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Geotechnical Investigation
Proposed High-Rise, Mixed-Use Development
925 Main Street West
Hamilton, Ontario

Prepared for:

925 Main Street West (Hamilton) Limited
c/o Effort Trust
50 King St. East
Hamilton Ontario
L8N 1A6

Landtek File: 19328
June 26, 2026

EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	Preliminary Coordination drawings indicate the proposed development to comprise of one, 29-storey and one, 26-storey residential tower with a five- and six-storey podium surround and four levels of unheated basement parking.
Report Deliverables	The Geotechnical Investigation report is required to provide an understanding of the subsurface conditions underlying the site and to provide preliminary design and construction recommendations for the proposed high-rise development.

SITE DETAILS AND SETTING

Coordinates	589020, 4790130	**Geodetic Elevation**	99 m to 101 m

Site Description	The site is located on the south-west corner of Main Street West and Longwood Road South, with the proposed development located on table lands at the top of the valley slope along the Chedoke Expressway. The site is currently unoccupied, with all former structures removed to ground surface level and only locally limited, asphalt surfaced pavements remaining.
Geology	Existing pavement materials were encountered at the ground surface in all boreholes. Fill material consisting of mainly silt was encountered underlying the pavement materials and extend to depths between approximately 1.5 m and 5.4 m. Interbedded clay, silt and sand deposits underly the fill materials. Bedrock was encountered at depths ranging between approximately 39.1 m and 47.2 m, equating to Geodetic elevations of approximately 60.1 m and 50.1 m respectively.
Groundwater	Groundwater, water seepages or saturated soils were encountered during drilling in the majority of boreholes at depths between approximately 3.0 m and 11.9 m below existing ground level, respectively. Further information pertaining to groundwater conditions is provided in the Hydrogeological Assessment for the site, as reported under separate cover.

ENGINEERING CONSIDERATIONS

Foundations	Based on the ground conditions observed at the borehole locations, it is considered by Landtek that the anticipated highly-loaded, high-rise structure can be, in part, supported by the native soils underlying the site using conventional, concrete strip or pads foundations. If the footing design criteria provided cannot be satisfied then an alternative solution may be considered, such as a raft, a deeper, piled solution, or a 'combination' pile-supported raft.
Settlements	In soils, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate for foundations. Any anticipated settlements for foundations seated within the bedrock should be considered negligible (i.e., less than 15 mm).
Earthquake Considerations	In accordance with the OBCC Table 4.1.8.4.-A "*Exceptions for Site Designation Using Vs_{30} Calculated from In Situ Measurements*", the Site Designation is considered X_{415} and the Site Class as 'X_C', with shale bedrock subcrop indicated by reflections from the MASW dataset, to be at a depth of approximately 36.0 m depth.
Damp Proofing and Waterproofing	Elements of the proposed four underground parking levels are expected to intersect groundwater. As such, it is recommended that all subsurface structures and associated areas (i.e., elevator pits etc.) above the "*seasonally highest groundwater level*" (see Landtek's Hydrogeological Assessment) and the associated buffer zone, are appropriately waterproofed.

CONSTRUCTION CONSIDERATIONS

Excavations	The subsurface soils to be encountered during excavation at the site are expected to behave as "*Type 2*" and "*Type* 3" materials according to the OHSA classification in Part III. The overburden soil deposits are considered readily excavatable using a hydraulic backhoe.
Subsurface Concrete	The native soils generally have a mild sulphate environment and are not aggressive to concrete (CSA criteria of less than 0.2 % water soluble sulphate in the soils). Therefore, normal General use (GU) hydraulic cement can be used for subsurface structures.
Construction Dewatering	Considerations regarding groundwater control and dewatering requirements during construction have been provided by the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

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1.0 INTRODUCTION

Landtek Limited (herein "*Landtek*") is pleased to submit this geotechnical investigation report for the proposed high-rise, mixed-use development located at the site identified as civic address 925 Main Street West in Hamilton, Ontario. Authorization to proceed with the work was received from Legacy Constructors Inc. and Urban Solutions Planning & Land Development (herein "*Urban Solutions*"), acting on behalf of 925 Main Street West (Hamilton) Limited and Effort Trust.

Based on preliminary Coordination Drawings, as issued by KNYMH Inc., reference 21009, dated February 20, 2026, and provided to Landtek by Urban Solutions, it is understood that the proposed high-rise development will consist of the following:

- One, 29-storey (Tower 'A') and one, 26-storey (Tower 'B') residential tower, with ground floor elevations of approximately 99.5 m Geodetic;
- A five- and six-storey podium and surround;
- Four levels (identified as P1 to P4) of unheated basement parking, equating to a lowest basement floor slab depth of approximately 12.0 m (assumed approximate Geodetic elevation 87.5 m), that cover the full site area;
- A commercial first floor with residential amenities, bike storage and administration offices;
- At-grade, commercial outdoor areas;
- Areas of landscaping and slope reconstruction; and,
- Deck, and limited areas of at-grade, pavement structures.

The primary objectives of this investigation are:

- To confirm the subsurface soil and groundwater conditions for foundation design and construction;
- Provide design and construction recommendations with regards to building foundations, at-grade floor slabs, pavement structures, and subsurface drainage and utilities; and,
- Assess the characteristics of the soils to be excavated and their impact on excavatability, reuse and shoring systems.

This report has been prepared for the Client, the nominated representatives, engineers, designers, project managers and approving Municipal Authorities pertaining to the proposed high-rise, mixed-use development located at the site identified as civic address 925 Main Street West in Hamilton, Ontario. Reliance on this report is also extended to Municipalities and Regulatory Authorities but is limited to the intended purpose of the report only.

Any further dissemination of this report outside of those parties previously detailed is not permitted without Landtek's prior written approval. Further details of the limitations of this report are presented in Appendix A.

2.0 SITE SETTING

2.1 Site Location and Description

The site is located in Hamilton, Ontario, and is centered at approximate grid reference 589020, 4790130 (UTM 17T coordinates). The Geodetic elevation of the ground surface at the site is approximately 99 m to 101 m.

The site location is shown in Figure 2.1.1 below.

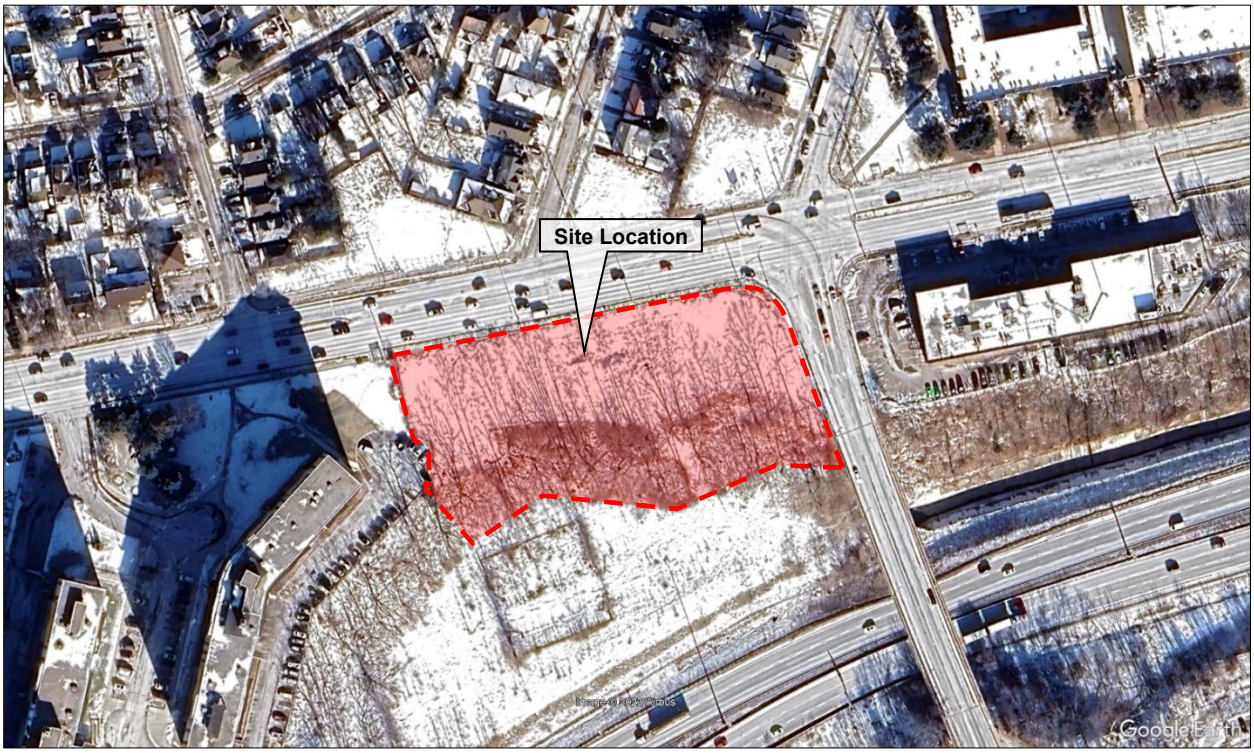


Figure 2.1.1: *Site Location and Surrounding Area*

The site is located on the south-west corner of Main Street West and Longwood Road South, with the proposed development located on table lands at the top of the valley slope along the Chedoke Expressway. The site is currently unoccupied, with all former structures removed to ground surface level and only locally limited, asphalt surfaced pavements remaining.

Based on a review of historical aerial photography for the site, it is understood that the site remained undeveloped until the mid-1950's. Between 1954 and 1964 the site was developed in phases and included earthworks southwards to increase the site area to its current footprint and the construction of small, commercial structures. No further site layout or development changes are noted since 1964 until site demolition in the early 2020's.

2.2 Published Geology

Based on previous geotechnical experience for the area and a review of the existing geological publications for the site area, Ontario Geological Survey (herein "*OGS*") Map P. 993 "*Quaternary Geology of the Grimsby Area*", the site is underlain by Lake Iroquois glaciolacustrine clay and silt deposits and silty and clayey till deposits of the Halton Till at depth.

The Ontario Department of Mines (herein "*ODM*") Map 2343 "*Paleozoic Geology of the Grimsby Area*" indicates that the superficial geology is underlain by red shale of the Queenston Formation and is expected to be encountered at significant depth beneath the site (±35.0 to ±45.0 m).

Information provided by historical borehole records from within the vicinity of the site, and held by the OGS, generally confirms the anticipated geological conditions beneath the site. Based on the data from records for Borehole ID 622072, located approximately 200 m south of the site, the soil profile comprises of silt and clay deposits to approximately 14.30 m depth, with till and interbedded sand deposits underlying to at least 15.5 m depth. Bedrock was not encountered.

2.3 Previous Geotechnical Investigations

Landtek has carried out a number of Geotechnical Investigation phases at the site, the findings of which are provided in the following reports:

- "*Preliminary Report, Geotechnical Investigation for Proposed Multi-Storey Building Development, 925 Main Street West at Longwood Road South, Hamilton, Ontario*", reference 14293, dated November 19, 2014;
- "*Slope Condition, Stability and Rehabilitation Appraisal, Proposed Columbia International School Residence, 925 Main Street West, Hamilton, Ontario*", reference 15014, dated September 19, 2016; and,
- "*Supplementary Geotechnical Investigation Letter Report, Proposed CIC Student Residence, 925 Main Street West, Hamilton, Ontario*", reference 19328, dated October 17, 2019.

This report is a compilation of the findings of the above Geotechnical Investigation reports.

Additional information has also been gleaned from the Hydrogeological Investigation completed for the site by Landtek, the finding of which are detailed in the following report:

- "*Hydrogeological Investigation Report, Proposed Residential Development, 925 Main Street West, Hamilton, Ontario*", reference 22371 and dated June 7, 2023.

3.0 FIELDWORK AND INVESTIGATION METHODOLOGY

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling and soil sampling, and field supervision. A total of 29 boreholes have been drilled at the site for both Geotechnical and Hydrogeological investigation purposes, as follows:

- October 10 to 15, 2014: Ten boreholes (boreholes BH1 to BH10) to depths between approximately 50.0 m and 39.6 m;
- September 25 and October 2, 2019: Four boreholes (boreholes BH101 to BH104) to depths between approximately 30.9 m and 49.1 m; and,
- September 6 and December 2, 2022: Fifteen boreholes and monitoring wells (boreholes BH9 and monitoring wells MW22-1S/D, MW22-2S/D, MW22-3S, MW22-4D, MW22-5S, MW22-6S/D, MW22-7S, MW22-8S/D, MW22-10S/D, and MW22-11) to depths between approximately 5.0 m and 15.2 m.

Full time supervision of drilling and soil sampling operations was carried out by a representative of Landtek, with all boreholes logged using those standard symbols and terms defined in Appendix B. The Exploratory Hole Location Plan, Drawing 19328-01, and associated borehole logs are provided in Appendix C.

Standard Penetration Tests (SPT's) and split spoon samples were taken at frequent depth intervals during drilling. Full time supervision of drilling operations was carried out by a representative of Landtek. The soil samples were transported to the Landtek's in-house, Canadian Council of Independent Laboratories (CCIL) certified laboratory and visually examined to determine their textural classification. Moisture contents were carried out on all samples.

The monitoring wells consisted of new 50 mm poly-vinyl chloride (PVC) screen with No.10 slots threaded onto a matching riser. The screens and risers were pre-threaded including o-ring seals such that no glues or solvents were used to connect the pipe sections. The annular space between the PVC well and the borehole was backfilled to approximately 0.3 m above the top of the screen section with sand pack, and then with bentonite to existing ground level. A J-Plug lockable air-tight cap was installed on the riser. Seven subsequent groundwater monitoring visits were undertaken by Landtek between 9 December 2022 and 23 May 2023.

Elevations at the borehole locations were established by Landtek relative to site measurements and the current topographical survey for the site, as completed by A. T. McLaren Limited, Drawing Reference 34539 and dated February 13, 2015.

In addition, a shear wave velocity sounding was also conducted on November 23, 2022 by Geophysics GPR International Inc. (herein "*Geophysics GPR*"), on behalf of Landtek, to determine the Site Seismic Classification for the site.

4.0 SUBSURFACE CONDITIONS

4.1 Overview

The borehole information is generally consistent with the geological data identified in Section 2.2, with the predominant soils comprising glaciolacustrine silt and clay deposits, till deposits and deeper shale bedrock.

The detailed borehole logs are presented in Appendix C, with the ground conditions encountered by the boreholes discussed in the following sections.

4.2 Organic Soils

Organic soils were not encountered during this investigation.

4.3 Existing Pavement Materials

Existing pavement materials were encountered in all boreholes. Asphalt thicknesses of the existing pavements range between approximately 75 mm and 250 mm.

Though variable, the asphalt is underlain in part by a pavement granular material comprising of a sand and gravel product that ranges in measured thicknesses of approximately 110 mm to 380 mm.

4.4 Fill Materials

Fill material was encountered underlying the pavement structure in all boreholes and extends to depths of between approximately 1.5 m and 5.4 m below existing ground level. The fill is primarily brown in colour and comprises predominantly of clay and silt with variable fractions of gravel and sand. Asphalt, concrete and brick fragments are also noted.

SPT ‘N’ values recorded from within the fill materials suggest the fill to be of a low to moderate, variable compaction. Moisture contents are generally in the order of 14 % to 24 %, which is as expected of an uncontrolled fill material of variable material type.

The moisture content testing results are presented on the borehole logs in Appendix C.

4.5 Clayey Silt and Silt

Clayey silt and interbedded silt deposits were encountered underlying the fill materials in all boreholes. These deposits extend to depths between approximately 15.2 m and 27.5 m. The clayey silt and silt deposits contain variable fractions of clay and fine sand, and are generally brown in colour, becoming grey at depth.

SPT ‘N’ values recorded from within the clayey silt and silt deposits range between 7 and 50, indicating the deposits to be of a firm to hard, but generally very stiff consistency. Moisture contents are in the order of 9 % to 30 %, which is as to be expected for a moist to very moist soil with variable clay and silt fractions as primary constituents.

The moisture content testing results are presented on the borehole logs in Appendix C.

4.6 Silty Sand to Sandy Silt

Silty sand to sandy silt deposits were encountered in all boreholes at depths between 3.0 m and 11.5 m below ground level, generally as interbeds with the clayey silt and silty clay deposits. The silty sand and sandy silt layers are between approximately 0.7 m and 3.0 m thick, and include variable but generally trace fractions of gravel, and are brown in colour.

SPT 'N' values ranging from 32 to 61 were reported, indicating the silty sand to be of a dense to very dense, but generally very dense condition. Moisture contents are in the order of 14 % to 24 %, which is as expected for a very moist to wet soil with silt and sand as primary constituents.

The moisture content testing results are presented on the borehole logs in Appendix C.

4.7 Sand

Sand deposits were encountered locally and at variable depth, ranging between 5.5 m depth and 11.4 m depth. The sands are approximately 2.3 m to 5.2 m thick and include trace fractions of gravel and silt and are generally brown in colour.

SPT 'N' values ranging from 13 to 55 were reported, indicating the sand deposits to be of a compact to very dense, but generally dense condition. Moisture contents are in the order of 11 % to 16 %, which is as expected for a very moist to wet soil with sand as a primary constituent.

The moisture content testing results are presented on the borehole logs in Appendix C.

4.8 Bedrock

Red shale of the Queenston Formation was encountered underlying the silty clay at depths ranging between approximately 39.1 m (borehole BH104) and 47.2 m (borehole BH102) below existing ground level, equating to Geodetic elevations of approximately 60.1 m and 50.1 m respectively.

No coring was conducted to establish rock quality, however previous geotechnical experience in the area indicates the shale is generally weak and moderately weathered in the upper layers, though becomes more competent at depth. The shale is typically classified under the Canadian Foundation Engineering Manual classification rating criteria as being a Grade R2 to R3 rock which is weak to medium strong rock.

It should be noted that the shale is a layered sedimentary bedrock deposit with widely spaced jointing and sub-horizontal bedding planes. Though not encountered during this investigation, the strata include interbedded, slightly weathered to fresh, grey, fine grained strong to extremely strong, calcareous siltstone and limestone seams, that tend to be much sounder and harder than the shale strata.

4.9 Groundwater

Groundwater, water seepages or saturated soils were encountered during drilling in the majority of boreholes at depths between approximately 3.0 m and 11.9 m below existing ground level, respectively. These conditions are interpreted as the groundwater '*strike*', i.e., the depth at which groundwater is encountered and is associated with the more permeable, silty and sandy deposits.

Seven return, groundwater monitoring well visits have been completed at the site, the results of which are presented in Table 4.9.1 following.

Table 4.9.1: Summary of Water Level Measurements

MW ID	Ground Elevation	Water Strike	Groundwater Monitoring Results						
			9/12/22	21/12/22	13/01/23	8/02/23	23/03/23	19/04/23	23/05/23
BH/MW1	99.14 m	9.3 m	9.36	9.60	9.37	-	8.36	9.39	9.25
BH/MW22-1S	99.78 m	3.0 m	3.83	3.57	3.13	3.36	2.92	3.31	3.31
BH/MW22-1D		11.5 m	9.15	9.25	9.20	-	9.15	9.08	9.0
BH/MW22-2S	99.16 m	-	-	4.27	3.43	3.57	3.06	3.55	3.62
BH/MW22-2D		11.9 m	11.92	11.93	11.90	-	11.97	11.95	11.95
BH/MW22-3S	99.13 m	-	3.82	3.49	3.08	3.16	2.64	3.10	3.19
BH/MW22-4D	99.32 m	11.5 m	9.38	9.59	9.42	9.62	9.51	8.95	9.39
BH/MW5	99.30 m	3.6 m	4.00	3.55	2.08	-	1.88	2.21	2.27
BH/MW22-5S	99.48 m	-	4.03	3.51	2.90	-	2.31	2.06	3.60
BH/MW22-6S	99.55 m	-	-	-	3.51	-	2.38	2.51	3.75
BH/MW22-6D		11.3 m	11.21	11.30	11.01	-	10.90	10.21	10.50
BH/MW22-7S	99.16 m	-	3.72	3.57	2.76	-	2.31	3.05	3.21
BH/MW22-8S	99.43 m	-	-	-	-	-	-	-	-
BH/MW22-8D		7.6 m	10.57	11.08	10.59	-	10.06	10.25	10.71
BH/MW22-10S	99.10 m	-	-	-	-	-	-	-	-
BH/MW22-10D	99.10 m	6.8 m	10.63	10.68	10.45	-	9.88	9.58	10.38
BH/MW22-11	99.26 m	-	-	-	4.32	-	4.07	-	-

It should be noted that groundwater conditions and surface water flow conditions are expected to vary according to the time of the year and seasonal precipitation levels. Water seepage is also expected from soil fissures above the water table.

Further information pertaining to groundwater conditions is provided in the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

5.0 FOUNDATION DESIGN CONSIDERATIONS

5.1 Shallow Foundation Considerations

5.1.1 Foundations in Native Soils

The existing fill materials present at the site are not considered a suitable bearing stratum due to the increased risk of excessive settlements. Based on the ground conditions observed at the borehole locations, it is considered by Landtek that the anticipated highly-loaded, high-rise structure can be, in part, supported by the native soils underlying the site using conventional, concrete strip or pads foundations. It is understood that the proposed structure will be a maximum of 29 storeys high and will include for four levels of unheated basement parking across the full site area. With an anticipated P4 basement floor level at approximately 12.0 m depth (approximate Geodetic elevation 87.5 m), foundations are expected to be seated at a depth of approximately 12.5 m to 13.5 m below ground level (approximate Geodetic elevation 87.0 m to 86.0 m).

Table 5.1.1.1 summarizes the recommended geotechnical reactions at the Serviceability Limit State (herein "*SLS*") and factored geotechnical resistances at the Ultimate Limit State (herein "*ULS*") for the native soils. It should be noted that the design parameters have been determined by Landtek for the design stage only.

In accordance with the Ontario Building Code Compendium, 2024 (herein "*OBCC*"), 9.12.2.2 (5), and based on local experience, the shallowing of exterior and interior footings to 0.9 m and 0.6 m depth below the basement finished floor level respectively, may be adopted for the proposed development. Such shallowing of foundations is to be limited to only those areas where a minimum of one basement level is to be included.

Table 5.1.1.1: Limit State Foundation Design Values

Approximate Founding Depth Ranges		Founding Stratum	Foundation Design Value	
Depth Range	Geodetic Elevation		SLS [1,2]	ULS [3,4]
12.5 m to 13.5 m	87.0 m to 86.0 m	Silts and Clayey Silts	200 kPa	300 kPa

Notes:
1. The National Building Code general safety criterion for the serviceability limit states is: SLS resistance ≥ effect of service loads.
2. Recommended SLS bearing values conform to Estimated Values based on soil types given in Tables K-8 and K-9 of the National Building Codes User's Guide.
3. The ULS resistance factor for shallow foundations is 0.5, as given in Table K-1 of the National Building Code User's Guide.
4. The National Building Code general safety criterion for the ultimate limit states is: factored ULS resistance ≥ effect of factored loads.

Where the bearing levels of the footings are at different design elevations, the footing base levels should be stepped along a line of 7V:10H, drawn upwards from the lowest footing, to avoid overlapping stresses.

Subsurface conditions can vary over relatively short distances and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. Therefore, a Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code (herein "*NBC*"), Volume 1, Clause 4.2.2.3.

Design factors related to structural loads will determine the most cost-effective foundation system for the proposed development. The impact on foundation size and soil bearing pressure is illustrated in Figure 5.1.1.1 and emphasizes that foundation design sizes, bearing pressures, and bearing levels must be taken into account to avoid excessive consolidation settlements.

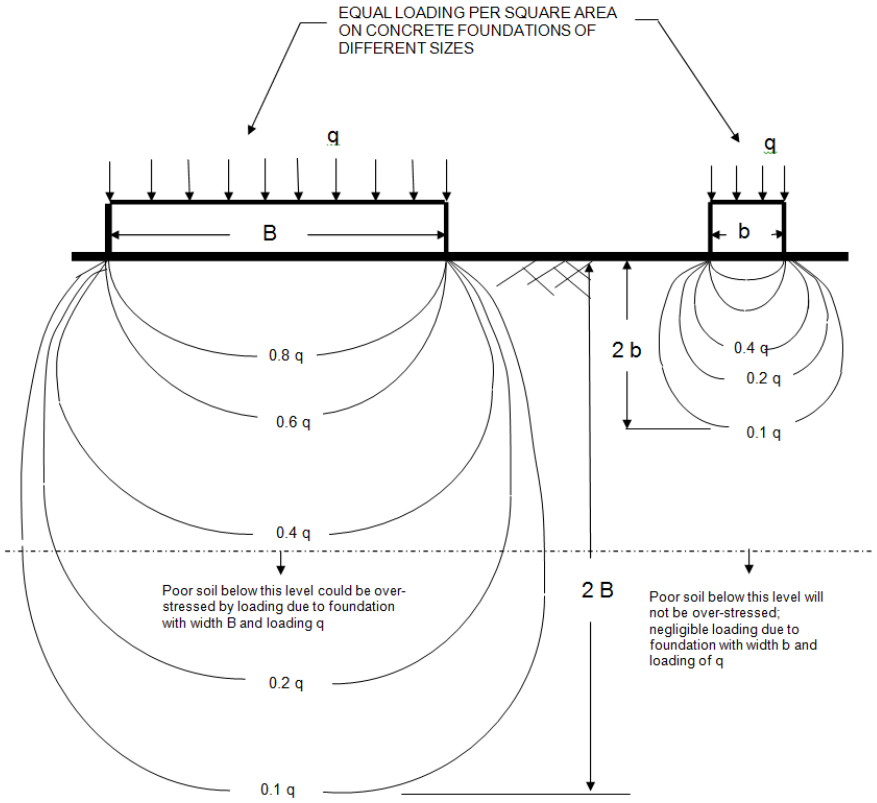


Figure 5.1.1.1: *Illustration of Load Distribution below Variable Size Foundations with the Same Applied Loading*

Footing foundations may be considered an appropriate option, though the acceptability of footings will depend upon design issues such as the elevation of the lowest floor level and the structural loading. If the footing design criteria provided in this report cannot be satisfied then an alternative solution may be considered, such as a raft, a deeper, piled solution, or a 'combination' pile-supported raft, particularly if the proposed structures are of a higher loading than anticipated.

5.1.2 Frost Susceptibility

The shallow soils encountered across the site are considered sensitive to water and frost, and their physical and mechanical properties are dependent on in-situ moisture content. As such, the founding soils at the site are considered to have a moderate to high frost susceptibility, being classified as Frost Group "*F4*" (Table 13.1 of the "*Canadian Foundation Engineering Manual*", 4th Edition). However, the identified depths for foundations, as given in Section 5.1 are considered to be below the maximum extents of influence from frost penetration in the Hamilton area.

Should any re-grading be required as part of the proposed development and adjacent to the new structures, it will be important to ensure that the associated exterior footings will have a minimum of 1.2 m of soil cover, or equivalent suitable insulation, for frost protection.

5.1.3 Settlement Considerations for Soils

Based on the information provided for the nature of the proposed development at the site, it is anticipated that the loads to be applied to the ground by any such structure will be generally moderate to high intensity.

As such, associated settlements are expected to be large but not significant. Therefore, the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

5.2 Raft Foundation Considerations

As outlined in Section 5.1.1, for foundations of a higher loading, particularly those of the proposed structure, a raft foundation may be considered an appropriate, shallow-founded alternative to strip or spread foundations.

The soil parameters to be used in the raft foundation design process include the modulus of subgrade reaction, corrected for the building footprint size, and the limiting average pressure at the underside of the raft foundation. The net average bearing pressure at the SLS acting on the underside of the raft should be taken as 180 kPa for the predominantly cohesive, clayey silts deposits (anticipated to be the founding stratum) at depths of approximately ±12.5 m to ±13.5 m (approximate Geodetic elevation ±87.0 m to ±86.0 m).

Design values for the modulus of subgrade reaction generally decrease when the size of the loaded plate (or footing) is larger than 0.3 m by 0.3 m. For cohesive soils, if the loaded area on the soil is a width of b and a length (as a ratio to b) of mb, the modulus of subgrade reaction can be taken as:

$$k_{vb} = \frac{k_{v1}}{b} \frac{[m + 0.15]}{[1.5\,m]}$$

where:

k_{v1} = modulus of subgrade reaction for a loaded plate of dimensions 0.3 m x 0.3 m;
= 30 MPa/m, considered representative of the predominant soil bearing conditions at depth across the site;
b = raft foundation width in metres;
m = ratio of foundation length to width where length, L, = mb
k_{vb} = modulus of subgrade reaction in MPa/m for actual foundation dimension b

The above recommended average bearing capacity provided for a raft foundation is based on the available borehole data, knowledge of the geotechnical and geological history of the area, and the condition that construction quality assurance inspection will be carried out by Landtek.

Construction quality assurance is considered essential to confirm that the bearing stratum and bearing levels are consistent with the findings of this report, and the foundation installations are in accordance with accepted best practices.

5.3 Deep Foundation Considerations

5.3.1 Piled Foundations in Bedrock

If higher bearing capacities are required to support the building loads, then an alternative, deeper founding solution may be required, such as the following:

- "*Cast in Place*" concrete caissons, which could be constructed without any unexpected difficulties, but, based on the conditions of deeper groundwaters, should incorporate the use of liners. It is anticipated that a dewatering system will not be required provided that liners are used appropriately to control the piezometric water level conditions encountered at depth; or,
- Continuous Flight Auger (CFA) piles.

For piles seated within the shale bedrock, it is considered that the weathered bedrock can support a factored geotechnical resistance of 1.25 MPa at the ULS and seated at a depth to provide a minimum 1.5 m rock socket (i.e., founded at a minimum of 1.5 m penetration depth into the weathered shale). This equates to a founding depth between approximately of approximately ±40.6 m (Geodetic elevation ±58.6 m) and ±48.7 m (Geodetic elevation ±50.6 m).

The following parameters should be applied for the bedrock when considering lateral pressures on loaded piles:

$$K_p = \text{Rankine passive pressure coefficient} = \tan^2(45 + \phi/2)$$

For the completely and highly weathered shale (residual soil):
- ϕ = Internal angle of friction should be taken as 26°; and,
- γ = Bulk unit weight should be taken as 22 kN/m^3.

For the weathered shale:
- ϕ = Internal angle of friction should be taken as 26°; and,
- γ = Bulk unit weight should be taken as 25.5 kN/m^3.

The frictional resistance (skin friction) developed by the native soils in the drilled shaft may be calculated as follows:

$$Q_s = 0.42 D_s \, [100 L_1]$$

Where:
- D_s = Diameter of drilled shaft
- L_1 = Length of pile within the silty sands and clays
- Q_s = value in kN

Table 5.3.1.1 summarizes the side resistance capacities for piles embedded in the weathered bedrock. The capacities have been calculated using the Zhang and Einstein method. The following assumptions have been made.

- The compressive strength of the shale bedrock maintains the average value; and,
- All sockets are smooth.

Table 5.3.1.1: Friction Capacities for Embedded Caissons

Embedment Depth[1]	Factored Side Resistance
1.5 m	0.94 MN/m

Notes:
1 Embedment depths within shale

For preliminary considerations, to calculate the skin friction load at an embedment depth of 1.5 m, based on an example with caisson diameter of 1.2 m, the load is determined as a multiplication of 1.2 m by 0.94 MN/m and is calculated to be 1.41 MN.

It should be noted however, that the final design and seating depths for any piled foundation solution is to be based on specific pile driving and pile load tests undertaken at the site prior to construction. As such, a specialist piling contractor should be consulted to establish the most appropriate design.

In addition, coring of bedrock and subsequent rock testing for strength parameter testing (Point Load index testing and Unconfined Compressive Strength testing) is also recommended if higher bearing capacity values are required.

5.3.2 Settlement Considerations for Piled Foundations

For settlement considerations within the weathered shale bedrock, the SLS condition will not govern the foundation design as the stress required to induce 25 mm of movement (typical settlement criteria for SLS) is anticipated to exceed ULS. Therefore, any anticipated settlements for foundations seated within the shale bedrock should be considered negligible (i.e., less than 15 mm).

5.4 Seismic Design Considerations

A shear wave velocity sounding to was conducted on November 23, 2022 by Geophysics GPR, on behalf of Landtek, to determine the Seismic Class at the site. The investigation included the Multi-channel Analysis of Surface Waves (herein "*MASW*") and the refraction method to generate shear-wave velocity model.

Based on the data received from the MASW fieldwork undertaken, the calculated Vs_{30} values indicate an average shear wave velocity of 415 m/s for a structure with four basement levels and foundations seated at a depth of approximately 10.0 m to 14.0 m below ground level (i.e., a maximum sounding depth of 44.0 m).

In accordance with the OBCC Table 4.1.8.4.-A "*Exceptions for Site Designation Using Vs_{30} Calculated from In Situ Measurements*", the Site Designation is considered X_{415} and the Site Class as 'X_C', with shale bedrock subcrop indicated by reflections from the MASW dataset, to be at a depth of approximately 36.0 m depth.

A copy of the MASW report, reference T224233, is provided as Appendix D to this report and as is required by the OBCC, the report is sealed by a Professional Engineer

5.5 Existing Building Demolition

It is understood that all remaining subsurface structures, including remaining foundations, pavement elements and services, will be removed prior to the proposed development. For the purposes of this report, it has been assumed that such existing structures and all associated substructures will be removed in full prior.

Should there be a need to fill excavations created by the demolition of the existing structure with engineered fill or unshrinkable backfill prior to commencing the proposed development, Landtek should be contacted to determine the most appropriate placement requirements of the fill material.

5.6 Damp Proofing and Waterproofing Considerations

Based on the anticipated minimum depth at which the foundations for the proposed development will be seated and the groundwater levels recorded during this investigation, it is expected that the proposed four levels of underground parking will be constructed such that it intersects the groundwater at the site.

As such, it is recommended that all subsurface structures and areas (i.e., basement walls, floor slabs, elevator pits etc.) are appropriately waterproofed below the established "*seasonally highest groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).

Any subsurface areas above the "*seasonally highest groundwater level*" and associated buffer zone should be, as a minimum, damp proofed and comply with the OBCC requirements. It is

recommended that such damp proofing system include a Delta Drainage Board or MiraDrain 2000 series product, or an approved alternative, along with an asphalt-based spray-on wall coating.

Further, more detailed information regarding groundwater conditions at the site and the "*seasonally highest groundwater level*" is provided in Landtek's Hydrogeological Assessment for the site, as provided under separate cover.

6.0 FLOOR SLAB AND PERIMETER DRAINAGE CONSIDERATIONS

Based on the borehole soil conditions and development information provided to Landtek, it should be possible to construct the lowest (i.e., basement) floor slab level using slab-on-grade methods. The subgrade support conditions are anticipated to be clayey silt and silt deposits, that should provide competent conditions for placing the vapour barrier material under dewatered conditions.

After the subgrade has been prepared to the underfloor design elevation it is recommended that the area be proof-rolled with a loaded tandem axle dump truck to delineate if there are soft or unstable ground conditions that require repair. This operation should be completed before the underfloor vapour barrier granular material is placed.

It is recommended that a minimum 200 mm layer of clear, 19 mm crushed quarried stone be used as the vapour barrier under the floor slab. The vapour barrier stone should meet the requirements of Ontario Provincial Standard Specifications (herein "*OPSS*") 1004 for 19 mm Type II clear stone. If a graded crushed stone is substituted for clear stone, the material should be limited to a maximum of 5 % fines (passing the 0.075 mm sieve). The floor slab thickness should meet the specifications of the project based on anticipated floor loadings.

The finished exterior ground surface should be sloped away from the buildings at a grade in the order of 2 %.

The concrete properties should meet the requirements of OPSS 1350. Contraction and isolation jointing practices should be in accordance with current Portland Cement Association recommendations, as given in the engineering bulletin "*Concrete Floors on Ground*", second edition, by R. E. Spears, and W. C. Panarese.

The design of concrete slabs on native soils may be made on the basis of a value of modulus of subgrade reaction of 30 MPa/m for native subgrade soils.

Unless the proposed structure is to be waterproofed as prescribed in Section 5.6, perimeter drainage should be provided around all subsurface floor areas where water may accumulate. This, however, is subject to the Municipal approval allowing for the discharge of groundwater into the Municipal storm system where the perimeter drainage is going to be installed at a depth below the established, "*seasonally highest groundwater level*".

Underfloor drains may be also required depending on the provision of waterproofing, or excavation and groundwater seepage conditions, particularly where below the groundwater level. Based on the anticipated foundation elevations for the three basement levels and deeper elevator pit, and when considering the groundwater monitoring data, groundwater is to be expected within the excavation profile for the proposed structure.

The drainage system should comply with the OBCC and associated amendments. Further details pertaining to perimeter and underfloor drainage systems are provided in Drawings 19328-02 and 19328-03 respectively, in Appendix E.

7.0 EARTH PRESSURE CONSIDERATIONS FOR SUBSURFACE WALLS

7.1 Earth Pressure Considerations for Soils

The earth pressure, p, acting on subsurface walls at any depth, h, in metres below the ground surface assumes an equivalent triangular fluid pressure distribution and may be calculated using the expression below. It is assumed that granular material is used as backfill. Allowances for pressure due to compaction operations should be included in the earth pressure determinations and a value of 12 kPa is applicable for a vibratory compactor and granular material.

If the structure retaining soil can move slightly, the active earth pressure case can be used in determining the lateral earth pressure. For restrained structures and no yielding an "*at rest*" earth pressure condition should be used. The determination of the earth pressures should be based on the following expression:

$$P_1 = K (\delta h + q)$$

where:
- P_1 = the pressure in kPa acting against any subsurface wall at depth, h, in metres (feet) below the ground surface;
- K = the at rest earth pressure coefficient considered appropriate for subsurface walls; OPSS 1010 Granular B Type 1 (pit-run sand and gravel) material has an effective angle of friction estimated to be 32° with a corresponding at rest earth pressure coefficient, K_o, of 0.45; and,
- δ = the moist bulk unit weight of the retained backfill; 21.5 kN/m^3.

and,
- q = the value for any adjacent surcharge in kPa, which may be acting close to the wall; and,
- h = the depth, in m, at which the pressure is calculated

Backfill materials required for behind the retaining structure is assumed to meet an OPSS 1010 Granular B Type 1 pit-run sand and gravel material or OPSS 1010 Granular A. The granular fill should be compacted to a minimum of 98 % of the material's SPMDD, or to the levels and backfilling procedures specified. Table 7.1 below provides those lateral earth pressure parameters for the predominant soils anticipated at the site.

Table 7.1: Recommended Lateral Pressure Parameters

Parameter	Site Soils	OPSS 1010 Granular A	OPSS 1010 Granular B Type I
Angle of Internal Friction, ϕ	32°	35°	32°
Unit Weight (KN/m^3)	19.5	23	22
Passive Earth Pressure Coefficient, K_p	4.20	3.70	3.25
At-Rest Earth Pressure Coefficient, K_o	0.38	0.43	0.47
Active Earth Pressure Coefficient, K_a	0.24	0.27	0.31

7.2 Hydrostatic Pressure Considerations

For waterproofed, subsurface walls below the established groundwater level, the pressure distribution on the wall should include the hydrostatic pressure. The determination of hydrostatic pressure should be based on the following expression:

$$P_2 = \delta_w h_w$$

where:
- P_2 = hydrostatic pressure;
- δ_w = unit weight of water; 9.8 kN/m^3; and,
- h_w = depth of wall, below reported water level.

8.0 SOIL CORROSIVITY AND SUBSURFACE CONCRETE

8.1 Concrete Class Considerations

The requirements for subsurface concrete subject to a sulphate and chloride environment are presented in Canadian Standards Association specification, CSA A23.1-14 *"Concrete Materials and Methods of Concrete Construction, Tables 1-4"*. Experience in the area indicates that the native soils generally have a mild sulphate environment and a low chloride concentration. It is recommended that subsurface concrete at the site have the characteristics for normal (GU) Portland cement.

For the parking garage decks and ramps it is recommended that the concrete exposure class be C-1 and the concrete have the following minimum properties:

- minimum 56-day compressive strength: 35 MPa;
- maximum water to cement ratio: 0.40;
- chloride ion penetrability requirement: < 1500 coulombs (within 91 days)
- cementing materials: GU (general use hydraulic cement) or GUb (blended general use)
- air content: as per CSA A23.1-14 Table 4, air content category 1 (freeze-thaw environment)

The concrete should be placed without segregation and should be consolidated to achieve a uniform dense mass.

8.2 Methods for Specifying Concrete

Alternative methods of specifying concrete for a project are outlined in CSA A23.1-14 and allow for "*Performance*" or "*Prescription*" based methods. Each method attaches different levels of responsibility to the owner, the contractor, and the concrete supplier. The pros and cons of each method should be examined prior to completion of the specifications for the project.

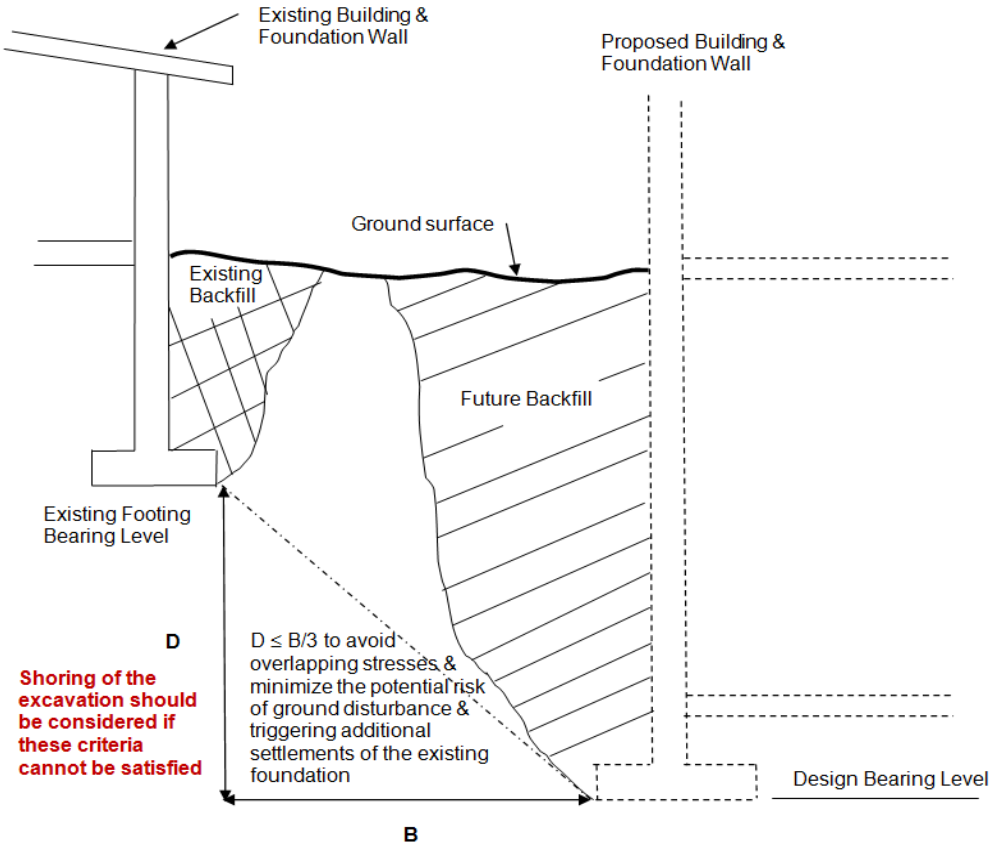
9.0 EXCAVATION AND BACKFILL CONSIDERATIONS

9.1 General Excavation Considerations for Soils

All temporary excavations and unbraced side slopes in the soils should conform to standards set out in the Occupational Health and Safety Act, Ontario Regulation 213/91 "*Construction Projects*" (herein "*OHSA*"). The subsurface soils to be encountered during excavation at the site are expected, in general, to behave as *"Type 3"* and *"Type 2"* materials according to the OHSA classification in Part III. Type 2 materials are characteristic of the generally very stiff "*clayey silts*" and "*dense sand deposits*". The "*fill material*" encountered on site is considered a Type 3 soil.

It should be possible to excavate the overburden soils with a hydraulic backhoe. Moist Type 2 soils are expected to be stable for short construction periods at slopes of approximately 45° to the horizontal (i.e., 1V:1H).

Excavations for new foundations should satisfy the criteria given in the example shown in Figure 9.1.1 to avoid overlapping stresses and minimize the risk of undermining existing adjacent structures, including utilities, and/or triggering additional settlements of the existing structures due to soil disturbance.



Example: If the separation between existing and new proposed footings is 2 m the difference in bearing elevation should not exceed 0.67 m.

Figure 9.1.1: *Criteria for Assessing Excavation Shoring Requirements (Not to Scale)*

Consideration should be given to any existing trench excavations and associated backfill that may be present directly behind cut slopes within the native soils that may appear to be stable on first

excavation. In these circumstances, slopes can suddenly slough or collapse due to the effects of the adjacent backfill.

Consequently, for excavation conditions that cannot satisfy the OHSA requirements for unbraced 1H:1V side slopes, a trench box system should be used, or temporary shoring should be installed to maintain safe working conditions. This may be more applicable to service trench excavations, though may also apply to basement excavations etc., particularly when in close proximity to new road pavements or associated infrastructure.

It should be noted that the design of a temporary shoring system, should one be required, is the responsibility of the Contractor. Therefore, a specialist shoring contractor should be consulted to provide the most appropriate shoring type method and associated installation procedures. Temporary shoring considerations are provided in more detail in Section 10.0 of this report. In any event, the shoring design should be based on the procedures outlined in the latest edition of the "*Canadian Foundation Engineering Manual*".

It is also recommended that lateral and vertical movement of the shoring system be monitored during construction to ensure that movements are within the acceptable range.

9.2 Short-Term (Construction) Dewatering Considerations

Based on the anticipated depths of excavation required for the three proposed basement parking levels and associated elevator pits, it is expected that foundation elements for the proposed structure will be seated within the level at which groundwater was encountered. As such, temporary dewatering will be required during the construction process.

Considerations regarding groundwater control and dewatering requirements during construction have been provided by the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

9.3 General Backfill Considerations

Backfill next to foundation walls and in service trenches should be selected to be compactable in narrow trench conditions. The fill materials present at the site are not considered suitable for re-use. The native soil encountered at the site are expected to be reusable as trench backfill and backfill around the proposed structures on the site. Any variation in the moisture contents of the soils encountered may require selective separation of material to avoid the use of wet soil.

Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. It is recommended that the target compaction specification for trench backfill be 97 % SPMDD with no individual test below 95 % SPMDD.

During inclement weather the native soils may become too wet to achieve satisfactory compaction. If construction is proposed for late in the year, a reduced level of trench compaction with a higher risk of future settlements is to be anticipated, and it is recommended that provisional contract quantities be established for the supply and placement of imported granular fill under such circumstances. The imported granular should meet the requirements of OPSS 1010 for Granular B Type I material as a minimum requirement.

10.0 TEMPORARY SHORING CONSIDERATIONS

The installation of temporary shoring is also recommended to maintain safe working conditions and eliminate the possibility of loss of ground and damage to nearby structures and buried utilities on the adjacent road allowances during excavation for the basement construction.

The requirement and application of shoring to support excavation side slopes will be dependent on the required excavation depth and the proximity of existing or newly constructed infrastructure adjacent to the excavation.

The preferred method of shoring will consist of a concrete caisson wall. This type of system is expected to provide the additional benefit of sealing the excavation from water penetration and loss of soil fines into the open excavation. Soldier piles and timber lagging may be considered as an option for a shoring system, though this type of system may require measures to prevent the loss of soil between the spaces of lagging boards where a wet or flowing soil layer may be present.

The shoring methods may provide lateral restraining force through the use of rakers or tieback anchors. Tieback anchors provide additional advantage since they do not protrude into the excavations as rakers would. However, the use of tieback anchors is also dependent upon whether permission is needed or whether it is physically possible to extend the anchors to the required distance into neighbouring properties. Any rakers should be designed to accommodate a geotechnical reaction at the SLS of 100 kPa and a geotechnical resistance at the ULS of 150 kPa.

It should be noted that the design of any temporary shoring system is the responsibility of the Contractor. Therefore, a specialist shoring contractor should be consulted to provide the most appropriate shoring type method and associated installation procedures. In any event, the shoring design should be based on the procedures outlined in the latest edition of the Canadian Foundation Engineering Manual. It is also recommended that lateral and vertical movement of the shoring system be monitored during construction to ensure that movements are within the acceptable range.

11.0 SLOPE RECONSTRUCTION CONSIDERATIONS

Due to the lateral and vertical variation of the fill materials across the site, in terms of strength, depth and type, and in order to maintain a competent slope profile, the existing slope is to be reconstructed.

The existing slope face and gradient should be improved by the addition of selected soils in a controlled, engineered manner, to create the shallower, more stable slope gradient of 3(H):1(V). The process of benching and material placement will result in the physical top of slope moving southwards in the order of approximately 15.0 m.

The following construction practices are recommended during reconstruction of the slope:

- The surface of the existing slope should be scarified to remove all organics and loose or soft materials;
- The existing slope face should be benched to prevent the formation of a slip plane between the existing slope soils, the benches compacted, and the engineered fill soil then placed and compacted;
- Soils to be used as engineered fill are to be approved granular, clay- or silt-based materials, not exceed 5 % organic content, and have a moisture content such that these soils are capable of achieving compaction of 95 % of their Standard Proctor Maximum Dry Density (SPMDD) value;
- Engineered fill is to be placed in horizontal lifts not exceeding 250 mm thick. Soils should be compacted to at least 95 % SPMDD value;
- Once reconstruction is completed, the slope should be aggressively vegetated to prevent future surface erosion; and,
- Stormwater and surface water management for the proposed residence is to include for the installation of appropriate crest drainage to control surface water flowing over the slope crest and across the slope face both during and after construction of the residence. This is to minimize surficial erosion from surface water runoff.

Prior to the placement of the first lift of engineered fill materials, the exposed subgrade soil should be inspected and proof-rolled using a loaded tandem axle truck and traversing the exposed subgrade for full coverage. The proof-rolling should be monitored by a geotechnical representative of this office to delineate any soft areas which may require repair.

12.0 SITE SERVICING CONSIDERATIONS

There is no indication that special pipe bedding materials or procedures are required for the installation of services. All bedding cover and backfill materials should be selected in accordance with OPSS 1010 Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

The pipes should be placed with a minimum bedding thickness in conformance of Ontario Provincial Standard Drawing (herein "*OPSD*") 802.010, 802.013 and 802.014 for flexible pipe and OPSD 802.030, 031, 032, 033 and 034 for rigid pipes. The type of bedding shall be selected to suit the applicable pipe strength and site conditions.

Bedding material shall be placed in layers not exceeding 300 mm in thickness, loose measurement, and compacted to 95 % of the SPMDD before a subsequent layer is placed. Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. Bedding on each side of the pipe shall be completed simultaneously. At no time shall the levels on each side differ by more than the 300 mm uncompacted layer. The remainder of the trench should be backfilled as per the requirements defined in Sections 9.0 of this report.

It is assumed all services will have a minimum of 1.2 m of soil cover for frost protection. For services installed at shallower depths, suitable insulation for frost protection is recommended.

13.0 SOIL RE-USE AND MANAGEMENT CONSIDERATIONS

13.1 General Soil Management Considerations

From a geotechnical perspective, and in order to optimize the use of the on-site soils, a Soil Management Plan should be established in accordance with the requirements of Ontario Regulation (herein "*O. Reg.*") 406/19 for excess soils and O. Reg. 153/04 for soil stockpiles.

The plan objective should be to achieve a self-sustainable development with respect to excavated materials and control the placement of organic soils so that there is negligible impact on the settlement performance of the compacted fill material. The soil management criteria should be per the following sections, as a minimum:

13.2 Organic and Deleterious Materials

Surface vegetation, topsoil and organic soils should not be placed within the proposed roadways, below finished subgrade level for pavement construction or building limits. These materials should be placed in landscaped areas where settlements are not critical.

13.3 Materials Reuse Management

13.3.1 Fill Compaction Requirements

Excavated soils for structural fill in pavement areas and building floor slab areas, which do not have topsoil or organic matter and are compactable with moisture contents within 2 % to 3 % of the optimum value, should be placed and compacted to a target density of 97 % of the SPMDD with no individual test result below 95 % SPMDD.

If engineered fill is required to support building foundations:

- the engineered fill should be placed and compacted in lifts to a target density of 100 % SPMDD with no individual tests below 98 % SPMDD; and,
- the soil should be placed in a loose lift thickness not exceeding 250 mm and should be compacted using a large (10 ton or larger) pad-foot type roller with vibratory capability.

If engineered fill to support building foundations is being considered it is recommended that a pre-construction meeting be scheduled to review the proposed fill materials, fill placement and compaction procedures, and the testing and inspection requirements.

Soils to be placed in landscaped areas where settlements are not critical should receive nominal compaction effort in order to achieve at least 90 % of the SPMDD.

13.3.2 Structural Fill Subgrades

Prior to the placement of any structural fill materials, the exposed subgrade soil should be inspected and proof-rolled using a loaded tandem axle truck and traversing the exposed subgrade for full coverage. The proof-rolling should be monitored by a geotechnical representative of this office to delineate any soft areas which may require repair.

14.0 PAVEMENT CONSIDERATIONS

14.1 At-Grade Asphalt Pavement Design Considerations

The proposed development is anticipated to include new access routes leading from Main Street West to deck pavements. Recommended pavement structure layer thicknesses are provided in Table 14.1.1. Site specific development requirements set out by the Corporation of the City of Hamilton (herein "*City of Hamilton*") may override the recommendations of this report. Connections and tie-ins to existing pavement structures should be completed in accordance with OPSS.MUNI.310.

The recommended pavement design section takes into account the accepted design practice that the total pavement structure thickness should meet or exceed one-half the anticipated depth of frost penetration for the geographical area (i.e., approximately 0.6 m) or as close as practicable.

Table 14.1.1: Recommended Asphalt Pavement Structure Layer Thicknesses

Pavement Layer	Light Duty Pavement Areas	Access and Fire Routes
Surface Course Asphalt OPSS HL 3	40 mm	40 mm
Binder Course Asphalt OPSS HL 8	50 mm	60 mm
Granular Base OPSS Granular A	150 mm	150 mm
Granular Subbase OPSS Granular B, Type II	300 mm[1]	350 mm[1]
Total Thickness	540 mm	600 mm

Notes:
1. If construction proceeds late in the year (i.e., November and December), the design thickness of pavement granular materials may have to be increased to address potential problems with subgrade instability and facilitate construction vehicle and truck access.

14.2 Sub-grade Preparation and Drainage

The overall performance of the pavement structure will greatly depend upon the support provided by the developed subgrade. A number of factors should be considered at the construction stages to ensure that an acceptable subgrade condition is developed and maintained:

- Sub-drains should be installed and should be 100 mm diameter perforated plastic pipe, with outfalls to catch basins at a continuous and uniform grade. The sub-drains should conform to OPSD 216.01;
- Any soft areas of notable deflection to the subgrade should be sub-excavated and replaced with a suitable backfill material approved by a qualified geotechnical engineer and compacted to 98 % of its SPMDD;
- The subgrade should be properly shaped, crowned and then proof-rolled under the full-time observation of a geotechnical representative of this office to delineate any soft areas which may require repair before placing the granular materials; and,
- Surface water should not be allowed to pond on the surface of or adjacent to the outside edges of any developed subgrade.

Should the pavements proposed for the development be constructed as a two-stage paving operation it will be important to ensure that the following is undertaken to develop the surface of the binder course being used as a "*temporary*" surface during the construction phase:

- The surface is thoroughly cleaned and power washed to remove all residual contaminants;

- All deficiencies are corrected to meet the required design specifications; and,
- A suitable tack coat is appropriately applied immediately prior to the placement of the upper asphaltic concrete course(s).

Such preparatory works are to be completed in accordance with the appropriate OPSS, as required.

14.3 Deck Pavement Design Considerations

It is understood that the footprint of the proposed development will cover the site area in full. As such, any pavement structures are anticipated to be deck structures rather than standalone pavement structures.

Such deck pavements should comprise a minimum 50 mm cover of OPSS HL 3 asphalt. The bedding or grading material to be placed between the concrete deck and the asphalt pavement surface should comprise either blinding sand or OPSS Granular A material, depending on the thickness of the layer required.

Tie-ins of deck pavements to the road pavement structure of Main Street West should match existing as a minimum, in accordance with OPSS 310.

14.4 Pavement Materials

14.4.1 Granular Subbase

Granular subbase materials should meet OPSS Granular B Type II requirements for 100 % native, crushed materials (50 mm crusher-run products).

14.4.2 Granular Base Course

Granular base course materials should meet OPSS Granular “A” specifications. Quarried 20 mm limestone crushed to Granular "A" gradation specifications is recommended.

14.4.3 Hot Mix Asphalt

The surface course asphalt should meet current specifications for HL 3, as prescribed by the City of Hamilton or, alternatively, OPSS 1150.

The standard asphalt binder grade for the climate conditions in Hamilton is PG 58-28. Given the anticipated low volume of commercial truck traffic it is considered that there is no requirement for a bump up to a higher PG grade of asphalt cement

14.4.4 Compaction

Granular base course and subbase course fill material should be compacted to 100 % SPMDD. Hot mix asphalt should be compacted to the criteria set out by the City of Hamilton.

14.5 Sidewalk Considerations

The construction of the concrete sidewalks at the site should be completed to the satisfaction of the City of Hamilton’s Engineering Standards, and as detailed in Table 14.5.1. The concrete and aggregates should be produced and placed to meet those standards also stipulated by the City of Hamilton’s Engineering Standards.

Table 14.5.1: Recommended Minimum Concrete Sidewalk Specifications

Materials	Compaction Requirements	Layer Thickness
Normal Portland GU (32 MPa) CAN3-CSA A23.1) - Class C-2	N/A	125 mm
Granular “A” Base	95 % SPMDD*	150 mm

* Standard Proctor Maximum Dry Density

Where finished sidewalks are on level ground, and to ensure that they remain free of ponding water, a final slope/gradient of the concrete sidewalk surface of at least 2 % should be maintained. In addition, construction joints in the sidewalk concrete should be properly sealed (e.g., bitumen filler) to minimize the water migration.

15.0 CLOSURE

The Limitations of Report, as stated in Appendix A, are an integral part of this report.

Soil samples will be retained and stored by Landtek for a period of three months after the report is issued. The samples will be disposed of at the end of the three-month period unless a written request from the client to extend the storage period is received.

We trust this report will be of assistance with the design and construction of the proposed development. Should you have any questions, please do not hesitate to contact our office.

Yours sincerely,

LANDTEK LIMITED

LICENSED PROFESSIONAL ENGINEER
R. DI CIENZO
PROVINCE OF ONTARIO

James Dann, B.Eng. (Hons) ACSM
Manager, Geotechnical Projects

Ralph Di Cienzo, P. Eng.
Consulting Engineer

APPENDIX A
LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the Boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the Boreholes.

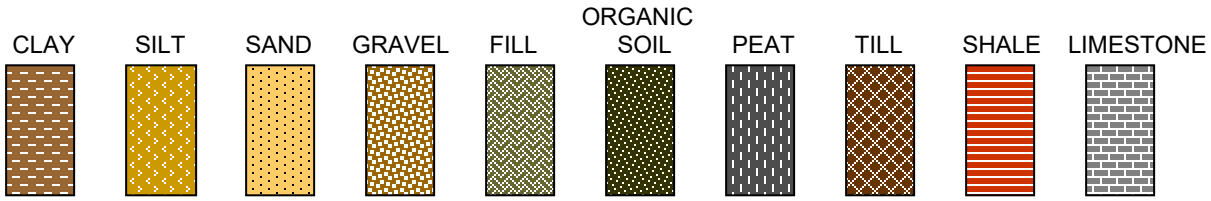
The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of Boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Additionally, bedrock contact depths throughout the site may vary significantly from what was encountered at the exact borehole locations. Contractors bidding on the project, or undertaking construction on the site should make their own interpretation of the factual borehole information, and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report were obtained by Landtek Limited or others, and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

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

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek Limited be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

APPENDIX B
SYMBOLS AND TERMS USED IN THE REPORT



RELATIVE PROPORTIONS

Term	Range
Trace	0 - 5%
A Little	5 – 15%
Some	15 – 30%
With	30 – 50%

CLASSIFICATION BY PARTICLE SIZE

Boulder ---------- > 200 mm
Cobble ---------- 80 mm – 200 mm
Gravel -
Coarse ---------- 19 mm – 80 mm
Fine ---------- 4.75 mm – 19 mm
Sand -
Coarse ---------- 4.75 mm – 2 mm
Medium -------- 2 mm – 0.425 mm
Fine ---------- 0.425 mm – 0.75 mm
Silt ---------- 0.075 mm – 0.002 mm
Clay ---------- < 0.002 mm

DENSITY OF NON-COHESIVE SOILS

Descriptive Term	Relative Density	Standard Penetration Test
Very Loose	0 – 15%	0 – 4 Blows Per 300 mm Penetration
Loose	15 – 35%	4 – 10 Blows Per 300 mm Penetration
Compact	35 – 65%	10 – 30 Blows Per 300 mm Penetration
Dense	65 – 85%	30 – 50 Blows Per 300 mm Penetration
Very Dense	85 – 100%	Over 50 Blows Per 300 mm Penetration

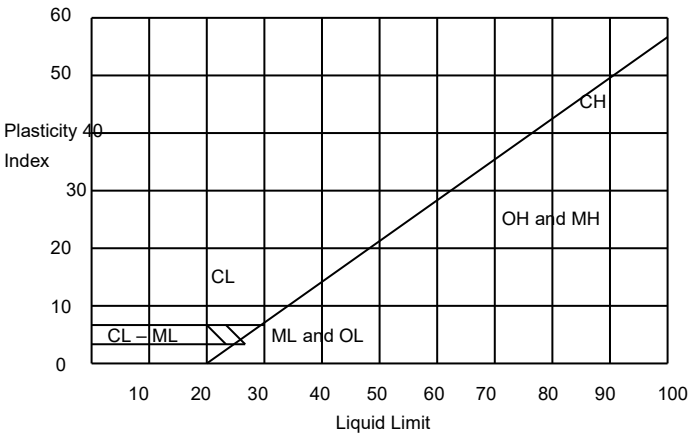
CONSISTENCY OF COHESIVE SOILS

Descriptive Term	Undrained Shear Strength kPa (psf)	N Value Standard Penetration Test	Remarks
Very Soft	< 12 (< 250)	< 2	Can penetrate with fist
Soft	12 – 25 (250 – 500)	2 – 4	Can indent with fist
Firm	25 – 50 (500 –1000)	4 – 8	Can penetrate with thumb
Stiff	50 – 100 (1000 – 2000)	8 – 15	Can indent with thumb
Very Stiff	100 – 200 (2000 – 4000)	15 – 30	Can indent with thumb-nail
Hard	> 200 (> 4000)	> 30	Can indent with thumb-nail

Notes: 1. Relative density determined by standard laboratory tests.
2. N value – blows/300 mm penetration of a 623 N (140 Lb.) hammer falling 760 mm (30 in.) on a 50 mm O.D. split spoon soil sampler. The split spoon sampler is driven 450 mm (18 in.) or 610 mm (24 in.). The “N” value is the Standard Penetration Test (SPT) value and is normally taken as the number of blows to advance the sampler the last 300 mm.

APPENDIX B CONTINUED
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 69 AND D 2488 – 69
(Unified Soil Classification System)

Major Divisions			Group Symbols	Typical Names	Classification Criteria		
Coarse-grained soils More than 50% retained on No. 4 sieve *	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve . . . . . GW, GP, SW, SP More than 12% pass No. 200 sieve . . . . . GM, GC, SM, SC 5 to 12% pass No.200 sieve . . . . . Borderline classifications requiring use of dual symbols	C_u=D60/D10 greater than 4; C_z = $(D30)^2$/(D10xD60) between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines		C_u=D60/D10 greater than 6; C_z = $(D30)^2$/ (D10xD60) between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with fines	SM	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils 50% or more passes No. 200 sieve *	Silts and clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Plasticity Chart For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. Equation of A-line: PI=0.73 (LL-20)		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silts			
			OL	Organic silts and organic silts of low plasticity			
	Silts and clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
	Highly organic soils		Pt	Peat, much and other highly organic soils	* Based on the material passing the 3 in. (76mm) sieve.		



APPENDIX C

DRAWING 19328-01 – EXPLORATORY HOLE LOCATION PLAN
BOREHOLE LOGS

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project location

Key:

Borehole drilled by Landtek Limited between September 25th and 27th, 2019.

Notes:

Borehole and monitioring well locations are to be considered approximate.

Site Plan extract taken from A.T.McLaren Limited topographical survey for the site, dated February 13, 2015.

Project Location extract from Google Maps.

revisions/ submissions

#	date	description
1	4 september 2019	issued for report

client
925 Main Street West (Hamilton) Limited

municipality
The Corporation of the City of Hamilton

project
Geotechnical Investigation
925 Main Street West, Hamilton

sheet
Borehole Location Plan

date: September 8th, 2019
drawn: MD
checked: IA
project #: 19273
scale: 1:400

19328-01

LANDTEK LIMITED

LOG OF BOREHOLE NO. 1

Project No.:	14293	Drill Date:	October 10, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. / Depth	Sample No.	Sample Type	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.6							
±100 mm Asphalt + ±480 mm Granular Base		0.0							
FILL mix of silt, clay, & sand, some gravel, very moist, brown to reddish-brown, (Loose to Compact)			1	SS	6	21.5			
			2	SS	11	25.0			
			3	SS	7	27.2			
		96.6							
SILT layered & fissured, clayey with clay and sand seams, iron staining, oxidized brown, very moist, wet at ±3.0 m, (Loose becoming Compact to Dense)		3.0	4	SS	4	26.4			
			5	SS	11	18.7			bentonite backfill
			6	SS	44	2.9			
		92.5							
SAND coarse grained, some gravel, some silt, iron stains, moist, brown (Dense)		7.1	7	SS	30	20.4			sand backfill to 8.5 m
		91.0							
SILT layered & fissured, clayey with clay and sand seams, iron staining, oxidized brown to grey below ±10.0 m, very moist to wet, (Loose to Compact)		8.6	8	SS	20	19.6			9.1 m 3.0 m of slotted 25 mm dia. PVC pipe WL = 11.2 m Nov. 7/2014
			9	SS	8	18.9			
		88.0							
SILTY CLAY, layered, silt seams, grey, moist, (Very Stiff)		11.6	10	SS	20				
		87.0							
BOREHOLE TERMINATED		12.6							12.2 m

SPT "N" Value scale: 0, 25, 50, 75, 100
Soil Moisture (%) scale: 0, 25, 50
Scale (m): 0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

Notes:
1. On completion, borehole open to 12.1 m and dry.
2. Water level measured at 11.3 m on October 29, 2014.
3. Water level measured at 11.2 m on November 7, 2014.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE NO. 2

Project No.:	14293	Drill Date:	October 10, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.0								
±100 mm Asphalt		0.0								
±600 mm Granular Base										
FILL			1	SS		9	2.5			
asphalt pieces, concrete pieces, sand			2	SS		50/150 mm	4.6			
and gravel		96.7								
BOREHOLE TERMINATED DUE TO AUGER REFUSAL ON LARGE PIECES OF CONCRETE/LIMESTONE RUBBLE		2.3								

SPT "N" Value: 0, 25, 50, 75, 100

Soil Moisture (%): 0, 25, 50

Scale (m): 0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

Notes: 1. On completion, borehole open to 2.3 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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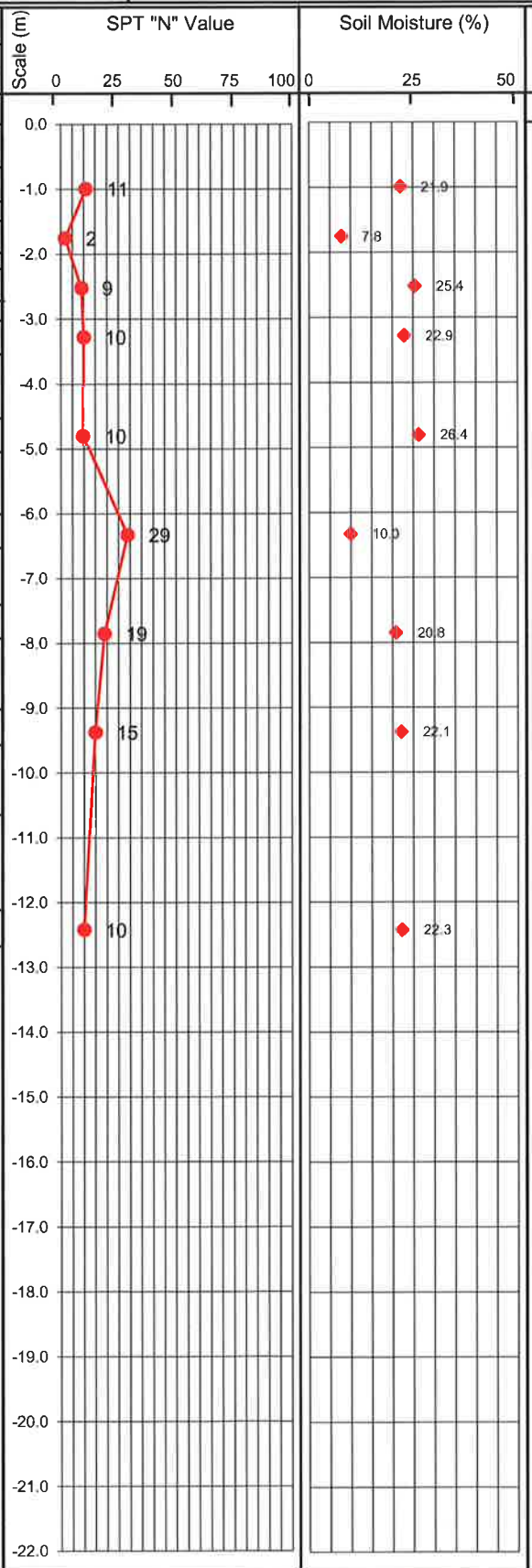
LOG OF BOREHOLE NO. 3

Project No.:	14293	Drill Date:	October 10, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Test Data
Ground Surface		99.2			
±100 mm Asphalt & ±380 mm Granular Base		0.0			
FILL mix of silt, clay, & sand, some gravel, black sand & pieces of red brick at , ±1.5 m, moist, (Very Loose)		97.2	1 2	SS SS	
SILT layered & fissured, clayey with clay & sand seams, iron staining, oxidized brown, moist to very moist, (Compact)		2.0 93.0	3 4 5	SS SS SS	
SILTY SAND some gravel, coarse grained, moist, brown, (Compact)		6.2 91.4	6 7	SS SS	
CLAYEY SILT layered & fissured, clay layers & some sand seams, very moist, oxidized brown, (Very Stiff)		7.8	8	SS	
SILTY CLAY layered, silt partings, unoxidized grey, very moist, (Stiff)		86.6	9	SS	
BOREHOLE TERMINATED		12.6			



GWL | Monitor Details

Notes: 1. On completion, borehole open to 12.2 m and water level at 11.9 m.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE NO. 4

Project No.:	14293	Drill Date:	October 10, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.2								
±115 mm Asphalt & ±350 mm Granular Base		0.0								
FILL mix of silt, clay & sand, some gravel & organic inclusions, very moist to wet, brown, (Loose)			1	SS		8	22.7			
			2	SS		5	26.2			
		97.0								
SILT layered & fissured, clayey with clay & sand seams, trace gravel, dilatant, very moist to wet, brown, (Loose to Compact)		2.2	3	SS		5	27.4			
			4	SS		8	26.9			
		94.2	5	SS		10	25.1			
BOREHOLE TERMINATED		5.0								

SPT "N" Value: 0 25 50 75 100 | Soil Moisture (%): 0 25 50

Scale (m): 0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

Notes: 1. On completion, borehole open to 4.6 m and west at bottom of hole.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE NO. 5

Project No.:	14293	Drill Date:	October 10, 2014
Project:	Proposed Mixed Use Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.5								
±150 mm Asphalt ±230 mm Granular		0.0								
FILL silty sand, asphalt pieces & organics, wet, brown, (Very Loose)		97.4	1	SS		2	17.1			
			2	SS		2	16.7			
CLAYEY SILT layered & fissured, iron staining, clay & sand seams, very moist to wet, oxidized brown, (Firm to Stiff)		2.1	3	SS		4	29.9			
			4	SS		9	24.2			
		94.5	5	SS		9	25.1			
BOREHOLE TERMINATED		5.0								

0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

0 25 50 75 100

0 25 50

Notes: 1. On completion, borehole open to 4.6 m and wet at bottom of hole.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE NO. 6

Project No.:	14293	Drill Date:	October 14, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. / Depth	Sample No.	Sample Type	SPT "N" Value (Scale (m))	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.3							
±100 mm Asphalt ±400 mm Granular Base		0.0							
FILL mix of silt, clay, black sand, gravel, asphalt pieces, very moist, brown, (Loose to Compact)		96.3	1	SS	11	17.6			
			2	SS	9	16.3			
			3	SS	14	17.0			
SILT (Possible Fill) mottled with organics, dark brown, very moist, (Compact)		3.0 85.3	4	SS	12	22.8			
SILT layered & fissured, clayey with clay & sand seams, iron staining, very moist to wet, brown, (Compact)		4.0 84.9	5	SS	13	25.7			
			6	SS	46	8.9			
SILTY SAND coarse, gravel, moist, brown, (Dense)		6.5 91.5	7	SS	6	22.3			
CLAYEY SILT layered & fissured, clayey with clay & sand seams, iron staining, very moist to wet, brown, ((Very Stiff)		7.8	8	SS	18	22.3			
saturated silty sand layer between ±12.2 and 12.6 m		84.9	9	SS	16	23.7			
SILTY CLAY trace gravel, fissured and fractured, very moist, unoxidized grey, (Firm to Very Stiff)		14.4	10	SS	16	18.9			
wet below ±18.0 m			11	SS	8	23.7			
see page 2 of 2		77.3							

Notes: 1. On completion, borehole open to 12.2 m and water level at 9.1 m.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LANDTEK LIMITED

LOG OF BOREHOLE NO. 6

Project No.:	14293	Drill Date:	October 15, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[ ] solid stem [x] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description **Continued from Page 1 of 2**	Symbol	Elev. / Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		77.3								
SILTY CLAY trace gravel, fissured and fractured, wet unoxidized grey (Firm to Very Stiff)		0.0	12	SS	-22.0 -24.0 -26.0	7	24.0			
			13	SS	-28.0	9	29.4			
hard, moist silty clay below ±36.0 m			14	SS	-30.0 -32.0 -34.0 -36.0	59	18.7			
Borehole Advanced by Wash Boring with Tricone Bit Below 37.2 m;		59.7			-38.0 -40.0					
BOREHOLE TERMINATED		39.6			-42.0 -44.0					

Notes: 1. On completion, borehole open to 12.2 m and water level at 9.1 m.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE NO. 7

Project No.:	14293	Drill Date:	October 15, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.2								
±115 mm Asphalt & ± 270 mm Granular		0.0								
FILL mottled mix of silt, clay, gravel, & sand with red brick & organic matter, concrete, moist, brown (Loose to Compact)			1	SS	0.0					
			2	SS	-1.0	12	14.7			
			3	SS	-2.0	12	17.9			
			4	SS	-3.0	9	18.0			
					-4.0	11	21.4			
			5	SS	-5.0	5	19.1			
		93.8			-6.0					
POSSIBLE FILL, mix of grey clay with gravel, sand, very moist, (Firm to Stiff)		5.4	6	SS	-7.0	15	17.5			
		92.5			-8.0					
SILT layered & fissured, clayey with clay seams, gravel, sand seams, very moist, (Compact)		6.7	7	SS	-9.0	17	22.6			
unoxidized grey below ±10.0 m					-10.0					
		88.1	8	SS	-11.0	17	22.7			
BOREHOLE TERMINATED		11.1			-12.0					
					-13.0					
					-14.0					
					-15.0					
					-16.0					
					-17.0					
					-18.0					
					-19.0					
					-20.0					
					-21.0					
					-22.0					

Notes: 1. On completion, borehole open to 10.7 m and wet at bottom of hole.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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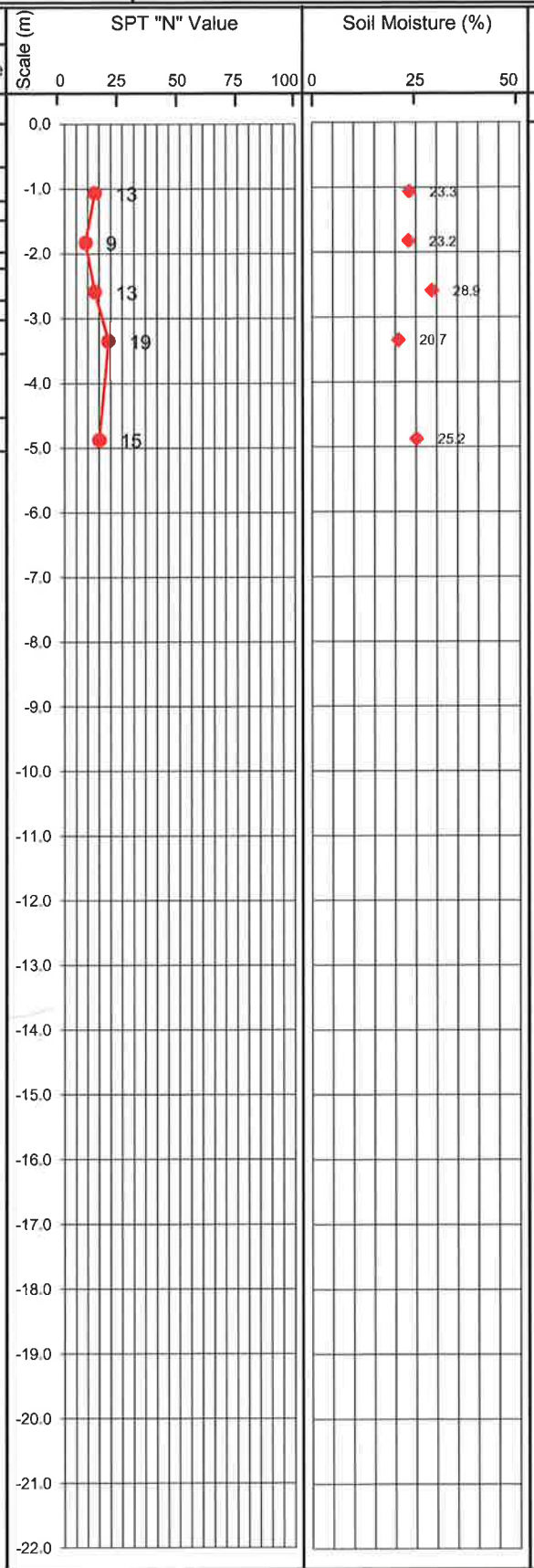
LOG OF BOREHOLE NO. 8

Project No.:	14293	Drill Date:	October 15, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Test Data
Ground Surface		99.4			
±115 mm Asphalt + ±500 mm Granular Base		0.0			
FILL mix of silt, clay, sand, gravel & organics, red-brown to black, moist, ((Compact)		97.0	1 2 3	SS SS SS	
CLAYEY SILT layered & fissured, clayey with clay seams, some sand, iron staining, very moist, oxidized brown, (Stiff to Very Stiff)		2.4 94.4	4 5	SS SS	
BOREHOLE TERMINATED		5.0			



GWL | Monitor Details

Notes: 1. On completion, borehole open to 4.6 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LANDTEK LIMITED

LOG OF BOREHOLE NO. 9

Project No.:	14293	Drill Date:	October 15, 2014
Project:	Proposed Multi-Storey Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Elev. Depth	Samples No.	Type	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface	99.2							
±90 mm Asphalt + ±430 mm Granular Base	0.0							
FILL mix of silt, clay & sand, some gravel, organics, brown to reddish brown, moist to wet, (Loose to Compact)		1	SS	10	19.5			
		2	SS	8	27.6			
	96.8	3	SS	10	25.6			
SILT layered & fissured, clayey with clay & sand seams, iron staining, very moist, oxidized brown to grey below ±5.0 m, (Compact)	2.4	4	SS	13	26.7			bentonite backfill
		5	SS	11	25.4			
	92.9	6	SS	69	18.0			
SAND some gravel, trace silt, medium grained, moist, brown, (Dense to Very Dense) unoxidized grey below 5.0 m	6.3 90.9	7	SS	47	4.2			sand backfill to 7.3 m 7.6 m 3.0 m of slotted 25 mm dia. PVC pipe W.L. = 9.2 m on Nov. 7/2014
CLAYEY SILT sand seams, moist, wet seam at 9.4 m, brown to grey, (Very Stiff)	8.3	8	SS	21	22.0			
	88.1	9	SS	18	24.3			10.7 m
BOREHOLE TERMINATED	11.1							

Scale (m): 0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

SPT "N" Value: 0, 25, 50, 75, 100

Soil Moisture (%): 0, 25, 50

Notes:
1. On completion, borehole open to 10.7 m and water level at 10.4 m.
2. Water level = 9.2 m depth on October 29, 2014.
3. Water level = 9.2 m depth on November 7, 2104.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LANDTEK LIMITED

LOG OF BOREHOLE NO. 10

Project No.:	14293	Drill Date:	October 15, 2014
Project:	Proposed Mixed Use Building Development	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic

Material Description	Symbol	Elev. / Depth	Samples No.	Samples Type	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		99.5							
±100 mm Asphalt, ±150 mm Mixed Granular		0.0							
FILL mixture of limestone, silt, and clay, some stone, trace sand, moist to very moist, brown (Firm to Stiff)			1	SS	13	5.9			
			2	SS	11	21.1			
Strong hydrocarbon odour at 2.5 m		96.6	3	SS	5	28.7			
CLAYEY SILT very moist, brown, strong hydrocarbon odour (Stiff)		2.9	4	SS	9	23.6			
unoxidized grey below ± 4.9 m			5	SS	12	24.7			
		94.0							
SAND some gravel, coarse grain sizes, moist, slight hydrocarbon odour, (Very Dense)		5.5	6	SS	67	3.6			
no hydrocarbon odour below ±7.5 m			7	SS	50	3.1			
		91.2							
CLAYEY SILT moist to very moist, grey (Stiff)		8.3							
		88.4	8	SS	12	20.1			
BOREHOLE TERMINATED		11.1							

Scale (m): 0.0, -1.0, -2.0, -3.0, -4.0, -5.0, -6.0, -7.0, -8.0, -9.0, -10.0, -11.0, -12.0, -13.0, -14.0, -15.0, -16.0, -17.0, -18.0, -19.0, -20.0, -21.0, -22.0

SPT "N" Value: 0, 25, 50, 75, 100

Soil Moisture (%): 0, 25, 50

Notes: 1. On completion, borehole open to 10.4 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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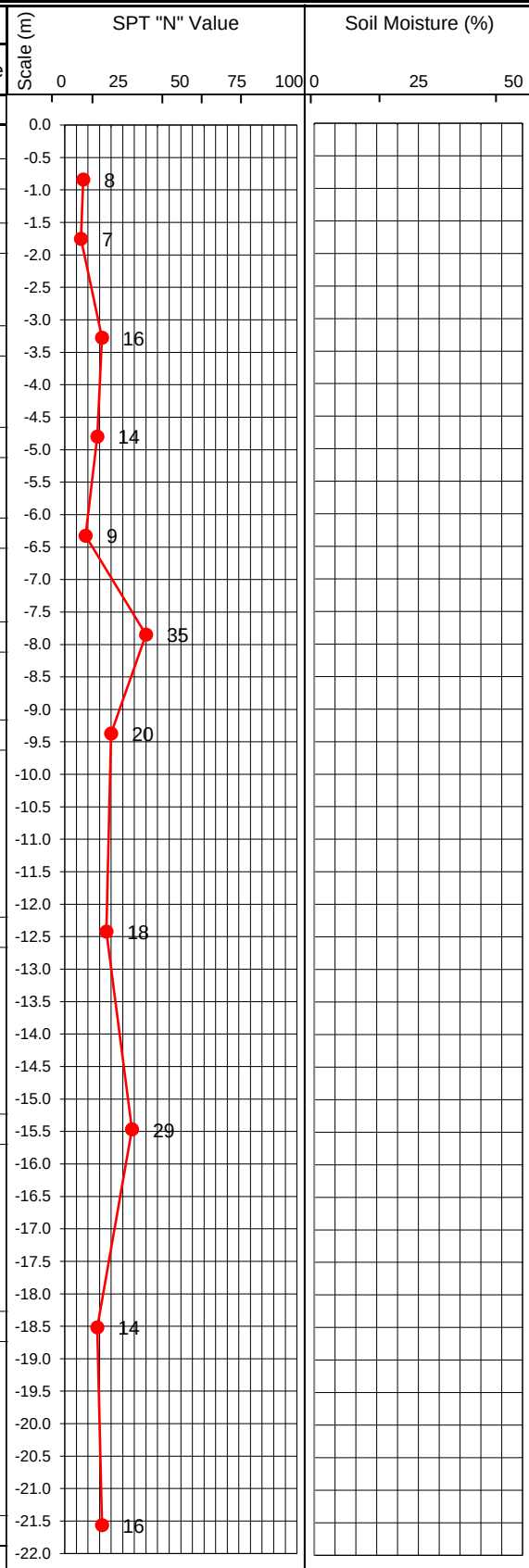
BH 101

Project No.:	19328	Drill Date:	September 25, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		99.3							
±150 mm of asphalt		0.0							
FILL: silty clay, moist, brown			1	SS	8				
CLAYEY SILT trace fine sand, sand seams, iron staining, loose to compact, moist			2	SS	7				
			3	SS	16				
		94.8							
SILT trace fine sand, brown, compact, moist		4.5	4	SS	14				
		93.3							
SILTY SAND trace gravel, brown, loose, very moist to wet		6.0	5	SS	9				
		91.7							
SILT trace fine sand, trace clay, sand seams, brown, dense to compact, very moist to wet		7.6	6	SS	35				
			7	SS	20				
…grey below approximately 12.5 m depth			8	SS	18				
...borehole cave-in from approximately 13.7 m depth to 16.5 m depth			9	SS	29				
		81.1							
SILTY CLAY trace fine sand, grey, stiff to very stiff, moist		18.2	10	SS	14				
		77.5	11	SS	16				
continued… (page 2)		21.8							



Notes:
1. Groundwater encountered at approximately 11.2 m depth.
2. Cave in recorded at approximately 13.7 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 101

Project No.:	19328	Drill Date:	September 25, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		77.3								
...continued		22.0								
SILTY CLAY trace fine sand, grey, stiff to very stiff, moist			12	SS		22				
...trace to some sand below approximately 27.5 m depth			13	SS		18				
		68.4	14	SS		23				
END OF BOREHOLE AT TARGET DEPTH		30.9								

SPT "N" Value: 0 25 50 75 100 | Soil Moisture (%): 0 25 50

Scale (m): -22.0 -22.5 -23.0 -23.5 -24.0 -24.5 -25.0 -25.5 -26.0 -26.5 -27.0 -27.5 -28.0 -28.5 -29.0 -29.5 -30.0 -30.5 -31.0 -31.5 -32.0 -32.5 -33.0 -33.5 -34.0 -34.5 -35.0 -35.5 -36.0 -36.5 -37.0 -37.5 -38.0 -38.5 -39.0 -39.5 -40.0 -40.5 -41.0 -41.5 -42.0 -42.5 -43.0 -43.5 -44.0

Notes:
1. Groundwater encountered at approximately 11.2 m depth.
2. Cave in recorded at approximately 13.7 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 102

Project No.:	19328	Drill Date:	October 1, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		99.0								
±150 mm of asphalt		0.0								
FILL silty clay and clayey silt, moist, brown			1	SS		6	14			
		95.7								
CLAYEY SILT trace fine sand, sand seams, iron staining, loose to compact, moist		3.3	2	SS		10	25			
		93.0								
SILTY SAND trace gravel, brown, loose, very moist to wet		6.0	3	SS		61	24			
		91.2								
CLAYEY SILT trace fine sand, trace clay, sand seams, brown, compact, very moist to wet		7.8	4	SS		27	23			
		83.8								
SILTY CLAY trace fine sand, grey, stiff, moist		15.2	5	SS		20	19			
…firm below approximately 21.5 m depth		77.2	6	SS		8	21			
continued… (page 2)		21.8								

Scale (m): 0.0, -0.5, -1.0, -1.5, -2.0, -2.5, -3.0, -3.5, -4.0, -4.5, -5.0, -5.5, -6.0, -6.5, -7.0, -7.5, -8.0, -8.5, -9.0, -9.5, -10.0, -10.5, -11.0, -11.5, -12.0, -12.5, -13.0, -13.5, -14.0, -14.5, -15.0, -15.5, -16.0, -16.5, -17.0, -17.5, -18.0, -18.5, -19.0, -19.5, -20.0, -20.5, -21.0, -21.5, -22.0

SPT "N" Value: 0, 25, 50, 75, 100

Soil Moisture (%): 0, 25, 50

Notes: 1.Groundwater encountered at approximately 12.2 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 102

Project No.:	19328	Drill Date:	October 1, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		77.2								
…continued		22.0								
SILTY CLAY trace fine sand, grey, stiff, moist			7	SS		7	31			
		65.7								
SILT trace clay, trace sand, red and grey, compact, moist to very moist		33.5	8	SS		23	16			
...very soft silt horizon encountered between approximately 39.2 m depths and 42.0 m depth										
		55.6								
continued… (page 3)		43.6								

Notes: 1.Groundwater encountered at approximately 12.2 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 102

Project No.:	19328	Drill Date:	October 1, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. / Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value 0 25 50 75 100	Soil Moisture (%) 0 25 50	GWL	Monitor Details	Test Data
Ground Elevation		55.2								
…continued **SILT** trace clay, trace sand, red and grey, compact, moist to very moist		44.0 52.0			-44.0 to -47.0					
SHALE BEDROCK (Queenston Formation) moderately weak, highly weathered, red		47.2 50.1			-47.5 to -49.0					
END OF BOREHOLE **AT TARGET DEPTH**		49.1			-49.5 to -66.0					

Notes: 1.Groundwater encountered at approximately 12.2 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 103

Project No.:	19328	Drill Date:	October 2, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value (Scale (m) 0 25 50 75 100)	Soil Moisture (%) (0 25 50)	GWL	Monitor Details	Test Data
Ground Elevation		99.4							
±75 mm of asphalt		0.0							
FILL: silty clay, moist, brown			1	SS	9	23			
			2	SS	6	27			
		94.9							
CLAYEY SILT trace fine sand, sand seams, iron staining, compact, moist		4.5	3	SS	14	26			
…wet below approximately 9.7 m depth		87.9							
SILTY SAND trace gravel, brown, dense, very moist to wet		11.5	4	SS	30	15			
		85.4							
SILT trace fine sand, trace clay, sand seams, brown and grey, dense to compact, very moist to wet		14.0	5	SS	31	19			
		77.6							
continued… (page 2)		21.8							

Notes: 1. Groundwater encountered at approximately 9.7 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 103

Project No.:	19328	Drill Date:	October 2, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		77.4								
…continued		22.0								
SILT trace fine sand, trace clay, sand seams, brown and grey, dense to compact, very moist to wet		75.0								
SILTY CLAY trace sand, grey, very stiff to hard, moist		24.4	6	SS		18	17			
			13	SS						
		68.5	7	SS		39	18			
END OF BOREHOLE AT TARGET DEPTH		30.9								

SPT "N" Value: 0 25 50 75 100 | Soil Moisture (%): 0 25 50

Scale (m): -22.0 -22.5 -23.0 -23.5 -24.0 -24.5 -25.0 -25.5 -26.0 -26.5 -27.0 -27.5 -28.0 -28.5 -29.0 -29.5 -30.0 -30.5 -31.0 -31.5 -32.0 -32.5 -33.0 -33.5 -34.0 -34.5 -35.0 -35.5 -36.0 -36.5 -37.0 -37.5 -38.0 -38.5 -39.0 -39.5 -40.0 -40.5 -41.0 -41.5 -42.0 -42.5 -43.0 -43.5 -44.0

Notes: 1. Groundwater encountered at approximately 11.2 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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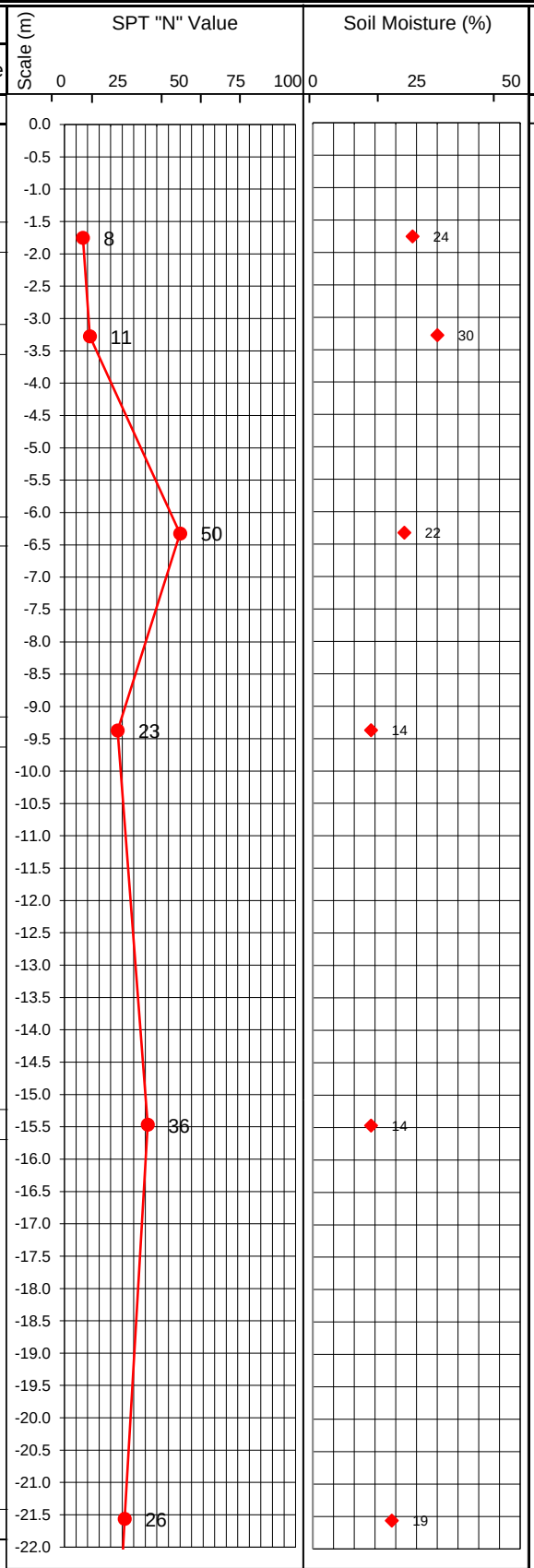
BH 104

Project No.:	19328	Drill Date:	September 27, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		99.2								
±150 mm of asphalt		0.0								
FILL silty clay and clayey silt, moist, brown			1	SS		8	24			
		96.0								
CLAYEY SILT trace fine sand, sand seams, iron staining, compact to very dense, brown, moist		3.2	2	SS		11	30			
			3	SS		50	22			
		91.7								
SILTY SAND trace gravel, brown, compact, very moist to wet		7.5								
		90.0	4	SS		23	14			
CLAYEY SILT trace fine sand, trace clay, sand seams, brown, compact, very moist to wet		9.2								
		84.7								
SILTY SAND trace gravel, brown, dense, very moist to wet		14.5	5	SS		36	14			
		82.4								
CLAYEY SILT trace fine sand, trace clay, sand seams, brown, compact, very moist to wet		16.8								
...red and grey below approximately 21.5 m depth		77.4	6	SS		26	19			
continued… (page 2)		21.8								



Notes: 1.Groundwater encountered at approximately 3.6 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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BH 104

Project No.:	19328	Drill Date:	September 27, 2019
Project:	Proposed Columbia International School Residence	Drill Method:	[x] solid stem [ ] Hollow stem [ ] DCPT
Location:	925 Main Street West, Hamilton, Ontario	Datum:	Geodetic (Approximate)

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	Scale (m)	SPT "N" Value	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Elevation		77.2								
…continued		22.0								
CLAYEY SILT trace fine sand, trace clay, sand seams, brown, compact, very moist to wet		71.7								
SILTY CLAY trace fine sand, grey, very stiff, moist		27.5	7	SS		17	18			
…red/grey below approximately 33.6 m depth			8	SS		27	9			
		60.1								
SHALE BEDROCK (Queenston Formation)		39.1								
moderately weak, highly weathered, red		59.1	9	SS		50/25 mm	9			
END OF BOREHOLE AT TARGET DEPTH		40.1								

-22.0 -22.5 -23.0 -23.5 -24.0 -24.5 -25.0 -25.5 -26.0 -26.5 -27.0 -27.5 -28.0 -28.5 -29.0 -29.5 -30.0 -30.5 -31.0 -31.5 -32.0 -32.5 -33.0 -33.5 -34.0 -34.5 -35.0 -35.5 -36.0 -36.5 -37.0 -37.5 -38.0 -38.5 -39.0 -39.5 -40.0 -40.5 -41.0 -41.5 -42.0 -42.5 -43.0 -43.5 -44.0

Notes: 1.Groundwater encountered at approximately 3.6 m depth.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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LOG OF BOREHOLE BHMW1

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2016-09-06
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25892
Easting: -79.902831
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Asphalt ~250 mm					
			Fill Clayey silt, trace sand, trace asphalt pieces. Brown and red, firm, moist.					
1		-1.0		1	SS		5	
				2	SS		3	
2		-2.0	**Clayey Silt** trace sand, trace organics. Brown and red, firm to stiff, moist.					
				3	SS		8	
3		-3.0	...no organics.	4	SS		8	
4		-4.0						
				5	SS		3	
5		-5.0						
			Sand some gravel, trace silt. Dense, brown, moist to very moist.					
6		-6.0		6	SS		55	
7		-7.0						

Undrained Shear Strength Values (kPa)
40 80 120 160

Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity
PL MC LL
10 20 30 40

Well Details: 3/8" Bentonite Pellets; 8" Drop-in Flushmount

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 10.6 depth on completion.
2. Groundwater level at approximately 9.3 m below the ground surface, measured on 20/09/2016.
3.
4.

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LOG OF BOREHOLE BHMW1

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2016-09-06
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25892
Easting: -79.902831
Ground Surface Elevation: 0

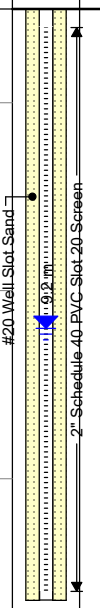
Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Subsurface Conditions	**Samples**				

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40

Well Details
Groundwater Conditions
Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
8	-8.0	...compact.	7	SS		24
9	-9.0		8	SS		18
10	-10.0	End of Log				
11	-11.0					
12	-12.0					
13	-13.0					
14	-14.0					
15	-15.0					



Additional Notes:
1. Borehole open to approximately 10.6 depth on completion.
2. Groundwater level at approximately 9.3 m below the ground surface, measured on 20/09/2016.
3.
4.

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LOG OF BOREHOLE BHMW22-1S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-02
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258838
Easting: -79.902538
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
		Asphalt ~75 mm										
		Fill Clayey silt, trace gravel, trace asphalt pieces, trace sand. Brown, stiff, moist.	1	SS	3 7 6 4	13		13.0				
1	-1.0		2	SS	2 2 3	5		5.0				
		...very moist.	3	SS	2 2 3	5		5.0				
2	-2.0		4	SS	3 3 5	8		8.0				
3	-3.0	**Sandy Silt** Brown, loose, very moist to wet.	5	SS	2 4 4	8		8.0				
		...loose to compact.	6	SS	3 4 6	10		10.0				
4	-4.0											
5	-5.0	**Clayey Silt** trace sand, trace gravel. Brown and grey, soft, moist.	7	SS	0 0 3	3		3.0				
		End of Log										
6	-6.0											
7	-7.0											

Well Details: 3/8" Bentonite Pellets; #20 Well Slot Sand; 1.3 m; 2" Schedule 40 PVC Slot 20 Screen; 8" Drop-in Flushmount

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage encountered at approximately 3.0 m below the ground surface.
3.
4.

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LOG OF BOREHOLE BHMW22-1D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-02
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258814
Easting: -79.902537
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength (kPa) / Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity (PL MC LL)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
		Asphalt ~75 mm										
		Fill Clayey silt, trace gravel, trace asphalt pieces.	1	SS	4 3 4 6	7		13.0				
1	-1.0		2	SS	5 3 3	6		9.0				
		...sandy silt, trace clay, trace gravel, no asphalt pieces. Brown, loose, very moist.	3	SS	5 3 3	6		8.0				
2	-2.0		4	SS	3 3 3	6		9.0				
3	-3.0	**Silt** trace gravel, trace sand. Brown, loose, very moist to wet.	5	SS	4 3 4	7		5.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
		...trace clay, trace iron staining. Loose to compact, moist.	6	SS	2 4 6	10		8.0				
4	-4.0	...no iron staining. Loose.	7	SS	1 2 3	5		7.0				
5	-5.0	...compact, very moist to wet.	8	SS	2 3 23	26		25.0				
6	-6.0	**Sand** trace gravel. Brown, dense, dry to moist.	9	SS	18 19 22	41		49.0				
7	-7.0		10	SS	15 15 15	30		20.0				

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage upon completion at approximately 11.5 m below the ground surface.
3.
4.

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Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

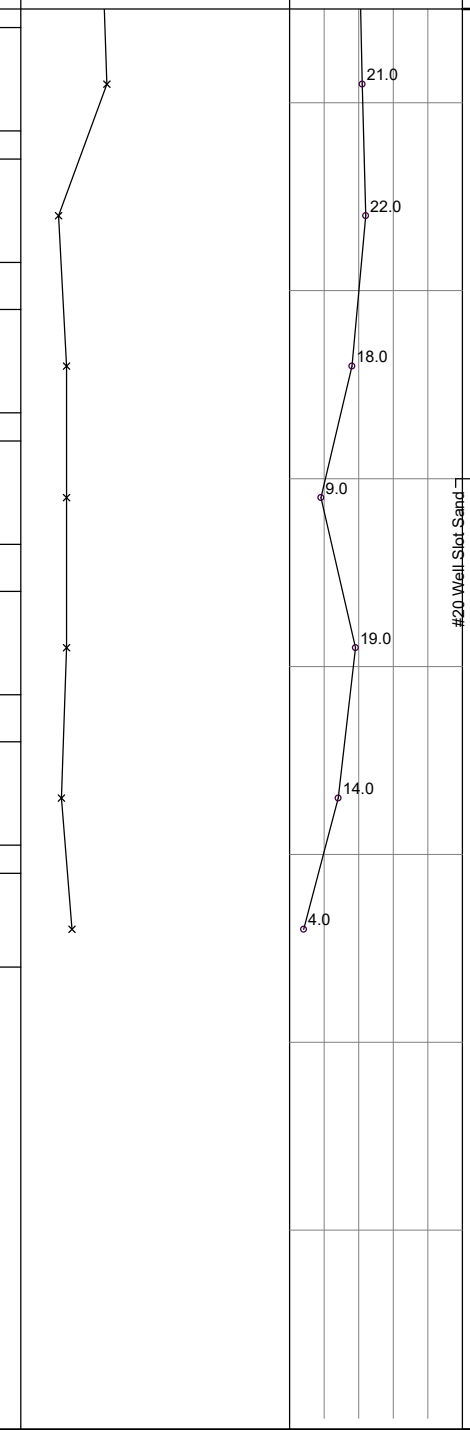
LOG OF BOREHOLE BHMW22-1D

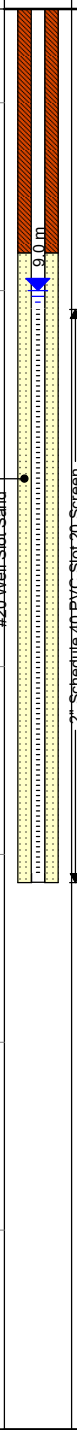
Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-02
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258814
Easting: -79.902537
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			...no gravel.	11	SS	11 14 18	32	
8		-8.0	**Sandy Silt** trace clay. Brown, compact, moist.	12	SS	6 6 8	14	
9		-9.0	**Clayey Silt** trace sand. Brown, very stiff, wet.	13	SS	8 7 10	17	
10		-10.0	...brown and grey, very moist to wet.	14	SS	8 7 10	17	
11		-11.0		15	SS	7 7 10	17	
12		-12.0		16	SS	5 6 9	15	
13		-13.0		17	SS	6 7 12	19	
14		-14.0	End of Log					
15		-15.0						





Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage upon completion at approximately 11.5 m below the ground surface.
3.
4.

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LOG OF BOREHOLE BHMW22-2S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-03
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258702
Easting: -79.902665
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL; 10 20 30 40)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
1		-1.0	**Asphalt** ~75 mm **Fill** Sandy silt, trace gravel, trace brick fragments, trace asphalt pieces. Brown, loose to compact, moist.	1	SS	6 4 6 6	10		16.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
			...loose.	2	SS	2 3 3	6		6.0				
2		-2.0	...compact.	3	SS	8 6 5	11		6.0				
			...no brick fragments, no asphalt pieces.	4	SS	3 3 4	7		8.0	#20 Well Slot Sand			
3		-3.0	**Sandy Silt** Brown and grey, loose, moist to very moist.	5	SS	3 2 4	6		7.0	3.6 m			
4		-4.0		6	SS	3 2 3	5		9.0		2" Schedule 40 PVC Slot 20 Screen		
5		-5.0		7	SS	3 2 5	7		9.0				
			End of Log										
6		-6.0											
7		-7.0											

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-2D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-03
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25871
Easting: -79.902626
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Asphalt ~75 mm					
			Fill Sandy silt, trace gravel, trace brick fragments, trace asphalt pieces. Brown, compact, moist.	1	SS	6 7 6 6	13	
1		-1.0	...loose.	2	SS	6 5 4	9	
				3	SS	4 4 4	8	
2		-2.0		4	SS	4 4 5	9	
3		-3.0	**Sandy Silt** Brown and grey, loose, moist.	5	SS	3 2 3	5	
4		-4.0	...trace gravel.	6	SS	3 4 4	8	
				7	SS	3 3 4	7	
5		-5.0	...compact.	8	SS	5 7 18	25	
6		-6.0	**Sand** trace gravel, trace silt. Brown, dense, dry to moist.	9	SS	16 26 23	49	
7		-7.0	...compact.	10	SS	12 12 8	20	

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
13.0
9.0
8.0
9.0
5.0
8.0
7.0
25.0
49.0
20.0

Well Details
3/8" Bentonite Pellets

Groundwater Conditions
8" Drop-in Flushmount

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.9 m below the ground surface.
3.
4.

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LOG OF BOREHOLE BHMW22-2D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-03
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25871
Easting: -79.902626
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
				11	SS	16 12 9	21	
8		-8.0						
			Silt trace sand inclusions. Brown, compact, moist.	12	SS	6 11 11	22	
9		-9.0						
				13	SS	6 8 10	18	
			...trace red shale fragments. Brown and grey.	14	SS	3 4 5	9	
10		-10.0						
			...moist to very moist.	15	SS	3 8 11	19	
11		-11.0						
			Sand Brown, compact, wet.	16	SS	9 8 6	14	
12		-12.0	...loose.	17	SS	2 2 2	4	
			End of Log					
13		-13.0						
14		-14.0						
15		-15.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40

21.0
22.0
18.0
9.0
19.0
14.0
4.0

Well Details

#20 Well Slot Sand
11.9 m
2" Schedule 40 PVC Slot 20 Screen

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.9 m below the ground surface.
3.
4.

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LOG OF BOREHOLE BHMW22-3S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-03
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258938
Easting: -79.902727
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt ~75 mm										
			Fill Silt, some sand. Brown, loose, moist.	1	SS	3 3 4 4	7		7.0				
1		-1.0	...very moist to wet.	2	SS	3 2 2	4		4.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
				3	SS	2 3 2	5		5.0				
2		-2.0											
			Silt some sand. Brown, loose to compact, very moist to wet.	4	SS	2 5 5	10		10.0	#10 Well Slot Sand			
3		-3.0	...loose.	5	SS	2 3 2	5		5.0	3.2 m			
			Sandy Silt Brown, loose, very moist.	6	SS	2 3 6	9		9.0		2" Schedule 40 PVC Slot 10 Screen		
4		-4.0	...trace cobbles.	7	SS	2 2 2	4		4.0				
5		-5.0	End of Log										
6		-6.0											
7		-7.0											

Additional Notes:
1. Borehole open to approximately 5.1 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

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LOG OF BOREHOLE BHMW22-4D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-04
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258838
Easting: -79.902733
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL; Moisture / Plasticity 10 20 30 40)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt ~75 mm										
			Fill Sandy silt, trace gravel. Brown and black, loose, moist.	1	SS	4 3 2 4	5		13.0				
1		-1.0		2	SS	3 2 4 4	6		9.0				
			...brownish red, moist to very moist.	3	SS	2 3 4	7		8.0				
2		-2.0		4	SS	2 3 5	8		9.0				
			Silt trace sand. Brown, loose, moist.										
3		-3.0	...very moist to wet.	5	SS	3 4 5	9		5.0	3/8" Bentonite Pellets			
			...moist.	6	SS	3 4 5	9		8.0				
4		-4.0											
			...grey.	7	SS	2 2 4	6		7.0				
5		-5.0							25.0				
				8	SS	2 2 4	6						
6		-6.0	**Sand** trace gravel, trace silt. Brown, dense, moist.	9	SS	23 19 17	36		49.0				
7		-7.0		10	SS	10 16 15	31		20.0		8" Drop-in Flushmount		

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.5 m below the ground surface.
3.
4.

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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-4D

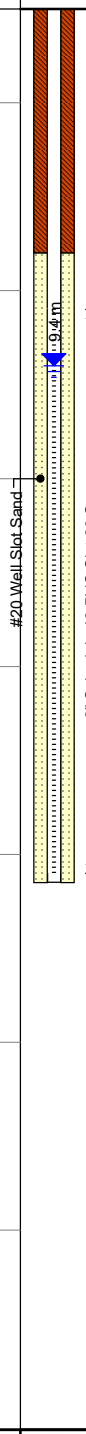
Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-04
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258838
Easting: -79.902733
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			...trace iron staining, very moist.	11	SS	12 10 9	19	
				12	SS	9 7 11	18	
			Clayey Silt trace sand inclusions. Brown, very stiff, moist.	13	SS	7 10 14	24	
			...grey and brown, very moist.	14	SS	4 7 9	16	
			...stiff, wet.	15	SS	4 6 8	14	
			...very stiff, very moist to wet.	16	SS	12 13 15	28	
			...dense.	17	SS	4 9 25 35	34	
			End of Log					

Undrained Shear Strength Values (kPa): 40, 80, 120, 160
Penetration Test Values (Blows / 0.3m): 20, 40, 60, 80
Moisture / Plasticity: PL, MC, LL; 10, 20, 30, 40



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.5 m below the ground surface.
3.
4.

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LOG OF BOREHOLE BHMW22-5s

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-03
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258778
Easting: -79.902866
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL) / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
		Asphalt ~75 mm										
		Fill Silt, trace sand, trace gravel. Brown and black, loose, moist. PHC odour.	1	SS	9 6 2 2	8		8.0				
1	-1.0	...no gravel.	2	SS	3 2 3	5		5.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
			3	SS	2 2 2	4		4.0				
2	-2.0		4	SS	2 2 2	4		4.0	#20 Well Slot Sand			
3	-3.0		5	SS	2 2 4	6		6.0	1.6 m	2" Schedule 40 PVC Slot 20 Screen		
		Silt trace sand. Brown and grey, loose, moist.	6	SS	2 2 3	5		5.0				
4	-4.0		7	SS	2 2 2	4		4.0				
5	-5.0	End of Log										
6	-6.0											
7	-7.0											

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW5

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

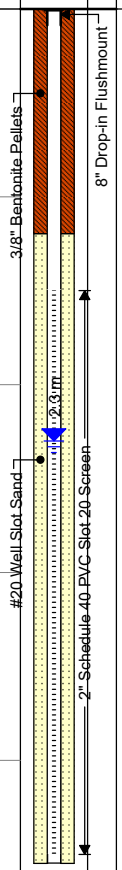
Drill Date: 2016-09-07
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258851
Easting: -79.902709
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Asphalt ~250 mm					
			Fill Sand and gravel. Grey, compact, dry.					
1		-1.0		1	SS		12	
			...sandy silt, trace gravel.	2	SS		2	
2		-2.0						
3		-3.0	**Silt** trace sand. Brown, loose, very moist to wet.	3	SS		5	
4		-4.0		4	SS		4	
5		-5.0	End of Log					
6		-6.0						
7		-7.0						

Penetration / Strength Results: Undrained Shear Strength Values (kPa) 40 80 120 160; Penetration Test Values (Blows / 0.3m) 20 40 60 80

Moisture / Plasticity: PL MC LL; Moisture / Plasticity 10 20 30 40



Well Details | Groundwater Conditions | Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.6 m depth on completion.
2. Groundwater level at 3.6 m below the ground surface, monitored on 20/09/2016.
3.
4.

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LOG OF BOREHOLE BHMW22-6S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-04
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258611
Easting: -79.903132
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Asphalt ~75 mm					
			Granular Sand and gravel, trace asphalt pieces.	1	SS	4 7 9 7	16	
			Fill Silt, trace gravel. Brown, loose, moist.					
1		-1.0		2	SS	2 3 3	6	
			...mosit to very moist.	3	SS	4 3 3	6	
2		-2.0		4	SS	2 3 5	8	
3		-3.0	**Silt** trace clay, trace sand, trace gravel. Brown, loose, very moist.	5	SS	3 3 4	7	
4		-4.0		6	SS	3 4 5	9	
			Clayey Silt trace sand. Grey, stiff, very moist to wet.	7	SS	3 4 5	9	
5		-5.0	End of Log					
6		-6.0						
7		-7.0						

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
5.0
5.0
4.0
5.0
6.0
6.0
13.0

Well Details
3/8" Bentonite Pellets
#20 Well Slot Sand
3.7 m
2" Schedule 40 PVC Slot 20 Screen
8" Drop-in Flushmount

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

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LOG OF BOREHOLE BHMW22-6D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-04
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25862
Easting: -79.903101
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Asphalt ~75 mm **Granular** Sand and gravel, trace asphalt pieces.	1	SS	4 7 9 7	16	
1		-1.0	**Fill** Silt, trace gravel. Brown, loose, dry to moist.	2	SS	2 3 3	6	
2		-2.0		3	SS	4 3 3	6	
				4	SS	2 3 5	8	
3		-3.0	**Silt** trace sand, trace gravel. Brown, loose, very moist.	5	SS	3 3 4	7	
4		-4.0		6	SS	3 4 5	9	
			Clayey Silt trace sand. Grey, stiff, very moist to wet	7	SS	3 4 5	9	
5		-5.0	...firm.	8	SS	1 3 3	6	
6		-6.0	**Silty Sand** trace gravel. Brown, dense, moist.	9	SS	30 26 22	48	
7		-7.0	...trace cobbles.	10	SS	13 24 20	44	

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
16.0
6.0
6.0
8.0
7.0
9.0
9.0
6.0
48.0
44.0

Well Details
3/8" Bentonite Pellets
8" Drop-in Flushmount

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.9 m below the ground surface
3.
4.

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LOG OF BOREHOLE BHMW22-6D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-11-04
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.25862
Easting: -79.903101
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
			...compact, no cobbles.	11	SS	6 7 9	16
8		-8.0	...very moist to wet.	12	SS	5 6 7	13
9		-9.0	**Silt** trace sand. Brown, compact, very moist.	13	SS	4 5 6	11
10		-10.0	...very moist to wet.	14	SS	4 5 8	13
11		-11.0	...brown and grey.	15	SS	3 5 7	12
12		-12.0		16	SS	6 8 10	18
				17	SS	6 16 23	39
13		-13.0	End of Log				
14		-14.0					
15		-15.0					

Penetration / Strength Results: Undrained Shear Strength Values (kPa) 40 80 120 160; Penetration Test Values (Blows / 0.3m) 20 40 60 80

Moisture / Plasticity: PL MC LL; Moisture / Plasticity 10 20 30 40

16.0
13.0
11.0
13.0
12.0
18.0
39.0

Well Details: #20 Well Slot Sand; 10.5 m; 2" Schedule 40 PVC Slot 20 Screen

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage encountered upon completion at approximately 11.9 m below the ground surface
3.
4.

LANDTEK LIMITED
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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-7S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258729
Easting: -79.903505
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt ~150 mm										
			Fill Silt, trace sand, trace clay, trace gravel. Brown, loose, moist.	1	SS	49 36 7 6	42		5.0				
1		-1.0		2	SS	2 3 4	7		5.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
			...trace iron staining. Compact.	3	SS	3 6 6	12		4.0				
2		-2.0											
			Silt some sand, trace iron staining. Brown, loose, very moist.	4	SS	1 2 3	5		5.0	#20 Well Slot Sand			
3		-3.0	...compact.	5	SS	3 4 7	11		6.0	3.2 m	2" Schedule 40 PVC Slot 20 Screen		
4		-4.0	...trace gravel. Brown and grey.	6	SS	3 5 5	10		13.0				
5		-5.0	End of Log										
6		-6.0											
7		-7.0											

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-8S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258595
Easting: -79.903807
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL) 10 20 30 40	Comments
		Asphalt ~150 mm							
		Granular Sand and gravel.	1	SS	5 4 5 4	9		9.0	
		Fill Silt, trace clay, trace sand, trace gravel, trace red brick fragments. Brown, loose, dry to moist.							
1	-1.0		2	SS	2 2 2	4		4.0	
		...trace iron staining, trace concrete/slag.	3	SS	2 1 1	2		2.0	
2	-2.0		4	SS	2 1 4	5		5.0	
3	-3.0		5	SS	2 3 3	6		6.0	
		Silt trace clay, trace sand, trace gravel. Brown, loose, moist.							
4	-4.0		6	SS	2 2 2	4		4.0	
		...loose to compact.	7	SS	3 5 5	10		10.0	
5	-5.0	End of Log							
6	-6.0								
7	-7.0								

Well Details: 3/8" Bentonite Pellets; #20 Well Slot Sand; 2" Schedule 40 PVC Slot 20 Screen; 8" Drop-in Flushmount
Groundwater Conditions
Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-8D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-02
Drilling Method: Hollw Stem
Datum: Geodetic

Northing: 43.258607
Easting: -79.903749
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength (kPa) / Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity (PL MC LL)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt ~150 mm										
			Granular Sand and gravel.	1	SS	5 4 5 4	9		9.0				
			Fill Silt, trace clay, trace sand, trace gravel, trace red brick fragments. Brown, loose, dry to moist.										
1		-1.0		2	SS	2 2 2	4		4.0				
			...trace iron staining, trace concrete/slag.	3	SS	2 1 1	2		11.0 / 2.0				
2		-2.0		4	SS	2 1 4	5		5.0				
3		-3.0		5	SS	2 3 3	6		6.0				
			Silt trace clay, trace sand, trace gravel. Brown, loose, moist.	6	SS	2 2 2	4		4.0				
4		-4.0	...loose to compact.	7	SS	3 5 5	10		10.0				
5		-5.0	...compact.	8	SS	3 5 6 33	11		11.0				
6		-6.0	**Silty Sand** trace gravel. Brown, compact, moist.	9	SS	15 12 7 5	19		19.0				
			...loose, very moist.	10	SS	2 4 4 3	8		8.0				
7		-7.0											

8" Drop-in Flushmount

3/8" Bentonite Pellets

Additional Notes:
1. Borehole open to approximately 13.6 m depth on completion.
2. Groundwater or water seepage encountered at approximately 7.6 m below the ground surface.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-8D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-02
Drilling Method: Hollw Stem
Datum: Geodetic

Northing: 43.258607
Easting: -79.903749
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL) / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
8	-8.0	**Silt** trace sand, trace clay. Brown, compact, very moist to wet.	11	SS	4 7 8 12	15		15.0				
			12	SS	4 8 10 13	18		18.0				
9	-9.0	...moist.	13	SS	8 9 12 15	21		21.0				
10	-10.0	...grey, very moist to wet.										
			14	SS	3 4 7 9	11		11.0				
12	-12.0	...loose.										
			15	SS	3 3 6 6	9		9.0				
13	-13.0	...compact.										
			16	SS	4 6 11 12	17		17.0				
14	-14.0	End of Log										
15	-15.0											

Well Details: #20 Well Slot Sand; 2" Schedule 40 PVC Slot 20 Screen; ▽ 10.7 m

Additional Notes:
1. Borehole open to approximately 13.6 m depth on completion.
2. Groundwater or water seepage encountered at approximately 7.6 m below the ground surface.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH9

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-02
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258755
Easting: -79.903999
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt Asphalt										
			Granular Sand and gravel	1	SS	20 3 5 5	8		8.0				
			Fill Silt, trace clay, trace sand, trace gravel. Brown, loose, moist.										
1		-1.0		2	SS	3 2 2	4		4.0				
			Silt trace sand, trace clay, trace iron staining. Brown, loose, moist.	3	SS	2 2 3	5		5.0				
2		-2.0	...loose to compact.	4	SS	3 4 6	10		10.0				
3		-3.0	...compact.	5	SS	2 6 5	11		11.0				
			End of Log										
4		-4.0											
5		-5.0											
6		-6.0											
7		-7.0											

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-10S

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258506
Easting: -79.90391
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
0			**Asphalt** ~150 mm										
			Fill Silt, trace sand, trace clay, trace gravel. Brown, loose, dry to moist.	1	SS	9 3 2 3	5		5.0	3/8" Bentonite Pellets	8" Drop-in Flushmount		
1		-1.0		2	SS	2 2 3	5		5.0				
			...trace brick fragments. Very moist.	3	SS	3 2 2	4		4.0				
2		-2.0											
				4	SS	1 2 3	5		5.0	#20 Well Slot Sand			
3		-3.0									2" Schedule 80 PVC Slot 20 Screen		
			Silt trace clay, trace sand. Brown, loose, moist.	5	SS	2 2 4	6		6.0				
			...trace iron staining. Grey.	6	SS	2 3 3	6		6.0				
4		-4.0											
				7	SS	3 5 8	13		13.0				
5		-5.0	End of Log										
6		-6.0											
7		-7.0											

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-10D

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258515
Easting: -79.90388
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength (kPa) / Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity (PL MC LL)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Asphalt ~150 mm										
			Fill Silt, trace sand, trace clay, trace gravel. Brown, loose, dry to moist.	1	SS	9 3 2 3	5		5.0				
1		-1.0		2	SS	2 2 3	5		5.0				
			...trace brick fragments. Very moist.	3	SS	3 2 2	4		4.0				
2		-2.0		4	SS	1 2 3	5		5.0				
3		-3.0		5	SS	2 2 4	6		6.0				
			Silt trace clay, trace sand. Brown, loose, moist.	6	SS	2 3 3	6		6.0				
4		-4.0	...trace iron staining. Grey and brown, compact.	7	SS	3 5 8	13		13.0				
5		-5.0	...no iron staining, no clay.	8	SS	4 4 6	10		10.0				
6		-6.0		9	SS	2 3 19	22		22.0				
			Silty Sand ...trace gravel. Brown, compact, moist. ...loose.	10	SS	3 2 3	5		5.0				
7		-7.0											

Penetration / Strength Results: Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲; Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×

Moisture / Plasticity: PL MC LL; Moisture / Plasticity ○ 10 20 30 40 ○

Well Details: 8" Drop-in Flushmount; 3/8" Bentonite Pellets

Additional Notes:
1. Borehole open to approximately 13.7 m depth on completion.
2. Groundwater or water seepage encountered at approximately 6.8 m below the ground surface.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-10D

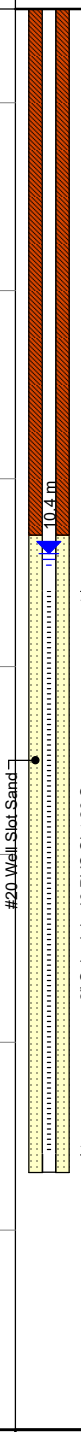
Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Hollow Stem
Datum: Geodetic

Northing: 43.258515
Easting: -79.90388
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
8	-8.0	**Silt** trace sand, trace gravel. Brown, loose, very moist to wet.	11	SS	3 3 2	5	
		...trace red sand seam. Compact.	12	SS	2 7 8	15	
9	-9.0	...trace iron staining.	13	SS	4 5 9	14	
10	-10.0		14	SS	2 4 7	11	
11	-11.0		15	SS	3 5 6	11	
12	-12.0	...grey.					
13	-13.0	...reddish brown.	16	SS	5 8 8	16	
14	-14.0	End of Log					
15	-15.0						

Undrained Shear Strength Values (kPa): 40, 80, 120, 160
Penetration Test Values (Blows / 0.3m): 20, 40, 60, 80
Moisture / Plasticity: PL, MC, LL; 10, 20, 30, 40



Additional Notes:
1. Borehole open to approximately 13.7 m depth on completion.
2. Groundwater or water seepage encountered at approximately 6.8 m below the ground surface.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW22-11

Project No.: 22372
Project Name: 925 Main Street West, Hamilton, Ontario
Location: 925 Main Street West, Hamilton, Ontario

Drill Date: 2022-12-01
Drilling Method: Solid Stem
Datum: Geodetic

Northing: 43.258602
Easting: -79.904001
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL) 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
		Asphalt ~150 mm										
		Fill Silt with gravel, trace pebbles, trace iron staining. Grey and brown, dense, dry to moist.	1	SS	8 7 40 55	47		5.0				
1	-1.0	...trace sand. Loose, moist.	2	SS	2 2 3	5		5.0				
		...sandy silt, trace black staining. Brown and red.	3	SS	1 1 2	3		4.0				
2	-2.0		4	SS	2 3 2	5		5.0				
		...trace brick fragments.										
3	-3.0		5	SS	2 2 2	4		6.0				
		Silt trace sand, trace gravel, trace iron staining. Reddish brown, loose, moist. Possible fill.	6	SS	4 4 5	9		6.0				
4	-4.0		7	SS	2 2 3	5		13.0				
5	-5.0	End of Log										
6	-6.0											
7	-7.0											

3/8" Bentonite Pellets
#20 Well Slot Sand
2" Schedule 40 PVC Slot 20 Screen
8" Drop-in Flushmount

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

APPENDIX D

SHEAR WAVE VELOCITY TESTING RESULTS

GEOPHYSICS GPR INTERNATIONAL INC.

6741 Columbus Road
Unit 14
Mississauga, Ontario
Canada, L5T 2G9

Tel.: 905-696-0656
Fax: 905-696-0570
info@geophysicsgpr.com
www.geophysicsgpr.com

Transmitted by Email: james@landtek.ca

December 28th, 2022 GPR file: T224233-1

James Dann, P.Eng.
Manager, Geotechnical
Landtek Ltd.
205 Nebo Road, Unit 48
Hamilton, ON
L8W 2E1

RE: Shear-wave velocity sounding at 925 Main Street West, Hamilton, Ontario

Dear Mr. Dann:

Geophysics GPR International Inc. has been requested by Landtek Ltd. to carry out a shear-wave velocity sounding at the above site in Hamilton.

The investigation included the multi-channel analysis of surface waves (MASW), the micro-tremor array measurements (MAM), the Spatial AutoCorrelation (SPAC), and the refraction methods to generate a shear-wave velocity model.

The survey was performed on November 23rd, 2022. Figure 1 shows the regional location of the site and Figure 2 illustrates the location of the seismic spread. Both figures are presented at the end of this report.

The following paragraphs describe the survey design, the principles of the test method, the methodology for interpreting the data, and provide a culmination of the results in table format.

MASW and MAM Surveys

Basic Theory

The Multi-channel Analysis of Surface Waves (MASW), the Micro-tremor Array Measurements (MAM) and the Spatial AutoCorrelation (SPAC) are seismic methods used to evaluate the shear-wave velocities of subsurface materials through the analysis of the dispersion properties of Rayleigh surface waves ("ground roll"). The dispersion properties are measured as a change in phase velocity with frequency. Surface wave energy will decay exponentially with depth. Lower frequency surface waves will travel deeper and thus be more influenced by deeper velocity layering than the shallow higher frequency waves. Inversion of the Rayleigh wave dispersion curve yields a shear-wave (V_s) velocity depth profile (sounding). The SPAC is considered a "passive" method, using the low frequency "signals" produced far away. The method can also be used with "active" seismic source records. This method generally allows deeper Vs soundings. The dispersion curve can then be merged with the one of higher frequency from the MASW to calculate a more complete inversion. Figure 3 outlines the basic operating procedure for the MASW method. Figure 4 is an example image of a typical MASW record and resulting 1D V_s model. A more detailed description of the method can be found in the paper *Multi-channel Analysis of Surface Waves,* Park, C.B., Miller, R.D. and Xia, J. Geophysics, Vol. 64, No. 3 (May-June 1999); P. 800–808.

Survey Design

The geometry of an MASW survey is similar to that of a seismic refraction investigation. A seismic spread usually consists of 12 to 24 vibration-monitoring devices (geophones) in a linear array, connected to a seismograph (Abem Terraloc Pro/Mark 6). The fundamental principle involves intentionally generating an acoustic wave at the surface and digitally recording the surface waves from the moment of source impact with a linear series of geophones on the surface. This is referred to as an "active source" method. A sledgehammer was used as the primary energy source with traces being recorded at 6 locations: approximately 6 m off both ends, 25 to 30 m off both ends, and in the middle of the spread. Data were collected with a geophone spacing of 3 m and 1m for a total of 10 shot records per sounding.

Unlike the refraction method, which produces a data point beneath each geophone, the shear-wave depth profile is the average of the bulk area within the middle third of the geophone spread.

The theoretical maximum depth of penetration (34.5 m) is half of the maximum seismic array length (69 m), in practice the maximum depth of penetration is often influenced by the geology.

The MAM/passive survey used the same geophone array set up as for the MASW survey. Unlike the MASW survey, the MAM method is considered a "passive source" method in that there is no time break and the motions recorded are from

ambient energy generated by cultural noise such as traffic, wind, wave motion, etc. Data collection for the passive method involves recording approximately 10 minutes of background "noise." The records generated by the MAM method contain lower frequency data, thus increasing the data resolution at greater depths of investigation. Typically the MAM results aid in clarifying the MASW results for depths greater than 20 m; however, the direction of noise propagation relative to the spread orientation can influence the results.

Interpretation Method and Accuracy of Results

The main processing sequence involved plotting, picking, and 1-D inversion of the MASW/MAM shot records using the SeisimagerSW™ software package and MASwAI from Geophysics GPR. The data inversions is done using the neural networks based algorithm MASwAI.

In theory, all MASW shot records should produce a similar shear-wave velocity profile. In practice, however, differences can arise due to energy dissipation and localized surface variations. The results of the inversion process are inherently non-unique and the final model must be judged to be geologically realistic. The inversion modelling also assumes that all layering is flat/horizontal and laterally uniform.

The results of the MASW/MAM tests are presented in chart format as Figure 5. The chart presents the 1-D shear wave velocity values from the inversion models of the passive and active seismic records.

The V_s30 value for the sounding is presented in Table 1. The V_s30 values are based on the harmonic mean of the shear wave velocities over the upper 30 m. The V_s30 value is calculated by dividing the total depth of interest (e.g. 30 m) by the sum of the time spent in each velocity layer up to that depth.

$$\bar{V}_{S30} = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} {H_i}/{V_i}} \quad | \quad \sum_{i=1}^{N} H_i = 30 \text{ m}$$

(N: number of layers; H_i: thickness of layer "i" ; V_i: V_S of layer "i")

This harmonic mean value reflects the equivalent single layer response. Table 2 at the end of the report displays the Vs30 calculations at various depths up to 30 meters.

The estimated error in the average V_s30 value determined through MASW tests is typically +/-10 to 15% for overburden sites. The shear-wave velocities modelled through the MASW method within bedrock have a higher estimated error.

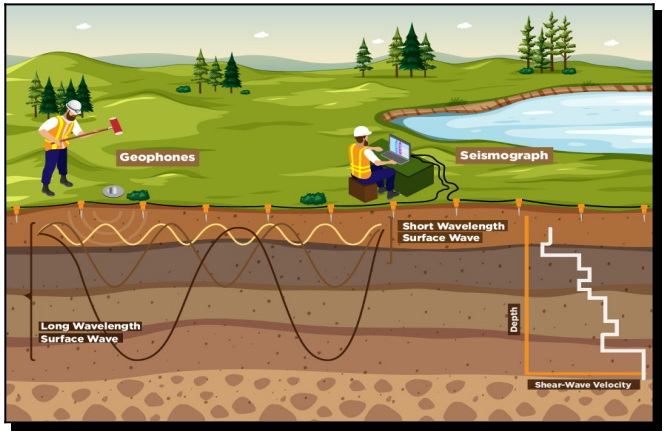
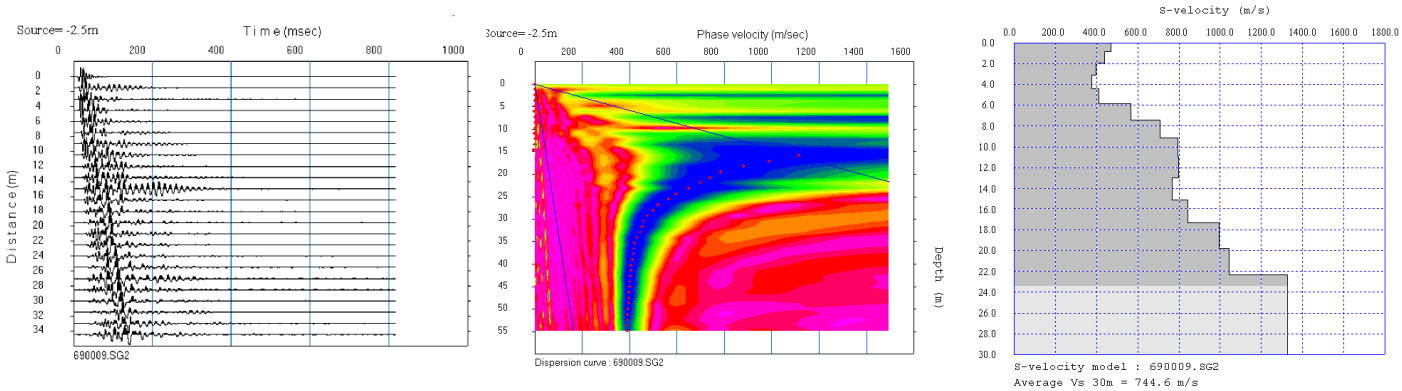


Figure 3: MASW Operating Principle



Raw Seismic Shot Record

Phase Velocity-Frequency Transformation indicating Dispersion Curve

1D Shear-Wave Velocity Profile from Inversion of Dispersion Curve

Figure 4: Example of a typical MASW shot record, phase velocity/frequency curve and resulting 1D shear-wave velocity model.

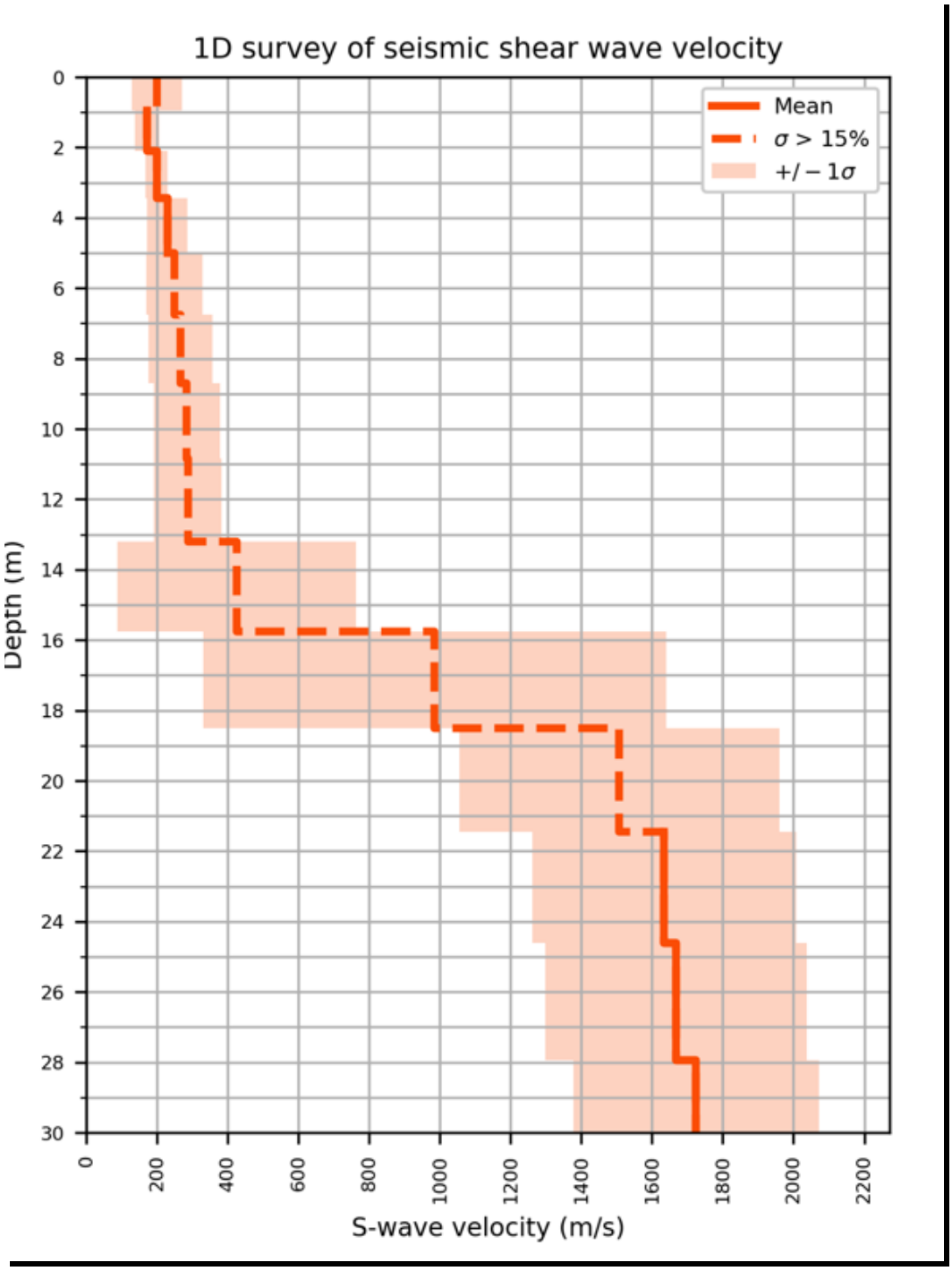


Figure 5: MASW Shear-wave Velocity Sounding

CONCLUSIONS

The approximate location of the shear-wave sounding is indicated in Figure 2.

The MASW shear-wave models are presented in Figure 5. The results are summarized in Table 1. The background seismic noise levels at this site were medium. The quality of the seismic records and the resulting dispersion curves was good.

Simple critical distance calculations from refracted P-waves show that the water table could be at 6 m deep. The shale bedrock could be approximately at 16 m deep.

No boreholes or geotechnical data were available at the time of this report.

Table 1: Calculated V_s30 values (m/s) from the MASW data (0 to 30 m)

Sounding	Minimum	Average	Maximum	Site Class
1	340	**415**	482	**C**

The calculated average V_s30 values from the 1D MASW soundings collected was 415 m/s +/-10 to 15%.

The V_s30 values calculated for the minimum and the maximum envelopes ranged from 340 to 482 m/s.

Based on the average V_s30 values (as determined through the MASW method) and table 4.1.8.4.A of the National Building Code of Canada, 2015 Edition, the investigated area is site class "C" ($360 < V_S30 \leq 760$ m/s).

It must be noted that the site classification provided in this report is based solely on the V_s30 value as derived from the MASW method and that it can be superseded by other geotechnical information. This geotechnical information includes, but is not limited to, the presence of sensitive and/or liquefiable soils, more than 3 m of soft clays, high moisture content, etc. The reader is referred to section 4.1.8.4 of the National Building Code of Canada, 2015 Edition for more information on the requirements for site classification.

Processing of the seismic data was performed by Anne Irvin, Ph.D. This report has been written by Lhoucin Taghya, P.Geo.

Lhoucin Taghya, P.Geo.
Geophysicist

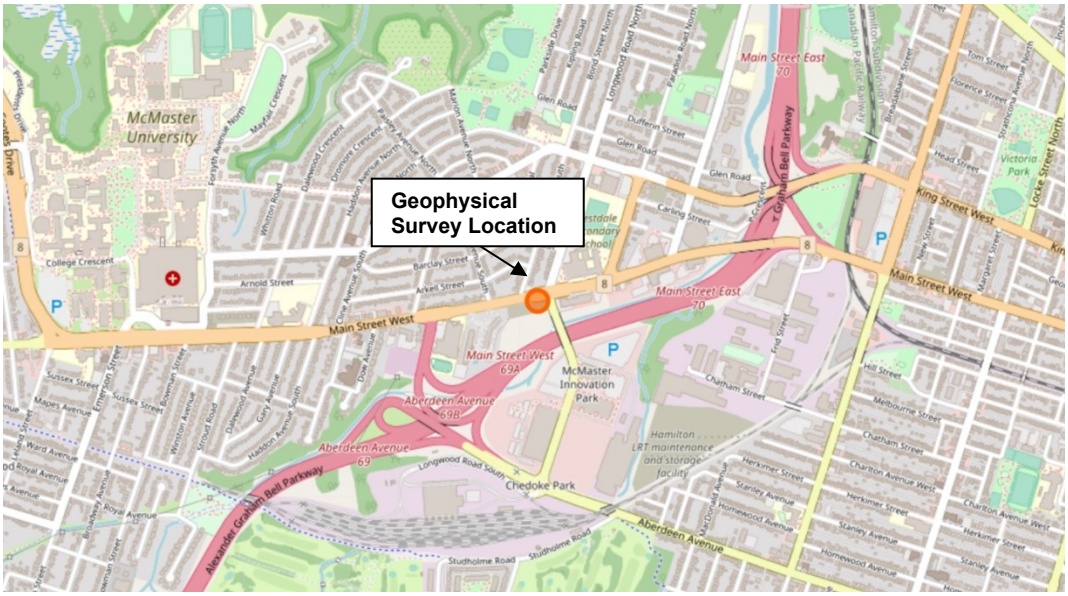


Figure 1: Regional location of the Site
(*Source: Open StreetMap™*)

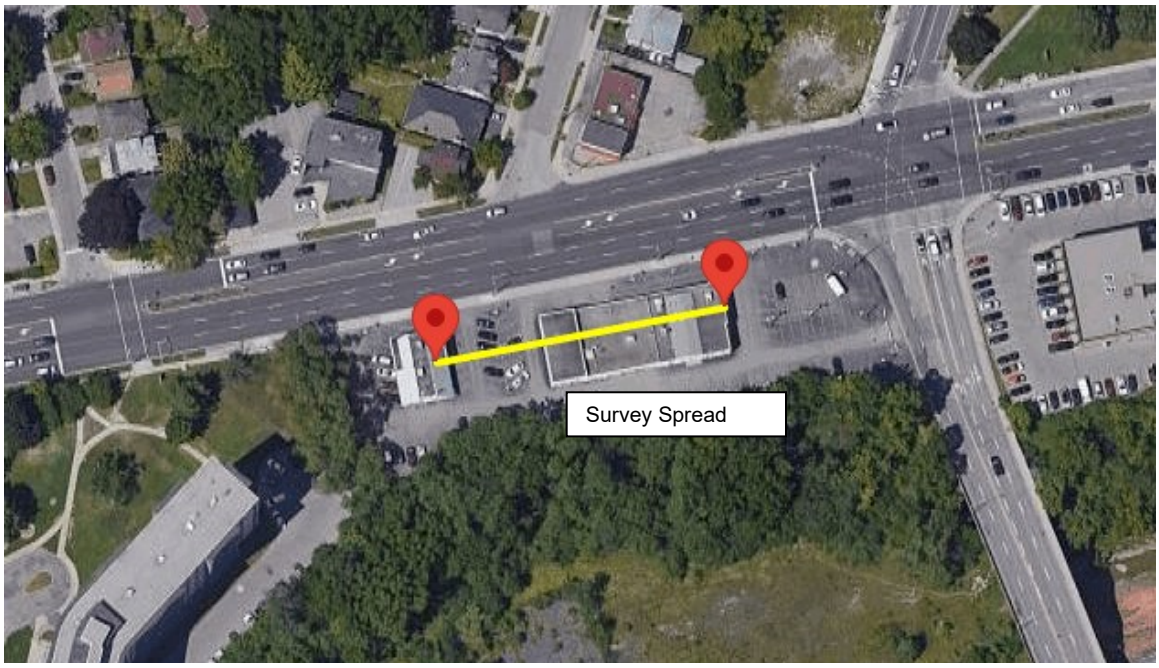


Figure 2: Location of the seismic spread
(Source: *Google Earth™*)

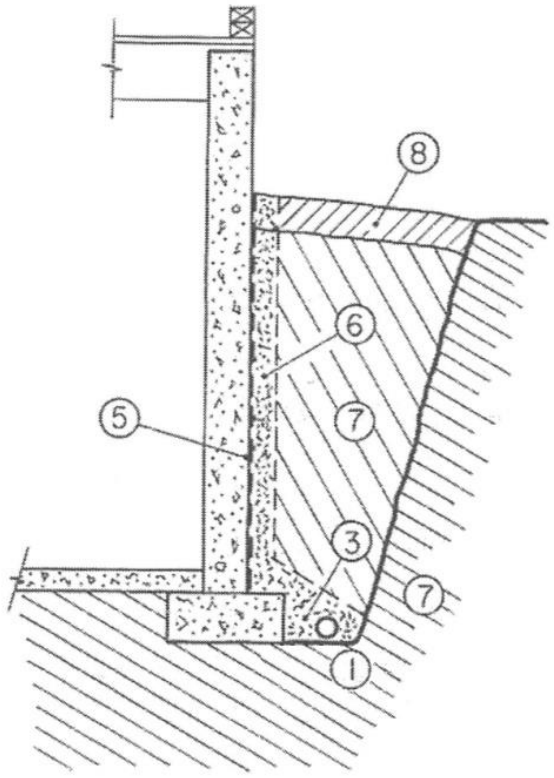
Table 2: V_{S30} Calculation for the Site Class

Depth	Vs			Thickness	Cumulative Thickness	Delay for Med. Vs	Cumulative Delay	Vs at given Depth Min.
	Min.	Median	Max.					
(m)	(m/s)	(m/s)	(m/s)	(m)	(m)	(s)	(m)	(m/s)
0	157.85	186.22	214.79	Grade Level				
0.95	152.4	166.85	181.31	0.95	0.95	0.005101	0.005101	186.2
2.10	177.66	192.21	206.75	1.15	2.10	0.006892	0.011994	175.1
3.45	194.14	224.13	254.12	1.35	3.45	0.007024	0.019017	181.4
5.00	205.25	246.57	287.9	1.55	5.00	0.006916	0.025933	192.8
6.75	213.39	259.07	304.75	1.75	6.75	0.007097	0.033030	204.4
8.70	222.08	270.8	314.33	1.95	8.70	0.007527	0.040557	214.5
10.85	222.38	268.25	314.11	2.15	10.85	0.007939	0.048497	223.7
13.20	245.33	429.67	614.01	2.35	13.20	0.008760	0.057257	230.5
15.75	782.85	1090.74	1398.63	2.55	15.75	0.005935	0.063192	249.2
18.50	1445.84	1652.68	1856.95	2.75	18.50	0.002521	0.065713	281.5
21.45	1639.2	1750.74	1964.75	2.95	21.45	0.001785	0.067498	317.8
24.60	1664.1	1772.09	1979.7	3.15	24.60	0.001799	0.069298	355.0
27.95	1670.12	1786.88	2003.91	3.35	27.95	0.001890	0.071188	392.6
30				2.05	30.00	0.001147	0.072335	414.7

V_{S30} (m/s)	**414.7**
Class	**C**

APPENDIX E

DRAWING 19328-02 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR DRAINAGE TO BASEMENT STRUCTURES
DRAWING 19328-03 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR UNDERFLOOR DRAINAGE SYSTEMS



① 100 mm, perforated or slotted pipe placed below the upper level of the floor slab.;
③ Filter material that is compatible with the grain size characteristics of the fine grained foundation and backfill soils, as well as with the perforations of the pipe;
④ Filter material continuously or intermittently placed next to the foundation wall to intercept water draining from window wells, down exterior walls and from low areas near the building;
⑤ Damp-proofing on wall – optional depending on the quality of the concrete wall;
⑥ Optional use of sheet drain, or synthetic fire blanket, next to the foundation wall to replace the soil filter according to ④;
⑦ Foundation and backfill soils, which may contain fine grained and erosion-susceptible materials;
⑧ "*Topping off*" material is to be graded such that it slopes outwards to lead surface water away from the building. It is usually desirable to use low permeability topsoil to reduce the risk of overloading the drainage pipe.

Based on Figure 12.1, Canadian Foundation Engineers Manual, Fourth Edition, 2006.

Additional Notes:

1. The perforated or slotted drainage pipe is to lead to a positive drainage sump or outlet. The invert of the pipe is to be a minimum of 150 mm below the underside of the proposed floor slab.
2. Backfill materials to the interior of the foundation walls may be clean, organic-free soils that can be compacted to the specified density within in a confined space.
3. Heavy, vibratory compaction equipment should not be used within 450 mm of the foundation wall. Fill is not to be placed or compacted within 1.8 m of the wall unless fill is being placed simultaneously on both sides of the wall.
4. The moisture barrier beneath the floor slab is to comprise at least 200 mm of compacted19mm clear stone or an equivalent free-draining material.
5. Should the 19 mm clear stone require surface blinding then 6mm stone chips are to be used.
6. The slab on grade should not be structurally connected to the foundation wall or footing.

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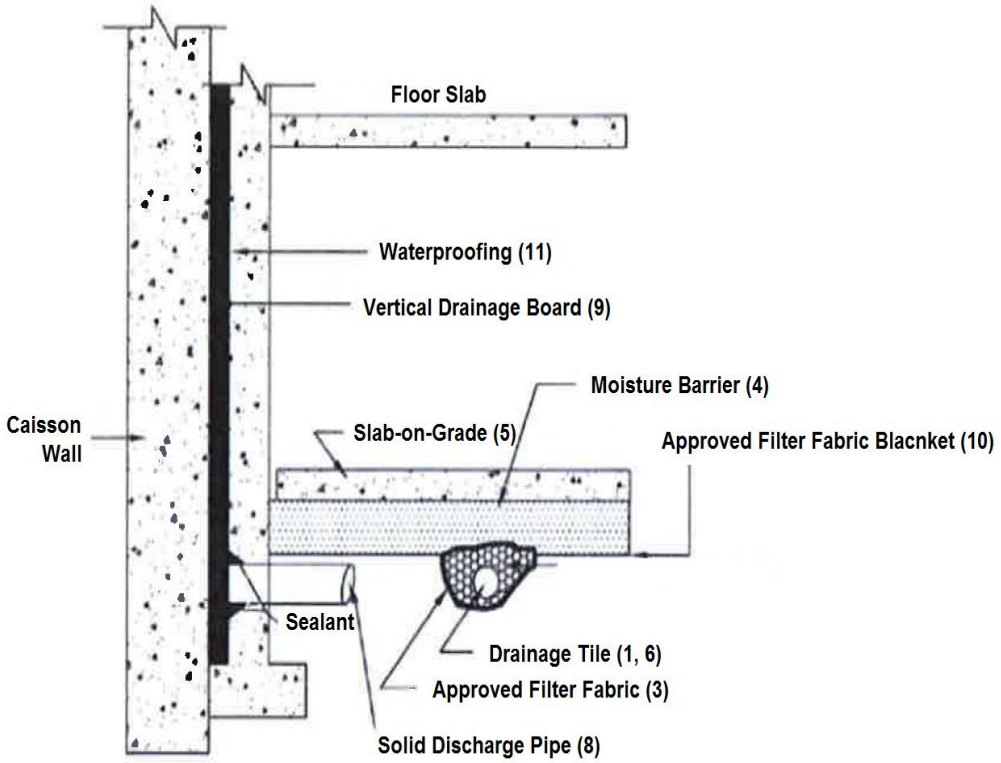
General Requirements for Drainage to Basement Structures

client	925 Main Street West (Hamilton) Limited
project	925 Main Street West, Hamilton, Ontario
project #	19328
drawing #	19328-02



Notes:

1. Drainage tile, if required for permanent dewatering, to consist of 100 mm diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns;
2. 19 mm clear stone – 150 mm top and side of drain. If the drain is not on the footing then place 100 mm of 19 mm clear stone below the drain;
3. Wrap the clear stone with an approved filter fabric (e.g., Terrafix 270R or equivalent);
4. Moisture barrier to be at least 200 mm of compacted, 19 mm clear stone or equivalent (and approved), free-draining material. A vapour barrier may be required for specialty floor coverings;
5. Typically, the slab-on-grade is not structurally connected to the wall or footing. However, if it is connected to the walls it should be designed accordingly;
6. Underfloor drain invert, where to be installed, to be at least 300 mm below underside of floor slab. Drainage tile should be placed in parallel rows 6 m to 8 m centres one way. Place drains on 100 mm of 19 mm clear stone and 150 mm of 19 mm clear stone on top and sides. Enclose clear stone with filter fabric as prescribed in Note (3);
7. Do not connect any underfloor drainage to perimeter drainage. The two systems are to remain separate.
8. Locate solid discharge at the middle of each bay between soldier piles;
9. Vertical drainage board (e.g., MiraDrain 6000 or equivalent) with filter cloth should be continuous from bottom to 1.2 m below exterior finished grade;
10. The entire subgrade is to be sealed with an approved filter fabric as in Note (3) where non-cohesive (silty/sandy/granular) soils are encountered below the groundwater table;
11. Where no permanent dewatering is proposed, the basement walls must be waterproofed below the seasonally highest groundwater level (plus 1.0 m to 1.5 m buffer) using bentonite or an equivalent waterproofing system;
12. The Geotechnical Report should be reviewed for site-specific details. Final detail must be approved before system is considered acceptable.

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General Requirements for Underfloor Drainage Systems			
client	925 Main Street West (Hamilton) Limited		
project	925 Main Street West, Hamilton, Ontario		
project #	19328	drawing #	19328-03