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Project No.: SM 230934-G February 1, 2024

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Attention: Jeremia Rudan
Project Manager

GEOTECHNICAL INVESTIGATION
PROPOSED MID-RISE RESIDENTIAL DEVELOPMENT
GARNER ROAD AND LUNDY'S LANE
NIAGARA FALLS, ONTARIO

Dear Mr. Rudan,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The scope of work was completed in general accordance with our proposal P230934, dated November 20, 2023. Our comments and recommendations based on our findings at the fifteen [15] borehole locations are presented in the following paragraphs.

1. INTRODUCTION

We understand that the project will involve the construction of six mid-rise residential buildings up to 16 storeys in height at the property located at the southeast quadrant of the intersection of Garner Road and Lundy's Lane in Niagara Falls, Ontario. The development is understood to have one shared underground parking level, however depending on constraints, may require up to two underground levels. The purpose of this preliminary geotechnical investigation work was to assess the subsurface soil and groundwater conditions, and to provide our comments and recommendations with respect to the design and construction of the proposed structure, from a geotechnical point of view.

This report is based on the above summarised project description, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project

design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation. It is noted that the information contained in this report does not reflect upon the environmental aspects of the site.

2. PROCEDURE

A total of fifteen [15] sampled boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The boreholes were advanced using continuous flight power auger equipment on December 5 to 8, 2023 under the direction and supervision of a staff member of SOIL-MAT ENGINEERS & CONSULTANTS LTD., to termination or auger refusal on assumed bedrock at depths of between approximately 6.7 to 11.0 metres below the existing ground surface.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings.

Groundwater observations were made during the drilling operations. Monitoring wells were installed at Borehole Nos. 1, 5, and 13 to allow for the future measurements of the groundwater level. The monitoring wells consisted of 50-millimetre PVC pipe, installed to depths of between 9.7 and 11.0 metres, screened in the lower 3.0 metres. The monitoring wells were encased in well filter sand up to approximately 0.3 metres above the screened portion, then with bentonite 'hole plug' to the surface and fitted with a protective steel 'stick up' casing. The remaining boreholes were backfilled in general accordance with Ontario Regulation 903, and the ground surface was reinstated even with the surrounding grade.

The boreholes were located in the field by representatives of SOIL-MAT ENGINEERS, based on accessibility over the site and clearance of underground utilities. The ground surface elevation at the borehole locations have been referenced to three site-specific geodetic benchmarks, described as the fire hydrant west of the north west corner of parking lot, the catch basin on the east side of the south parking lot, and the manhole at the north east corner of the site. These benchmarks were noted to have geodetic elevations of 187.84, 187.44, and 187.93 metres, respectively, as per the J.D. Barnes

Ltd. topographic survey 'Plan of Township Lot 139' (File No. 17-17-171-topo with utilities.dgn, Reference No. 17-16-171-01) that was provided to our office.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Borehole Nos. 1 to 15, inclusive, following the text of this report. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed at the exact depths of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is located east of the Garner Road and Lundy's Lane intersection in Niagara Falls, Ontario. The site is currently occupied by two commercial buildings and associated surrounding parking areas, as well as a vacant plot of land at the east and west portions of the site. The site is bound to the south by the Garner Place Subdivision currently under construction, to the east by existing commercial properties, to the west by Garner Road and to the north by Lundy's Lane. The site has an overall topographic relief of up to approximately 2 metres from west to east.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Topsoil

A surficial veneer of topsoil approximately 300 to 400 millimetres in thickness was encountered at Borehole Nos. 1 to 5, 13, 14, and 15. It is noted that the depth of topsoil may vary across the site and from the depths encountered at the borehole locations, and a conservative approach should be taken in estimating topsoil quantities across the site. It is also noted that the term 'topsoil' has been used from a geotechnical point of view, and does not necessarily reflect its nutrient content or ability to support plant life.

Pavement Structure

Borehole Nos. 6 to 12 were advanced through the pavement structure of the existing parking areas. The pavement structure encountered at these locations consisted of approximately 75 to 125 millimetres of asphaltic concrete overlying approximately 250 to 1,100 millimetres of compact granular base materials. It is also noted that a thin veneer

of topsoil roughly 150 millimetres thick was noted above the pavement structure at Borehole No. 6, which was located just off the parking lot.

Silty Sand/Sandy Silt

A deposit of silty sand/sandy silt was encountered beneath the topsoil layer at Borehole Nos. 2, 3, and 4. The fine grained fill material was brown in colour, containing trace amounts of gravel, and inclusions of organics and construction debris. The silty sand/sandy silt fill was generally in a loose to very loose state, and proven to depths of approximately 1.5 to 2.3 metres below the ground surface. It is noted that while not explicitly identified at the borehole locations, greater extents of fill material may be encountered across the site.

Silty Clay/Clayey Silt, and Silt

Native silty clay/clayey silt was encountered beneath the surficial topsoil and fill deposits, where encountered, at all of the borehole locations. The native cohesive soils were brown to grey in colour, transitioning to grey below a depth of approximately 4 to 5 metres. The silty clay/clayey silt soils encountered contained trace to some sand and gravel, and were generally stiff to very stiff in consistency. It is noted that the soils generally transitioned to firm in consistency below a depth of about 4 metres on the western part of the site, in Borehole Nos. 1 to 6. The cohesive soils transitioned to a predominately silty soil at some of the borehole locations, and was proven to auger refusal on assumed bedrock at depths of approximately 6.7 to 11.0 metres below the existing ground surface. Sampling spoon refusal or uncharacteristically high 'N-values' were occasionally encountered, likely due to the presence of large gravel or cobbles.

Limestone/Dolostone Bedrock

Bedrock was inferred from spoon refusal, at depths of approximately 6.7 to 10.9 metres at Borehole Nos. 2, 5, 7, 11, 13, 14, and 15. The depth and elevation of the inferred bedrock surface has been summarised in the following table:

TABLE A: ASSUMED BEDROCK DEPTHS AND ELEVATIONS

Borehole No.	Surface Elevation [m]	Assumed Bedrock Depth [m]	Assumed Bedrock Elevation [m]
1	187.35	>9.8	<177.6
2	187.54	10.3	177.2
3	187.29	>6.7	<180.6
4	187.44	>6.7	<180.7
5	187.04	10.9	176.1
6	187.18	>6.7	<180.5
7	187.36	9.7	177.7
8	187.89	>6.7	<181.2
9	187.67	>6.7	<181.0
10	187.76	>6.7	<181.1
11	187.59	7.3	180.3
12	187.85	>6.7	<181.2
13	187.97	7.6	180.4
14	187.72	7.0	180.7
15	188.22	6.7	181.5

Based on the bedrock elevations noted above, the bedrock was encountered at elevations of approximately 176.1 to 177.7 metres along the west side of the site, and 180.29 to 181.52 metres along the east side of the site, suggesting the bedrock elevation is higher at the east end of the site than the west. From a review of available published information and past experience in the area, the bedrock consists of Limestone and Dolostone of the Lockport formation. The bedrock is considered very competent in terms of excavation and foundation requirements for the project, however the upper levels of the bedrock are often weathered and fractured, and are noted to be susceptible to 'vugs' and solution cavities. The bedrock was not cored as part of this investigation.

A review of available published information [Quaternary Geology of Ontario, Southern Sheet Map 2556] indicate the subsurface soils to fine-textured glaciolacustrine deposits of silt and clay, with minor sand and gravel. These conditions are consistent with our experience in the area and observations during drilling.

Grain Size Analyses

Grain size analyses were conducted on selected samples of the soils recovered from the boreholes. The results of this grain size testing can be found appended to the end of this report, and are summarized as follows:

TABLE B: GRAIN SIZE ANALYSES

Sample ID	Depth (m)	% Clay	% Silt	% Sand	% Gravel	Estimated Permeability, k [cm/sec]	Estimated Infiltration Rate [mm/hr]
BH2 SS2	0.76	6	46	44	4	10^{-4}	50 to 60
BH5 SS6	4.57	18	79	3	0	10^{-7}	10 to 15
BH9 SS3	2.29	30	67	3	0	10^{-7}	<10
BH11 SS4	3.05	32	63	5	0	10^{-8}	<5
BH14 SS3	1.52	48	44	8	0	10^{-9}	<5

Note 1: Infiltration rate estimated using Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

The field and laboratory testing demonstrate the native soils to consist of clay and silt mixtures with trace sand and gravel. Clay content was generally noted to increase with depth, with soils consisting predominately of clayey silt. According to the Unified Soil Classification System (USCS), the soils are generally classified as C.L. – Inorganic clays of low plasticity and M.L. – Inorganic silts and very fine sands. These soils would generally behave as a low permeability to an effectively impermeable cohesive material.

Groundwater Observations

Borehole Nos. 5, 6, 7, 8, and 9 were noted to be open and 'wet' at depths of approximately 6.1 to 9.0 metres below the ground surface, while Borehole No. 4 had caved and was wet at a depth of approximately 6 metres upon completion of drilling. The remainder of the boreholes were noted as being open and 'dry' upon completion of drilling. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. As noted above, a monitoring well was installed at Borehole Nos. 1, 5, and 13, to allow for future measurements of the static groundwater level. The results of this groundwater monitoring will be reported under a separate cover at a later date.

Manual readings of the monitoring wells at various dates were taken, and have been summarised as follows:

TABLE C: MONITORING WELL READINGS SUMMARY

	Ground Surface Elevation [m]	Monitoring Well Depth/Elev. [m]	Screened Interval Depth/Elev. [m]	01/08/24		01/25/24	
				Groundwater Depth [m]	Groundwater Elevation [m]	Groundwater Depth [m]	Groundwater Elevation [m]
MW1	187.35	9.7 / 177.65	6.6 to 9.7 / 180.75 to 177.65	3.07	184.28	2.98	184.37
MW5	187.04	11.0 / 176.04	7.9 to 11.0 / 179.14 to 176.04	4.07	182.97	3.85	183.19
MW13	187.97	8.1 / 179.87	5.0 to 8.1 / 176.77 to 179.87	2.28	185.69	1.96	186.01

Based on our observations during drilling, monitoring well readings, etc., the static groundwater level is estimated at depths of approximately 4 to 5 metres, at elevations of roughly 182.5 to 183.5 metres, based on the monitoring well readings summarised above, however shallower, perched deposits should also be expected, especially during the 'wet' times of the year. The monitoring wells were equipped with data loggers to allow for ongoing continuous measurements of the groundwater level. The results of this monitoring will be reported under a separate cover.

4. FOUNDATION CONSIDERATIONS – COMMERCIAL BLOCK AND MID-RISE BUILDINGS

As noted above, it is understood that the proposed development will have one to two underground parking levels, with founding levels on the order of 4 to 8 metres below the existing, however the number of underground levels has not been established at this state.

4.1 SHALLOW FOUNDATIONS

The soil conditions encountered at the borehole locations are generally considered suitable to support the proposed structures on conventional spread footings founded in the undisturbed native soils, below any fill or otherwise unsuitable material, as noted above. Footings founded within the competent, undisturbed native soils may designed considering a factored Ultimate Limit State [ULS] bearing capacity of 225 kPa [~4,500 psf], and a Serviceability Limit State [SLS] bearing capacity of 150 kPa [~3,000 psf], based on total and differential settlements not exceeding 25 and 20 millimetres,

respectively. The exposed footing beds must be hand cleared of any loose or disturbed material, or ponded water, immediately prior to the placement of the concrete.

4.1.1 RAFT SLAB

In the event that the proposed loading results in a spread footing coverage of 50 per cent of the building foot print or more, a raft slab may be considered to support the mid-rise structures. It is recommended that a raft slab be designed considering a 100 kPa [~2,000 psf] SLS and 150 kPa [~3,000 psf] ULS bearing capacity. If a flexible design approach is used, a conservatively value of subgrade modulus of k = 25 MN/m^3 [~90 pci] may be considered on the competent native soils. Depending on the depth of the raft slab foundation relatively to the groundwater level, the raft slab may also need to be designed to resist hydrostatic uplift pressures where founded below the static groundwater level.

4.1.2 GROUND IMPROVEMENT

It may be feasible to implement ground improvement techniques to provide an increased available bearing capacity within the native soils, which may allow for the use of spread footings or a raft slab where such foundations may otherwise not have been possible based on limited available bearing capacity. A specialty contractor may be consulted regarding the feasibility of such ground improvement systems.

4.1.3 CAISSONS

Depending on the loads of the proposed mid-rise buildings, it may be necessary to found the proposed structures on deep foundations extending to the competent limestone bedrock, encountered at depths of approximately 6.7 to 10.9 metres below the existing ground or 181.5 to 176.1 metres in elevation, below any significantly fractured or weathered layers. On a preliminary basis, the limestone bedrock may be conservatively considered capable of supporting bearing capacities of 1,000 kPa [~20,000 psf] , however high bearing capacities are likely available. In the event that caissons or another deep foundation scheme is considered to support the proposed structure, the depth and condition of the bedrock should be confirmed via additional, more thorough investigations including coring and unconfined compressive strength testing of the bedrock.

A steel liner will be required to maintain the integrity of the open caisson excavation, and to prevent the infiltration of groundwater. The contractor should be prepared to provide such a liner during installation of caissons.

In the event that it is not possible to fully dewater the open caissons, the contractor should be prepared to place concrete by means of a 'tremmie' pipe method. The contractor should maintain a positive head of concrete in the liner while it is being removed to avoid the intrusion of loose materials [known as 'necking'] into the caisson. The base of the caissons should be thoroughly cleaned to remove all loose or disturbed material immediately prior to the placement of concrete. The installation of caissons should be monitored by a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD.

4.2 GENERAL FOUNDATION COMMENTS

It is noted that the SLS value represents the Serviceability Limit State, which is governed by the tolerable deflection [settlement] based on the proposed building type, using unfactored load combinations. The ULS value represents the Ultimate Limit State and is intended to reflect an upper limit of the available bearing capacity of the founding soils in terms of geotechnical design, using factored load combinations. There is no direct relationship between ULS and SLS; rather they are a function of the soil type and the tolerable deflections for serviceability, respectively. Evidently, the bearing capacity values would be lower for very settlement sensitive structure and larger for more flexible buildings. It is also noted that the SLS and ULS bearing capacities are equivalent within the competent limestone bedrock, as in order for serviceability limits to be realized, ultimate failure of the bedrock would have to occur.

The support conditions afforded by the founding soils are usually not uniform across the site, neither are the loads on the various foundation elements. It is therefore recommended that the footings and foundation walls be provided with continuous structural reinforcement to account for potential variable support and loading conditions.

In areas where it will be necessary to provide adjacent footings at different founding elevations, the lower footing should be constructed before the higher footing is constructed, if possible, and the higher footing should be set below an imaginary line drawn up from the edge of the lower footing at 10 horizontal to 7 vertical. This practice will limit stress transfer from the higher footings to lower footings.

The fine grained to cohesive soils encountered are susceptible to disturbance from moisture conditions and construction traffic. Consideration should be given to the placement of a layer of coarse crushed granular material such as an OPSS Granular 'B' Type II (crushed bedrock) at the base of the excavation. This would provide a stable, clean working surface for workers during construction of foundations. Alternatively, the use of a thin, lean-mix [~5 MPa] concrete 'mud slab' would also provide such a stable working surface.

All footings, pile caps, grade beams, etc. exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings and foundations should be designed and constructed in accordance with the current Ontario Building Code.

With foundations designed as outlined above and as required by the Building Code, and with careful attention paid to construction detail, total and differential settlements should be well within normally tolerated limits of 25 and 20 millimetres, respectively, for the type of building and occupancy expected. As is typical in most new construction, 'cosmetic' cracking of plasterboard, foundation walls, etc. should be anticipated within the first year of construction as a result of shrinkage, minor settlement, etc. Subsequent to repair, additional cracking should be minimal.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations of this report and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the borehole locations.

5. SEISMIC DESIGN CONSIDERATIONS

The structure shall be designed according to Section 4.1.8 of the Ontario Building Code, Ontario Regulation 332/12. Based on the subsurface soil conditions encountered in this investigation the applicable Site Classification for the seismic design is Site Class D – Stiff Soil, based on the average soil characteristics for the site. It is noted that a seismic site class of C may be available, however would need to be confirmed via site specific shear wave velocity testing.

The seismic data from Supplementary Standard SB-1 of the Ontario Building Code for Niagara Falls are as follows:

$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	$S_a(5.0)$	$S_a(10.0)$	PGV	PGA
0.321	0.157	0.072	0.0320	0.0076	0.0030	0.207	0.121

6. PERIMETER DRAINAGE AND WATERPROOFING CONSIDERATIONS

In the event that the design consists of only one underground level, or building raised, basement levels would be sufficiently above the groundwater levels. Where two underground levels are considered, it may be necessary that the foundations and basement slab be designed as water tight, making use of suitable membrane systems beneath the slab and against the exterior of foundation walls. This will likely require the use of foundation wall systems intended for 'blind side' or 'single face' application, where excavation shoring is provided. The system should also incorporate a water-stop component between the footing/grade beam/mat slab and foundation walls. This approach to construct the foundations as watertight would avoid the requirement for permanent drainage and dewatering systems, however the foundation walls and floor slab will be required to be designed to resist the hydrostatic pressure considering a high groundwater level of perhaps 1 to 2 metres below the ground surface.

Alternatively, it may be possible to sufficiently control groundwater buildup around the foundations with an appropriately designed perimeter and underfloor drainage system, however additional studies including hydrogeological dewatering assessments would be required to estimate the peak rate of infiltration of groundwater for both during construction, and long-term design. Permit approval from the City of Niagara Falls would be required for such a design, depending on the proposed method and volume of discharge.

If a permanent dewatering system would be permitted and considered, the volume of groundwater control required during construction should be monitored and used to assist in sizing the permanent drainage requirements. At a minimum it is recommended that the perimeter weeping tile consist of a 150-millimetre diameter perforated pipe, surrounded with 200 millimetres of 20-millimetre clear stone, with the stone in turn encased by a nonwoven filter fabric such as Mirafi 140N/Terrafix 270R or equivalent.

Where the building is not designed as watertight and depending on basement depths, to address the potential for the build-up of groundwater beneath the basement floor slabs, in addition to under slab damp proofing measures recommended in the following section, under-floor drainage should be provided. Under-floor drains may consist of 150-millimetre diameter perforated pipe, with a geofabric sock, placed in the clear stone beneath the floor slabs on nominal 4 to 6 metre centres. It is noted that the under-floor and perimeter drainage systems should have separate piping, i.e. piping from perimeter system does not connect to the under-floor system, in order to prevent surcharging of the under-floor system. They may outlet into a common sump-pit, though separate systems would be preferred.

For commercial and basementless buildings, where the finished floor level is less than 300 millimetres above the finished exterior grade consideration should be given to the provision of a perimeter weeping tile system to prevent the buildup of water against foundations. Where provided, the perimeter drainage system should consist of a minimum 100-millimetre diameter perforated pipe, encased in a geofabric sock and covered with a minimum of 200 millimetres of a 20-millimetre clear stone product, and the clear stone in turn encased by a heavy filter geotextile product. The suppliers of the filter geotextile should be consulted as to the type best suited for this project. Great care should be taken during the installation of the drains, as even a small break in the filtering materials could result in loss of fines into the drains with attendant performance difficulties, including settlements of the ground surface. The perimeter drains should outlet to a gravity sewer connection, a nearby catch basin, or a sump pit a minimum of 150 millimetres below the underside of finished floor. The exterior grade around the structure should be sloped away from the structure to prevent the ponding of water against the foundation walls. The enclosed Drawing No. 2 and 3 shows schematics of the typical perimeter drainage requirements for slab-on-grade foundation construction, with and without a basement, respectively

Elevator pit excavations extending below the basement floor level should be designed to be water-tight, regardless of the water proofing or drainage design adopted for the basement levels.

7. BASEMENT FLOOR SLAB CONSIDERATIONS

The floor slabs of the proposed commercial and mid-rise residential buildings may be constructed using conventional slab-on-grade techniques on a prepared subgrade. The exposed subgrade surface should be well compacted in the presence of a representative of SOIL-MAT ENGINEERS. Any soft 'spots' delineated during this work must be sub-excavated and replaced with quality backfill material compacted to a minimum of 98 per cent of its standard Proctor maximum dry density [SPMDD]. Granular fill, such as an imported Ontario Provincial Standard Specification [OPSS] Granular 'B' Type II (crushed bedrock) or approved alternative is preferred within the building footprint due to its relative insensitivity to weather conditions, ease in achieving the required degree of compaction, and its quick response to applied stresses.

As with all concrete floor slabs, there is a tendency for the floor slabs to crack. The slab thickness, concrete mix design, the amount of steel and/or fibre reinforcement and/or wire mesh placed into the concrete slab, if any, will therefore be a function of the owner's tolerance for cracks in, and movements of, the slabs-on-grade, etc. The 'saw-cuts' in

the concrete floors, for crack control, should extend to a minimum depth of 1/3 of the thickness of the slab.

A moisture barrier will be required under the floor slabs such as the placement of at least 200 millimetres of compacted 20-millimetre clear stone. At a minimum the moisture barrier material should contain no more than 10 per cent passing the No. 4 sieve. Where 'non-damp' floor slabs are required, as for instance under sheet vinyl floor coverings, etc., extra efforts will be required to damp proof the floor slab, as with the additional provisions of a heavy 'poly' sheet, damp proofing sprays/membranes, drainage board products, etc. Where 'poly' sheets are used care should be taken to prevent puncturing and tearing and a sufficiently heavy gauge material be provided.

Curing of the slab-on-grade must be carefully specified to ensure that slab curl is minimised. This is especially critical during the hot summer months of the year when the surface of the slab tends to dry out quickly while high moisture conditions in the moisture barrier or water trapped on top of any 'poly' sheet at the saw cut joints and cracks, and at the edges of the slabs, maintains the underside of the slab in a moist condition.

It is important that the concrete mix design provide a limiting water/cement ratio and total cement content, which will mitigate moisture related problems with low permeance floor coverings, such as debonding of vinyl and ceramic tile. It is equally important that excess free water not be added to the concrete during its placement as this could increase the potential for shrinkage cracking and curling of the slab.

8. EXCAVATIONS

Excavations for the installation of foundations and underground services are anticipated to extend to depths of up to approximately 2 to 4 metres below the existing grade where one underground level is incorporated, and up to perhaps 8 metres where two underground levels are incorporated. Excavations above the static groundwater level through the fine grained to cohesive silty clay/clayey silt and silt soils would be expected to remain stable at inclinations of up to 45 to 60 degrees to the horizontal. Where wet/more permeable silty or sandy seams are encountered, during periods of extended precipitation, or where excavations extend below the static groundwater level, the sides of excavations should be expected to 'slough in' to as flat as 3 horizontal to 1 vertical, or flatter. Not withstanding the foregoing, however, all excavations must comply with the current Occupational Health and Safety Act and Regulations for Construction Projects. The native fine grained soils encountered would conservatively be considered a Type 3 soil, as outlined in the Ontario Health and Safety Act III – Excavation. Excavation slopes

steeper than those required in the Safety Act must be supported and a senior geotechnical engineer from this office should monitor the work.

As noted above the static groundwater level is estimated at depths of approximately 4 to 5 metres, pending a more detailed assessment of the groundwater level, potentially above the proposed basement depths where two underground levels are considered. As such, where one underground level is considered, excavations are expected to be sufficiently above the groundwater level, however this should be confirmed once details of the development have been finalized, Regardless, some minor infiltration of water through permeable seams, surface runoff, etc., should be expected, however such infiltration should be readily handled via conventional construction dewatering techniques. In the event that two underground levels are considered, greater rates of infiltration of groundwater, as well as runoff into the open excavations, should be anticipated. However, given the low permeability of the fine grained to cohesive soils encountered, the rate of infiltration is anticipated to be relatively low, such that it should be possible to adequately control groundwater infiltration for short construction periods using conventional construction dewatering methods, such as pumping from sumps in the base of the excavation. Multiple pumps should be anticipated for deeper excavations which extend below the static groundwater level. The rate of groundwater infiltration will be largely be influenced by the method of excavation shoring utilised, being greatest for open cuts, and lowest for continuous support systems such as caisson walls or sheet piling. More groundwater should be anticipated when connections are made to existing services, or where relatively deep excavations are required. Surface water should be directed away from the excavations.

The base of the excavations in the native soils encountered in the boreholes should generally remain firm and stable, however may require stabilisation where exposed to moisture conditions and construction traffic. With excavation bases stabilised as required, standard pipe bedding, as typically specified by the Ontario Provincial Standard Specification should be satisfactory, compacted to 95 per cent of its standard Proctor maximum dry density [SPMDD], should suffice.

Any utility poles, light poles, etc. located within 3 metres of the top of an excavation slope should be braced to ensure their stability. Likewise, temporary support might be required for other existing above and below ground structures, including existing underground services, roadways, existing dwellings, etc. depending on their proximity to the trench excavations.

9. BACKFILL CONSIDERATIONS

The excavated material will consist primarily of the silty clay/clayey silt soils encountered in the boreholes as described above. These soils are generally considered suitable for use as engineered fill, trench backfill, etc., provided that they are free of organics, construction debris, or other deleterious material, and that its moisture content can be controlled to within 3 per cent of its standard Proctor optimum moisture content. Some selective sorting of excavated materials to remove organics, construction debris, or otherwise unsuitable material should be expected to be required.

It is noted that the on-site soils encountered are not considered to be free draining and should not be used where this characteristic is necessary. It is also noted that these fine grained to cohesive soils will present difficulties in achieving effective compaction where access with compaction equipment is restricted. The on-site soils encountered are generally considered to be slightly 'wet' of their standard Proctor optimum moisture content. Some moisture conditioning will be required depending upon the weather conditions at the time of construction. It is noted that these soils will become nearly impossible to compact when wet of its optimum moisture content. Any material that becomes wet to saturated should be spread out to allow to dry, or removed and discarded, or utilised in non-settlement sensitive areas.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of the 'wet' backfill material is also lowered, thereby reducing its ability to support construction traffic and therefore impacting roadway construction. If the soil is well dry of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. The cohesive soils encountered may require high compaction energy to achieve acceptable densities if the moisture content is not close to its standard Proctor optimum value. It is therefore very important that the moisture content of the backfill soils be within 3 per cent of its standard Proctor optimum moisture content during placement and compaction to minimise long term subsidence [settlement] of the fill mass. Any imported fill required in service trenches or to raise the subgrade elevation should have its moisture content within 3 per cent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should be present on-site during the backfilling and compaction operations to confirm the uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction

'runs'. All structural fill, backfill within service trenches, areas to be paved, etc., should be placed in loose lifts not exceeding 300 millimetres in thickness and compacted to a minimum of 98 per cent of its standard Proctor maximum dry density [SPMDD]. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

10. MANHOLES, CATCH BASINS AND THRUST BLOCKS

Properly prepared bearing surfaces for manholes, valve chambers, etc. in the native competent soils, stabilised where required, will be practically non-yielding under the anticipated loads. Proper preparation of the founding soils will tend to accentuate the protrusion of these structures above the pavement surface if compaction of the fill around these structures is not adequate, causing settlement of the surrounding paved surfaces. Conversely, the pavement surfaces may rise above the valve chambers and around manholes under frost action. To alleviate the potential for these types of differential movements, free-draining, non-frost susceptible material should be employed as backfill around the structures located within the paved roadway limits, and compacted to a minimum of 98 per cent of its SPMDD.

The thrust blocks in the native soils may be conservatively sized as recommended by the applicable Ontario Provincial Standard Specification conservatively using a horizontal allowable bearing pressure of up to 150 kPa [~3,000 psf]. Any backfill required behind the blocks should be a well-graded granular product and should be compacted to a minimum of 98 per cent of its SPMDD.

11. PAVEMENT STRUCTURE DESIGN CONSIDERATIONS

All areas to be paved must be cleared of all organic and otherwise unsuitable materials, and the exposed subgrade proof rolled with 3 to 4 passes of a loaded tandem-axle truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means should be subexcavated and replaced with suitable backfill material. Alternatively, the soft areas may be repaired by punching coarse aggregate, such as a 50-millimetre clear crushed stone, into the soft areas. The need for sub-excavations of softened subgrade materials will be reduced if construction is undertaken during dry periods of the year and careful attention is paid to the compaction

operations. The fill over shallow utilities cut into or across paved areas must also be compacted to a minimum of 98 per cent of its SPMDD

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and to prevent softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction, therefore precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. SOIL-MAT should be given the opportunity to review the final pavement structure design and subdrain scheme prior to construction to ensure that they are consistent with the recommendations of this report.

If construction is conducted under adverse weather conditions, additional subgrade preparation may be required. During wet weather conditions, such as during the fall and spring months, it should be anticipated that additional subgrade preparation will be required, such as additional depth of Ontario Provincial Standard Specification [OPSS] Granular 'B', Type II (crushed bedrock) sub-base material. It is also important that the sub-base and base granular layers of the pavement structure be placed as soon as possible after exposure, preparation and approval of the subgrade level.

The suggested pavement structures outlined in Table D below are based on subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience, and may be considered for parking lots, etc. around the mixed-use block. The outlined pavement structure may be expected to have an approximate fifteen to twenty year life, assuming that regular maintenance is performed.

Should a more detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

TABLE D: TYPICAL SUGGESTED PAVEMENT STRUCTURES

LAYER DESCRIPTION	COMPACTION REQUIREMENTS	LIGHT DUTY SECTIONS	HEAVY DUTY [TRUCK ROUTE]
Asphaltic Concrete Wearing course OPSS HL 3 or HL 3A	Min. 92 % Marshall MRD	40 millimetres	40 millimetres
Binder Course OPSS HL 8	Min. 92 % Marshall MRD	50 millimetres	80 millimetres
Base Course OPSS Granular A	100% SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% SPMDD	300 millimetres	450 millimetres

* Marshall MRD denotes Maximum Relative Density.
* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

It is our opinion that this design is suitable for use on a residential roadway section, provided that the subgrade has been prepared as specified and is good and firm before the sub-base course material is placed. If the subgrade is soft, remedial measures as discussed above may have to be implemented and/or the sub-base thickness may have to be increased. The granular sub-base and base courses and asphaltic concrete layers should be compacted to OPSS or City of Niagara Falls requirements. A program of in-place density testing must be carried out to monitor that compaction requirements are being met. We note that this pavement structure is not to be considered as a construction roadway design.

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honeycomb surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

12. TOWNHOUSE CONSTRUCTION

The native soils encountered at the borehole locations are considered capable of supporting the loads associated with typical residential dwelling and townhouse structures on conventional spread footings, below any fill, organic, or otherwise unsuitable materials. Spread footings may be considered capable of supporting bearing pressures of up to 150 kPa [~3,000 psf] SLS and 225 kPa [~3,000 psf] ULS may be considered in the competent native soils. The founding surfaces must be hand cleaned of any loose or disturbed material, along with any ponded water, immediately prior to placement of foundation concrete.

In the event that site grading works result in engineered fill below founding elevations, the general recommendations presented in the Backfill Considerations above should be strictly adhered to, with compaction to a minimum of 98 percent of its SPMDD, verified by monitoring and testing by a representative of SOIL-MAT ENGINEERS present on a full time basis. If there is a short fall in the volume of fill required, then the source of imported fill should be reviewed for gradation, Proctor value, compatibility with existing fill, environmental characteristics and be approved by this office prior to use. The design bearing capacity for footings within the engineered fill should be limited to 100 kPa [~2,000 psf] SLS and 150 kPa [~3,000 psf] ULS.

The support conditions afforded by the native soils and/or engineered fill are generally not uniform across the building footprint, nor are the loads on the various foundation elements. As such it is recommended that consideration be given to the provision of nominal reinforcement in the footings and foundation walls to account for variable support and loading conditions. The use of nominal reinforcement is considered good construction practice as it will act to reduce the potential for cracking in the foundation walls due to minor settlements, heaving, shrinkage, etc. and will assist in resisting the pressures generated against the foundation walls by the backfill. Such nominal reinforcement is an economical approach to the reduction and prevention of costly foundation repairs after completion and later in the life of the buildings. This reinforcement would typically consist of two continuous 15M steel bars placed in the footings [directly below the foundation wall], and similarly two steel bars placed approximately 300 millimeters from the top of the foundation walls at a minimum, depending on ground conditions exposed during construction. These reinforcement bars would be bent to reinforce all corners and under basement windows, and be provided with sufficient overlap at staggered splice locations. At 'steps' in the foundations and at window locations, the reinforcing steel should transition diagonally, rather than at 90 degrees, to maintain the continuous tensile capacity of the reinforcement. Where footings are founded on, or partially on, engineered fill the above provision for nominal reinforcement would be required.

All basement foundation walls should be suitably damp proofed in accordance with the Ontario Building Code, including the provision of a 'dimple board' type drainage product, and provided with a perimeter drainage tile system outlet to a gravity sewer connection or positive sump pit a minimum of 150 millimetres below the basement floor slab. The clear stone material surrounding the weeping tile should be encased with a geotextile material to prevent the migration of fines from the foundation wall backfill into the clear stone product. In the event that sump pit systems are required we would recommend that the sump pump system should be constructed with an 'oversized' reservoir and a 'back-flow' prevention valve so that the sump pump will not cycle repeatedly within short time periods.

All footings exposed to the environment must be provided with a minimum of 1.2 meters of earth or equivalent insulation to protect against frost penetration. This frost protection would also be required if construction were undertaken during the winter months. All footings must be proportioned to satisfy the requirements of the Ontario Provincial Building Code.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations outlined in this report, and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the borehole locations.

13. PRELIMINARY HYDROGEOLOGICAL CONSIDERATIONS

As noted above, it is understood that the proposed development will include one to two underground parking levels, though this has not yet been established, with an estimate groundwater level on the order of 4 to 5 metres below the existing ground surface. The soils encountered consisted predominately of silt and clay, and are considered low permeability to effectively impermeable, based on the grain size analyses summarised above. Considering one underground parking level, the proposed excavations are anticipated to be sufficiently above the groundwater level. Regardless, as noted above, minor infiltration of water through permeable seams, as well as from surface runoff, should be anticipated, especially during the 'wet' times of the year. Such infiltration is expected to be minor, less than 50,000 L/day, and not due to groundwater, such that an Environmental Activity and Sector Registry [EASR] or Permit to Take Water [PTTW] would not be required.

In the event that two underground parking levels are considered, it is likely that the proposed excavations will extend below the groundwater level. In such an event, a more detailed hydrogeological dewatering assessment would be required to estimate peak flow rates during construction dewatering. It is anticipated that given the size of the development, such excavations extending below the groundwater level may exceed 50,000 L/day or even 400,000 L/day such that an EASR or PTTW may be required, pending confirmation of peak flows via a more detailed hydrogeological assessment.

14. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The material in it reflects SOIL-MAT ENGINEERS' best judgement in light of the information available at the time of preparation. The subsurface descriptions and borehole information are intended to describe conditions at the borehole locations only. It is the contractors' responsibility to determine how these conditions will affect the scheduling and methods of construction for the project. 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. SOIL-MAT ENGINEERS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

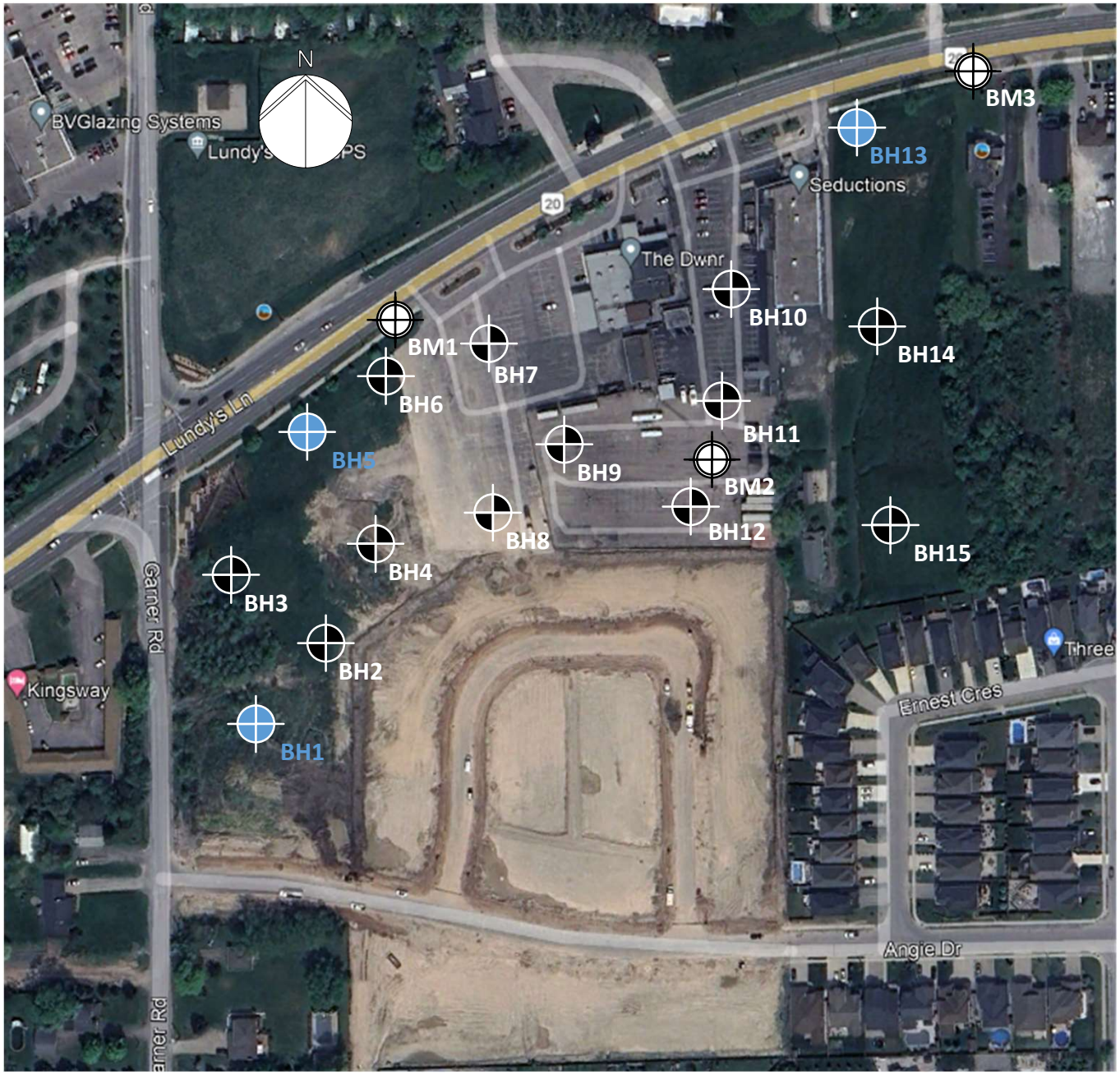
Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Malcolm Green, B.Tech.
Junior Engineer

Kyle Richardson, P. Eng.
Project Engineer

Enclosures: Drawing No. 1, Borehole Location Plan
Log of Borehole Nos. 1 to 15, inclusive
Grain Size Analyses
Drawing No. 2, Basement Perimeter Drainage
Drawing No. 3, Slab-on-Grade Perimeter Drainage

Distribution: 1198815 Ontario Limited [pdf]



LEGEND

- Borehole Location — BH#
- Benchmark — BM
- Monitoring Well — BH#

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 230934-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Proposed Residential Development
Garner Road and Lundy's Lane
Niagara Falls, Ontario

Borehole Location Plan

Project No. SM 230934-G

Date: November 2023

Drawn: KR

SM 230934-G
Borehole Location Plan

Drawing No. 1

Log of Borehole No. 1

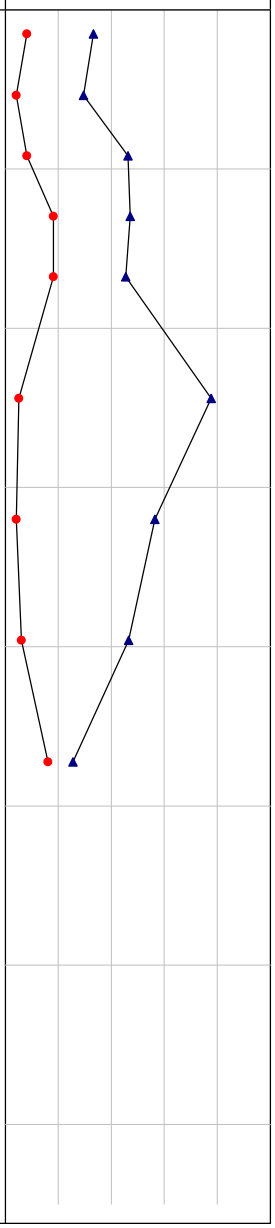
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772055
E: 650725

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.35	Ground Surface							
0 / 0	187.00	**Topsoil** Approximately 300 millimetres of topsoil.							
1 / 0		**Silty Clay/Clayey Silt** Brown, trace gravel, occasional construction debris in upper levels, firm to stiff.	SS	1	3,4,4,3	8			
2 / 1			SS	2	2,2,2,3	4		<1.0	
3 / 1			SS	3	3,3,5,5	8		1.0	
4 / 1			SS	4	4,8,10,14	18		3.5	
5 / 2			SS	5	4,7,11,11	18		3.0	
6 / 2									
7 / 3									
8 / 3									
9 / 3									
10 / 3									
11 / 4									
12 / 4									
13 / 4	183.20	Transition to grey in colour, soft to firm in consistency.							
14 / 4			SS	6	1,3,2,2	5		<1.0	
15 / 5									
16 / 5									
17 / 5									
18 / 5									
19 / 6									
20 / 6									
21 / 6			SS	7	2,2,2,3	4		<1.0	
22 / 7									
23 / 7									
24 / 7									
25 / 7									
26 / 8			SS	8	3,3,3,3	6		<1.0	
27 / 8									
28 / 8									
29 / 8									
30 / 9									
31 / 9			SS	9	4,6,10,11	16		1.0	
32 / 9	177.60	End of Borehole							
33 / 10									
34 / 10									
35 / 10									
36 / 11									
37 / 11									
38 / 11									
39 / 12									
40 / 12									
41 / 12									
42 / 13									
43 / 13									
44 / 13									
45 / 13									
46 / 14									
47 / 14									
48 / 14									
49 / 14									

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 5, 2023 to termination at a depth of 9.75 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following groundwater level readings have been measured:

January 8, 2024 - 3.07 metres below the existing ground surface

Drill Method: Solid Stem Auger
Drill Date: December 5, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

Soil-Mat Engineers & Consultants Ltd.
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Datum: Geodetic
Field Logged by: MG
Checked by:
Sheet: 1 of 1

Log of Borehole No. 2

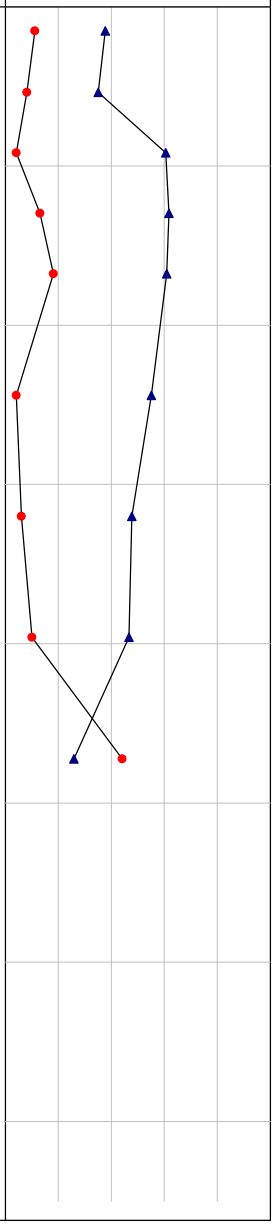
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772078
E: 650746

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.54	Ground Surface							
0 / 0	187.20	**Topsoil** Approximately 300 millimetres of topsoil, some gravel.	SS	1	3,4,7,6	11			
3 / 1		**Silty Sand/Sandy Silt** Brown, trace gravel, occasional organic inclusions, loose.	SS	2	4,4,4,6	8			
6 / 2	185.20		SS	3	4,3,1,2	4			
8 / 3		**Silty Clay/Clayey Silt** Brown, occasional sand seams in upper level, stiff.	SS	4	2,5,8,10	13		2.5	
10 / 3			SS	5	4,8,10,11	18		3.0	
13 / 4	183.40	Transition to grey in colour, soft to firm in consistency.							
16 / 5			SS	6	2,2,2,3	4		1.0	
20 / 6			SS	7	2,2,4,5	6		1.0	
26 / 8			SS	8	2,5,5,5,	10			
31 / 9			SS	9	10,18,26,36	44		>4.5	
33 / 10	177.20	End of Borehole Auger Refusal on Assumed Bedrock							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 5, 2023 to auger refusal on assumed bedrock at a depth of 10.3 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 5, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Datum: Geodetic
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Sheet: 1 of 1

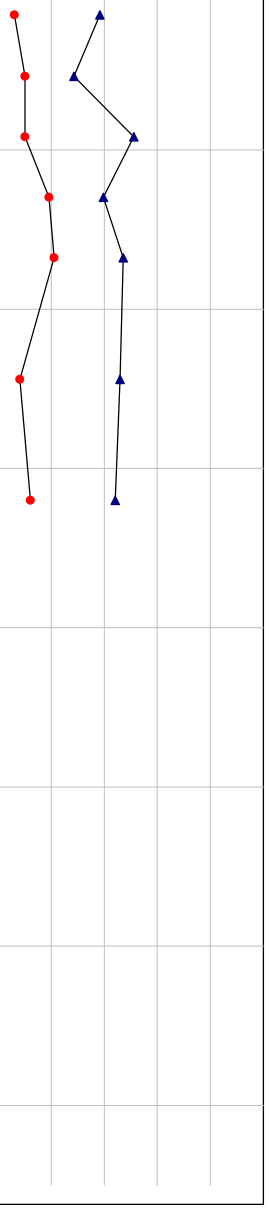
Log of Borehole No. 3

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772112
E: 650701

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.29	Ground Surface							
0 / 0	187.00	**Topsoil** Approximately 300 millimetres of topsoil, some gravel.	SS	1	3,4,2,1	6			
3 / 1			SS	2	5,5,5,2	10			
		Silty Sand/Sandy Silt							
6 / 2	185.40	Brown, some gravel, loose.	SS	3	2,4,6,7	10		1.5	
		Silty Clay/Clayey Silt							
		Brown, trace sand in upper level, stiff.	SS	4	4,7,12,13	19		2.5	
10 / 3			SS	5	4,8,13,15	21		>4.5	
13 / 4	183.20	Transition to grey in colour.							
16 / 5			SS	6	3,3,5,6	8		3.5	
20 / 6									
21 / 6	180.60		SS	7	4,4,8,8	12		2.0	
23 / 7		End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 5, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 5, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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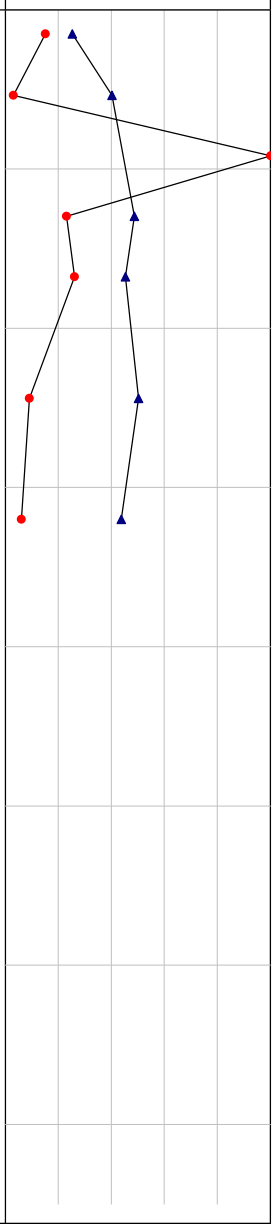
Datum: Geodetic
Field Logged by: MG
Checked by:
Sheet: 1 of 1

Log of Borehole No. 4

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson. P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772111
E: 650736

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.44	Ground Surface								
0–3 / 0–1	187.10	**Topsoil** Approximately 300 millimetres of topsoil, some gravel.		SS	1	5,8,7,4	15			
3–6 / 1–2	185.60	**Silty Sand/Sandy Silt** Brown, trace gravel, occasional organic inclusions and construction debris, very loose.		SS	2	1,1,2,25	3			
				SS	3	50/0	100			
6–13 / 2–4	183.40	**Silty Clay/Clayey Silt** Brown, some gravel in upper levels, very stiff to firm.		SS	4	6,10,13,16	23			
				SS	5	4,10,16,20	26		>4.5	
13–16 / 4–5		Transition to grey in colour.								
				SS	6	4,4,5,6	9		2.0	
16–21 / 5–6										
				SS	7	2,2,4,6	6		2.5	
21–22 / 6–7	180.70	End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on December, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as 'wet' and caved to a depth of 18 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 5, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Datum: Geodetic
Field Logged by: MG
Checked by:
Sheet: 1 of 1

Log of Borehole No. 5

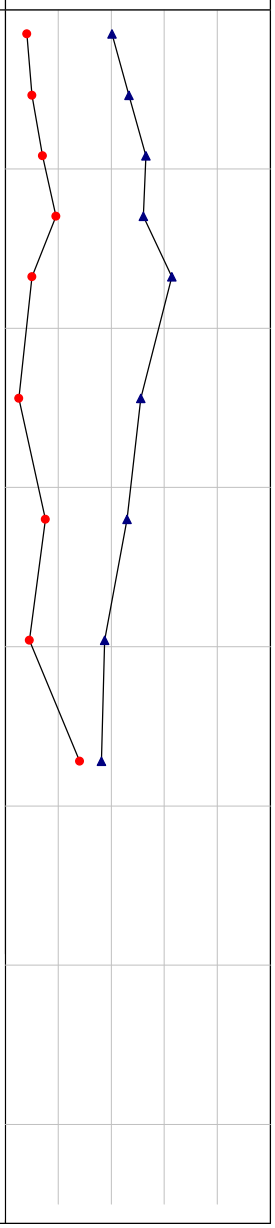
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772156
E: 650738

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.04	Ground Surface							
0–1 / 0	186.70	**Topsoil** Approximately 300 millimetres of topsoil..	SS	1	2,2,6,17	8			
1–4 / 1–2		**Silty Clay/Clayey Silt** Brown, trace gravel, occasional construction debris in upper levels, stiff.	SS	2	2,4,6,8	10		2.0	
			SS	3	4,6,8,13	14		>4.5	
			SS	4	5,8,11,12	19		2.5	
4–5 / 2–3			SS	5	4,4,6,8	10		3.0	
13–16 / 4–5	182.90	**Silt** Brown, trace clay and gravel, occasional sand in the lower level, loose to compact.	SS	6	9,2,3,2	5		<1.0	
16–23 / 5–7			SS	7	4,7,8,9	15			
23–26 / 7–8			SS	8	4,4,5,5	9			
26–31 / 8–9			SS	9	4,12,16,18	28			
35–36 / 10–11	176.10	End of Borehole Auger Refusal on Assumed Bedrock							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 6, 2023 to auger refusal on assumed bedrock at a depth of 11 metres.
2. Borehole was recorded as open and 'wet' upon completion and backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.
4. A monitoring well was installed. The following free groundwater level readings have been measured:

January 8, 2024 - 4.07 metres below the existing ground surface

Drill Method: Solid Stem Auger
Drill Date: December 6, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Log of Borehole No. 6

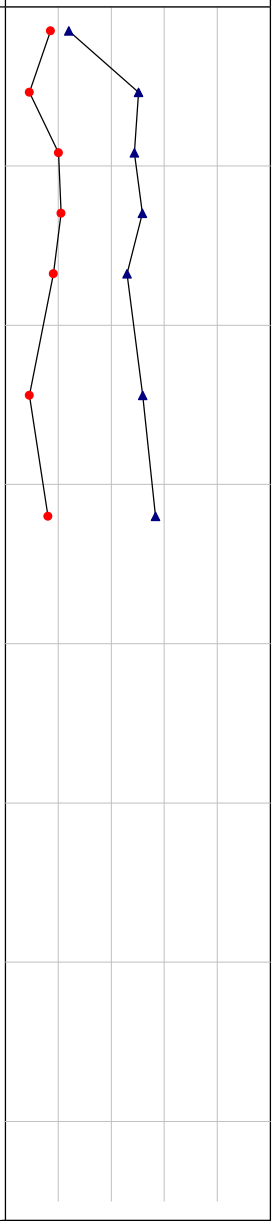
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 47721801
E: 650764

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.18	Ground Surface								
0–2 / 0–1	186.60	**Topsoil** Approximately 150 millimetres of topsoil.		SS	1	8,9,8,6	17			
		Pavement Structure Aproximately 125 millimetres of asphaltic concrete overlying 250 millimetres of compact granular base.		SS	2	2,3,6,8	9		3.0	
5–7 / 1–2				SS	3	6,9,11,12	20		4.5	
8–10 / 2–3		**Silty Clay/Clayey Silt** Brown, reworked in upper level, stiff to very stiff.		SS	4	6,9,12,12	21		>4.5	
				SS	5	6,7,11,11	18			
13 / 4	183.10									
		Silt Brown, trace clay, compact.		SS	6	3,4,5,5	9			
20–21 / 6	180.50			SS	7	2,7,9,9	16			
22 / 7		End of Borehole								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 6, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 6.1 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 6, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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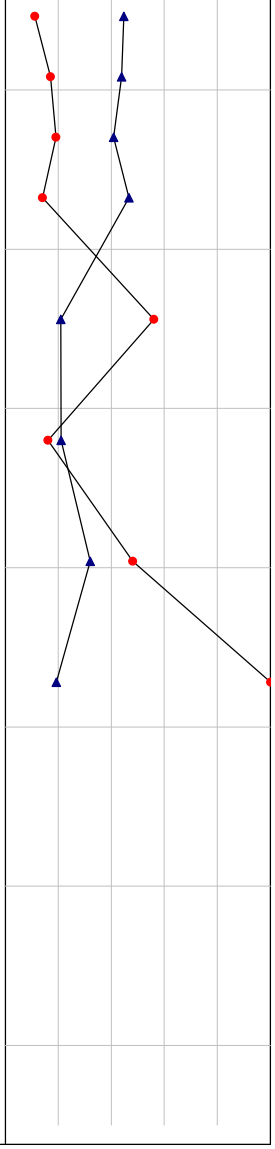
Log of Borehole No. 7

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772188
E: 650795

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.36	Ground Surface								
0 / 0	186.90	**Pavement Structure** Aproximately 120 millimetres of asphaltic concrete overlying 410 millimetres of compact granular base.								
3 / 1		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, reworked in upper level, stiff to very stiff.		SS	1	3,4,7,17	11		2.0	
6 / 2				SS	2	5,7,10,11	17		>4.5	
9 / 3				SS	3	6,8,11,17	19		>4.5	
12 / 4				SS	4	5,5,9,9	14		4.0	
16 / 5				SS	5	7,22,34,29	56		4.0	
18 / 5.5	181.80	Transition to grey in colour.								
22 / 6.5				SS	6	6,7,9,12	16		2.0	
26 / 8				SS	7	10,14,34,44	48			
29 / 9	178.20									
31 / 9.5	177.70	**Silty Sand and Gravel** Brown, very dense.		SS	8	50/0	100			
		End of Borehole Auger Refusal on Assumed Bedrock								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 8, 2023 to auger refusal on assumed bedrock at a depth of 9.75 metres.

2. Borehole was recorded as open and 'wet' at a depth of 2 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 8, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Log of Borehole No. 8

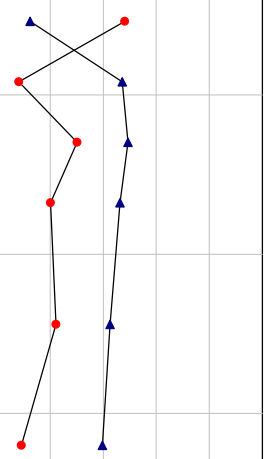
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772121
E: 650803

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.89	Ground Surface								
0–3 / 0–1		**Pavement Structure** Aproximately 125 millimetres of asphaltic concrete overlying 1100 millimetres of compact granular base, overlying 50 millimetres of asphaltic concrete, overlying 75 millimetres of compact granular base								
3 / 1	186.60	**Silty Clay/Clayey Silt** Brown, trace to some sand, reworked in upper level, firm to very stiff.		SS	1	2,38,10,1	48			
4–7 / 1–2				SS	2	2,3,5,6	8			
7–10 / 2–3				SS	3	6,11,19,22	30		>4.5	
10–13 / 3–4				SS	4	6,8,12,12	20		4.0	
13–16 / 4–5				SS	5	4,10,12,12	22			
16–21 / 5–6				SS	6	4,4,5,5	9		1.5	
21 / 6	181.20	End of Borehole								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 6, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 6.1 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 6, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Log of Borehole No. 9

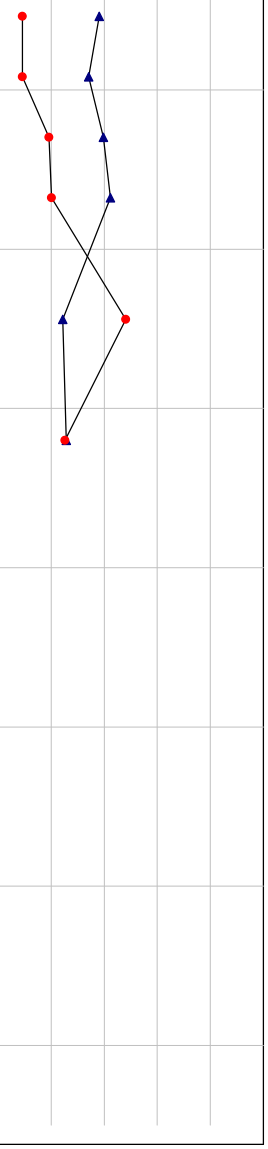
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772159
E: 650837

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
ft / m	187.67	Ground Surface								
0 / 0	187.30	**Pavement Structure** Aproximately 75 millimetres of asphaltic concrete overlying 300 millimetres of compact granular base.								
1 / 1		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, stiff to very stiff.		SS	1	11,6,5,5	9			
2 / 1				SS	2	2,3,6,9	9		>4.5	
3 / 2				SS	3	6,9,10,11	19		4.5	
4 / 3				SS	4	7,9,11,12	20		3.5	
5 / 4										
6 / 5				SS	5	14,20,28,42	48			
7 / 6	181.00									
8 / 7		End of Borehole		SS	6	13,13,12,14	25		>4.5	
9 / 8										
10 / 9										
11 / 10										
12 / 11										
13 / 12										
14 / 13										
46 / 14										

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 8, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'wet' at a depth of 5.8 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 8, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Log of Borehole No. 10

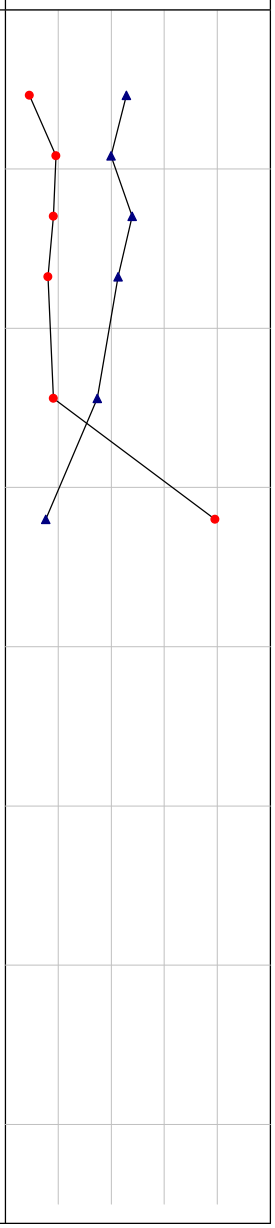
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772207
E: 650900

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.76	Ground Surface								
0 / 0	187.40	**Pavement Structure** Aproximately 100 millimetres of asphaltic concrete overlying 300 millimetres of compact granular base.								
1 / 0		**Silty Clay/Clayey Silt** Brown, trace sand, some gravel in lower level, very stiff.		SS	1	3,4,5,6	9		1.5	
2 / 1				SS	2	5,9,10,11	19		4.0	
3 / 1				SS	3	5,8,10,13	18		3.5	
4 / 2				SS	4	6,7,9,10	16		4.5	
5 / 3				SS	5	5,8,10,13	18			
6 / 4				SS	6	10,35,44,50	79			
7 / 5	181.10	End of Borehole								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 6, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 6, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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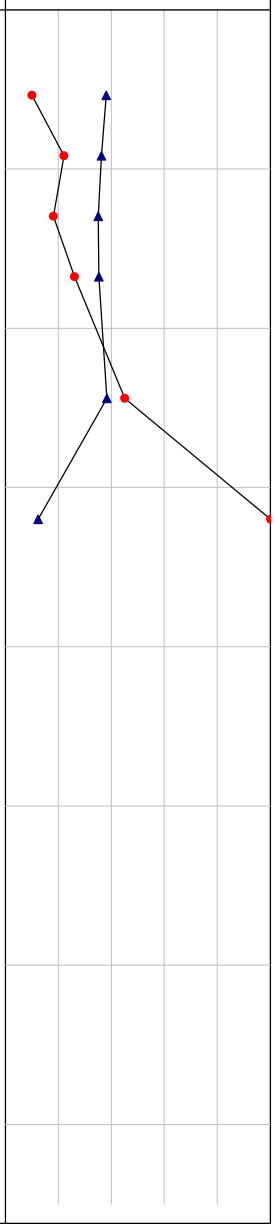
Log of Borehole No. 11

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772181
E: 650895

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.59	Ground Surface								
0 / 0	187.20	**Pavement Structure** Aproximately 75 millimetres of asphaltic concrete overlying 300 millimetres of compact granular base.								
		Silty Clay/Clayey Silt Brown, occasional construction debris in upper level, very stiff.		SS	1	2,5,5,7	10		3.0	
				SS	2	4,9,13,16	22		4.5	
				SS	3	5,8,10,12	18		>4.5	
				SS	4	6,10,16,17	26			
4 / 1	183.50	**Silt** Brown, trace clay, some gravel and sand in lower level, compact to very dense.		SS	5	13,22,23,20	45			
				SS	6	50/0	100			
7 / 2	180.30	End of Borehole Auger Refusal on Assumed Bedrock								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 8, 2023 to auger refusal on assumed bedrock at a depth of 7.3 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 8, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Log of Borehole No. 12

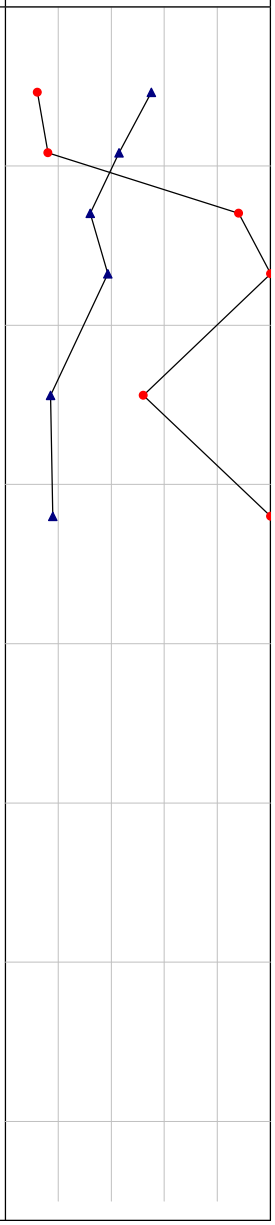
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772136
E: 650883

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.85	Ground Surface								
0 / 0	187.50	**Pavement Structure** Aproximately 125 millimetres of asphaltic concrete overlying 275 millimetres of compact granular base.								
3 / 1				SS	1	3,5,7,6	12		3.0	
5 / 1	186.30	**Silty Clay/Clayey Silt** Dark brown, trace gravel, stiff.		SS	2	3,4,12,13	16			
8 / 2		**Silt** Brown, trace clay, gravel, and sand, compact to very dense.		SS	3	19,36,52,29	88			
10 / 3				SS	4	50/0	100			
16 / 5				SS	5	9,21,31,30	52			
20 / 6				SS	6	50/0	100			
21 / 6	181.20	End of Borehole								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 7, 2023 to termination at a depth of 6.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 7, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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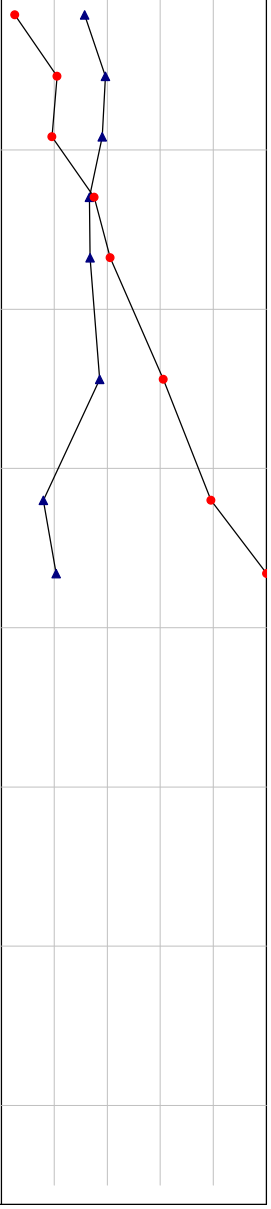
Log of Borehole No. 13

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772283
E: 650955

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.97	Ground Surface							
0–1 / 0	187.50	**Topsoil** Approximately 450 millimetres of topsoil.	SS	1	2,2,3,3	5			
1–3 / 1		**Silty Clay/Clayey Silt** Brown, trace gravel, very stiff.	SS	2	5,9,12,13	21		>4.5	
3–6 / 1–2	186.10		SS	3	6,8,11,12	19		>4.5	
6–10 / 2–3		**Silt** Brown, trace sand and gravel, dense to very dense.	SS	4	8,17,18,15	35			
10–13 / 3–4			SS	5	15,26,15,9	41			
15–16 / 4–5			SS	6	16,31,30,26	61			
20–23 / 6–7			SS	7	16,34,45,55	79			
23–24 / 7	180.40		SS	8	50/0	100			
25 / 8		End of Borehole							
		Auger Refusal on Assumed Bedrock							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 7, 2023 to auger refusal on assumed bedrock at a depth of 8.2 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:

Drill Method: Solid Stem Auger
Drill Date: December 7, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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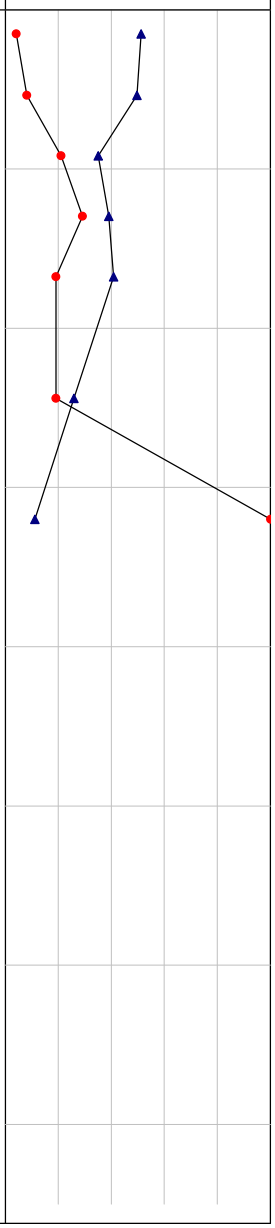
Log of Borehole No. 14

Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772270
E: 650959

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	187.72	Ground Surface								
0–1 / 0	187.30	**Topsoil** Approximately 400 millimetres of topsoil.		SS	1	2,1,3,2	4			
1–3 / 1		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, stiff to very stiff.		SS	2	3,3,5,7	8		2.5	
3–6 / 1–2				SS	3	5,9,12,13	21		4.5	
6–9 / 2–3				SS	4	7,12,17,17	29		>4.5	
9–11 / 3				SS	5	5,8,11,26	19		>4.5	
11–16 / 4–5				SS	6	7,8,11,16	19		4.0	
16–18 / 5	182.10	**Silty Sand and Gravel** Brown, very dense.		SS	7	50/0	100			
18–23 / 6–7	180.70	End of Borehole Auger Refusal on Assumed Bedrock								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 7, 2023 to auger refusal on assumed bedrock at a depth of 6.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 7, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

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Datum: Geodetic
Field Logged by: MG
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Log of Borehole No. 15

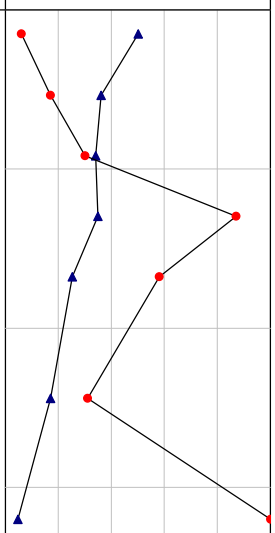
Project No: SM 230934-G
Project: Mid-Rise Residential Development
Location: Garner Place, Niagara Falls
Client: 1198815 Ontario Limited

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4772132
E: 650975

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	188.22	Ground Surface								
0–1 / 0	187.80	**Topsoil** Approximately 400 millimetres of topsoil.		SS	1	1,2,4,5	6			
1–5 / 1–2		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, very stiff.		SS	2	6,6,10,16	17		>4.5	
				SS	3	7,12,18,20	30			
				SS	4	26,40,47,47	87			
				SS	5	17,27,31,34	58			
16–18 / 5	182.60			SS	6	10,14,17,45	31			
18–21 / 6	181.50	**Silty Sand and Gravel** Brown, very dense.		SS	7	50/0	100			
21–23 / 7		End of Borehole Auger Refusal on Assumed Bedrock								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on December 7, 2023 to auger refusal on assumed bedrock at a depth of 6.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: December 7, 2023
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling Company Ltd.

Soil-Mat Engineers & Consultants Ltd.
401 Grays Road · Hamilton, Ontario · L8E 2Z3
T: 905.318.7440 · TF: 800.243.1922 · F: 905.318.7455
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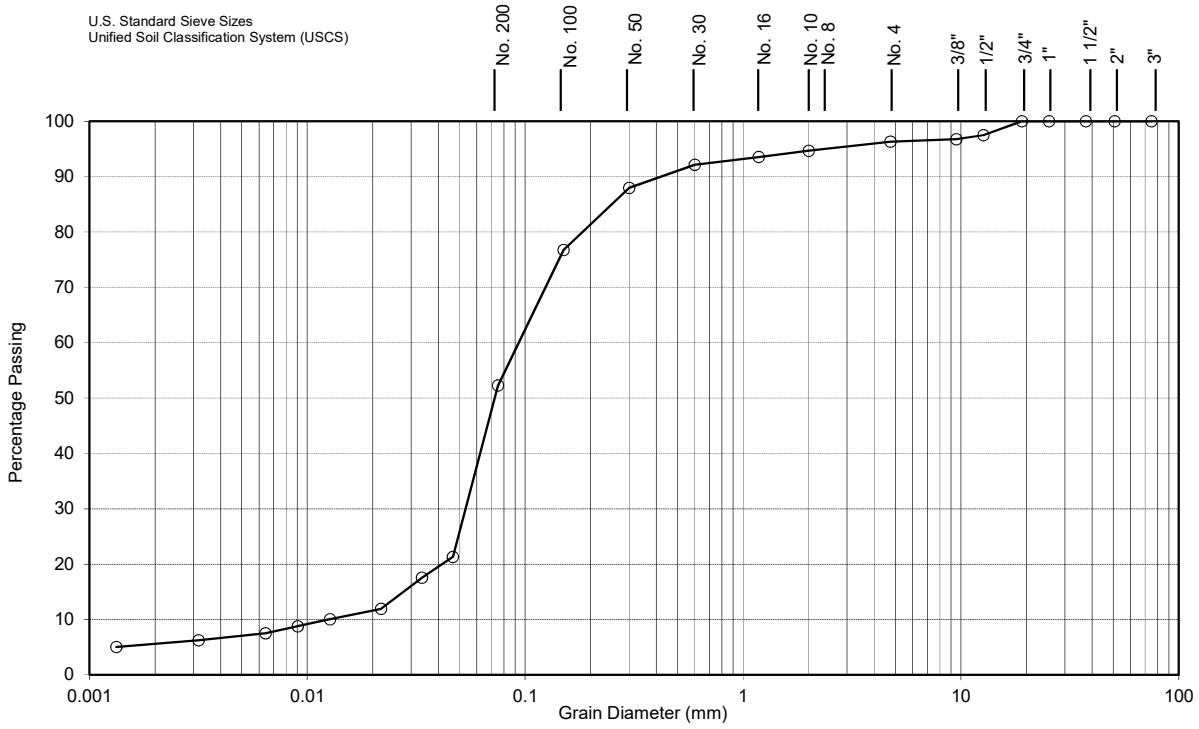
Datum: Geodetic
Field Logged by: MG
Checked by:
Sheet: 1 of 1

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

Lab No.:	**24-025**	Notes: Depth: 2.5'			
Borehole No.:	**2**				
Sample No.:	**2**				
CLAY [%]:	**6**	Soil Description:	**Reddish Brown Silt and Sand w/ traces of Clay and Gravel**		
SILT [%]:	**46**		**M.L. - Inorganic silts and very fine sands to S.M. - Sand-silt mixtures**		
SAND [%]:	**44**				
GRAVEL [%]:	**4**	Estimated Infiltration Rate [mm/hr] :	**50 to 60**	Estimated Permeability, k [cm/s]	**10^{-4}**
D_{10} (Effective Diam. in mm):	**0.0127**	Coefficient of Uniformity C_U:	**7.3**	Coefficient of Curvature C_C:	**2.4**

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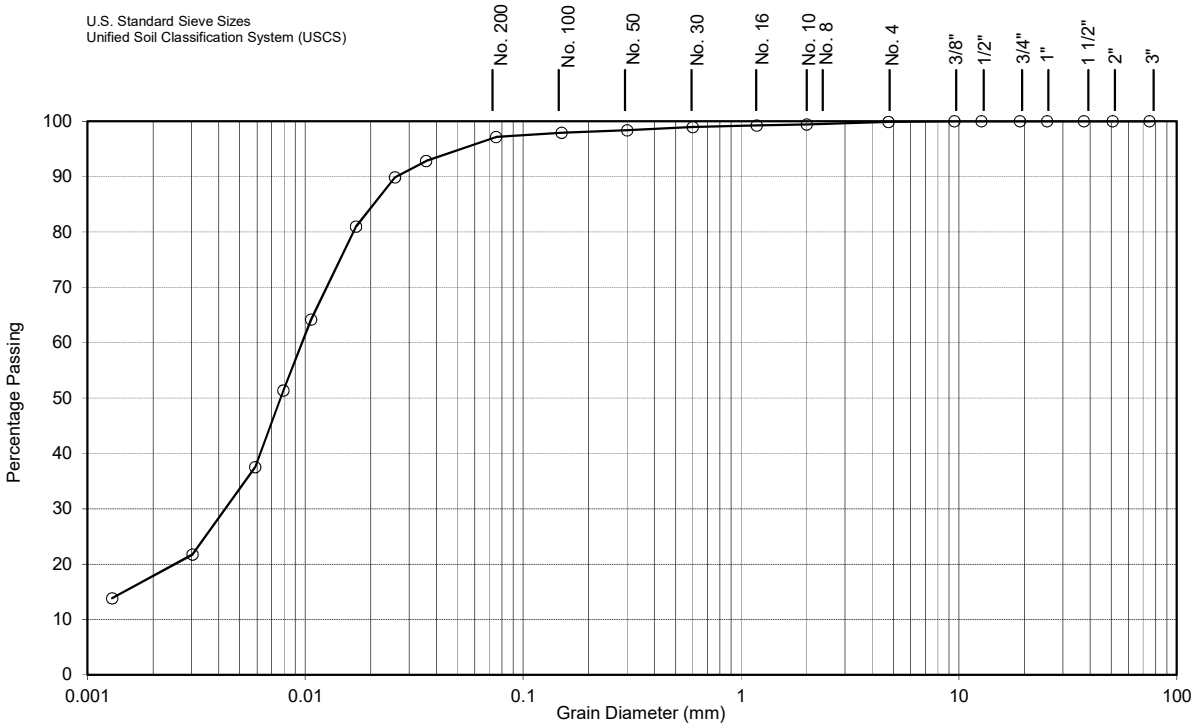
Garner Place - Lundy's Lane, Niagara Falls ON

January 2024	**Grain Size Analysis No. 1**	**Project No.: SM 230934-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE

Lab No.:	**24-026**	Notes: Depth: 15'			
Borehole No.:	**5**				
Sample No.:	**6**				
CLAY [%]:	**18**	Soil Description:	**Reddish Brown Silt w/ some Clay and a trace of Sand**		
SILT [%]:	**79**		**M.L. - Inorganic silts and very fine sands, clayey silts with slight plasticity to**		
SAND [%]:	**3**		**C.L. - Inorganic clays of low to medium plasticity**		
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**10 to 15**	Estimated Permeability, k [cm/s]	**10^{-7}**
D_{10} (Effective Diam. in mm):	**0.0009**	Coefficient of Uniformity C_U:	**10.8**	Coefficient of Curvature C_C:	**2.1**

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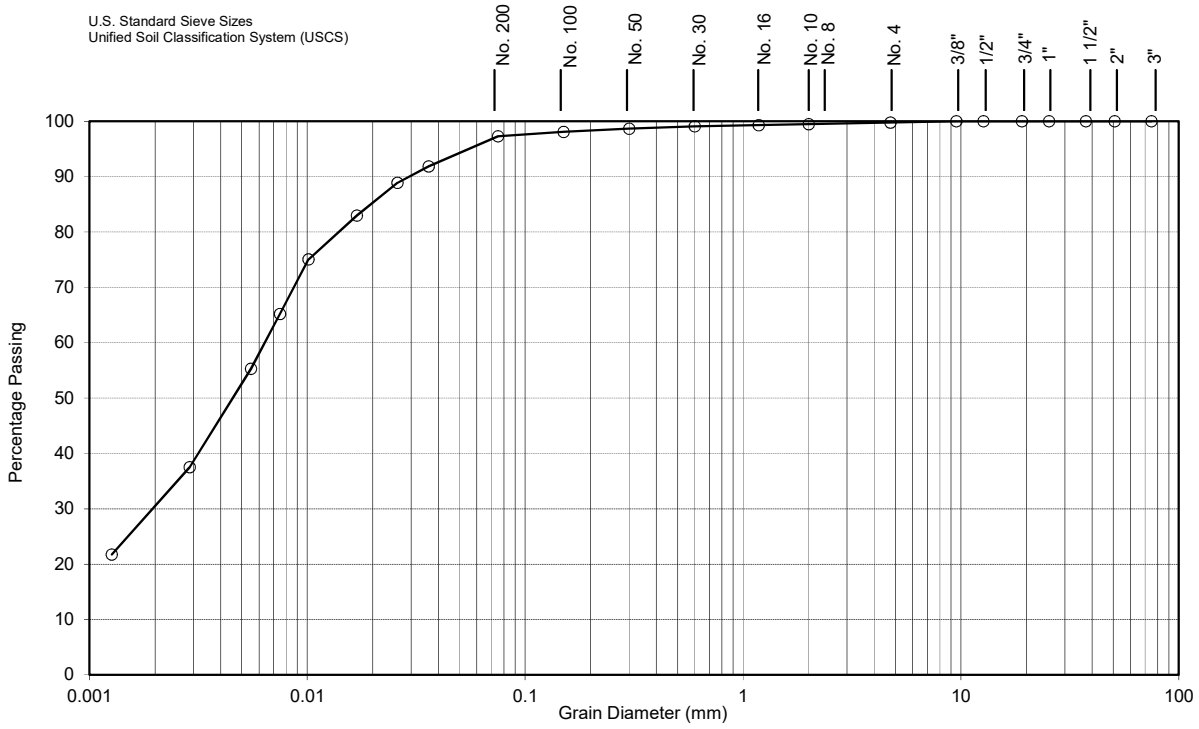
January 2024	**Grain Size Analysis No. 2**	**Project No.: SM 230934-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

Lab No.:	**24-027**	Notes: Depth: 7.5'			
Borehole No.:	**9**				
Sample No.:	**3**				
CLAY [%]:	**30**	Soil Description:	**Brown Clayey Silt w/ a trace of Sand**		
SILT [%]:	**67**		**M.L. - Clayey silts with slight plasticity, inorganic silts and very fine sands**		
SAND [%]:	**3**				
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 10**	Estimated Permeability, k [cm/s]	**10^{-7}**
D_{10} (Effective Diam. in mm):	**0.0007**	Coefficient of Uniformity C_U:	**9.1**	Coefficient of Curvature C_C:	**0.9**

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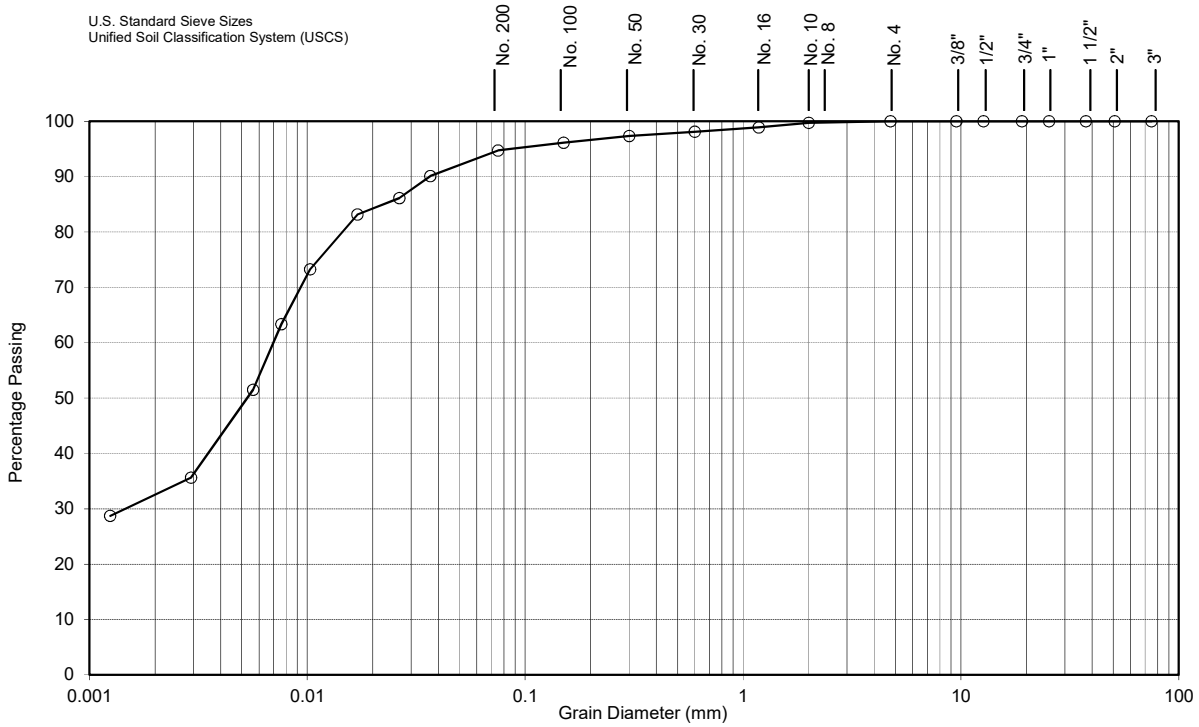
Garner Place - Lundy's Lane, Niagara Falls ON

January 2024	**Grain Size Analysis No. 3**	**Project No.: SM 230934-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

Lab No.:	**24-028**	Notes: Depth: 10'			
Borehole No.:	**11**				
Sample No.:	**4**				
CLAY [%]:	**32**	Soil Description:	**Reddish Brown Clayey Silt w/ a trace of Sand**		
SILT [%]:	**63**		**M.L. - Clayey silts with slight plasticity, inorganic silts and very fine sands**		
SAND [%]:	**5**				
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-8}**
D_{10} (Effective Diam. in mm):	**0.0002**	Coefficient of Uniformity C_U:	**35.0**	Coefficient of Curvature C_C:	**1.8**

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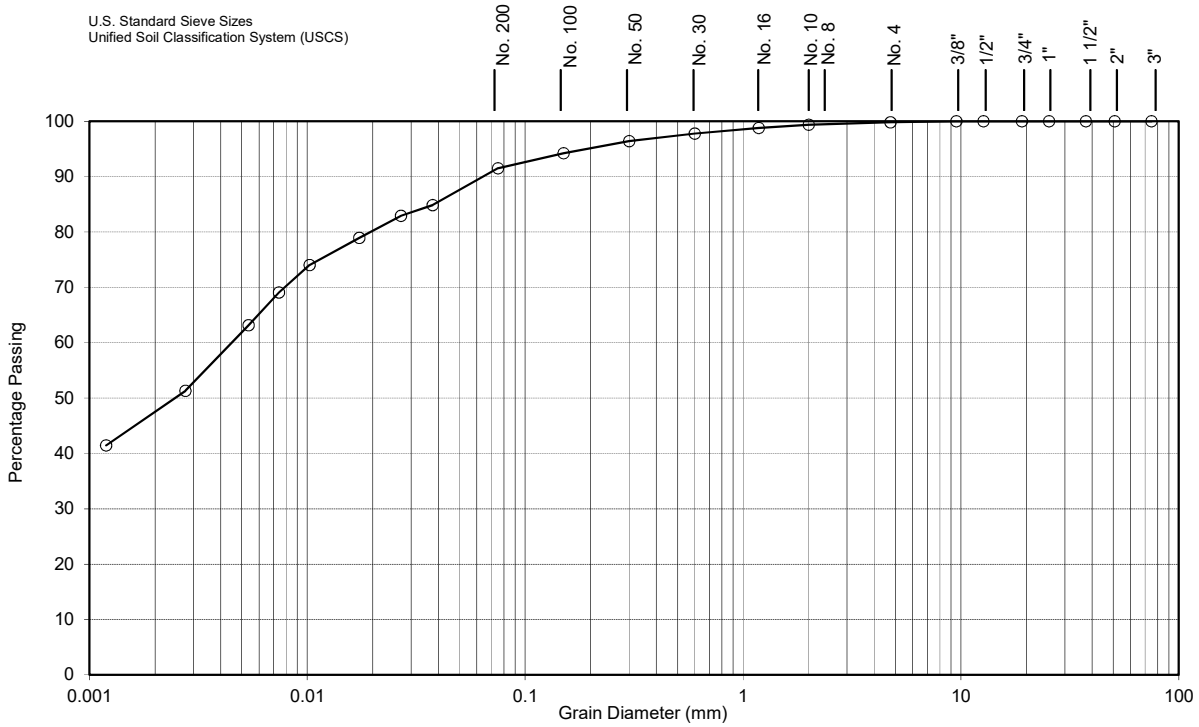
Garner Place - Lundy's Lane, Niagara Falls ON

January 2024	**Grain Size Analysis No. 4**	**Project No.: SM 230934-T**

Mechanical & Hydrometer Analyses



CLAY	SILT	FINE	MEDIUM	COARSE	FINE	COARSE
		SAND			GRAVEL	

Lab No.:	**24-029**	Notes: Depth: 5'			
Borehole No.:	**14**				
Sample No.:	**3**				
CLAY [%]:	**48**	Soil Description:	**Brown Clay and Silt w/ a trace of Sand**		
SILT [%]:	**44**		**C.L. - Inorganic clays of low to medium plasticity to**		
SAND [%]:	**8**		**M.L. - Inorganic silts and very fine sands**		
GRAVEL [%]:	**0**	Estimated Infiltration Rate [mm/hr] :	**< 5**	Estimated Permeability, k [cm/s]	**10^{-9}**
D_{10} (Effective Diam. in mm):	**0.00008**	Coefficient of Uniformity C_U:	**55.0**	Coefficient of Curvature C_C:	**0.7**

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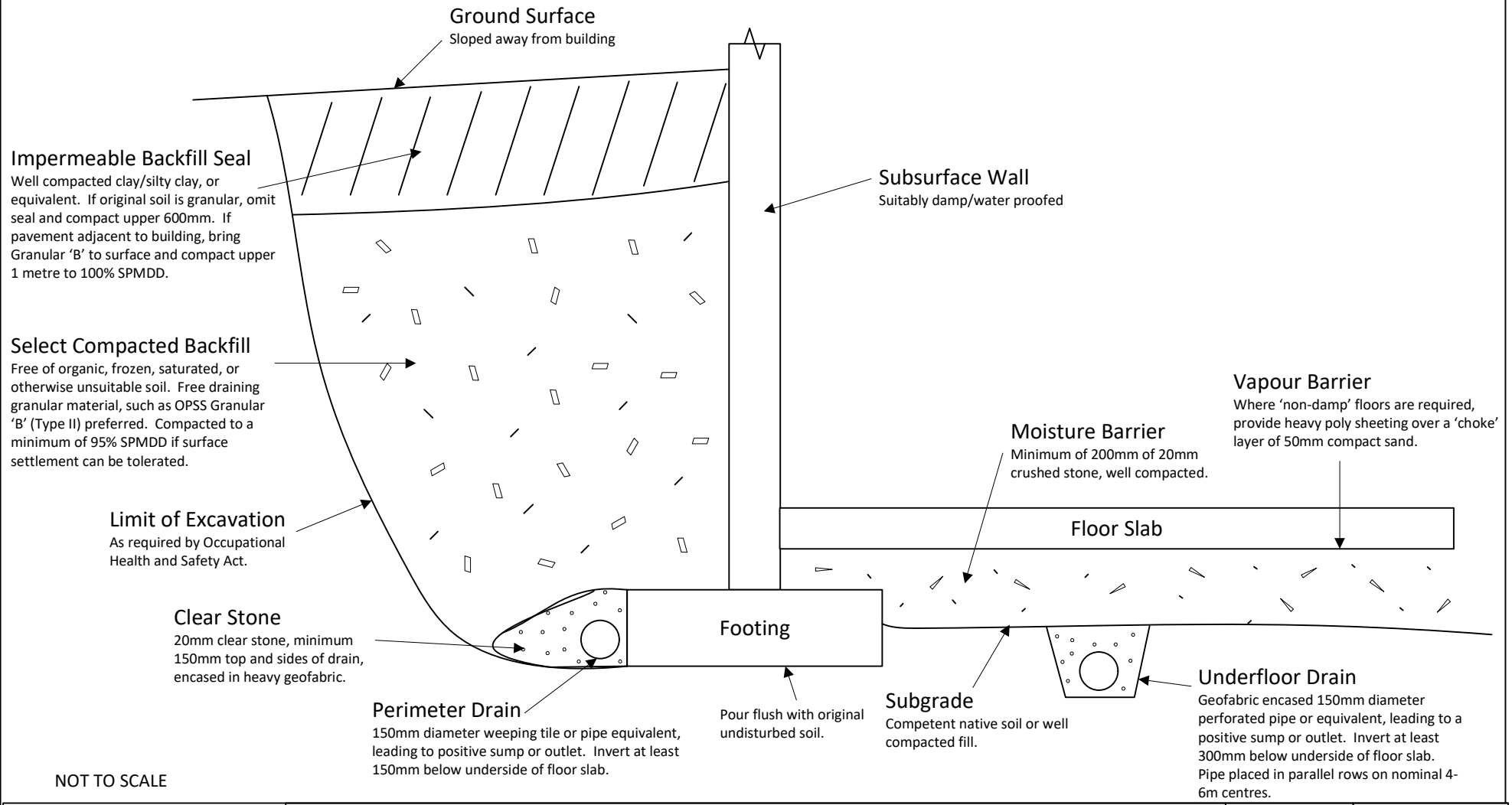
Garner Place - Lundy's Lane, Niagara Falls ON

January 2024	**Grain Size Analysis No. 5**	**Project No.: SM 230934-T**



NOT TO SCALE

Soil-Mat

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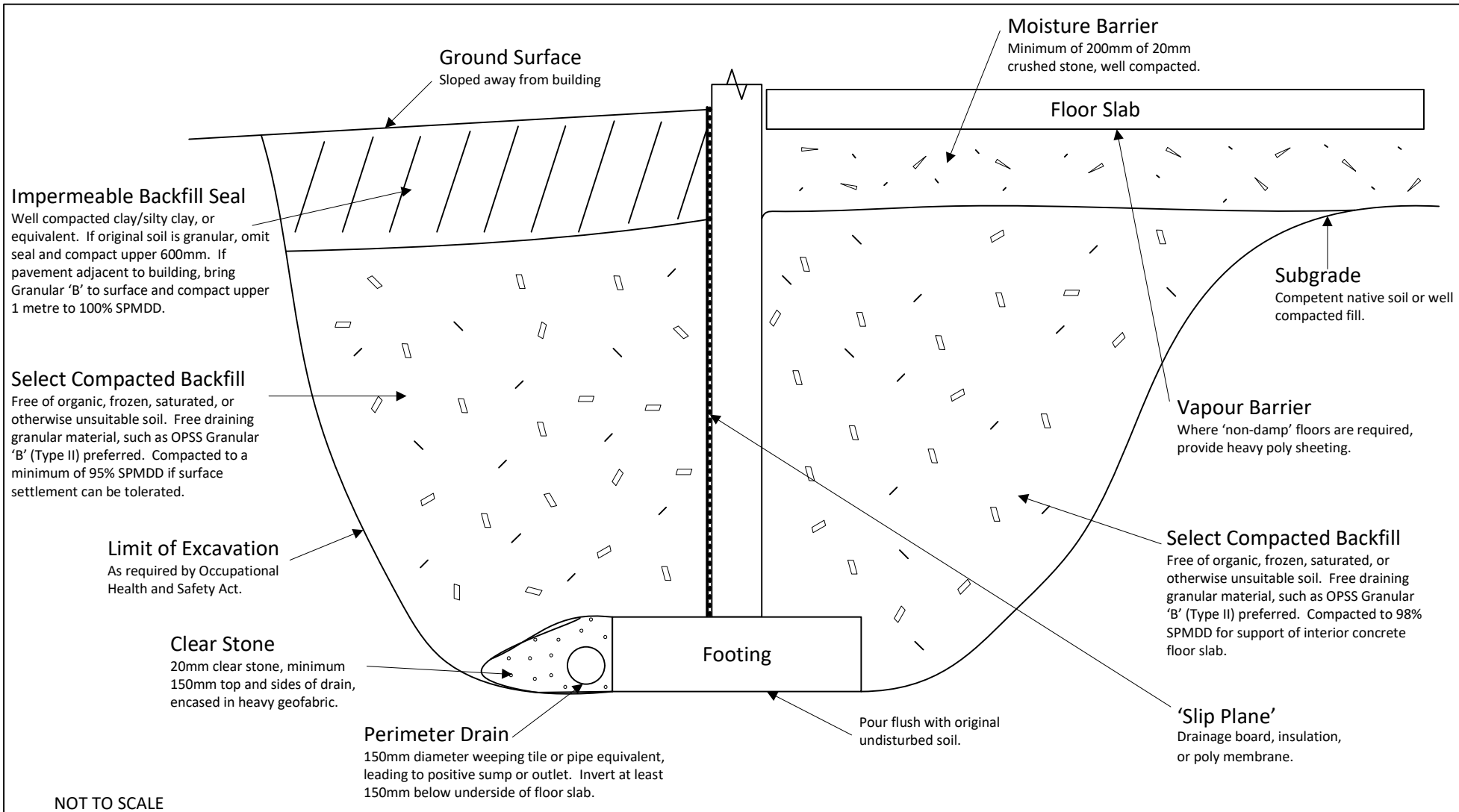
Project No.:	SM 230934-G
Date:	02/01/24

Typical Design Requirements
Drainage and Backfill for Basement Walls

Drawing No. 2



NOT TO SCALE

Soil-Mat

Soil-Mat Engineers & Consultants Ltd.

Project No.:	SM 230934-G
Date:	02/01/24

Typical Design Requirements
Slab-on-Grade with Perimeter Drainage

Drawing No. 3