• W3 – Lambeth Farms Inc.

c/o York Developments

Geotechnical Investigation

Project Name
Proposed Residential Subdivision
3700 Colonel Talbot & 3645 Bostwick Road
London, Ontario

Project Number
LON-00014456-GE

Prepared By:
exp Services Inc.
15701 Robin's Hill Road
London, ON N5V 0A5
Canada

Date Submitted
March 18, 2016
Revised May 26, 2016
Updated June 21, 2016
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1. Introduction

As requested, **exp** Services Ltd. has conducted a geotechnical investigation in conjunction with a proposed residential subdivision to be located between 3700 Colonel Talbot Road and 3645 Bostwick Road in London, Ontario.

This report summarizes the results of the investigation, and provides geotechnical engineering guidelines to assist with the design and construction of the proposed project.

1.1 Terms of Reference

The geotechnical investigation was generally done in accordance with our proposal dated December 17, 2015. Authorization to proceed with the preliminary investigation was received from Mr. Sean Eden of York Developments on February 2, 2016. Additional drilling occurred in August of 2017 to support **exp**'s assessment as requested by York Developments. Borehole information from that drilling has been incorporated into this report. The report has been updated to incorporate the findings and monitoring data.

The purpose of the investigation was to examine the subsoil and groundwater conditions at the site by advancing a series of boreholes at the locations illustrated 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 excavated at the site, **exp** Services Inc. has provided engineering guidelines for the geotechnical design and construction of the proposed development. More specifically, this report provides comments on excavations, dewatering, site preparation, foundations, slab-on-grade and basement construction, bedding and backfill, earthquake design considerations, and pavement recommendations.

This report is provided on the basis of 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.

2. Methodology

The fieldwork for the preliminary investigation was carried out on February 25th and 26th, 2016. In general, the geotechnical investigation consisted of drilling twenty (20) boreholes at the locations denoted on **Drawing 1** as BH1 to BH20, inclusive. Additional boreholes were advanced on August 10th, 11th and 14th, 2017 to aid in **exp**'s Hydrogeological Assessment. The additional seven (7) borehole locations are labelled as BH101/MW to BH105/MW on **Drawing 1**. Nested wells (i.e. one deep borehole/well, one shallow borehole/well) were installed at the locations of Borehole BH102 and BH104.

The boreholes and the monitoring well installations were completed by a specialist drilling subcontractor under supervision of **exp** geotechnical staff. The boreholes and the monitoring well installations were advanced utilizing a track-mounted drill rig equipped with continuous flight solid and hollow stem augers, soil sampling and soil testing equipment. In each borehole, disturbed soil samples were recovered at depth intervals of 0.75 m and 1.5 m using conventional split spoon sampling equipment and Standard Penetration Test (SPT) methods.

During the excavation, the stratigraphy in the boreholes was examined and logged in the field by **exp** geotechnical personnel.

Short-term groundwater levels within the open boreholes and long-term groundwater level within the installed monitoring wells were observed and are recorded in the borehole and monitoring well logs found in **Appendix A**.

Representative samples of the various soil strata encountered at the test locations were taken to our laboratory in London for further examination by a geotechnical engineer and laboratory classification testing. Laboratory testing for this investigation comprised of routine moisture content determinations with results presented on the borehole logs found in Appendix A and one (1) grain size analysis with results presented in **Appendix B**.

The location of each borehole was established in the field using UTM coordinates. Ground surface elevations were interpreted from City of London digital mapping.

Samples remaining after the classification testing will be stored for a period of three months following the date of sampling. After this time, they will be discarded unless prior arrangements have been made for longer storage.

3. Site and Subsurface Conditions

3.1 Site Description

At the time of the investigation, the study area was characterized by agricultural land, surrounded by fields, a church to the southeast and residential areas to the west and southwest.

In general, the site is relatively flat with minor raised areas toward the west of the site.

3.2 Site Physiography

Overburden deposits in the study area were formed by numerous glacial events during the Wisconsinan ice age approximately 15,000 to 25,000 years before present. Thick glacial ice sheets advanced several times into the southern part of the province from various directions and then receded creating the present configuration of moraines, abandoned spillways, drumlins, eskers, abandoned shorelines, and various stillwater sediment deposits. The surficial deposits were mapped and categorized into a number of physiographic regions by Chapman and Putnam (1984).

The Mount Elgin Ridges physiographic region consists of a series of morainic ridges which trend generally parallel to the present-day Lake Erie shoreline. These morainic ridges are composed mainly of clay-silt till and represent minor standstills of the ice front of a continental glacier shrinking into the Lake Erie basin. From north to south these moraines are the Ingersoll, Westminster, St. Thomas, and Norwich Moraines.

3.3 Soil Stratigraphy

The detailed stratigraphy encountered in the boreholes is shown in the borehole logs found in **Appendix A**, and summarized in the following paragraphs. It must be noted that boundaries of soil indicated in the borehole logs are inferred from non-continuous sampling and observations during drilling. 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.

3.3.1 Topsoil

Each borehole was surfaced with a layer of topsoil. The topsoil, generally described as dark brown to black silt loam, loose and moist with rootlets, extended to depths ranging between about 250 mm and 460 mm.

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

3.3.2 Glacial Till

Underlying the topsoil, the predominant material, typically a silty clay till was encountered and extended to depths ranging from 1.6 to 11.7 m below ground surface (bgs), extending throughout the depth of some boreholes. Multiple till layers were encountered in some of the

deeper boreholes. The silty clay till was generally described as brown (often transitioning to grey below 2.3 to 5.0 m below existing grade), with trace to some sand, trace to some gravel, and stiff to hard (based on tactile examination, observed drill resistance, and Standard Penetration Test (SPT) N Values typically ranging from 11 to 60 blows per 300 mm of split spoon sampler penetration). Based on laboratory testing, the *in situ* water content of the silty clay till ranged between 11 and 25 percent, generally indicative of moist soil conditions.

In the upper 1.4 m below ground surface (bgs) of Boreholes BH4, BH6, BH10, and BH20, the silty clay till was firm in consistency with SPT N Values of 6 to 7.

Sandy silt till was observed below the silty clay till in Boreholes BH102/MW, BH103/MW, BH104/MW, and BH105/MW. It was brown with trace to some clay, trace gravel and very dense (SPT N Values of greater than 50 blows per 150 mm split spoon penetration). Through tactile examination, the sandy silt till was found to be in a damp to moist state.

3.3.3 Silty Sand

Within Boreholes BH3, BH7, BH20, BH102/MW and BH102B/MW, a stratum of silty sand was encountered below the silty clay material and extended to depths ranging between 4.0 to 6.6 m below existing grades. The silty sand was generally described as brown, fine to medium grained, containing trace clay, trace to some gravel, and compact to very dense (based on tactile observations, observed drill resistance, and Standard Penetration Test (SPT) N Values ranging from 11 to 50 blows per 300 mm of split spoon sampler penetration). Based on laboratory testing, the *in situ* water content of the silty sand ranged between 5 and 12 percent, generally indicative of moist soil conditions. In Boreholes BH102/MW and BH102B/MW, the silty sand was in a wet state as determined through tactile examination.

A grain size analysis was carried out on a sample of the silty sand in Borehole BH102/MW with results presented in Figure 1, **Appendix B**.

3.3.4 Silt/Sandy Silt

A layer or layers of silt/sandy silt were encountered in Boreholes BH10, BH15/MW, BH101/MW, BH102/MW, BH102B/MW, BH104/MW and BH105/MW. The silt occasionally contained trace to some clay and was generally described as grey with trace sand to sandy and compact to very dense (based on tactile examination, observed drill resistance, and Standard Penetration Test (SPT) N Values ranging from 15 to greater than 50 blows per 150 mm split spoon sampler penetration). Based on laboratory testing, the *in situ* water content of the silt ranged between 7 and 14 percent, generally indicative of moist soil conditions.

The sandy silt encountered in Boreholes BH104/MW and BH105/MW was brown in colour. The sandy silt in Borehole BH104/MW was described as very moist and dilatant while the sandy silt at Borehole BH105/MW was located just below the topsoil and was in a moist state.

3.5.5 Sand/Sand and Gravel

Boreholes BH19, BH101/MW, BH104/MW, BH104B/MW and BH105/MW encountered a layer of sand or sand and gravel. The sand/sand and gravel was generally described as brown becoming grey below 10.8 m bgs in Borehole BH104/MW, with trace to some silt. It was compact to very dense (based on SPT N Values of 15 to greater than 50 mm per 150 mm split

spoon sampler penetration) and very moist to wet (*in situ* moisture content of 11 percent and tactile examination). Based on tactile examination, the lower layers of sand and sand and gravel in Borehole BH104/MW were described as damp to moist, and damp.

3.4 Groundwater

Ten (10) monitoring wells in total were installed at the site. Three (3) were installed during the drilling February 25th and 26th, 2016 and seven (7) were installed between August 11th and 14th, 2017. The wells were installed to depths ranging between 1.5 m and 14.2 m bgs. The summary of well construction details is presented in Table 1 (below).

Well ID	Ground Elevation (m)	Completion Depth (m bgs)	Screen Length (m)
BH3/MW	265.2	6.1	3.0
BH12/MW	273.0	7.6	3.0
BH15/MW	269.7	6.1	3.0
BH101/MW	270.6	7.6	1.5
BH102/MW	273.0	10.1	1.5
BH102B/MW	273.0	7.0	1.5
BH103/MW	271.2	12.2	3.0
BH104/MW	271.6	14.2	3.0
BH104B/MW	271.6	7.3	1.5
BH105/MW	263.7	1.5	0.6

Table 2 (below) summarizes the stabilized groundwater level measurements recorded in the monitoring wells on the subject site.

Well ID	Depth to Groundwater (m bgs) *(Elevation of Groundwater, m ASL)*			
	Mar. 17/16	**Jun. 1/17**	**Aug. 16/17**	**Sep. 14/17**
BH3/MW	6.1 *(259.1)*	Dry	N/A	N/A
BH12/MW	0.8 *(272.2)*	1.1 *(271.9)*	4.6 *(268.4)*	4.9 *(268.1)*
BH15/MW	5.0 *(264.7)*	6.0 *(263.7)*	N/A	N/A
BH101/MW	N/A	N/A	6.3 *(264.3)*	6.4 *(264.2)*
BH102/MW	N/A	N/A	Dry	Dry
BH102B/MW	N/A	N/A	4.3 *(268.7)*	4.8 *(268.2)*
BH103/MW	N/A	N/A	Dry	Dry
BH104/MW	N/A	N/A	Dry	Dry
BH104B/MW	N/A	N/A	4.9 *(266.7)*	5.9 *(265.7)*
BH105/MW	N/A	N/A	1.2 *(262.5)*	1.5 *(262.2)*

Note: N/A denotes a damaged well, well not yet installed, or that no water level reading was taken.

The monitoring wells have been registered with the Ministry of Environment and Climate Change (MOECC), in accordance with Ontario Regulation 903, and remain intact for the purposes of ongoing monitoring of stabilized groundwater conditions, as needed. The measurements provided in Table 2 above indicate a variation of the shallow overburden groundwater table between approximate elevations of 259.1 m and 272.2 m over the monitored period, with the groundwater level generally deepening in an easterly to westerly direction.

Details of the groundwater conditions observed within the boreholes are provided on the attached Borehole Logs. Upon completion of drilling, the open borehole excavations were examined for the presence of groundwater and groundwater seepage. All boreholes without observation wells installed were open and dry upon completion of drilling with the exception of Boreholes BH19 and BH20, with measurements of 2.4 m bgs and 4.3 m bgs respectively.

It is 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 higher levels in wet seasons. Capillary rise effects should also be anticipated in fine-grained soil deposits.

3.5 Methane Gas Testing

An RKI Gx-2003 Gas Detector was used in the upper levels of the boreholes. The unit measures LEL combustibles, methane gas, oxygen content, carbon monoxide and hydrogen sulfide in standard confined space gases. No methane gas was detected in the tested boreholes/monitoring wells.

4. Discussion and Recommendations

4.1 General

It is understood that the proposed development will consist primarily of single detached residential dwellings and condominium buildings. The residential subdivision is expected to have complete municipal servicing, and will be accessed with paved local roads.

The following sections of this report provide geotechnical comments and recommendations regarding site preparation, excavations and dewatering, building foundations, slab-on-grade and basement construction, earthquake design considerations, and pavement design.

4.2 Site Preparation

Prior to placement of foundations, pipe bedding and/or engineered fill, all surficial topsoil, vegetation and/or otherwise deleterious materials should be stripped. The surficial topsoil may be stockpiled on site for possible reuse as landscaping fill.

Following the removal of the topsoil and prior to fill placement, the exposed subgrade should be inspected by a geotechnical engineer. Any loose or soft zones noted in the inspection should be over-excavated and replaced with approved fill.

It is recommended that construction traffic be minimized on the finished subgrade, and that the subgrade be sloped to promote surface drainage and runoff.

In the building areas where the grade will be raised, the fill material should comprise imported granular or approved onsite (excavated) material. The fill material should be inspected and approved by a geotechnical engineer and should be placed in maximum 300 mm (12 inch) thick lifts and uniformly compacted to 100 percent Standard Proctor Maximum Dry Density (SPMDD) within 3 percent of optimum moisture content. The geometric requirements for engineered fill are provided on **Drawing 2**.

The natural materials on site would be suitable for reuse as engineered fill. The material should be examined and approved by a geotechnical engineer prior to reuse.

In areas along the proposed roadways, fill material used to raise grades may comprise onsite excavated soils, or imported granular fill approved by an engineer. The fill should be placed in maximum 300 mm (12 inch) thick lifts and uniformly compacted to 95/98 percent SPMDD within 3 percent of optimum moisture content in order to provide adequate stability for the new pavements.

In situ compaction testing should be carried out during the fill placement to ensure that the specified compaction is being achieved.

If imported fill material is utilized 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 MOECC standards for placement and transportation. The disposal of excavated materials must conform to the MOECC Guidelines and requirements. **Exp** can be of assistance if an assessment of the materials is required.

4.3 Excavation and Dewatering

Side slopes of temporary excavations must conform to Regulation 213/91 of the Occupational Health and Safety Act of Ontario. The stiff to hard silty clay till is classified as Type 2 soil, while the silty sand, silt/sandy silt, sand/sand and gravel and firm silty clay till is classified as Type 3 soil. For excavations which extend through and terminate in Type 2 soil, temporary excavation side slopes may be cut near vertical in the bottom 1.2 m (4 ft), and should be cut at an inclination of 1 horizontal to 1 vertical above that level. For excavations which extend through and/or terminating in Type 3 soils, temporary excavation side slopes must be cut at an inclination of 1 horizontal to 1 vertical from the base of the excavation. Should groundwater egress loosen the side slopes, slopes of 3H:1V or flatter will be required.

Geotechnical inspection at the time of excavation can confirm the soil type present.

Although not encountered, it should be noted that the presence of cobbles and boulders in natural glacial deposits may influence the progress of excavation and construction.

Localized base improvement may be required for services bedded in wet silty soils especially in wet weather seasons. Some areas of crushed stone bedding enclosed with a geotextile may be required upon the recommendation of a geotechnical engineer when additional information becomes available through field inspections during the construction stage.

Based on the soil texture encountered during the investigation, significant groundwater infiltration is not anticipated within service trench and foundation excavations to typical depths. Groundwater infiltration can likely be accommodated using conventional sump pumping techniques; however, if groundwater infiltration persists, more extensive dewatering measures may be required. **Exp** would be pleased to provide further information in this regard, upon request.

The 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 for this project, it should be noted that for projects requiring positive groundwater control with a removal rate more than 50,000 litres per day, an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW) will be required. PTTW applications are required for removal rates more than 400,000 L per day and will need to be approved by the MOECC per 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 which may be required to support the application.

4.4 Building Foundations

It is understood that low rise residential units will be constructed at the site. The proposed residential units can be supported on conventional spread and strip footings founded below the topsoil or unsuitable soils on the natural competent subgrade soils, or engineered fill.

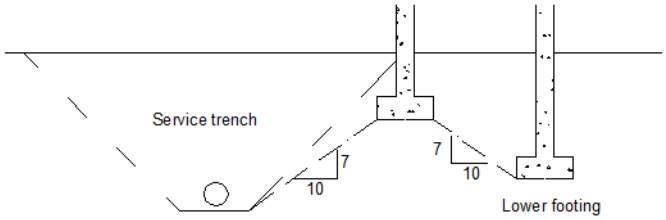
The footings placed on the natural undisturbed subgrade below depth of approximately 1.2 m bgs can be designed for the following bearing resistances:

Bearing Resistance at Serviceability Limit States (SLS) 145 kPa (3000 psf)

Factored Bearing Resistance at Ultimate Limit States (ULS) 220 kPa (4500 psf).

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.

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

If the grades are to be raised or restored due to unsuitable soils, engineered fill can be used over the competent subgrade, as described in the previous Section 4.2. For footings placed on engineered fill, it is recommended that the strip footings be widened to 500 mm (20 inches), and contain nominal concrete reinforcing steel. Verification of the soil conditions and the extent of reinforcement is best determined by the geotechnical engineer, at the time of excavation.

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.

It should be noted that the recommended bearing capacities have been calculated by **exp** from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, if more specific information becomes available with respect to conditions between boreholes when foundation construction is underway. The interpretation between the boreholes 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 Basements

The basement floors can be cast slab-on-grade provided the subgrade is stripped of all topsoil and other obviously objectionable material. The subgrade should then be proof-rolled thoroughly. Any soft spots detected should be dug out and replaced with clean compactable excavated material placed in accordance with the requirements outlined in Section 4.2.

A 200 mm (8 inch) compacted layer of 19 mm (¾ inch) clear stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

The installation and requirement of vapour barrier under the floor slab, where applicable, should conform to the flooring manufacturer's and designer's requirements. Moisture emission testing is recommended to determine the concrete condition prior to flooring installation.

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 (psf) acting at a depth h:

K = earth pressure coefficient, assumed to be 0.40;

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

h = depth to point of interest in m (ft) and,

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

If basements are planned, installation of perimeter drains is required. 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 Slab-on-Grade Construction

Preparation of the subgrade should include the removal of all topsoil and/or deleterious material from the proposed building area. The entire floor slab area should then be thoroughly proof-rolled with a heavy roller and examined by a geotechnical engineer. Any excessively soft or loose areas should be sub-excavated and replaced with suitable fill and compacted. Where the exposed subgrade requires reconstruction to achieve the design elevations, structural fill should be used. It is recommended that structural fill be comprised of granular material, such as OPSS Granular 'B', or approved alternative material. The fill should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density (SPMDD). For best compaction results, the *in situ* moisture content of the fill should be within about three percent of optimum, as determined by Standard Proctor density testing.

No special underfloor drains are required provided that the exterior grades are lower than the floor slab, and positively sloped away from the slab. It is recommended that an impermeable soil seal such as clay, asphalt or concrete be provided on the surface to minimize water infiltration from the exterior of the building. See **Drawing 4** for Drainage and Backfill recommendations for slab-on-grade construction.

A moisture barrier, consisting of a 200 mm (8 in.) thick, compacted layer of 19 mm (3/4 in.) clear stone, should then be placed between the prepared granular sub-base and the floor slab. The installation and requirement of a vapor barrier under a concrete slab should conform to the flooring manufacturer's and designer's requirements. Moisture emission testing 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., 0.45 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.

For slab on grade design, the modulus of subgrade reaction (*k*) can be taken as 25 MPa/m for the compacted stone layer over the compacted granular subbase.

The water-to-cement ratio and slump of concrete utilized in the floor slabs should be strictly controlled to minimize shrinkage of the slabs. 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.

4.7 Foundation Backfill

In general, the existing natural soils excavated from the foundation area should be suitable for re-use as foundation wall backfill if the work is carried out during relatively dry weather. The materials to be re-used should be within three percent of optimum moisture for best compaction results. Materials should be stockpiled per their composition; i.e. sandy soils should not be mixed with clayey soils.

If the weather conditions are very wet during construction, then imported granular material such as OPSS Granular 'B' should be used. Site review by the geotechnical consultant may be advised.

The backfill must be brought up evenly on both sides of walls not designed to resist lateral earth pressures.

During construction, the fill surface around the perimeter of structures should be sloped in such a way that the surface runoff water does not accumulate around the structure.

4.8 Pipe Bedding and Trench Backfill

The subgrade soils beneath the water and sewer pipes which will service the site are generally expected to comprise of glacial till. For services constructed on the natural soil or engineered fill, the bedding should conform to City of London and OPS Standards. The bedding course may be thickened if portions of the subgrade become wet during excavation. Bedding aggregate should be placed around the pipe to at least 300 mm (12 inch) above the pipe, and 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.

The trenches above the specified pipe bedding should be backfilled with inorganic on-site soils placed in 300 mm thick lifts and uniformly compacted to at least 95% SPMDD. For trench backfill within 1 metre below the roadway subbase, the fill should be uniformly compacted to at least 98% SPMDD. A program of *in situ* density testing should be set up to ensure that satisfactory levels of compaction are achieved.

Based on the results of this investigation, the majority of the excavated natural sands, silts and glacial till material may be used for construction backfill provided that reasonable care is exercised in handling. In this regard the material should be within 3 percent of the optimum moisture as determined in the standard Proctor density test, and stockpiling of material for prolonged periods of time should be avoided. This is particularly important if construction is carried out in wet or otherwise adverse weather.

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 **Drawing 5** and **6**. A program of *in situ* density testing should be set up to ensure that satisfactory levels of compaction are achieved.

4.9 Shallow Groundwater

Shallow groundwater was observed in Borehole BH12/MW in March 2016 and June 2017 and in Borehole BH105/MW in August and September 2017. It is likely that the water was perched overtop of relatively impermeable glacial till deposits.

Soils excavated from below the stabilized groundwater table may be too wet for reuse as backfill unless adequate time is allowed for drying, or if the material is blended with approved dry fill; otherwise, it may be stockpiled onsite for reuse as landscape fill.

As noted previously, disposal of excavated materials off site should conform to current MOECC guidelines.

Shallow groundwater flow across the site is typically affected by the soil permeability, topography and drainage. Intermediate and deep aquifers are significantly less affected by surface conditions. The monitoring wells installed at the site are set into the shallow groundwater.

The texture of the predominant subgrade soils in the area is described as silty clay till and sand and silt layers. The clay deposits generally have a very low permeability and act as an effective barrier to minimize vertical groundwater movement.

In any event, the following general recommendations are provided for review and consideration.

The natural excavated soils should be used as backfill where possible to minimize the change in hydraulic conductivity within the service trenches.

In the event the sewer excavations encounter any wet sandy soils, and for those areas where the excavations extend below the stabilized shallow groundwater table, clay collars may be installed at strategic locations, if necessary, as part of the contingency plan. This can be best assessed during the early stage of construction by a geotechnical engineer.

4.10 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. The subsoils on the Site generally consist of topsoil over silty sand, sand/sand and gravel, silt/sandy silt and silty clay till. It is anticipated that the proposed structure(s) will be founded on the silty clay till.

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 founding level) are to be used. The boreholes advanced on Site were to a maximum of about 14.2 m depth. Therefore, the site classification recommendation would be based on the available information as well as our interpretation of conditions below the boreholes 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 building is "D" as per Table 4.1.8.4.A, Site Classification for Seismic Site Response, OBC 2012.

4.11 Pavement Design

Areas to be paved should be stripped of all topsoil, organics and other obviously unsuitable material. The exposed subgrade must then be proof-rolled. Any soft spots 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 discussed 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 specified street classifications (local roads) and anticipated subgrade conditions.

Recommended Pavement Structure Thickness				
Pavement Layer	Compaction Requirements	Local Road/Laneways between Condominium Units	Collector Road	Arterial Road (Bostwick or Colonel Talbot Road Tie-In)
Asphaltic Concrete	97% Marshall Density	40 mm HL-3 50 mm HL-8	40 mm HL-3 2 x 45 mm HL-8	60 mm HL-3 2 x 60 mm HL-8
Granular 'A' (Base)	100% SPMDD[1]	150 mm	150 mm	150 mm
Granular 'B' (Subbase)	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. 4) The City of London pavement design is based on allowable deflection as Determined by Benkleman Beam Rebound testing.				

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. As well, if only a portion of the pavement will be in place during construction, the granular subbase may have to be thickened, and/or the subgrade improved with a geotextile separator.

Samples of both the Granular 'A' and Granular 'B' aggregates should be checked for conformance to OPSS 1010 prior to utilization 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. The asphalt should be placed in accordance with OPSS 310 and compacted to at least 97 percent of the Marshall mix design bulk density. A tack coat should be applied between the surface and binder asphalt.

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 catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. In low areas, subdrains may be required to intercept excess subsurface moisture and prevent subgrade softening, as shown on **Drawing 7**, depending upon soil conditions at the time of construction. 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.

To minimize the effects of differential settlements of service trench fill, it is recommended that wherever practical, placement of binder asphalt be delayed for approximately six months after the granular sub-base is put down. The surface course asphalt should be delayed for a further one year. Prior to the surface asphalt being placed, it is recommended that a pavement evaluation be carried out on the base asphalt to identify repair areas or areas requiring remedial works prior to surface asphalt being placed.

4.12 Curbs and Sidewalks

The concrete for the curbs, gutters and sidewalks 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 must be covered with insulating blankets to protect against freezing. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature, and slump tests should be made from the same batch of concrete from which test cylinders are made.

The subgrade for the sidewalks should comprise of undisturbed natural competent soil of well-compacted fill. A minimum 150 mm thick layer of compacted Granular 'A' type aggregate should be placed beneath the sidewalk slabs. It is recommended that the Granular 'A' be compacted to a minimum 100 percent SPMDD, to provide adequate support for the concrete sidewalk. Construction traffic should be kept off the placed curbs and sidewalks as they are not designed to withstand heavy traffic load.

4.13 Methane Gas Testing

An RKI Gx-2003 Gas Detector was used in the upper levels of the boreholes. The unit measures LEL combustibles, methane gas, oxygen content, carbon monoxide and hydrogen sulfide in standard confined space gases. No methane gas was detected in the tested boreholes.

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

4.14 Inspection and Testing Requirements

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

- Subgrade examination prior to engineered fill placement;
- Inspection and Materials testing during engineered fill placement (full-time supervision is recommended) and 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 for residential footings set on engineered fill to confirm its suitability to support the design bearing pressures;
- Visual examination of concrete reinforcing steel placement in footings set on engineered fill; and,
- Benkleman Beaming of roads for City of London assumption.

Exp would be pleased to prepare an inspection and testing work program prior to construction, incorporating the above items.

5. General Comments

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 in regards to 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.

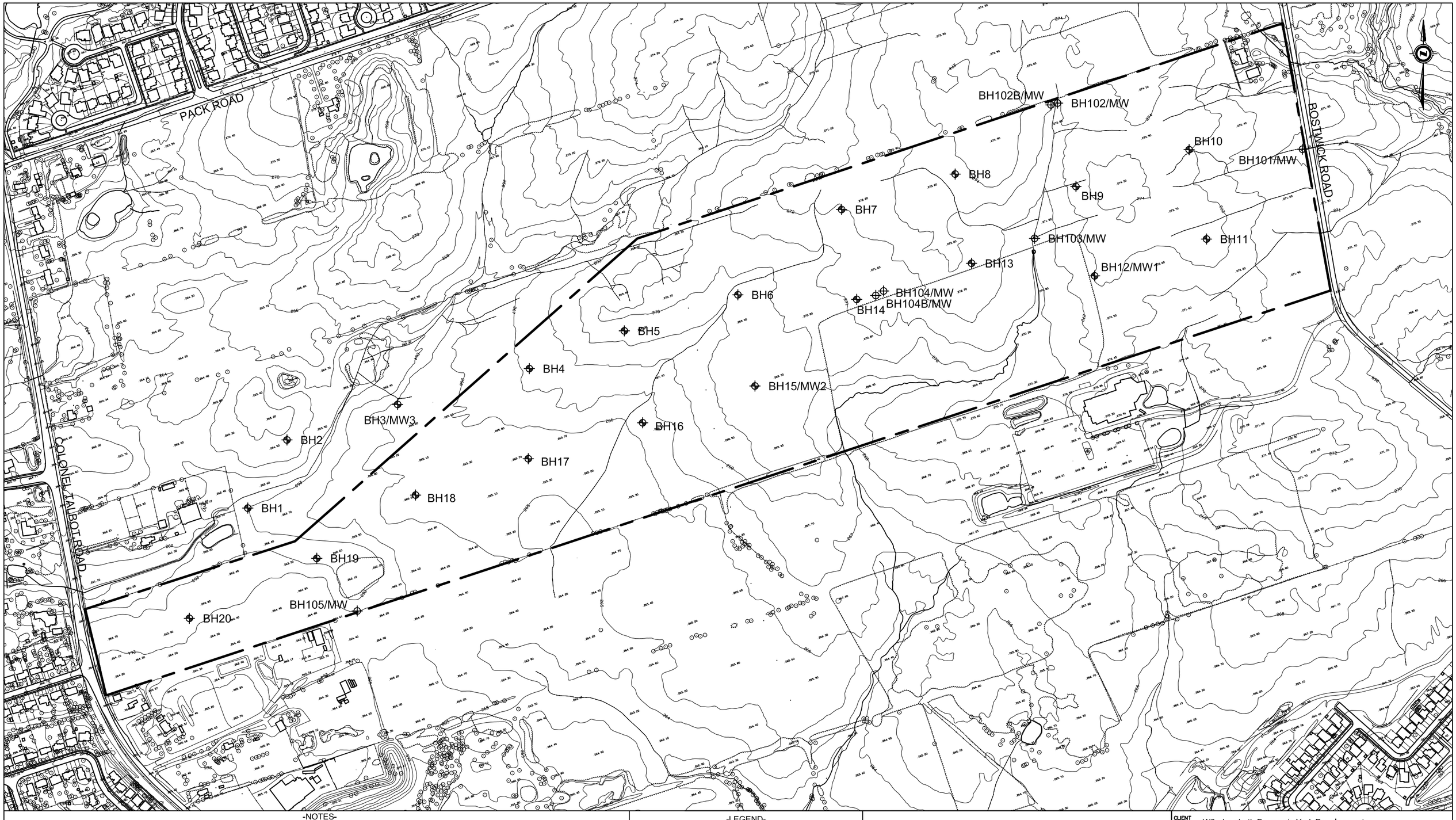
The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than 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

This report was prepared for the exclusive use of W3 Lambeth Farms Inc. c/o York Developments and may not be reproduced in whole or in part, without the prior written consent of **exp**, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **Exp** Services Inc. 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 trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Drawings



-NOTES-

1. The site plan has been reproduced from City of London Digital Mapping and should be read in conjunction with exp Geotechnical Report LON-00014456-GE.

-LEGEND-

BH20	Approximate Borehole Location (2016)
BH105/MW	Approximate Borehole Location (2017)

Geotechnical Investigation

Proposed Residential Development

3700 Col. Talbot Rd & 3645 Bostwick Rd, London, ON

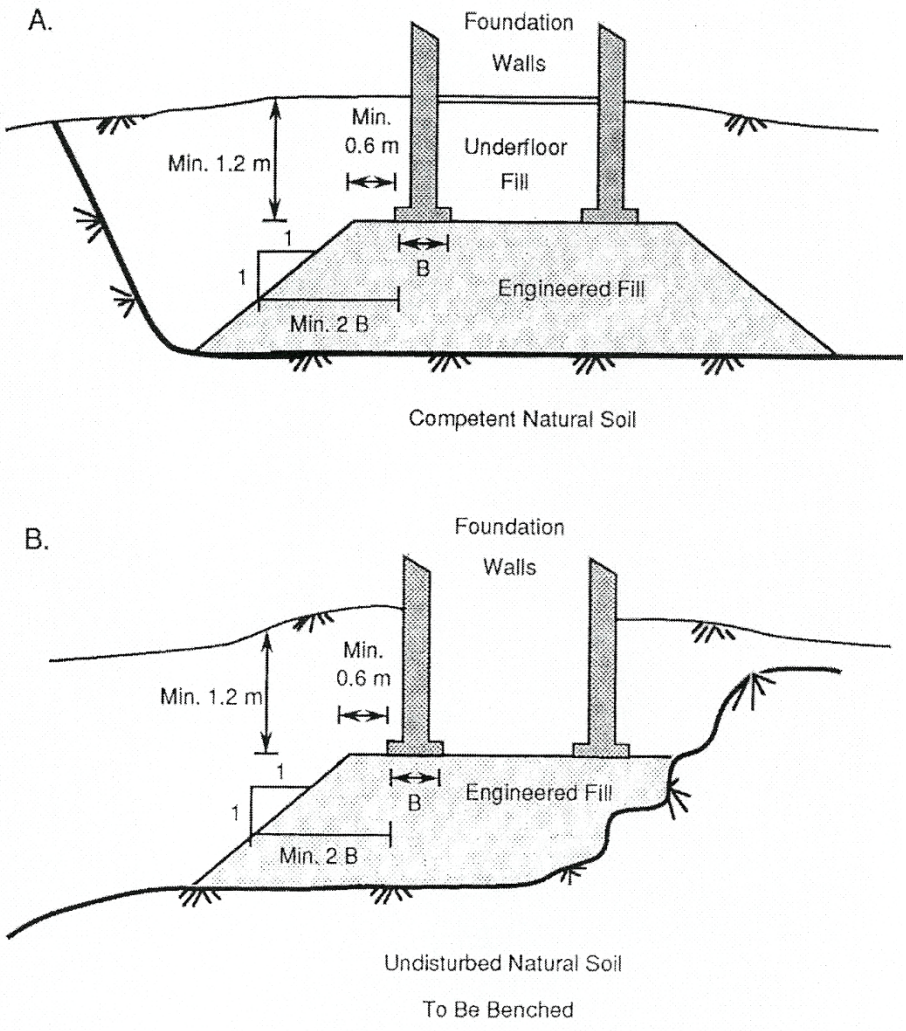
CLIENT	W3 - Lambeth Farms c/o York Developments
TITLE	Borehole Location Plan
DRAWN BY: E.B.	REVIEWED BY: B.C.

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

DATE	SCALE	PROJECT NO.	DWG.
OCTOBER 2017	NTS	LON-00014456-GE	1

DRAWING 2 – GEOMETRIC REQUIREMENTS FOR FOUNDATIONS ON ENGINEERED FILL

Schematic (Not to Scale)

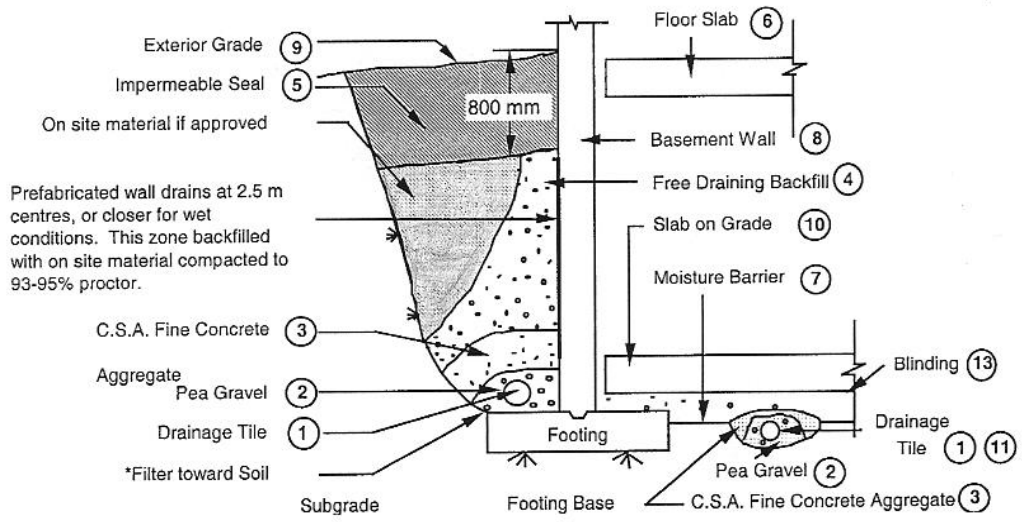


SECTION VIEW
Section A – Typical Section of Slab-on-Grade Building
Section B – Typical Section of Building with Basement
Refer to Detailed Notes on following page.

NOTES FOR ENGINEERED FILL PLACMENT:

1. The area must be stripped of all topsoil contaminated fill material, and other unsuitable soils, and proof rolled. Soft spots must be dug out. The stripped natural subgrade must be examined and approved by an **exp** Engineer prior to placement of engineered fill.
2. In areas where engineered fill is placed on a slope, the fill should be benched into the approved subgrade soils. **Exp** would be pleased to provide additional comments and recommendations in this regard, if required.
3. All excavations must be carried out in accordance with the Occupational Health and Safety Regulation of Ontario (Construction Projects - O.Reg. 213.91)
4. Material used for engineered fill must be free of topsoil, organics, frost and frozen material, and otherwise unsuitable or compressible soils, as determined by a Geotechnical Engineer. Any material proposed for use as engineered fill must be examined and approved by **exp**, prior to use onsite. Clean compactable granular fill is preferred.
5. Approved engineered fill should be placed in maximum 300 mm thick lifts, and uniformly compacted to 100% Standard Proctor dry density throughout. For best compaction results, engineered fill should be within 3 percent of its optimum moisture content, as determined by the Standard Proctor density test. Imported fill should satisfy the MOECC regulations and requirements.
6. Full time geotechnical monitoring, inspection and *in situ* density (compaction) testing by **exp** is required during placement of the engineered fill.
7. Site grades should be maintained during area grading activities to promote drainage, and to minimize ponding of surface water on the engineered fill mat. Rutting by construction equipment should be kept to a minimum, where possible. Additional work to ensure suitability of engineered fill may be required if fill is placed in extreme (hot/cold) weather.
8. The fill must be placed such that the specified geometry is achieved. Refer to sketches (previous page) for minimum requirements. Proper environmental protection will be required, such as providing frost penetration during construction, and after the completion of the engineered fill mat.
9. An allowable bearing pressure of 145 kPa (3000 psf) may be used provided that all conditions outlined above, and in the Geotechnical Report are adhered to.
10. These guidelines are to be read in conjunction with the attached Geotechnical Report. (**exp** Project No. LON-00014456-GE)
11. For foundations set on engineered fill, footing enhancement and/or concrete reinforcing steel placement is recommended. The footing geometry and extent of concrete reinforcing steel will depend on site specific conditions. In general, consideration may be given to having a minimum strip footing width of 500 mm (20 inches), containing nominal steel reinforcement. Alternatively, concrete reinforcement may be recommended in the top and bottom of the foundation wall strip. The final footing geometry and extent of reinforcement is best determined in the field, by a Geotechnical Engineer.
12. For residential sites in the City of London, a letter from the Geotechnical Consultant will be required to verify the extent of engineered fill placement, prior to issuance of Building Permits. Footing Base inspections are required to verify the suitability of the subgrade soils, at the time of construction. In situ density tests may also be required at the footing base level to confirm material density.

DRAWING 3 – BACKFILL AND BASEMENT DRAINAGE DETAIL (NOT TO SCALE)

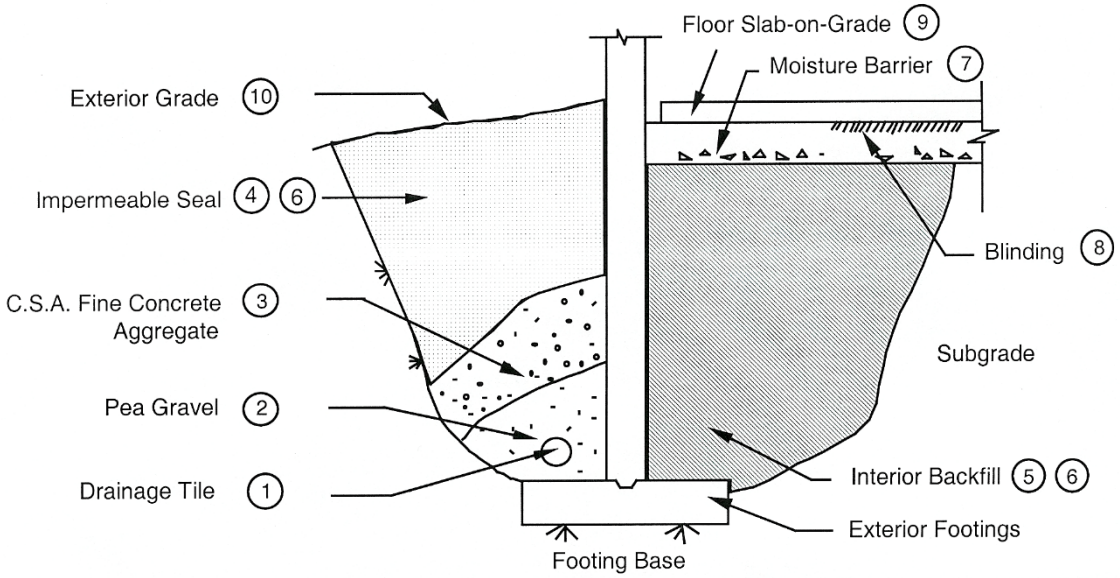


NOTES:

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 4 – DRAINAGE AND BACKFILL RECOMMENDATIONS (NOT TO SCALE)

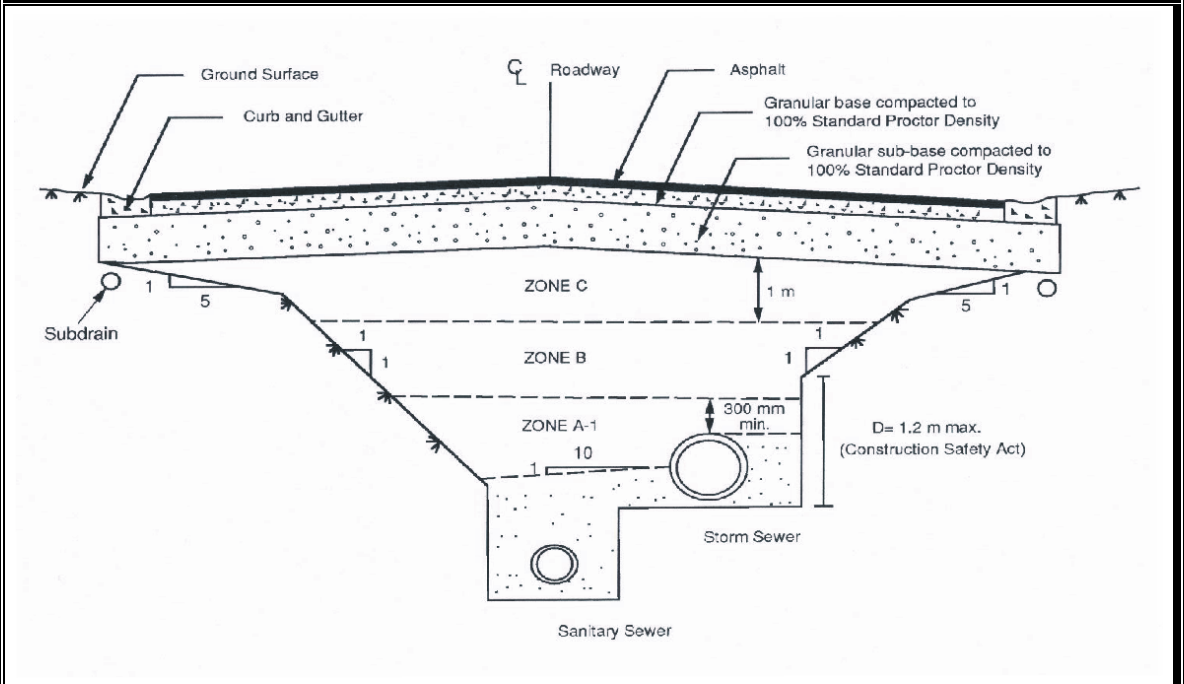


NOTES:

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 interior 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. Impermeable backfill seal of compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Compact backfill to 95 percent Standard Proctor Maximum Dry Density.
5. The interior fill may be any clean, inorganic soil which may be compacted to at least 95 percent Standard Proctor density in this confined space.
6. Do not use heavy compaction equipment within 450 mm (18 in.) of the wall. Do not fill or compact within 1.8 m (6 ft) of wall unless fill is placed on both sides simultaneously.
7. Moisture barrier to be at least 200 mm (8 in.) of compacted 20 mm (3/4 in.) clear, crushed stone or equivalent free-draining material.
8. If the 20 mm (3/4 in.) clear stone requires surface binding, use 60 mm (1/4 in.) clear stone chips.
9. Slab on grade should not be structurally connected to wall or footing.
10. Exterior grade to slope away from building.

This system is not normally required if the floor is at least 300 mm (1 ft.) above exterior grade.

DRAWING 5 – 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 6 – TRENCH BACKFILL REQUIREMENTS

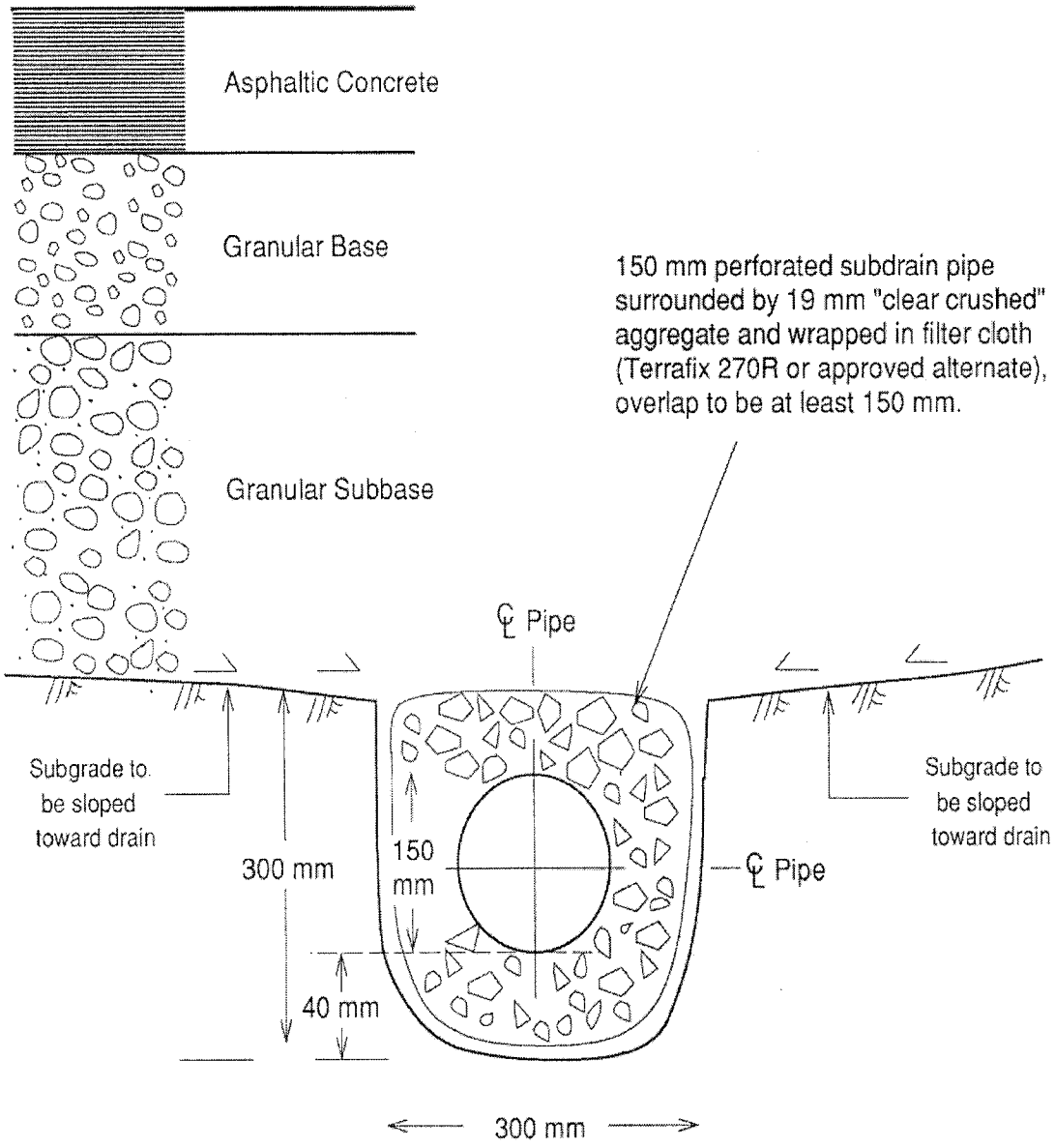
Requirements for backfill in service trenches, etc. should conform to current City of London and OPSS requirements. A summary of the general recommendations for trench backfill is presented on **Drawing 5**.

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 7 – PAVEMENT SUBDRAIN DETAIL



NOTES:

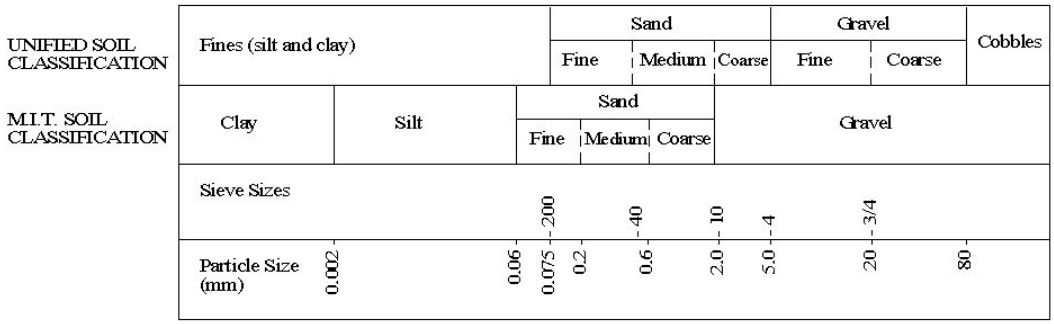
1. All dimensions in millimetres.
2. All subdrains to be set on at least 1% grade draining to a positive outlet.
3. Subgrade soil conditions should be verified onsite, during subgrade preparation works, following site servicing installations.

Scale: NTS

Appendix A – Borehole 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

BH1
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

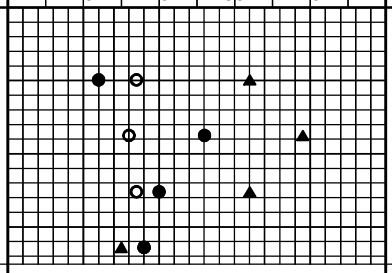
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	263.0								
	262.5	**TOPSOIL** - 460 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist			SS	S1	275	12	17
		- 75 mm, very moist sand lamination near 1.1 m bgs			SS	S2	320	26	16
2									
		- becoming grey near 2.3 m bgs			SS	S3	320	20	17
3	259.5				SS	S4	370	18	18
		End of Borehole at 3.5 m bgs.							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH2
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

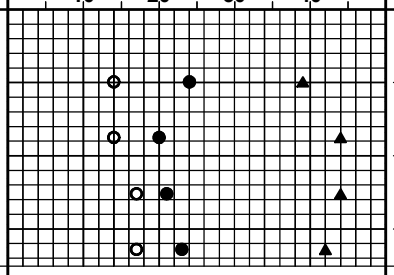
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**264.5**								
	264.1	**TOPSOIL** - 360 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, very stiff, moist			SS	S1	275	24	14
2					SS	S2	320	20	14
3					SS	S3	320	21	17
	261.0	- becoming grey near 3.1 m bgs			SS	S4	275	23	17
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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

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SAMPLE LEGEND
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Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS

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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

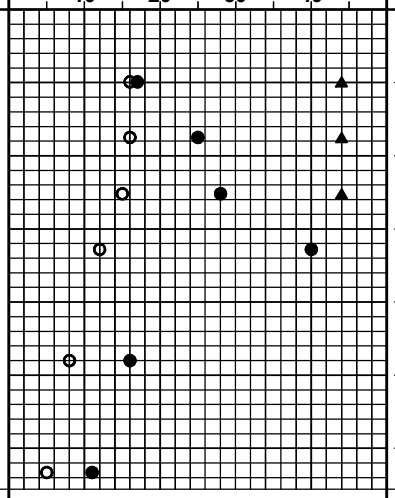
BH3/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	265.2						
	264.8	**TOPSOIL** - 430 mm					
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, very stiff, moist	SS	S1	275	17	16
2			SS	S2	320	25	16
			SS	S3	370	28	15
3	261.9		SS	S4	370	40	12
4		**SILTY SAND** - brown, fine to medium grained, trace clay, some gravel, compact to dense, moist					
5			SS	S5	370	16	8
6	258.6		SS	S6	320	11	5
7		**End of Borehole at 6.6 m bgs.**					
8							
9							
10							
11							
12							
13							
14							
15							



NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
March 17, 2016 - 6.1 m bgs, Elev: 259.1 m
June 1, 2017 - 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
H Hydrometer
S Sieve Analysis
γ Unit Weight
P Field Permeability
K Lab Permeability
C Consolidation
CD Consolidated Drained Triaxial
CU Consolidated Undrained Triaxial
UU Unconsolidated Undrained Triaxial
UC Unconfined Compression
DS Direct Shear

WATER LEVELS
Apparent
Measured
Artesian (see Notes)

BOREHOLE LOG

BH4
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

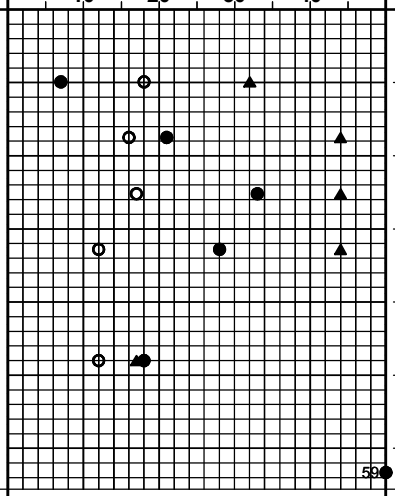
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	267.2								
	266.9	**TOPSOIL** - 280 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, very stiff to hard, moist - firm in upper 1.4 m bgs			SS	S1	275	7	18
2					SS	S2	320	21	16
					SS	S3	415	33	17
3		- becoming grey near 2.8 m bgs			SS	S4	370	28	12
4									
5					SS	S5	370	18	12
6	260.6				SS	S6	320	59	
		End of Borehole at 6.6 m bgs.							
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH5
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

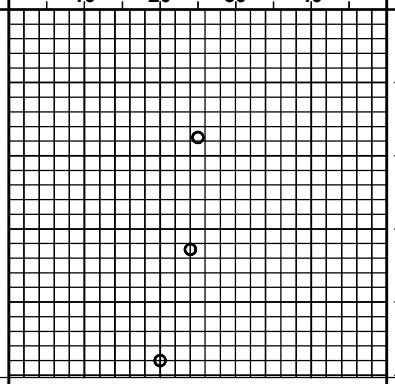
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	269.3								
	269.0	**TOPSOIL** - 300 mm							
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist							
1									
2					AS	S1			25
3					AS	S2			24
4		- becoming grey near 4.0 m bgs							
5	264.3				AS	S3			20
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

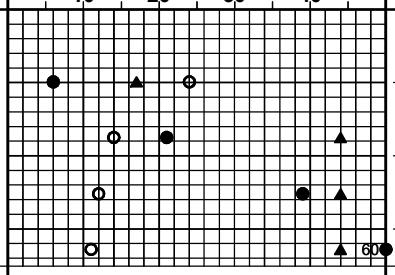
WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH6
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**269.3**								
	269.0	**TOPSOIL** - 350 mm							
1		**SILTY CLAY TILL** - brown, trace to some sand, trace to some gravel, very stiff to hard, moist - firm in upper 1.4 m bgs			SS	S1	185	6	24
2					SS	S2	185	21	14
					SS	S3	230	39	12
3	265.8	- becoming grey near 3.0 m bgs			SS	S4	370	60	11
		End of Borehole at 3.5 m bgs.							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									



NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH7
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

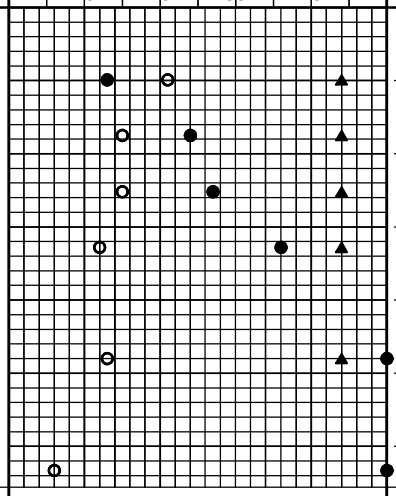
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	272.0								
	271.8	**TOPSOIL** - 250 mm							
1		**SILTY CLAY TILL** - brown, trace sand, some gravel, stiff to very stiff, moist			SS	S1	320	13	21
2					SS	S2	370	24	15
					SS	S3	320	27	15
3		- becoming hard near 2.9 m bgs			SS	S4	275	36	12
4		- silt layer encountered near 3.4 m bgs							
5					SS	S5	275	50*	13
	266.4								
6		**SILTY SAND** - brown, fine to medium grained, trace clay, trace gravel, very dense, moist							
	265.4				SS	S6	275	50**	6
7		**End of Borehole at 6.6 m bgs.**							
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.
5) * denotes 50 blows per 100 mm split spoon penetration.
** denotes 50 blows per 130 mm split spoon penetration.

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

BH8
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.8								
	273.5	**TOPSOIL** - 280 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist							
2					AS	S1			17
3					AS	S2			16
4		- becoming grey near 3.7 m bgs							
5	268.8				AS	S3			17
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH9
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.5								
	273.2	**TOPSOIL** - 300 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace to some gravel, stiff to very stiff, moist							
2					AS	S1			16
3					AS	S2			15
4		- becoming grey near 4.2 m bgs							
5	268.5				AS	S3			17
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH10
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

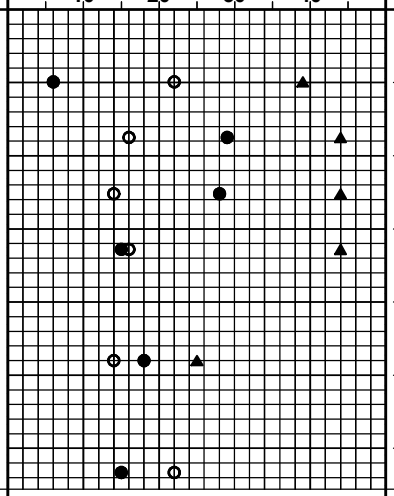
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.1								
	272.9	**TOPSOIL** - 250 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist - firm in upper 1.4 m bgs			SS	S1	140	6	22
2					SS	S2	275	29	16
		- becoming grey near 2.4 m bgs			SS	S3	370	28	14
3					SS	S4	320	15	16
4									
	268.2				SS	S5	320	18	14
5		**SILT** - grey, trace to some clay, trace sand, trace gravel, compact, moist							
6	266.6				SS	S6	275	15	22
	266.5	**SILTY CLAY TILL** - grey, trace sand, trace gravel, very stiff, moist							
7		**End of Borehole at 6.6 m bgs.**							
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH11
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.3								
	273.0	**TOPSOIL** - 300 mm							
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist							
1									
2					AS	S1			20
3					AS	S2			16
4		- becoming grey near 3.9 m bgs							
5	268.3				AS	S3			12
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH12/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

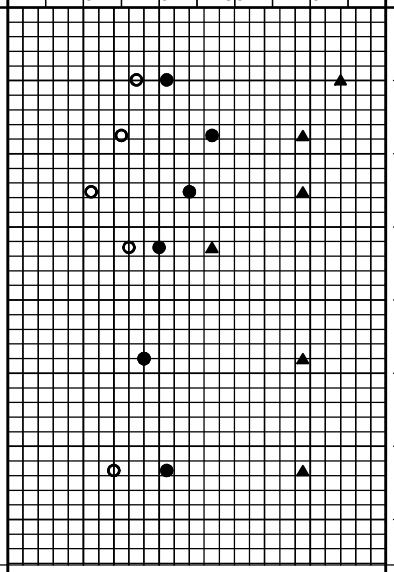
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level **Sept 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.0								
	272.7	**TOPSOIL** - 280 mm							
1		**SILTY CLAY TILL** - brown, trace to some sand, trace to some gravel, very stiff, moist			SS	S1	275	21	17
2					SS	S2	320	27	15
					SS	S3	275	24	11
3					SS	S4	370	20	16
4		- becoming grey near 4.0 m bgs							
5					SS	S5	415	18	18
6					SS	S6	370	21	14
7	265.4								
		End of Borehole at 7.6 m bgs.							
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) Water Level Readings:
March 17, 2016 - 0.8 m bgs, Elev: 272.2 m
June 1, 2017 - 1.1 m bgs, Elev: 271.9 m
August 16, 2017 - 4.6 m bgs, Elev: 268.4 m
September 14, 2017 - 4.9 m bgs, Elev: 268.1 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

BH13
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

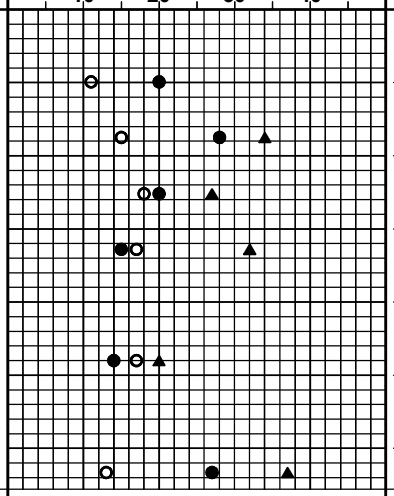
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	272.7								
	272.4	**TOPSOIL** - 350 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist			SS	S1	320	20	11
2					SS	S2	415	28	15
					SS	S3	320	20	18
3		- becoming grey near 2.9 m bgs			SS	S4	320	15	17
4									
5					SS	S5	415	14	17
6	266.1				SS	S6	275	27	13
7		**End of Borehole at 6.6 m bgs.**							
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH14
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	271.6								
	271.2	**TOPSOIL** - 360 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist							
2					AS	S1			16
3					AS	S2			17
4		- becoming grey near 4.0 m bgs							
5	266.6				AS	S3			16
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

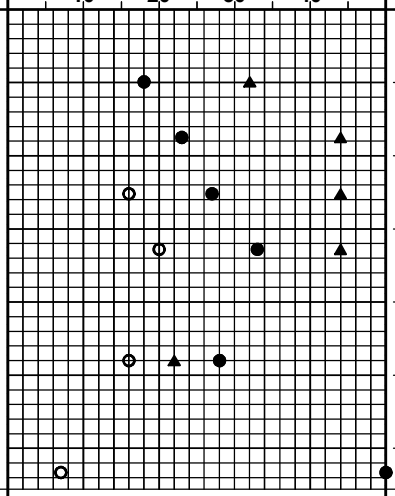
WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH15/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 25, 2016** Water Level **June 1/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	269.7						
0	269.5	**TOPSOIL** - 250 mm					
1		**SILTY CLAY TILL** - brown, trace to some sand, trace to some gravel, very stiff to hard, moist	SS	S1	320	18	
2			SS	S2	370	23	
3			SS	S3	370	27	16
4			SS	S4	415	33	20
5		- becoming grey near 5.0 m bgs	SS	S5	370	28	16
6	263.5						
	263.1	**SILT** - grey, trace clay, trace to some sand, very dense, moist	SS	S6	370	50*	7
7		**End of Borehole at 6.6 m bgs.**					
8							
9							
10							
11							
12							
13							
14							
15							



NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas concentration was detected upon completion of drilling.
4) * denotes 50 blows per 130 mm split spoon penetration.
5) Water Level Readings:
March 17, 2016 - 5.0 m bgs, Elev: 264.7 m
June 1, 2017 - 6.0 m bgs, Elev: 263.7 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

BH16
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

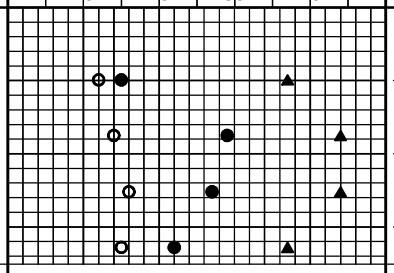
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**266.4**								
	266.1	**TOPSOIL** - 300 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, very stiff, moist			SS	S1	230	15	12
2					SS	S2	320	29	14
					SS	S3	320	27	16
3	262.9	- becoming grey near 3.0 m bgs			SS	S4	370	22	15
4		**End of Borehole at 3.5 m bgs.**							
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH17
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	265.5								
	265.2	**TOPSOIL** - 280 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist							
2					AS	S1			22
3					AS	S2			20
4		- becoming grey near 4.0 m bgs							
5	260.5				AS	S3			17
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH18
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

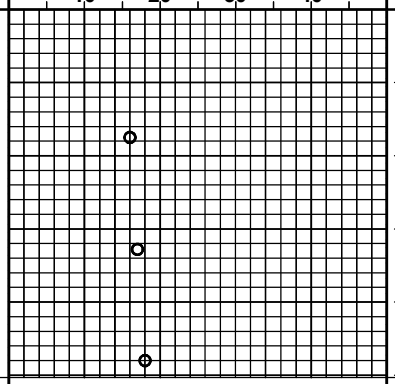
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	265.3								
	265.0	**TOPSOIL** - 300 mm							
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist							
1									
2					AS	S1			16
3					AS	S2			17
4		- becoming grey near 4.0 m bgs							
5	260.3				AS	S3			18
		End of Borehole at 5.0 m bgs.							
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

BH19
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

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
0	262.8									
	262.5	**TOPSOIL** - 300 mm								
1	261.4	**SAND** - brown, medium grained, trace clay, trace to some silt, trace gravel, compact, very moist			SS	S1	230	15	11	
2		**SILTY CLAY TILL** - brown/grey, trace sand, trace gravel, very stiff, moist		▽	SS	S2	275	20	17	
3	259.3				SS	S3	320	26	16	
					SS	S4	275	20	16	
4		**End of Borehole at 3.5 m bgs.**								
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open to 2.7 m bgs and groundwater measured near 2.4 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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

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Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

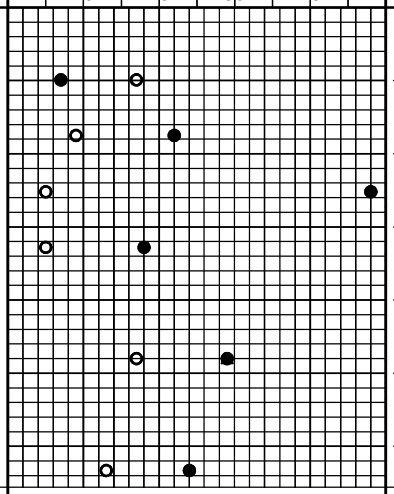
PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **Feb 26, 2016** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	263.8								
	263.5	**TOPSOIL** - 350 mm							
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, firm, moist			SS	S1	140	7	17
	262.2								
2		**SILTY SAND** - brown, trace clay, trace to some gravel, compact to dense, moist			SS	S2	140	22	9
					SS	S3	90	48	5
3					SS	S4	90	18	5
	259.8								
4		**SILTY CLAY TILL** - grey, trace sand, trace gravel, very stiff, moist		▽					
5					SS	S5	275	29	17
6	257.2				SS	S6	275	24	13
		End of Borehole at 6.6 m bgs.							
7									
8									
9									
10									
11									
12									
13									
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014456-GE.
2) Borehole open to 5.5 m bgs and groundwater measured near 4.3 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.

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)

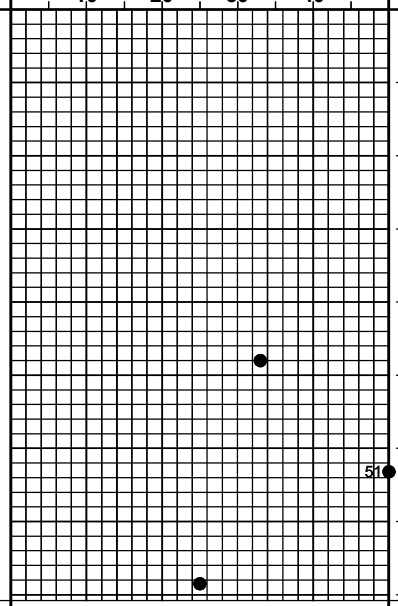
BOREHOLE LOG

BH101/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 10, 2017** Water Level **Sept. 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	270.6						
	270.3	**TOPSOIL** - 280 mm					
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist					
2							
3							
4	266.3	- becoming grey near 4.0 m bgs					
5		**SILT** - grey, trace fine sand, dilatant, dense, very moist	SS	S1	400	33	
	265.0						
6		**SAND** - brown, fine to medium grained, trace silt, compact to very dense, very moist to wet	SS	S2	450	51	
7							
8	262.5		SS	S3	450	25	
		End of Borehole at 8.1 m bgs.					
9							
10							
11							
12							
13							
14							
15							

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) Water Level Readings:
August 16, 2017 - 6.3 m bgs, Elev: 264.3 m
September 14, 2017 - 6.4 m bgs, Elev: 264.2 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 **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 10, 2017** Water Level **Sept. 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	273.0						
	272.7	**TOPSOIL** - 300 mm					
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist					
		- becoming grey near 4.0 m bgs					
	268.1		SS	S1	400	21	
5	267.4	**SILTY SAND** - brown, fine to medium grained, trace clay, compact, wet					
		SILT - grey, some fine sand, some clayey layering, compact, moist to very moist	SS	S2	400	24	
7	265.9						
		SILTY CLAY TILL - grey, trace sand, trace gravel, hard, moist	SS	S3	450	33	
	264.4						
		SILT - grey, trace fine sand, very dense, moist to very moist	SS	S4	450	74	
10	262.9						
		SILTY CLAY TILL - grey, trace sand, trace gravel, hard, moist	SS	S5	450	30	
	261.3						
		SANDY SILT TILL - brown, trace to some clay, trace gravel, very dense, moist	SS	S6	250	50 *	
	260.4						
13		**End of Borehole at 12.6 m bgs.**					
14							
15							

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

74

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) * denotes 50 blows per 130 mm split spoon penetration.
5) Water Level Readings:
August 16, 2017 - dry
September 14, 2017 - 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
H Hydrometer
S Sieve Analysis
γ Unit Weight
P Field Permeability
K Lab Permeability
C Consolidation
CD Consolidated Drained Triaxial
CU Consolidated Undrained Triaxial
UU Unconsolidated Undrained Triaxial
UC Unconfined Compression
DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH102B/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 11, 2017** Water Level **Sept. 14/17**

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
0	273.0									✤ S Field Vane Test (#=Sensitivity) ▲ Penetrometer ■ Torvane; 100 200 kPa; W_P W W_L; ● SPT N Value × Dynamic Cone; 10 20 30 40
	272.7	**TOPSOIL** - 300 mm								
1		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist								
2										
3										
4		- becoming grey near 4.0 m bgs								
	268.1									
5	267.4	**SILTY SAND** - brown, fine to medium grained, trace clay, compact, wet								
6		**SILT** - grey, some fine sand, some clayey layering, compact, moist to very moist								
7	266.0	**End of Borehole at 7.0 m bgs.**								
8										
9										
10										
11										
12										
13										
14										
15										

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) Water Level Readings:
August 16, 2017 - 4.3 m bgs, Elev: 268.7 m
September 14, 2017 - 4.8 m bgs, Elev: 268.2 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 **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 11, 2017** Water Level **Sept. 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	271.2						
0	270.9	**TOPSOIL** - 350 mm					
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist					
4		- becoming grey near 4.0 m bgs					
5			SS	S1	450	15	
6			SS	S2	450	19	
7		- occasional silt seams encountered near 6.3 m bgs					
8			SS	S3	450	18	
9			SS	S4	450	48	
10	261.1	- becoming sandy and hard near 9.4 m bgs					
		SANDY SILT TILL - brown, trace clay, trace gravel, very dense, moist					
11			SS	S5	450	90	
12	258.6		SS	S6	250	50*	
13		**End of Borehole at 12.6 m bgs.**					
14							
15							

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

90

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) * denotes 50 blows per 130 mm split spoon penetration.
5) Water Level Readings:
August 16, 2017 - dry
September 14, 2017 - 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

BH104/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 11, 2017** Water Level **Sept. 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	271.6						
	271.3	**TOPSOIL** - 300 mm					
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist					
4		- becoming grey near 4.0 m bgs	SS	S1	450	24	
6	265.1		SS	S2	450	27	
	264.7	**SAND AND GRAVEL** - brown, trace silt, well graded, compact, very moist	SS	S3	450	46	
	264.1	**SILTY CLAY TILL** - grey, trace sand, trace gravel, some sandy layering, hard, moist	SS	S4	450	50**	
8		**SANDY SILT TILL** - brown, trace clay, trace gravel, very dense, damp					
	262.8						
		SAND - brown, fine to medium grained, trace to some silt, trace gravel, very dense, damp to moist	SS	S5	425	50**	
11		- becoming grey near 10.8 m bgs	SS	S6	425	50**	
12			SS	S7	350	50*	
	258.2						
	257.5	**SANDY SILT** - brown, dilatant, very dense, very moist	SS	S8	450	67	
	257.4	**SAND AND GRAVEL** - grey, well graded, trace silt, very dense, damp					
15		**End of Borehole at 14.2 m bgs.**					

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

67

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) * denotes 50 blows per 100 mm split spoon penetration.
** denotes 50 blows per 130 mm split spoon penetration.
5) Water Level Readings:
August 16, 2017 - dry
September 14, 2017 - 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

BH104B/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 14, 2017** Water Level **Sept. 14/17**

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
	271.6									✤ 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	271.3	**TOPSOIL** - 300 mm								
		SILTY CLAY TILL - brown, trace sand, trace gravel, stiff to very stiff, moist								
1										
2										
3										
4		- becoming grey near 4.0 m bgs								
5										
6										
	265.1									
	264.7	**SAND AND GRAVEL** - brown, trace silt, well graded, compact, very moist								
7	264.3	**SILTY CLAY TILL** - grey, trace sand, trace gravel, some sandy layering, hard, moist								
8		**End of Borehole at 7.3 m bgs.**								
9										
10										
11										
12										
13										
14										
15										

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) Water Level Readings:
August 16, 2017 - 4.9 m bgs, Elev: 266.7 m
September 14, 2017 - 5.9 m bgs, Elev: 265.7 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

BH105/MW
Sheet 1 of 1

CLIENT **W3 - Lambeth Farms, c/o York Developments** PROJECT NO. **LON-0014456-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3700 Col. Talbot Rd & 3645 Bostwick Rd** DATES: Boring **August 14, 2017** Water Level **Sept. 14/17**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	263.7								
	263.4	**TOPSOIL** - 300 mm							
	263.1	**SANDY SILT** - brown, compact, moist							
1		**SAND** - brown, fine to medium grained, some silt, compact, very moist to wet							
	262.0								
2		**SILTY CLAY TILL** - brown, trace sand, trace gravel, stiff to very stiff, moist			SS	S1	400	21	
		- becoming grey near 2.5 m bgs							
3					SS	S2	325	14	
4									
5					SS	S3	450	11	
6					SS	S4	450	13	
7									
8					SS	S5	450	18	
9					SS	S6	450	15	
10									
11					SS	S7	450	24	
	252.0								
12		**SANDY SILT TILL** - brown, trace clay, trace gravel, very dense, moist							
	251.1				SS	S8	250	50*	
13		**End of Borehole at 12.6 m bgs.**							
14									
15									

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 interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-0014456-GE.
2) bgs denotes below ground surface.
3) No significant methane gas reading was detected upon completion of drilling.
4) * denotes 50 blows per 100 mm split spoon penetration.
4) Water Level Readings:
August 16, 2017 - 1.2 m bgs, Elev: 262.5 m
September 14, 2017 - 1.5 m bgs, Elev: 262.2 m

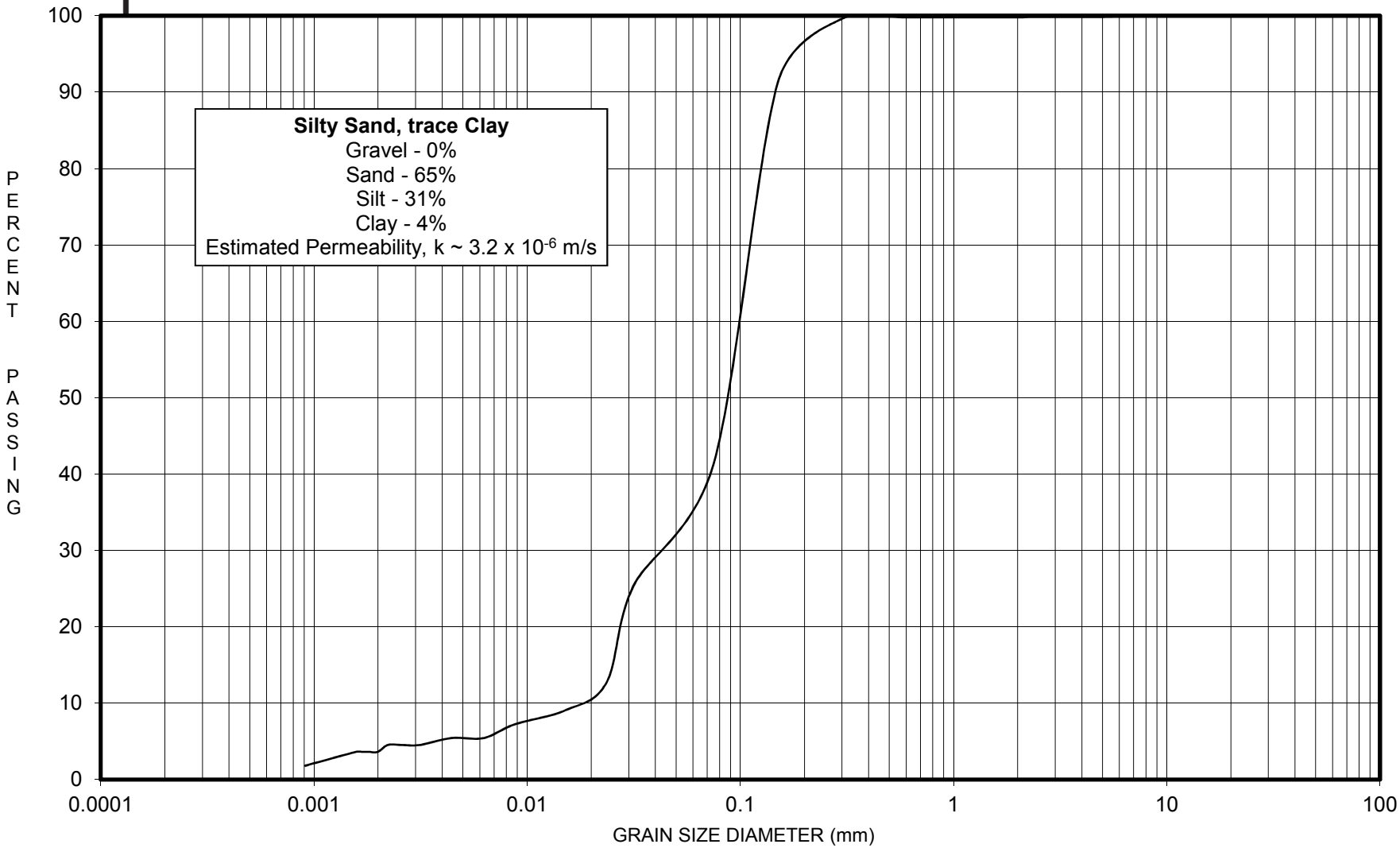
SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

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)

Appendix B – Grain Size Analysis

MECHANICAL GRAIN SIZE ANALYSIS



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	
	SILT			SAND			GRAVEL			
MODIFIED M.I.T. CLASSIFICATION	**Sample Description: Silty Sand (BH102 S1, 4.9 - 5.0 m bgs)**						**W3 Lambeth Farms Project: LON-00014456-GE**			**Figure 1**

Appendix C – Inspection and Testing Schedule

INSPECTION & TESTING SCHEDULE

The following program outlines suggested minimum testing requirements during backfilling of service trenches and construction of pavements. In adverse weather conditions (wet/freezing), increased testing will be required. The testing frequencies are general requirements and may be adjusted at the discretion of the engineer based on test results and prevailing construction conditions.

I TRENCH BACKFILL

ZONE A	-	one in situ density test per 100 cubic meters or 50 linear metres of trench whichever is less
	-	one laboratory grain size and Proctor density test per 50 density tests or 4000 cubic metres or on change of material (source, visual)
ZONE A1	-	one in situ density test per 75 cubic metres of material or 25 linear metres of each lift of fill
	-	one laboratory grain size and Proctor density test per each 50 density tests or 4000 cubic metres of material placed or as directed by the engineer
ZONES B & C	-	one in situ density test per 150 cubic metres of material or 50 linear metres or each lift whichever is less
	-	one laboratory grain size and Proctor density test per 50 density tests or 4000 cubic metres of material placed or as directed by the engineer

II PAVEMENT MATERIALS

GRANULAR SUBBASE	-	one in situ density test per 50 linear metres of road
	-	one laboratory grain size and standard Proctor test per 50 density tests or 4000 cubic metres or each change of material (visual, source), as determined by the engineer
GRANULAR BASE	-	one in situ density test per 50 linear metres of road
	-	one laboratory grain size and Proctor per 50 density tests or 8000 cubic metres or change in material (visual, source), as determined by the engineer
	-	Benkelman beam testing at 10 metre intervals per lane, after final grading and compaction. Asphaltic concrete should not be placed until rebound criteria have been satisfied.
ASPHALTIC CONCRETE	-	one in situ density test per 25 linear metres of roadway
	-	one complete Marshall Compliance test including stability flow, etc. for each mix type to check mix acceptability. One extraction and gradation test per each day of paving to be compared to job mix formula

NOTES: Where testing indicates inadequate compaction, additional fill should not be placed until the area is recompacted and retested at the discretion of the engineer.

Appendix D – 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.