m bgs, Elevation 263.94 m

SAMPLE LEGEND
AS Auger Sample | SS Split Spoon | ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) | VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent | Measured | Artesian (see Notes)

BOREHOLE LOG

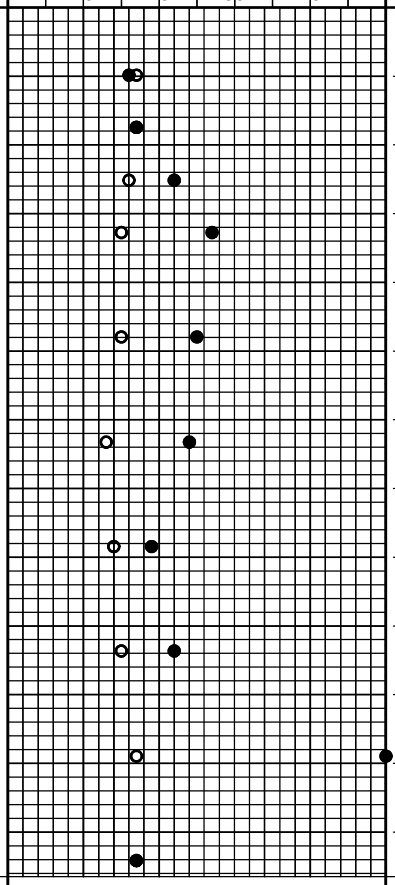
BH103/MW
Sheet 1 of 1

CLIENT **Amarico Properties Inc.** PROJECT NO. **LON-00015718-GB**
PROJECT **Westwinds Lands** DATUM **Geodetic**
LOCATION **3563 Bostwick Road, London, Ontario** DATES: Boring **November 14, 2018** Water Level **Jan 15/19**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	276.6						
	276.2	**TOPSOIL** - 400 mm					
1		**CLAYEY SILT TILL** - brown, trace sand, trace gravel, very stiff, moist	SS	S1	400	16	17
2			SS	S2	450	17	17
3			SS	S3	450	22	16
			SS	S4	450	27	15
4		- becoming grey near 3.4 m bgs - wet sandy silt seam encountered near 4.0 m bgs					
5			SS	S5	450	25	15
6			SS	S6	450	24	13
7							
8			SS	S7	450	19	14
9		- occasional wet silt seams encountered near 9.1 m bgs	SS	S8	450	22	15
	266.9						
10		**SILT** - grey, trace clay, trace sand, occasional clayey layering, dilatant, compact to very dense, wet					
11			SS	S9	450	50	17
12							
	264.0		SS	S10	450	17	17
13		**End of Borehole at 12.7 m bgs.**					
14							
15							
16							

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40



NOTES

1) Borehole Log interpretation requires assistance by EXP before use by others. Borehole Log must be read in conjunction with EXP Report LON00015718-GB.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
December 19, 2018 - 11.45 m bgs, Elevation 265.15 m
January 15, 2019 - 10.79 m bgs, Elevation 265.81 m

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

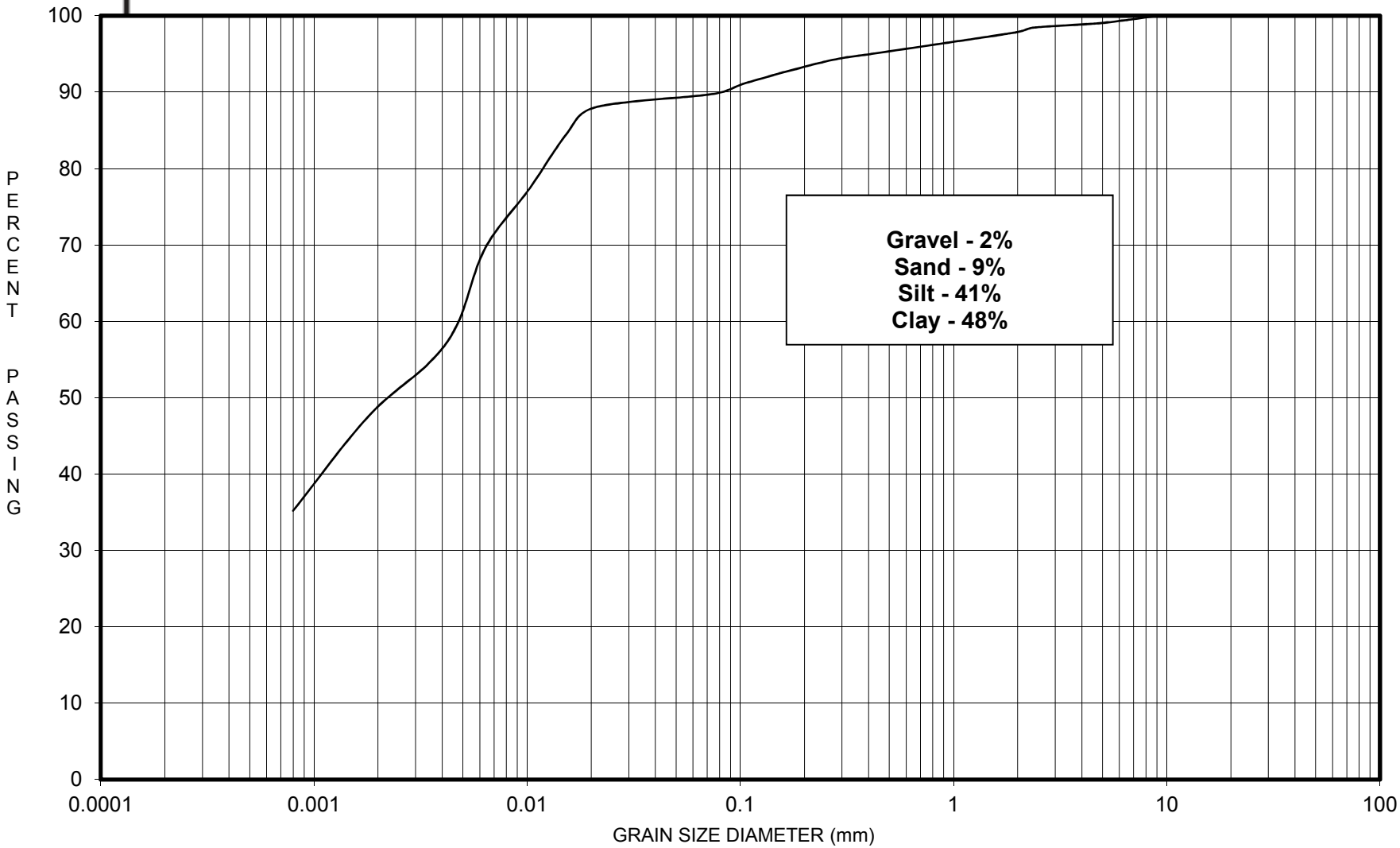
Approximate Elevation (m)	Soil Description
TP101	
276.6 – 276.3	TOPSOIL – 250 mm
276.3 – 275.7	SANDY SILT – brown, loose, very moist
275.7 – 272.0	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
273.5	- becoming grey
272.0	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP102	
274.7 – 274.4	TOPSOIL – 250 mm
274.4 – 273.8	SANDY SILT – brown, loose, very moist
273.8 – 269.2	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
271.3	- becoming grey
269.2	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP103	
275.1 – 274.8	TOPSOIL – 250 mm
274.8 – 274.2	SANDY SILT – brown, loose, very moist
274.2 – 269.6	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
272.4	- becoming grey
269.6	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP104	
276.5 – 276.2	TOPSOIL – 300 mm
276.2 – 275.6	SANDY SILT – brown, loose, very moist
275.6 – 271.0	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
274.4	- becoming grey
271.0	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.

Approximate Elevation (m)	Soil Description
TP105	
274.9 – 274.6	TOPSOIL – 250 mm
274.6 – 274.0	SANDY SILT – brown, loose, very moist
274.0 – 269.4	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
271.8	- becoming grey
269.4	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP106	
274.4 – 274.1	TOPSOIL – 250 mm
274.1 – 273.5	SANDY SILT – brown, loose, very moist
273.5 – 268.9	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
272.0	- becoming grey
268.9	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP107	
274.0 – 273.7	TOPSOIL – 250 mm
273.7 – 273.1	SANDY SILT – brown, loose, very moist
273.1 – 268.5	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
271.9	- becoming grey
268.5	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.
TP108	
274.5 – 274.2	TOPSOIL – 250 mm
274.2 – 273.6	SANDY SILT – brown, loose, very moist
273.6 – 269.0	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
271.4	- becoming grey
269.0	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.

Approximate Elevation (m)	Soil Description
TP109	
276.4 – 276.0	TOPSOIL – 410 mm
276.0 – 275.4	SANDY SILT – brown, loose, very moist
275.4 – 270.8	CLAYEY SILT TILL – brown, trace sand, trace gravel, stiff to very stiff, moist
273.7	- becoming grey
270.8	*Test pit terminated.*
	Test pit was open upon completion of excavation; no groundwater seepage was observed upon completion of excavation.

Appendix B – Laboratory Results

MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			
MODIFIED M.I.T. CLASSIFICATION	**Sample Description: BH103/MW S4, 3.0-3.5 m**						**Westwinds Lands Project: LON-00015718-GB**			**Figure 1**

Appendix C - Limitations and Use of Report

LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to exp by its client ("Client"), communications between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.