GEOTECHNICAL INVESTIGATION REPORT
PROPOSED RESIDENTIAL DEVELOPMENT
CROFT STREET
PORT HOPE, ONTARIO
PROJECT NO. G024359A1

Prepared for:

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation that was completed for a proposed residential development along Croft Street, west of Rose Glen Road, in the Municipality of Port Hope, Ontario. This investigation was conducted as authorized by Mr. Al Leblanc of Leblanc Enterprises (the Client), in accordance with our proposal dated January 18, 2013 (PG-1898).

D.M. Wills Associated (Wills) provided a drawing which was used to create the attached Test Hole Location Plan (Plate 1). It is Geo-Logic's understanding that the development shall consist of multi-unit residential buildings with no basements and foundation requirements being typical of residential dwellings. In addition, the proposed development shall include roadway construction, service installation, and construction of a storm water management pond (SWP).

2.0 PURPOSE AND SCOPE

The purpose of this geotechnical investigation is to define the subsurface soil and groundwater conditions at the project site, and to develop geotechnical recommendations regarding earthwork construction, dewatering, trenching and service installation (bedding and backfill), road construction (including pavement structure), building foundations, slab on grade, and SWP construction.

Please note that the contents of this report must in no way be construed as an opinion of this site's environmental status.

The following scope of work was performed in order to accomplish the foregoing purposes.

1. Underground services were cleared prior to advancing the test pits. The test pits were located as shown on the Test Hole Location Plan (Plate 1).
2. The subsurface conditions were explored by advancing, sampling and logging a total of fourteen (14) test pits to depths ranging from approximately 3.5 to 4.0 metres below existing grade (mbeg). The subsurface conditions observed are presented in Test Pit logs contained in Appendix A.
3. Temporary piezometers were installed in selected test pits to facilitate measurement of groundwater levels.
4. The ground at the test pits was reinstated as close as possible to its original condition upon completion of the fieldwork.
5. Geotechnical analyses of materials encountered was performed by means of laboratory testing to obtain relevant soil properties, including grain size and moisture content. The laboratory results are attached in Appendix B.
6. Geotechnical engineering analysis of acquired field and laboratory data, and preparation of a geotechnical investigation report outlining our findings, conclusions, and recommendations.

3.0 FIELD AND LABORATORY PROCEDURES

A field investigation was conducted under the supervision of Geo-Logic staff on March 8, 2013. The work consisted of subsurface exploration by means of advancing and sampling a total of fourteen (14) exploratory test pits to depths ranging from about 3.5 to 4.0 mbeg, at locations shown on Plate 1. A log of each test pit was maintained, and representative samples of the soils encountered were obtained and returned to the laboratory.

The test pits were excavated using a rubber-tire back-hoe. Representative samples were obtained directly from the excavators bucket or from the excavation walls.

Soil samples obtained from the test pits were inspected in the field immediately upon retrieval for type, texture, and colour. All test pits were backfilled following completion of the fieldwork. All samples were sealed in clean plastic containers and transported to the Geo-Logic laboratory for further visual-tactile examination, and to select appropriate samples for laboratory analysis.

Groundwater measurements and observations were obtained from the open test pits during the excavation operations. Groundwater data is presented on individual test pit logs.

Laboratory testing of various soil properties was conducted on selected samples, and consisted of moisture content tests on all recovered soil samples, and grain size distribution analyses on four (4) representative samples (including four hydrometer tests).

Ground surface elevations at the test pit locations were measured in respect to a local temporary benchmark (top of manhole on Croft Street) with an elevation of 106.01 m as reported on Wills' electronic drawing, entitled "10322 MP R2007.dwg". These interpolated elevations are for analytical purposes only, and must be verified prior to finalizing any design or contract parameters upon which they are based.

4.0 SITE LOCATION AND CONDITION

The site is located within the Municipality of Port Hope on Croft Street between Rose Glen Road and Wellington Street. The Property is currently vacant land. The property is generally open across the area of the proposed development with some treed areas in the southern sections. The sites topography slopes form the northern section down to southern section.

5.0 SUBSURFACE CONDITIONS

5.1 GENERAL

Details of the subsurface conditions encountered at the site are presented graphically on the test pit logs in Appendix A. It should be noted that the boundaries between the strata have been inferred from the test pit observations. They generally represent a transition from one soil type to another, and should not be inferred to represent an exact plane of geological change. Further, conditions may vary between and beyond the test pits.

The test pits typically encountered a surficial layer of topsoil, over native till. Thirteen (13) of the open test pits encountered ground water seepage within localized, isolated zones of depth during the excavation operations at depths ranging from surface to approximately 2.4 mbeg, the remaining test pit did not encounter seepage during the excavation operations.

The following sections describe the major soil strata and subsurface conditions encountered during this investigation in more detail.

5.2 TOPSOIL

A layer of surficial topsoil was encountered in all of the test pits. The topsoil ranged in thickness from approximately 100 to 200 mm. This soil was observed to be in a damp, loose state, with a silty, highly organic content. As such, it is expected to be devoid of any structural engineering properties.

5.3 TILL

An underlying layer of till was encountered in all of the test pits, immediately beneath the topsoil. This soil was first encountered at a depths ranging from approximately 0.3 to 0.4 mbeg and extended to the full depth of the investigation. The till generally appeared brown in colour. This soil typically consisted of clayey silty sand to sandy silty clay, with varying amounts of gravel. This soil was typically in a moist to wet and compact to very dense in-situ state, with the density generally increasing with depth.

Moisture content tests conducted on samples of the till yielded values that ranged from approximately 6 to 36 % moisture by weight. Grain size distribution tests performed on representative samples of the till suggest the following compositional ranges: 0 to 11 % gravel, 23 to 41 % sand, and 48 to 77 % silt and clay-sized particles (Plates B-1 to 4). Hydrometer analyses conducted on these samples of the till suggest they contain approximately 20 to 39 % particles between 5 and 75 μm in size.

Based on the laboratory and field test results, combined with visual-tactile examination, the till is expected to possess a moderate susceptibility to frost action, is generally wetter than optimal for compaction purposes, and will exhibit poor drainage characteristics. The till may be suitable for reuse as trench, pavement subgrade, or common backfill material (not as structural backfill beneath footings or floor slabs), provided it is free of organic materials, a final review and approval to do so is obtained at the time of construction, and with the understanding that prior processing (such as aeration) will likely be required to lower the moisture content to adequate levels for compaction and workability purposes prior to being approved.

5.4 GROUNDWATER

Thirteen (13) of the open test pits encountered ground water seepage during the excavation operations. The seepage was contained within localized zones of depth ranging from approximately 0.0 to 2.4 mbeg, the remaining test pit did not encounter seepage during the excavation operations.

The seepage observed in several of the test pits occurred from within the saturated upper layers of the topsoil and till. Test pits TP-4, 5, 7 and 9 encountered seepage from within the topsoil layers. Test pits TP-1 to 3, 6 and 10 to 14 encountered seepage from within coarser-grained layers of the till. The seepage observed in these open test pits was relatively slow, with minimal accumulation of water in the open test pits during the fieldwork.

The following table summarizes the depths (and corresponding elevations) at which groundwater seepage was encountered in each test pit:

Table 1: Groundwater Seepage Depths / Elevations

Test Pit	Soil Exhibiting Groundwater Seepage	Depth at Which Seepage was Observed in Open Test Pit	
		Depth (mbeg)	Elevation (m)
TP-1	Till	0.9	106.2
TP-2	Till	0.8	106.1
TP-3	Till	0.9	106.7
TP-4	Topsoil	0 to 0.2	108.1 to 108.3
TP-5	Topsoil	0 to 0.1	108.0 to 108.1
TP-6	Till	0.9	107.0
TP-7	Topsoil	0 to 0.1	107.2 to 107.3
TP-8	No Seepage Observed		
TP-9	Till	1.7 to 2.4	107.4 to 108.1
TP-10	Topsoil	0 to 0.1	110.5 to 110.6
TP-11	Till	1.8 to 2.3	106.9 to 107.4
TP-12	Till	1.2	104.2
TP-13	Till	1.2	104.2
TP-14	Till	1.2	104.0

It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation, and temperature.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 GENERAL

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report. The following recommendations are governed by the physical properties of the subsurface materials that were encountered at the site, and assumes that they are representative of the overall site conditions. It should be noted that these conclusions and recommendations are intended for use by the designers only. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and the like. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

The test pits typically encountered a surficial layer of topsoil, over native till. Thirteen (13) of the open test pits encountered ground water seepage during the excavation operations at depths ranging from surface to approximately 2.4 mbeg, the remaining test pit did not encounter seepage during the excavation operations.

Details regarding our conclusions and recommendations are outlined in the following sections.

6.2 SITE PREPARATION, EXCAVATION, AND DEWATERING

It is recommended that any and all topsoil, fill, vegetation, organic and organic-bearing materials be stripped and removed from the proposed roadway, building envelope areas (including floor slab areas), and SWP area prior to commencing earthwork construction. The subexcavated surfaces must be proof rolled and/or approved by a member of Geo-Logic Inc. prior to placement of fill or foundations.

Excavations should be carried out to conform to the manner specified in Ontario Regulation 213/91 and the Occupational Health and Safety Act and Regulations for Construction Projects (OHSA). All excavations above the water table not exceeding 1.2 m in depth may be constructed with vertical, unsupported slopes. The native soils encountered during this investigation are generally classed by OHSA as Type 2. As such, unsupported walls of excavations in this soil must maintain a gradient of 1 horizontal to 1 vertical (1H:1V) or flatter to within 1.2 m of the bottom of the excavation.

This investigation did not include any chemical testing. Note that the Municipality may require some form of chemical testing of the soils prior to any excess soils being handled and/or removed from the site.

The Port Hope Low-Level Radioactive Waste Management Office (LLRWMO) was contacted and attended the site to monitor radioactive levels within test pits during the fieldwork program. The LLRWMO maintained records of their findings, and while onsite during the fieldwork, verbally reported to Geo-Logic that their readings were within their acceptable levels.

Based on groundwater measurements and the anticipated depth of excavations for service installations and potentially for basement areas, it is expected that groundwater seepage into open excavations will be encountered. It is noted that many of the test pits encountered saturated soils in the surface and near-surface zones. Pumping from collection sumps to an acceptable outlet should typically control the groundwater seepage and infiltration. The native till soils are expected to exhibit a hydraulic conductivity on the order of approximately 10^{-5} to 10^{-6} cm/sec (more hydraulically-conductive, localized zones such as sand seams within the till may also be encountered). If any excavations require more intensive dewatering / groundwater control, the use of filtered sumps, or other suitable method of dewatering and/or sheet piling may be necessary.

6.3 SERVICE INSTALLATION

The materials encountered during this investigation at the anticipated service invert elevations typically consist of native till soils. As such, a normal compacted Class "B" bedding is recommended for all underground services. Class "B" bedding is Granular "A", or 19 mm crusher run limestone, as per Ontario Provincial Standard Specifications (OPSS). The minimum recommended bedding thickness for the underground services is 150 mm. All bedding should be compacted to 100 % of its Standard Proctor Maximum Dry Density (SPMDD).

It is recommended that cover backfilling of the underground services be accomplished using Granular "A", sand, or other suitable material as allowed by the Municipality's standards, to a minimum of 300 mm above the pipe. Compaction of this material should be 100 % SPMDD. Approved, suitable excavated soil can be reused as trench backfill provided the soil is workable and at a moisture content that will permit adequate compaction. (Note that much of the till is overly wet for workability and compaction purposes, and would therefore require prior processing such as aeration to lower its moisture content before being considered as reusable for backfill.) Saturated silts, organics and wet clay should not be reused. A final review and approval to reuse any soils must be made during construction. Compaction of any native soil in service trenches is recommended to be a minimum of 98 % of its SPMDD.

It is recommended that trench plugs be installed to restrict and minimize the migration of groundwater along the trenches. The trench plugs should be located so as to eliminate this migration of groundwater along preferential pathways within the trenches. The location of trench plugs should be finalized once the overall sewer layout and grading design is completed.

6.4 ROAD CONSTRUCTION

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed development's new roadways for their construction:

1. Remove any free organic topsoil, fill, organics and organic-bearing materials, loam, frozen earth, and boulders larger than 150 mm in diameter encountered at subgrade elevation for the full width of construction.
2. Proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. Any deleterious areas thus delineated should be replaced with acceptable earth fill or granular material compacted to a minimum of 95 % of its SPMDD.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials. If curb lines are to be constructed, 150 mm diameter perforated pipe subdrains should be installed appropriately along them. The pipe should be encased in filter fabric and surrounded by clear stone aggregate. It is recommended that the subdrains outlet to the storm sewer system.
4. Construct transitions between varying depths of granular base materials at a rate of 1:25 minimum.

The subgrade soils encountered in these areas consisted of soils possessing moderate frost susceptibility. In this regard, based on the relatively low volume of vehicular traffic anticipated along these roads and municipal standards, the following minimum flexible pavement structure is recommended for the construction of the new roadway areas.

Table 2: Pavement Structure – Proposed Development (Roads and Parking Areas)

Profile	Material	Minimum Thickness (mm)	In Conformance with OPSS Form
Asphalt Surface	H.L. 3	40	1150
Asphalt Base	H.L. 8	50	
Granular Base	Granular "A"	150	1010
Granular Subbase	Granular "B"	300	

Table 3: Pavement Structure – Croft St. and Emergency Access

Profile	Material	Minimum Thickness (mm)	In Conformance with OPSS Form
Asphalt Surface	H.L. 3	40	1150
Asphalt Base	H.L. 8	50	
Granular Base	Granular "A"	150	1010
Granular Subbase	Granular "B"	450	

The following steps are recommended for optimum construction of these planned paved areas:

1 The Granular "A" and "B" courses should be compacted to a minimum 100 % of their respective SPMDD's.
2 All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS Form 310 or equivalent. All asphaltic concrete should be compacted to between 92.0 and 96.5 % of their respective laboratory Maximum Relative Densities (MRD's).
3 Adequate drainage should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 % of their optimum moisture content. All granular materials should be compacted to 100 % SPMDD. Granular materials should consist of Granular "A" and "B" conforming to the requirements of OPSS Form 1010 or equivalent.

It is noted that the above recommended pavement structures are for the end use of the project. During construction of the project the recommended granular depths may not be sufficient to support loadings encountered.

6.5 STO[illegible]

It is Geo-Logic' [illegible] s proposed to be located in the southern portion [illegible] P being at lowest elevation of approximately 1[illegible] d by Wills. Test pits TP-13 and 14 are located wi[illegible] pth of the SWP beneath existing grade, it is expec[illegible] f native till. The gradation of a sample of this so[illegible] g composition: 0 % gravel, 23 % sand, and 77 % s[illegible] % between 5 and 75 μm, 57 % less than 5um in [illegible] the area of the proposed SWP is expected to be o[illegible] It is noted, however, that slight variations in the [illegible] permeability of the soil in both vertical and horiz[illegible] f coarser till materials, such as were encountered [illegible]

Aaron
Gran 'B' Recomendation
We can justify 300
450 Recomendation for
Gran 'B' in Acces Rd
Based on the Sentence
Noted above ok?

Preliminary design details for the SWP were provided by Wills. Based on the soils observed, and the proposed base elevations, it appears that construction of the SWP in this area is feasible.

In general, excavation of the soils for the SWP is expected to be straightforward, provided that appropriate measures are taken during construction to minimize any overland or near-surficial flow of water into the area. Some groundwater and surficial water inflow into the open excavations may be expected, however this is expected to be controlled by pumping from within the excavation.

It is recommended that the SWP subgrade surface be proof rolled, and a representative of Geo-Logic approve the subgrade prior to construction of the berms. Berm construction may utilize excess site till soils having a hydraulic conductivity of at least 10^{-5} cm/sec. (Note that prior processing such as aeration may be necessary to lower the moisture content of the till to levels that are appropriate for workability and compaction purposes). Such operations should place the till soils in lifts no thicker than 150mm prior to compaction, and compacted to at least 95% SPMDD.

For the purpose of the proposed SWP, the soils observed should be stable from slip circle failure if sloped at 3 horizontal to 1 vertical (3H:1V) or flatter in the long term both above and below the water table. An assessment of Will's proposed SWP design indicates that a SWP and berms built in accordance with design and geotechnical recommendations will be stable. It is recommended that a geotechnical engineer (or representative) approve the SWP and berm subgrade prior to placement of fill materials, and test/inspect the materials and compaction efforts throughout construction of the SWP berms.

The till material will require vegetative root mass (or otherwise suitable erosion protection) to minimize erosional forces on exposed slopes. As requested, by the Ganaraska Region Conservation Authority (GRCA) a minimum 0.3 m freeboard should be provided.

Slopes and berms of the SWP should be constructed so as to reduce or eliminate the effects of surficial erosion. Features to do so may include slope vegetation, installation of erosion or gabion mats, rip rap, and/or other acceptable stabilizing features.

The native till soils in a recompacted form would generally not be suitable to form the SWP's "liner" since the expected permeability would be too high. The native undisturbed till would have a sufficiently low permeability where they could substitute for a liner. An inspection of the excavated and exposed surface should be performed at the time of construction, to assess whether any discrete or localized areas of increased hydraulic conductivity is present within the exposed soils, in which case such areas may be lined with a more suitable (ie, less hydraulically conductive) material. Material suitable for such lining should have a hydraulic conductivity of 10^{-6} cm/sec or less, or utilize a suitable manufactured liner installed in accordance with manufacturer's specifications.

It is recommended that a regular maintenance program for the SWP include monitoring of it for any potential slope erosion, degradation, or otherwise undesirable structural conditions. Should any such conditions become evident, immediate mitigative actions must be performed.

6.6 FOUNDATION DESIGN

In general, it is recommended that structural loading for the multi-unit buildings be supported on spread and continuous strip footings for column and load bearing walls, respectively. The footings should be founded on the compact to dense native soils, prepared in accordance with Section 6.2 of this report. Alternatively, suitably reinforced footings may be founded on engineered fill placed directly on the compact to dense native soil, prepared in accordance with Section 6.2 of this report. Such suitably competent native soils were typically first encountered in the test pits at depths of approximately 0.5 to 0.6 mbeg.

For design purposes, and based on the multi-unit residential houses, it is generally recommended that footings constructed on the compact to dense native soils or engineered fill be proportioned using the following bearing capacities (see next page):

Table 4: Bearing Pressures for Footing Design

Parameter		Bearing Pressure	
		Compact to dense, undisturbed native soil	Engineered fill
In terms of Limit Equilibrium	Factored Bearing Capacity at ULS	290 kPa (6,000 psf)	230 kPa (4,750 psf)
	Bearing Capacity at SLS	145 kPa (3,000 psf)	120 kPa (2,500 psf)

Any footings (and foundation walls) placed on engineered fill must be suitably reinforced, using two (2) continuous runs of 15M rebar throughout the footings, and two (2) runs of 20M rebar throughout near the top and bottom of the foundation walls. Any engineered fill upon which footings are placed must be *at least 300mm* in thickness.

The following is recommended for the construction of any engineered fill:

1. Remove any and all existing vegetation, topsoil, fill, organics, and organic-bearing soils to the competent, undisturbed native soil from within the area of the proposed engineered fill.
2. The area of the engineered fill should extend horizontally 1.0 m beyond the outside edge of the building foundations and then extend downward at a 1:1 slope to the competent native soil.
3. The base of the engineered fill area must be approved by a member of Geo-Logic Inc. prior to placement of any fill, to ensure that all unsuitable materials have been removed, that the materials encountered are similar to those observed, and that the subgrade is suitable for the engineered fill.
4. Place well graded granular fill equivalent to Granular "B" Type I (conforming to OPSS 1010) up to the underside of footings in maximum 300 mm lifts, compacted to 100% of its SPMDD. Any fill material placed under sufficiently wet conditions should consist of an approved, rock-based fill, with the inclusion of appropriate geotextile fabric around the rock-based fill should the rock fill contain enough voids to warrant (to minimize any migration of fines from surrounding soils).
5. Full time testing and inspection of the engineered fill will be required, to ensure compliance with material and compaction specifications.

Should any larger buildings (i.e., larger that the anticipated one to two-storey residential dwellings) be proposed, it is recommended that further subsurface exploration be conducted to assess the soil properties in such areas.

All exterior footings or footings in unheated areas, should be founded at least 1.2 m below the final adjacent grade for frost protection. Footings and walls exposed to frost action should be backfilled with non-frost susceptible granular material.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of Geo-Logic Inc. This will ensure that the foundation bearing material has been prepared properly at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

For design purposes, based on the conditions encountered in our test holes and experience with and knowledge of subsurface conditions in the project's general area, this property is classed as Class D for Seismic Response, in accordance with the Ontario Building Code.

Should basement or otherwise subgrade areas be incorporated into any of the buildings' designs, it is recommended that for drainage purposes, perimeter drains be installed about the structure. The subdrains would serve to drain seepage water that infiltrates the backfill, intersect the groundwater, and help relieve hydrostatic pressures due to any seasonally high groundwater levels. The perimeter drain should consist of a perforated pipe, at least 150 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The subdrain should discharge to a positive sump or other permanent frost free outlet.

For foundations constructed in accordance with the foregoing manner, total and differential settlements are estimated to be less than 25 mm.

6.7 SLAB ON GRADE

Floors may generally be constructed as normal slabs-on-grade, on granular fill over native, inorganic subsoils prepared in accordance with Section 6.2 of this report. The floor slab should be formed over a base course consisting of at least 150 mm of Granular "A" backfill as per OPSS (or 19mm clear stone beneath basement areas) compacted to a minimum of 100% of its SPMDD. All grade increases or infilling below the granular or clearstone should be constructed as engineered fill, in accordance with the corresponding recommendations provided in Section 6.6 of this report. All fill placed as engineered fill must be inspected, approved and compaction verified by personnel from Geo-Logic.

Based on groundwater observations, under-floor drains are recommended beneath any basement area floor slabs. The under-floor drains should consist of a perforated pipe, at least 150 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The subdrains should discharge to a positive sump or other permanent frost free outlet.

The granular backfill material should not contain any sulphurous mineral such as pyrite and, in general, should not consist of shale. All slabs should be structurally separated from the columns and foundation walls. It should be noted that floor slabs situated in the vicinity of columns and walls may settle by the same amount as the adjacent foundations. Therefore, particular attention should be given to the design of partitions, etc. that could be affected by the differential movements of the floor slab.

6.8 RETAINING WALLS

It is Geo-Logic's understanding that the development will include construction of a retaining wall in the northwesten corner of the site, (top the west of TP-6, 10 and 11). It is recommended that free draining backfill to retaining walls be provided, and at a minimum a layer of drainage tile should be installed at the inside base of the retaining wall, or as otherwise or additionally directed by the retaining wall manufacture. Retaining walls located above the groundwater table may be designed for lateral earth pressures using the following equation:

$p = k\ (w\ h + q)$, where:

- p = the lateral earth pressure in kPa acting on the subsurface wall at depth h;
- k_a = the coefficient of active earth pressure;
  (= 0.3 for walls restrained from the bottom only);
  (= 0.5 for walls restrained at the top and bottom*);
- k_p = the coefficient of passive earth pressure, (= 3.0);
- w = the granular or native soil bulk density in kN/m^3;
  (= 21.0 kN/m^3 for well compacted, OPSS-approved Granular "B");
  (= 20.0 kN/m^3 for native soils);
- h = the depth (in metres) below the exterior grade at which the earth pressure is being calculated; and
- q = the equivalent value of any surcharge (in kN/m^3) acting on the ground surface adjacent to the walls.

(*) This value is recommended for rigid walls retaining compacted backfill.

The recommended value for the coefficient for sliding friction between the soil and the concrete is 0.4. In addition to the above, hydrostatic forces must be taken into account in the design where the walls extend below the groundwater table. Also, any additional surcharge loading that will influence the wall must be taken into account in its design.

For design purposes, it is recommended that the retaining walls be constructed as directed by the retaining wall manufacture's specifications. The bearing capacities of the compact to dense native soils or engineered fill are as previously outlined in Table 3 (Section 6.6).

The base course of the retaining wall should be place at the depth outlined by the retaining wall manufacture's specification and/or the retaining wall designer; should the retaining wall manufacture's specification require frost protection, the retaining wall should be founded at a depth equivalent to 1.2 metres of earth cover.

6.9 TEST PITS DURING TENDERING

Due to the limitations of this report, (see Section 7.0 - "Statement of Limitations"), we recommend test pits be dug at representative locations of the site during the tendering stage, with mandatory attendance by bidding contractors. This will allow them to make their own assessments of the soil and groundwater conditions at the site and how these will affect their proposed construction methods, techniques and schedules.

6.10 DESIGN REVIEW AND INSPECTION

We recommend that our firm be retained to review the foundation design and grading proposals when they are available. Where significant grade changes are proposed the client must allow Geo-Logic to review the soil conditions in any such area(s) to assess the potential for impacts prior to finalizing the design.

Geotechnical inspection and compaction testing must be carried out to ensure compliance with our recommendations.

7.0 STATEMENT OF LIMITATIONS

The attached Statement of Limitations is an integral part of this report. Should questions arise regarding any aspect of this report, please contact our office

Sincerely yours,

Geo-Logic Inc.
GEOTECHNICAL ENGINEERS
AND HYDROGEOLOGISTS

Pete Hynes, B.A.Sc.

Garnet Brenchley, P.Eng.

STATEMENT OF LIMITATIONS

This report is intended solely for Leblanc Enterprises and other parties explicitly identified in the report and is prohibited for use by others without Geo-Logic's prior written consent. This report is considered Geo-Logic's professional work product and shall remain the sole property of Geo-Logic. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to Geo-Logic. Client shall defend, indemnify and hold Geo-Logic harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

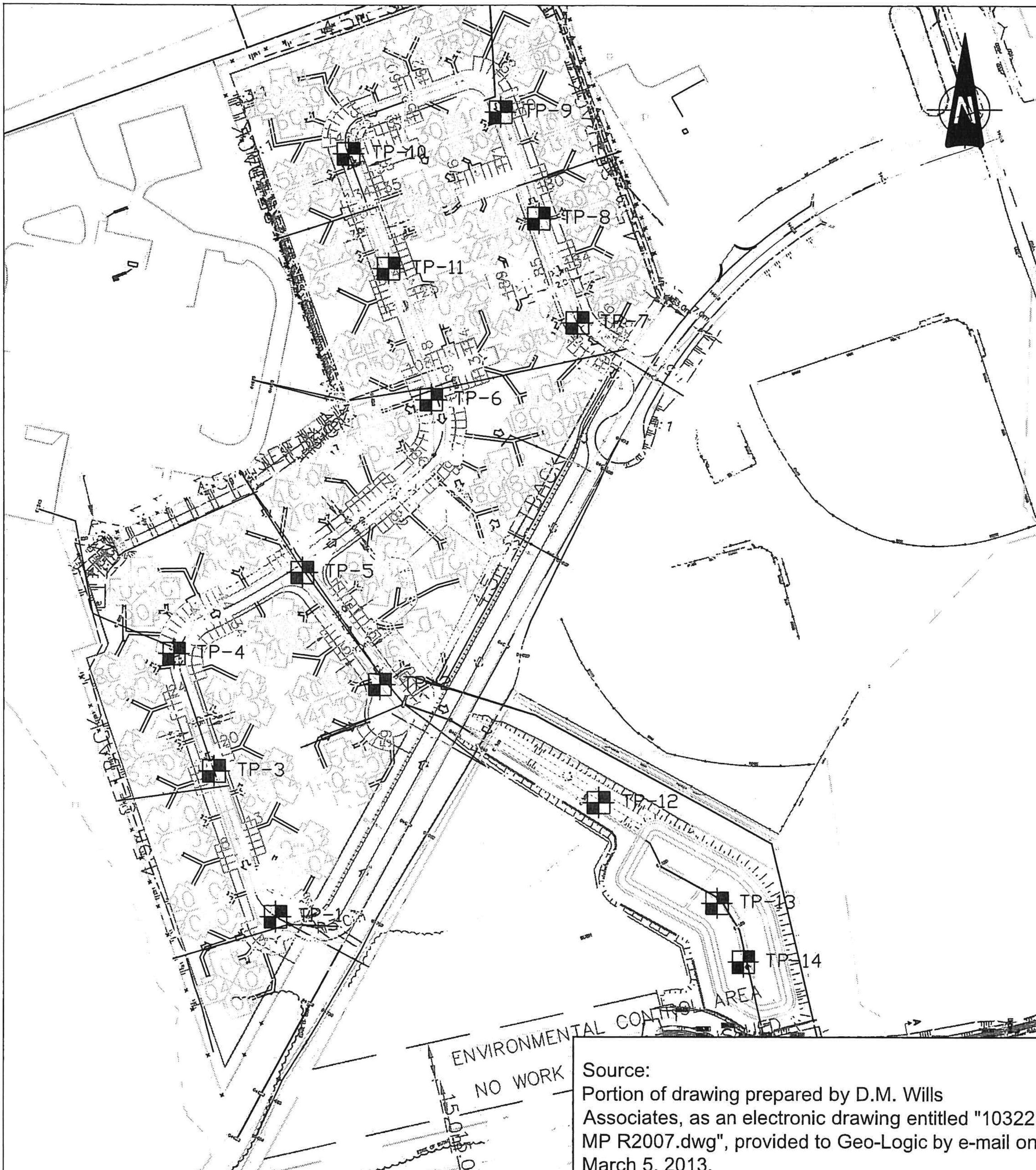
The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent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

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

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

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the fourteen (14) testhole locations only. The subsurface conditions confirmed at the 14 testhole locations may vary at other locations. The subsurface conditions can also be significantly modified by construction activities on site (ex. excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Geo-Logic is completed.

ENCLOSURES



Source:
Portion of drawing prepared by D.M. Wills Associates, as an electronic drawing entitled "10322 MP R2007.dwg", provided to Geo-Logic by e-mail on March 5, 2013.

TEST HOLE LOCATION PLAN

GEOTECHNICAL INVESTIGATION
CROFT STREET DEVELOPMENT
CROFT STREET
PORT HOPE, ONTARIO

PROJECT NO. :	G024359A1
SCALE :	1:2000
DATE :	MARCH, 2013
PLATE NO. :	1

GEO-LOGIC INC.
347 PIDO ROAD, UNIT 29
PETERBOROUGH, ON K9J 6X7
(705) 749-3317 FAX (705) 749-9248 WEB: www.geo-logic.ca

APPENDIX A

TEST PIT LOGS

REFERENCE No.: G024359A1 ENCLOSURE No.: A-1

GEO-LOGIC www.geo-logic.ca

TEST PIT No.: TP-1

ELEVATION: 107.1 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Shear test (Cu) △ Field; Sensitivity (S) ☐ Lab; ○ Water content (%); W_p W_l Atterberg limits (%)

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Water content (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (150 mm)				
		0.2		**TILL** - Brown Silty Sand, with Clay, wet, compact				Seepage observed from sidewalls of open test pit at approximately 0.9 m No groundwater seepage observed below 0.9 m depth
		0.9		Brown Sandy Silt and Clay, moist, compact				
					GS-1	16	○	GS-1: 0% Gravel 23% Sand 77% Silt and Clay 39% between 5 and 75 um
		2.4		Dense				
					GS-2	14	○	
		3.0		Brown Clayey Silty Sand, trace Gravel, moist to wet, compact				
		4.0		END OF TEST PIT				

Depth scale: ft 1–14; m 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-2

GEO-LOGIC www.geo-logic.ca

TEST PIT No.: TP-2

ELEVATION: 106.9 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Shear test (Cu): △ Field, □ Lab; Sensitivity (S); ○ Water content (%); w_p — w_l Atterberg limits (%)

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Water content (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (150 mm)				
		0.2		**TILL** - Brown Silty Sand, wet, compact				
		0.8		Brown Sandy Silt and Clay, moist, compact				Seepage observed from sidewalls of open test pit at approximately 0.8 m
4.5	1.4				GS-1	19	○ (~19)	No groundwater seepage observed below 0.8 m depth
		2.4		Dense				
		3.0		Brown Clayey Silty Sand, trace Gravel, moist, compact				
10.5	3.2				GS-2	16	○ (~16)	
		4.0		END OF TEST PIT				

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-3

GEO-LOGIC www.geo-logic.ca	TEST PIT No.: TP-3 ELEVATION: 107.6 m	TEST PIT REPORT Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

- WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (150 mm)				
		0.2		**TILL** - Brown Silty Sand, with Clay, moist to wet, compact				Seepage observed from sidewalls of open test pit at approximately 0.9 m
4–5	1.5				GS-1	15	○ (water content ~15)	No groundwater seepage observed below 0.9 m depth
8	2.5	2.4		Brown Clayey Silty Sand, trace Gravel, moist, compact to dense				
10–11	3.0–3.5				GS-2	18	○ (water content ~18)	
13	4.0	4.0		END OF TEST PIT				

Depth scale: ft 1–14; m 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-4

GEO-LOGIC INC. www.geo-logic.ca

TEST PIT No.: TP-4

ELEVATION: 108.3 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (m)	m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
	0.0	GROUND SURFACE			
0.0–0.2		**TOPSOIL** (175 mm)			Seepage observed from sidewalls of open test pit from topsoil layer (approximately 0 to 0.2 m)
0.2–2.1	0.2	**TILL** - Brown Silty Sand, with Clay, wet, compact	GS-1	17	No groundwater seepage observed below 0.2 m depth
2.1–3.5	2.1	Brown Clayey Silty Sand, trace Gravel, moist to wet, very dense	GS-2	13	
3.5	3.5	END OF TEST PIT			

Shear test (Cu) / Sensitivity (S): △ Field, □ Lab; ○ Water content (%); Atterberg limits (%) w_p w_l

Depth scale: ft 1–14; m 0.5–4.5. Plot scale: 10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1

ENCLOSURE No.: A-5

GEO-LOGIC www.geo-logic.ca

TEST PIT No.: TP-5

ELEVATION: 108.1 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes

DATE: March 8, 2013

EXCAVATION COMPANY: Behan

METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) △ Field ☐ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%) w_p w_l (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (125 mm)				Seepage observed from sidewalls of open test pit from topsoil layer (approximately 0 to 0.1 m)
		0.1		**TILL** - Brown Silty Sand, with Clay, moist, compact				No groundwater seepage observed below 0.1 m depth
					GS-1	14	○ (14)	
		2.3		Brown Clayey Silty Sand, trace Gravel, moist, very dense				
					GS-2	6	○ (6)	GS-2: 11% Gravel, 41% Sand, 48% Silt and Clay, 23% between 5 and 75 um
		4.0		END OF TEST PIT				

Depth scale: ft 1–14; m 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-6

GEO-LOGIC INC. www.geo-logic.ca

TEST PIT No.: TP-6
ELEVATION: 107.9 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE
▼ - WATER LEVEL

Shear test (Cu): △ Field, □ Lab; Sensitivity (S); ○ Water content (%); W_p W_l Atterberg limits (%)

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Water content (%) (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (200 mm)				
		0.2		**TILL** - Brown Silty Sand, with Clay, moist, compact				Seepage observed from sidewalls of open test pit at approximately 0.9 m No groundwater seepage observed below 0.9 m depth
~4.5	~1.4				GS-1	26	○ (26)	
		2.6		Brown Clayey Silty Sand, trace Gravel, moist, very dense				
~9.5	~2.9				GS-2	11	○ (11)	
		4.0		END OF TEST PIT				

Depth scale: ft 1–14; m 0.5–4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1

ENCLOSURE No.: A-7

www.geo-logic.ca

TEST PIT No.: TP-7

ELEVATION: 107.3 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes

DATE: March 8, 2013

EXCAVATION COMPANY: Behan

METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

▧ GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); W_p W_l Atterberg limits (%) — 10 20 30 40 50 60 70 80 90	COMMENTS
		0.0		GROUND SURFACE				
				TOPSOIL (125 mm)				Seepage observed from sidewalls of open test pit from topsoil layer (approximately 0 to 0.1 m)
		0.1		**TILL** - Brown Silty Sand, with Clay, moist, compact				No groundwater seepage observed below 0.1 m depth
					GS-1	14	○	
		2.3		Brown Clayey Silty Sand, trace Gravel, moist, very dense				
					GS-2	8	○	
		4.0		END OF TEST PIT				

Depth scale: ft 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14; m 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1

ENCLOSURE No.: A-8

www.geo-logic.ca

TEST PIT No.: TP-8

ELEVATION: 108.7 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes

DATE: March 8, 2013

EXCAVATION COMPANY: Behan

METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

▧ GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); W_p W_l Atterberg limits (%) — 10 20 30 40 50 60 70 80 90	COMMENTS
		0.0		GROUND SURFACE				No groundwater seepage observed during the excavation of the test pits
		0.1		**TOPSOIL** (125 mm)				
1, 2	0.5			**TILL** - Brown Silty Sand, with Clay, moist, compact				
3, 4	1.0	0.9		Brown Sandy Silty Clay, wet, compact				
5, 6, 7, 8	1.5, 2.0, 2.5				GS-1	24	○	
9, 10, 11, 12	3.0, 3.5	2.7		Brown Clayey Silty Sand, trace Gravel, moist, dense to very dense	GS-2	16	○	
13, 14	4.0, 4.5	4.0		END OF TEST PIT				

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 | ENCLOSURE No.: A-9

GEO-LOGIC www.geo-logic.ca

TEST PIT No.: TP-9
ELEVATION: 109.8 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE
▼ - WATER LEVEL

Depth (m)	m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
	0.0	GROUND SURFACE			
		TOPSOIL (125 mm)			
	0.2	**TILL** - Brown Clayey Silty Sand, moist to wet, compact			
1.4			GS-1	36	Seepage observed from sidewalls of open test pit between approximately 1.7 and 2.4 m
	1.7	Brown Silty Sand, with Gravel, wet, compact			No groundwater seepage observed below 2.4 m depth
	2.4	Brown Sandy Silty Clay, trace Gravel, moist, very dense			
2.9			GS-2	11	GS-2: 8% Gravel, 29% Sand, 63% Silt and Clay, 29% between 5 and 75 um
	4.0	END OF TEST PIT			

Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%) w_p w_l

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 | ENCLOSURE No.: A-10

www.geo-logic.ca

TEST PIT No.: TP-10
ELEVATION: 110.6 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE
▼ - WATER LEVEL

Shear test (Cu) △ Field; Sensitivity (S) □ Lab; ○ Water content (%); w_p w_l Atterberg limits (%)

m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Comments
0.0	GROUND SURFACE			
0.0–0.1	**TOPSOIL** (100 mm)			Seepage observed from sidewalls of open test pit from topsoil layer (approximately 0 to 0.1 m) No groundwater seepage observed below 0.1 m depth
0.1	**TILL** - Brown Silty Sand, with Clay, moist, compact	GS-1 (approx. 1.2–1.5 m)	7	
2.3	Brown Clayey Silty Sand, trace Gravel, moist to wet, dense to very dense	GS-2 (approx. 2.7–3.0 m)	32	
4.0	END OF TEST PIT			

Depth scale: ft 0–14; m 0.0–4.5

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-11

www.geo-logic.ca

TEST PIT No.: TP-11
ELEVATION: 109.2 m

TEST PIT REPORT

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE
▼ - WATER LEVEL

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)

m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	COMMENTS
0.0	GROUND SURFACE			
	TOPSOIL (175 mm)			
0.2	**TILL** - Brown Silty Sand, with Clay, moist, compact	GS-1	31	
1.7	Brown Silty Sand, with Gravel, wet, compact			Seepage observed from sidewalls of open test pit between approximately 1.8 and 2.3 m
2.3	Brown Clayey Silty Sand, trace Gravel, moist, dense to very dense	GS-2	7	No groundwater seepage observed below 2.3 m depth
4.0	END OF TEST PIT			

Depth scale: ft 1–14; m 0.5–4.5. Plot scale: 10 20 30 40 50 60 70 80 90

TEST PIT LOG GEOTECH G024359A1, 13-03-17, TEST PIT LOGS.GPJ GEOLOGIC.GDT 3/22/13

REFERENCE No.: G024359A1 ENCLOSURE No.: A-12

www.geo-logic.ca

TEST PIT No.: TP-12

ELEVATION: 105.4 m

TEST PIT REPORT

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Shear test (Cu), Sensitivity (S): △ Field, □ Lab; ○ Water content (%); w_p – w_l Atterberg limits (%)

Depth (m)	m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
0.0	0.0	GROUND SURFACE			
0.0–0.2		**TOPSOIL** (175 mm)			
0.2–2.6	0.2	**TILL -** Brown Silty Sand, with Clay, moist to wet, compact	GS-1	25	Seepage observed from sidewalls of open test pit at approximately 1.2 m No groundwater seepage observed below 1.2 m depth
2.6–4.0	2.6	Brown Clayey Silty Sand, trace Gravel, moist to wet, dense to very dense	GS-2	20	
4.0	4.0	END OF TEST PIT			

Depth scale: ft 1–14; m 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Water content scale: 10 20 30 40 50 60 70 80 90

REFERENCE No.: G024359A1 ENCLOSURE No.: A-13

GEO-LOGIC www.geo-logic.ca

TEST PIT No.: TP-13

ELEVATION: 105.4 m

TEST PIT REPORT

Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes DATE: March 8, 2013

EXCAVATION COMPANY: Behan METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

- WATER LEVEL

m Below Existing Grade	Description of Soil and Bedrock	Type and Number	Moisture Content (%)	Comments
0.0	GROUND SURFACE			
0.0	**TOPSOIL** (200 mm)			
0.2	**TILL** - Brown Silty Sand, with Clay, moist to wet, compact			Seepage observed from sidewalls of open test pit at approximately 1.2 m No groundwater seepage observed below 1.2 m depth
1.2	Brown Silty Sandy Clay, moist to wet, compact	GS-1	36	GS-1: 0% Gravel 23% Sand 77% Silt and Clay 20% between 5 and 75 um
2.7	Brown Clayey Silty Sand, trace Gravel, moist to wet, dense to very dense	GS-2	21	
4.0	END OF TEST PIT			

Shear test (Cu) / Sensitivity (S): △ Field, □ Lab; ○ Water content (%); Atterberg limits (%) (W_p, W_l)

Scale: 10 20 30 40 50 60 70 80 90

Depth scale: ft 1–14; m 0.5–4.5

REFERENCE No.: G024359A1 | ENCLOSURE No.: A-14

GEO-LOGIC www.geo-logic.ca	TEST PIT No.: TP-14 ELEVATION: 105.2 m	TEST PIT REPORT Page: 1 of 1

CLIENT: Leblanc Enterprises

PROJECT: Croft Street Development, Port Hope, Ontario

LOGGED BY: P. Hynes   DATE: March 8, 2013

EXCAVATION COMPANY: Behan   METHOD: Rubber-tired Back-ho

NOTES: Elevations measured in respect to local benchmark (top of manhole on Croft Street - 106.01 m)

LEGEND

GS - GRAB SAMPLE

▼ - WATER LEVEL

Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%)	COMMENTS
	0.0	GROUND SURFACE		%	10 20 30 40 50 60 70 80 90	
0.0–0.2	0.0	**TOPSOIL** (200 mm)				
0.2–1.2	0.2	**TILL** - Brown Silty Sand, with Clay, moist, compact				
1.2–2.4	1.2	Brown Sandy Silty Clay, moist to wet, compact	GS-1	25	○ (approx. 25)	Seepage observed from sidewalls of open test pit at approximately 1.2 m No groundwater seepage observed below 1.2 m depth
2.4–4.0	2.4	Brown Clayey Silty Sand, trace Gravel, moist, dense to very dense	GS-2	21	○ (approx. 21)	
4.0	4.0	END OF TEST PIT				

Shear test symbols: △ Field, □ Lab

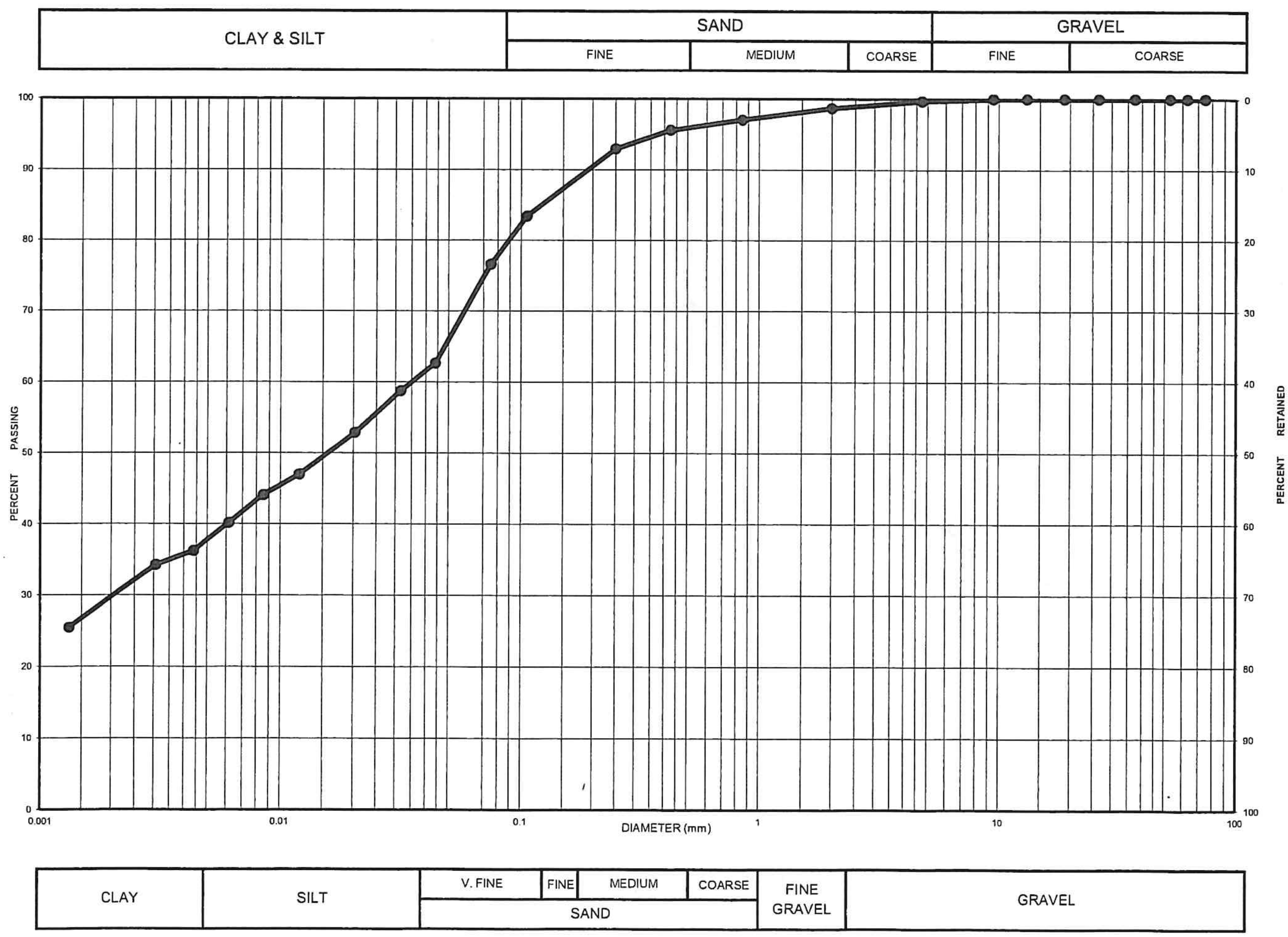
APPENDIX B

LABORATORY DATA

GEO-LOGIC INC. 347 Pido Road Unit 29 Peterborough, ON, K9J 6X7 Tel: (705) 749-3317 Fax: (705) 749-9248

GRAIN SIZE DISTRIBUTION CHART

Client:	*Leblanc*	Ref No.:	*SS-13-33*
Project:	*G024359A1*	Location:	*Croft Street, Port Hope*
Borehole No.:	*TP1*	Sample No.:	*GS1*
Depth:	*1.2 to 1.5 m*	Enclosure:	*B-1*

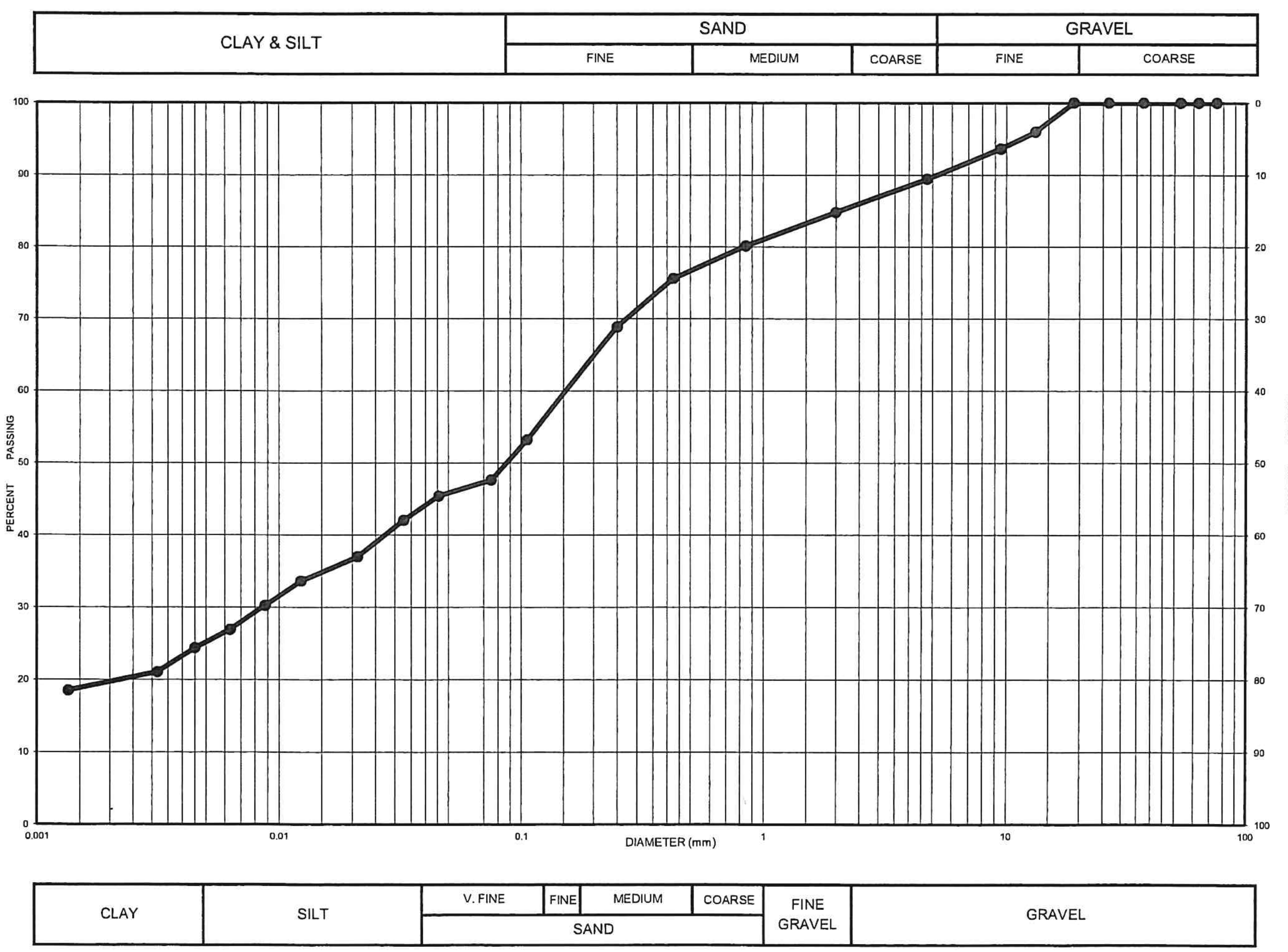


Sample No.	Depth	% Gravel	% Sand	% Silt / Clay
TP1,GS1	1.2 to 1.5 m	0	23	77

GEO-LOGIC INC. 347 Pido Road Unit 29 Peterborough, ON, K9J 6X7 Tel: (705) 749-3317 Fax: (705) 749-9248

GRAIN SIZE DISTRIBUTION CHART

Client:	*Leblanc*	Ref No.:	*SS-13-33*
Project:	*G024359A1*	Location:	*Croft Street, Port Hope*
Borehole No.:	*TP5*	Sample No.:	*GS2*
Depth:	*2.7 to 3.0 m*	Enclosure:	*B-2*



Sample No.	Depth	% Gravel	% Sand	% Silt / Clay
TP5,GS2	2.7 to 3.0 m	11	41	48

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GRAIN SIZE DISTRIBUTION CHART

Client:	*Leblanc*	Ref No.:	*SS-13-33*
Project:	*G024359A1*	Location:	*Croft Street, Port Hope*
Borehole No.:	*TP9*	Sample No.:	*GS2*
Depth:	*2.7 to 3.0 m*	Enclosure:	*B-3*

Sample No.	Depth	% Gravel	% Sand	% Silt / Clay
TP9,GS2	2.7 to 3.0 m	8	29	63

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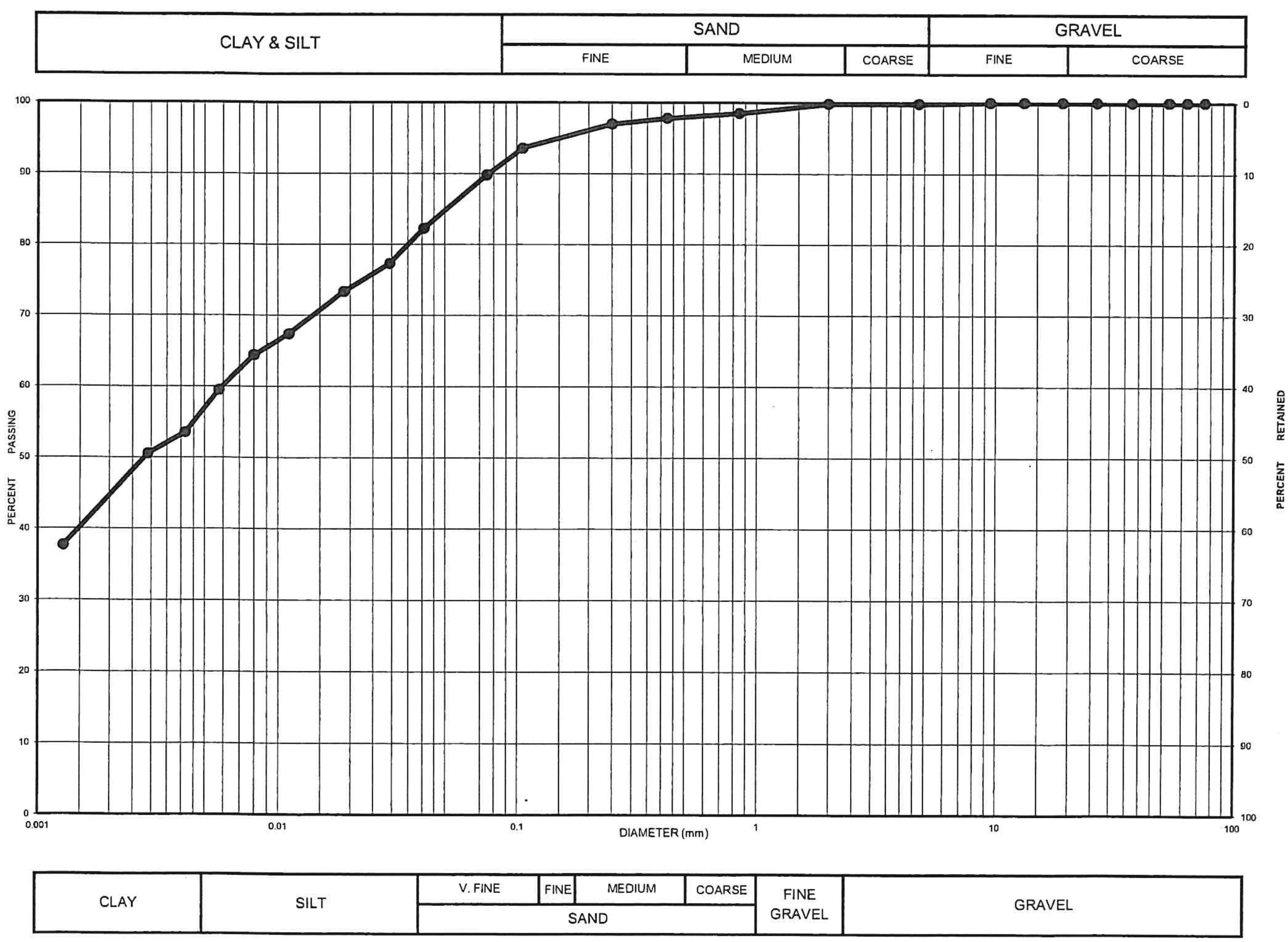
GRAIN SIZE DISTRIBUTION CHART

Client:	*Leblanc*	Ref No.:	*SS-13-33*
Project:	*G024359A1*	Location:	*Croft Street, Port Hope*
Borehole No.:	*TP13*	Sample No.:	*GS1*
Depth:	*1.2 to 1.5 mbeg*	Enclosure:	*B-4*



Sample No.	Depth	% Gravel	% Sand	% Silt / Clay
TP13,GS1	1.2 to 1.5 mbeg	0	10	90