PATERSON GROUP

Geotechnical Investigation

Proposed Commercial Development

4828 Bank Street
Ottawa, Ontario

Prepared for Bank & Dun Developments Inc.

Report PG7262-2 dated October 1, 2024

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Bank & Dun Developments Inc. to conduct a geotechnical investigation for the proposed commercial development to be located at 4828 Bank Street in the City of Ottawa (reference should be made to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the geotechnical investigation were to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes.
- Provide geotechnical recommendations pertaining to the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

Investigating for the presence or potential presence of contamination on the subject property was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

Based on the available conceptual plan, it is understood that the proposed development will consist of four slab-on-grade commercial buildings (Buildings A to D) within the subject site.

Further, it is understood that the remainder of the site will generally be occupied by parking areas, access roads, loading zones, and landscaped areas. It is also expected that the subject site will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current geotechnical investigation was carried out from September 12 to 19, 2024, and consisted of advancing a total of 10 boreholes to a maximum depth of 6.2 m below the existing ground surface. Furthermore, at that time, a total of 10 boreholes were completed within the west portion of the subject site a maximum depth of 9.0 m below the existing ground surface along with the current geotechnical program and covered under a different report. In addition, historical test holes were completed by this firm and others in 2005 during previous geotechnical investigations.

The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the subject site taking into consideration site features and underground utilities. The test hole locations are presented on Drawing PG7262-2 – Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a low clearance track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The testing procedure consisted of augering, excavating, and coring to the required depth at the selected location and sampling the overburden and/or bedrock.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split spoon (SS) sampler. The bedrock was cored to assess the bedrock quality. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and rock cores (RC) were placed in cardboard boxes.

All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split spoon, and rock core samples were recovered from the boreholes are shown as AU, SS, and RC, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1. Photographs of the rock core are presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Diamond drilling was completed at the selected borehole location to confirm the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are presented as RC on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio of the bedrock sample length recovered over the drilled section length, in percentage.

The RQD value is the total length ratio of intact rock core length of more than 100 mm in one drilled section over the length of the drilled section, in percentage. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data Sheets in Appendix 1 of this report.

Groundwater

For the current investigation, monitoring wells were installed in BH 3-24, BH 6-24, and BH 7-24, and the remainder of the boreholes were fitted with a flexible polyethylene standpipe to permit monitoring of the groundwater levels. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Monitoring Well Installation

Typical monitoring well construction details are described below:

- ❑ Up to 1.5 m of slotted 32 or 51 mm diameter PVC screens at base the base of the boreholes.
- ❑ 32 or 51 mm diameter PVC riser pipe from the top of the screen to the ground surface.
- ❑ No.3 silica sand backfill within annular space around the screen.

- ❑ 300 mm thick bentonite hole plug directly above the PVC slotted screen.
- ❑ Clean backfill from the top of the bentonite plug to the ground surface.

Refer to the Soil Profile and Test Data sheets in Appendix 1 for specific well construction details.

3.2 Field Survey

The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high-precision handheld GPS and referenced to a geodetic datum. The locations of the test holes, and the ground surface elevation at each test hole location, are presented on Drawing PG7262 - 2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples and rock cores were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Moisture content testing was completed on all recovered soil samples from the current investigation. The results of the testing are presented in Section 4.2 and are provided in Appendix 1.

Sample Storage

All soil samples and rock cores will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless directed otherwise.

3.4 Analytical Testing

Two (2) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples were submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Section 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently undeveloped, vacant, and grass and/or gravel-covered with small trees throughout various locations. The site is bordered by vacant and undeveloped land to the north, by Bank Street to the east, by Dun Skipper Drive followed by vacant and undeveloped land to the south, and by Cedar Creek Drive followed by residential properties to the west.

Reference should be made to Figure 1 – Key Plan in Appendix 2 of the current report.

The ground surface across the subject site gradually slopes down toward the north with approximate geodetic elevations ranging between 96.0 to 99.9 m. The subject site is relatively at grade with surrounding roadways and properties.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile at the test hole locations consists of topsoil and/or fill underlain by a silty sand deposit and/or glacial till layer further underlain by bedrock.

Fill extending to depths ranging from 0.5 to 1.1 m below the existing ground surface. The fill was generally observed to consist of brown silty sand with variable amounts of gravel, clay, and crushed stone. Further, a deposit of silty sand extending to a depth of 0.7 m below the existing ground surface was observed at BH 5-24, BH 6-24, BH 15-24, BH 16-24, and BH 17-24. The silty sand layer consists of loose brown silty sand, trace to some gravel and clay.

The fill and silty sand layers were observed to be underlain by a layer of glacial till deposit extended to approximate depths ranging between 1.1 to 5.9 m below the ground surface. The glacial till deposit generally consists of dense to very dense, grey silty sand or sandy silt with variable amounts of gravel, cobbles, and boulders.

Practical refusal to augering was encountered at depths ranging from 0.5 to 2.7 m below the existing ground surface at several borehole locations across the subject site.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Bedrock consisting of sandstone with dolomite interbedding was encountered at borehole BH 6-24 at a depth of 4.0 m below the existing ground surface. The bedrock was cored at the locations of borehole BH 6-23 to a depth of 6.2 m. RDQ values indicate that the bedrock consists of good to excellent quality.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Based on available geological mapping, the bedrock consists of interbedded sandstone and dolomite of the March Formation and is expected to be encountered at depths ranging from 3 to 5 m.

4.3 Groundwater

Groundwater levels were recorded at each test hole location and presented in Table 1 below. The groundwater level readings are presented in the Soil Profile and Test Data sheets in Appendix 1.

Table 1 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 1-24	99.37	0.25	99.12	September 26, 2024
BH 2-24	99.28	Dry	N/A	
BH 3-24*	97.37	1.66	95.71	
BH 4-24	98.52	1.66	96.86	
BH 5-24	97.32	1.87	95.45	
BH 6-24*	96.86	2.80	94.06	
BH 7-24*	99.30	3.88	95.42	
BH 16-24	97.42	Dry	N/A	
BH 17-24	96.08	Dry	N/A	

Table 1 – Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level		Date Recorded
		Depth (m)	Elevation (m)	
BH 18A-24	99.73	Dry	N/A	

Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.

* - A monitoring well has been installed in these boreholes.

It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations. It should be noted that groundwater levels are subject to seasonal fluctuations, therefore the groundwater levels could vary at the time of construction.

Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately elevations from **95.00 to 96.00 m**. The recorded groundwater levels are also provided on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

5.0 Discussion

5.1 Geotechnical Assessment

Based on the available information, it is understood that the proposed development will consist of slab-on-grade commercial buildings. From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that the proposed commercial buildings be founded on conventional spread footings bearing on an undisturbed, dense to very dense glacial till deposit or clean surface sounded bedrock.

It is anticipated that the removal of bedrock and/or large boulders will be required for building construction and servicing installation. Therefore, the contractor should be prepared for bedrock removal and the presence of large boulders within the subject site.

Due to the absence of the sensitive silty clay deposit within the subject site, the proposed development will not be subjected to permissible grade raise restrictions.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and any fill containing significant amounts of deleterious or organic materials should be stripped from under any buildings and other settlement sensitive structures.

If encountered, existing foundation walls and other construction debris should be entirely removed from within the building perimeters. Under paved areas, existing construction remnants, such as foundation walls should be excavated to a minimum of 1 m below final grade.

Any soft areas should be removed and backfilled with OPSS Granular B Type II, with a maximum particle size of 50 mm and compacted to 98% of the material's SPMDD.

Fill Placement

Fill placed for grading throughout the building footprint should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. Imported fill material should be tested and approved prior to delivery to the site. The fill should be placed in a maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill and beneath exterior parking areas where settlement of the ground surface is of minor concern. These materials should be spread in a maximum of 300 mm thick loose lifts and compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in maximum 300 mm thick loose lifts to at least 98% of the material's SPMDD.

The placement of subgrade material should be reviewed at the time of placement by Paterson personnel. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless used in conjunction with a geocomposite drainage membrane, such as Miradrain G100N or Delta Terraxx.

Fill used for grading beneath the base and subbase layers of paved areas should consist, unless otherwise specified, of clean imported granular fill, such as OPSS Granular A, Granular B Type II or select subgrade material. This material should be tested and approved by Paterson prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the paved areas should be compacted to at least 100% of its SPMDD.

Bedrock/Boulder Removal

Bedrock and/or boulder removal may be required at the subject site and can be accomplished by hoe ramming where the bedrock and/or boulders are weathered, and/or where only small quantities need to be removed. Sound bedrock and/or boulders may be removed by line drilling in conjunction with controlled blasting and/or hoe ramming.

Excavating boulders and bedrock will often lead to over excavation due to the natural aspect of boulders and lamination in the rock. The contractor should be ready to backfill and compact over excavated areas with engineered fill or lean concrete. Paterson should review field conditions as they arise on site.

Prior to considering blasting operations, the blasting effects on the existing services, buildings, and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in the proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries or claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 50 mm/s during the blasting program to reduce the risks of damage to the existing structures. The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be carried out using near vertical sidewalls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing of the overburden. The 1 m horizontal ledge setback can be eliminated with a shoring program which has drilled piles extending below the proposed founding elevation.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz).

In addition, it should be noted that the guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to be completed to minimize the risks of claims during or following the construction of the proposed buildings.

5.3 Foundation Design

Bearing Resistance Value (Conventional Shallow Foundation)

Clean Surface Sounded Bedrock

Footings supported directly on clean, surface-sounded bedrock can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **3,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

Soil Bearing Surface

Footings placed on an undisturbed, dense to very dense glacial till can be designed using a bearing resistance value at serviceability limit states (SLS) of **200 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **325 kPa**.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of the concrete for the footings. The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Settlement

Footings bearing on an undisturbed soil or an acceptable weathered bedrock bearing surface or an approved engineered fill and designed for the bearing resistance values at SLS provided herein will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Footings bearing on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels.

Adequate lateral support is provided to an undisturbed glacial till or a weathered bedrock bearing surface when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil or weathered bedrock or a material of the same or higher capacity as the in situ soil or weathered bedrock.

Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passes through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete.

Bedrock/Soil Transition

Where a footing is founded partly on bedrock and partly on soil, it is recommended to decrease the soil bearing resistance value by 25% for the portion placed on a soil bearing medium to reduce the potential long-term total and differential settlements.

Also, at the soil/bedrock transitions, it is recommended that a minimum depth of 500 mm of bedrock be removed from below the founding elevation for a minimum length of 2 m on the bedrock side. This area should be subsequently reinstated with an engineered fill, such as OPSS Granular A or Granular B Type II and compacted to a minimum of 98% of the material SPMDD.

The width of the sub-excavation should be a minimum of 500 mm greater than the width of the footing. Steel reinforcement, extending a minimum of 3 m on both sides of the 2 m long transition, should be placed in the top portions of the footing and foundation walls.

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site to determine the applicable seismic site classification for the proposed building in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012.

The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2 of the present report.

Field Program

The seismic array was located within the proposed building footprint, as presented in Drawing PG7262-2 - Test Hole Location Plan attached to the present report. Paterson field personnel placed 24 horizontal 4.5 Hz geophones mounted to the surface by means of two 75 mm ground spike attached to the geophone land case. The geophones were spaced at 2 m intervals and were connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a laptop computer and a hammer trigger switch attached to a 12 pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio.

The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were 10.0, 3.0 and 2.0 m away from the first geophone and last geophone, and at the centre of the geophone array.

Data Processing and Interpretation

Interpretation of the shear wave velocity results was completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct, reflected and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, Vs_{30}, of the upper 30 m profile immediately below the proposed building foundation. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location.

The bedrock velocity was interpreted using the main refractor wave velocity, which is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases. Based on our testing results, the average overburden shear wave velocity is **638 m/s**, while the bedrock shear wave velocity is **2,794 m/s**. Further, the testing results indicate the average overburden thickness to be approximately 7 m.

For slab-on-grade construction, the Vs_{30} was calculated using the standard equation for average shear wave velocity calculation from the Ontario Building Code (OBC) 2012 and as presented below.

$$V_{s30} = \frac{Depth_{of\ interest}(m)}{\left(\frac{Depth_{Layer1}(m)}{V_{s_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{S_{Layer2}}(m/s)}\right)}$$

$$V_{s30=} \frac{30\ m}{\left(\frac{7\ m}{638\ m/s} + \frac{23\ m}{2{,}794\ m/s}\right)}$$

$$V_{s30=}\ 1{,}562\ m/s$$

Based on the results of the seismic testing, the average shear wave velocity Vs_{30}, for the proposed buildings in the commercial development is **1,562 m/s**. It should be noted that even though the calculated Vs_{30} corresponds to a Site Class A, as the foundation elevation is expected to be located more than 3 m from the bedrock surface, a Site Class A is not applicable. Therefore, a **Site Class C** is applicable for the design of the proposed commercial development as per Table 4.1.8.4.A of the OBC 2012.

The soils underlying the subject site are not susceptible to liquefaction.

5.5 Slab on Grade Construction

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil and/or approved fill is considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction.

For structures with slab-on-grade construction, it is recommended that the upper 200 mm of sub-slab fill consist of OPSS Granular A crushed stone compacted to a minimum of 98% of the materials SPMDD.

All backfill material within the footprint of the proposed buildings should be placed in a maximum 300 mm thick loose layers and compacted to a minimum of 98% of the material's SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

5.6 Pavement Design

For design purposes, the following pavement structures, presented below, are recommended for the design of car only parking areas, heavy truck parking areas, and access at the subject site.

Table 2 - Recommended Pavement Structure - Car-Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

Table 3 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

For slab on grade projects, the use of a perimeter foundation drain is optional, but highly recommended to mitigate frost heave and movement of the backfill material around the foundations and especially near access doors. The system should consist of a 100 mm to 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, which is placed at the footing level or at a minimum 0.6 m below the concrete sidewalks around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

If the proposed buildings include below-grade space, backfill against the exterior sides of the foundation walls should consist of free-draining, non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geo-composite board, such as Delta Terraxx, MiraDrain G100N or equivalent, connected to the perimeter foundation drainage system.

If the proposed buildings do not include below-grade space, then backfill against the exterior sides of the foundation wall may consist of on-site excavated fill, provided it is maintained in an unfrozen state and at a suitable moisture content for compaction. Imported granular materials, such as clean sand or OPSS Granular B Type II granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are recommended to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as isolated piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure, and require additional protection, such as soil cover of 2.1 m, or an equivalent combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

Temporary Side Slopes

The temporary excavation side slopes anticipated should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. For the proposed development, it is expected that sufficient room will be available for the greater part of the excavation to be undertake by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsurface soil is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain safe working distance from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Excavation below the bedrock should be benched a minimum of 450 mm from the overburden if opened over an extended period and can be completed near vertical.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent material specifications and standard detail drawings from the department of public works and services, infrastructure services branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on a soil subgrade. If the bedding is placed on bedrock, the thickness of the bedding should be increased to 300 mm. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe, should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 98% of the SPMDD.

It should generally be possible to re-use the moist (not wet) site-generated fill above the cover material if the excavation and filling operations are carried out in dry weather conditions. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD. All cobbles larger than 200 mm in their longest direction should be segregated from re-use as trench backfill.

6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Groundwater Control for Building Construction

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (GU – General Use cement) would be appropriate for this site. The chloride content and pH of the samples indicate that they are not a significant factor in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non-aggressive to very aggressive corrosive environment.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that a material testing and observation program be performed by the geotechnical consultant. The following aspects of the program should be performed by Paterson:

- ❑ Review of the final design grading and servicing details from a geotechnical perspective.
- ❑ Review and inspection of the installation of the foundation drainage systems.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

All excess soil must be handled as per ***Ontario Regulation 406/19: On-Site and Excess Soil Management*.**

8.0 Statement of Limitations

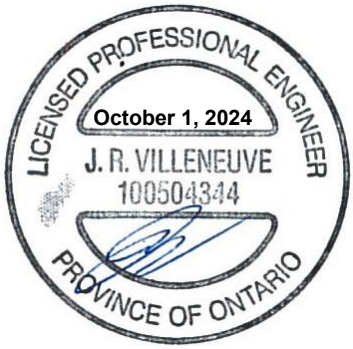
The recommendations provided in this report are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Bank & Dun Developments Inc., or their agents, is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.



Yashar Ziaeimehr, M.A.Sc., EIT

Joey R. Villeneuve, P.Eng., ing., M.A.Sc.

Report Distribution:

- ❑ Bank & Dun Developments Inc. (Email Copy)
- ❑ Paterson Group (1 Copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

HISTORICAL SOIL PROFILE AND TEST DATA SHEETS

ROCK CORE PHOTOGRAPHS

ANALYTICAL TESTING RESULTS

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376245.10 **NORTHING:** 5019329.13 **ELEVATION:** 99.37

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7262

HOLE NO. : BH 1-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							99
FILL: Crushed stone 0.10m [99.27m]			AU 1			21.93		0.2 m 2024-09-26	
FILL: Loose, silty sand, trace clay and gravel 0.69m [98.68m]		1	SS 2	79	31-9-24-34 33	25.0			98
GLACIAL TILL: Dense to very dense silty sand, with gravel, cobbles and boulders, trace clay			SS 3	33	23-50-/-/ 50/0.08	6.92			
- Clay content decreasing with depth 2.31m [97.06m]		2	SS 4	71	50-/-/-/ 50/0.13	7.39			97
End of Borehole									
Practical refusal to augering at 2.31 m depth		3							96
(GWL at 0.25 m - September 26, 2024)		4							95
		5							94
		6							93
		7							92
		8							91
		9							90
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376203.98 **NORTHING:** 5019340.94 **ELEVATION:** 99.28

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7262

HOLE NO. : BH 2-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Gravel and crushed stone 0.10m [99.18m]		0	AU 1			4.6	○		99
FILL: Loose, brown silty sand, some gravel 0.69m [98.59m]									
GLACIAL TILL: Compact to very dense, brown silty sand, with gravel, cobbles and boulders, trace clay		1	SS 2	79	3-8-18-41 26	21.11	○		98
			SS 3	94	12-40-50-/ 90/0.13	7.12	○		
- Clay content decreasing with depth 2.44m [96.84m]		2	SS 4	91	26-50-/-/ 50/0.13	7.17	○		97
End of Borehole									
Practical refusal to augering at 2.44 m depth		3							96
(Borehole dry - September 26, 2024)		4							95
		5							94
		6							93
		7							92
		8							91
		9							90
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376265.39 **NORTHING:** 5019379.03 **ELEVATION:** 97.37

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7262

HOLE NO. : BH 3-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Crushed stone 0.08m [97.29m]		0	AU 1			5.95	○		97
FILL: Loose, brown silty sand, with gravel 0.69m [96.68m]									
GLACIAL TILL: Compact to very dense, brown silty sand to sandy silt, some gravel, trace clay		1	SS 2	83	3-5-6-15 11	13.5	○		96
		2	SS 3	92	8-24-29-41 53	14.91	○	1.7 m 2024-09-26	95
2.67m [94.70m]			SS 4	71	26-50-/-/ 50/0.03	11.58	○		
End of Borehole		3							94
Practical refusal to augering at 2.67 m depth									
(GWL at 1.66 m - September 26, 2024)		4							93
		5							92
		6							91
		7							90
		8							89
		9							88
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376280.40 **NORTHING:** 5019343.40 **ELEVATION:** 98.52

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7262

HOLE NO. : BH 4-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							98
FILL: Crushed stone 0.08m [98.44m]			AU 1			4.86			
FILL: Loose brown silty sand, with gravel 0.69m [97.83m]		1	SS 2	63	5-5-7-13 12	20.13			97
GLACIAL TILL: Compact, brown silty sand to sandy silt, with gravel, cobbles and boulders, trace clay			SS 3	0	50-/-/-/ 50/0.05			1.7 m 2024-09-26	
2.18m [96.34m]		2	SS 4	100	50-/-/-/ 50/0.08	7.54			96
End of Borehole									
Practical refusal to augering at 2.18 m depth		3							95
(GWL at 1.66 m - September 26, 2024)		4							94
		5							93
		6							92
		7							91
		8							90
		9							89
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376222.68 **NORTHING:** 5019391.16 **ELEVATION:** 97.32

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 12, 2024

FILE NO. : PG7262

HOLE NO. : BH 5-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
Loose, brown **SILTY SAND**, trace gravel and organics		0	AU 1			9.62	○		97
0.69m [96.63m]									
GLACIAL TILL: Very dense, brown silty sand, with cobbles and boulders, trace gravel		1	SS 2	91	17-50-/-/ 50/0.13	8.36	○		96
			SS 3	89	29-50-/-/ 50/0.08	7.91	○	1.9 m 2024-09-26	
2.51m [94.81m]		2	SS 4	75	46-50-/-/ 50/0.05	7.88	○		95
End of Borehole									
Practical refusal to augering at 2.51 m depth		3							94
(GWL at 1.87 m - September 26, 2024)		4							93
		5							92
		6							91
		7							90
		8							89
		9							88
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376201.46 **NORTHING:** 5019413.96 **ELEVATION:** 96.86

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 13, 2024

FILE NO. : PG7262

HOLE NO. : BH 6-24

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE	0					96
TOPSOIL and organics 0.28m [96.58m]						
Loose, brown **SILTY SAND**, some clay 0.69m [96.17m]		AU 1			23.24	
GLACIAL TILL: Very dense, brown silty sand, occasional gravel, cobbles and boulders	1	SS 2	92	24-30-45-50 75	8.8	95
- Boulders between 1.8 m to 3.0 m depth	2	SS 3	80	23-50-/-/ 50/0.1	9.86	94
- Coring was completed through out boulders		RC 1	19			
3.96m [92.90m]	3					93
BEDROCK: good to excellent quality, interbedded grey sandstone and dolomite	4	RC 3 RC 2	100	RQD 100		92
			100	RQD 89		
	5	RC 4	100	RQD 100		91
6.15m [90.71m]	6					90
End of Borehole	7					89
(GWL at 2.80 m - September 26, 2024)	8					88
	9					87
	10					

PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80

△ REMOULDED SHEAR STRENGTH, Cur (kPa)

▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80

PL (%) WATER CONTENT (%) LL (%) 20 40 60 80

MONITORING WELL CONSTRUCTION

2.8 m ▼ 2024-09-26

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376274.95 **NORTHING:** 5019311.77 **ELEVATION:** 99.30

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 13, 2024

FILE NO. : PG7262

HOLE NO. : BH 7-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Crushed stone		0	AU 1			7.74			99
0.61m [98.69m]									
FILL: Loose, brown silty sand, with gravel and crushed stone, trace clay		1	SS 2	92	7-18-20-21 38	7.26			98
0.69m [98.61m]									
GLACIAL TILL: Dense, brown silty sand, with gravel, cobbles and boulders		2	SS 3	42	16-50-/-/ 50/0.13	7.59			
- Broken rock fragments at 1.93 m depth			SS 4	0	50-/-/-/ 50/0.1				97
- Boulders and dense silty sand below 2.69 m depth		3	RC 1	61					
- Coring was completed through out boulders			SS 5	50	50-/-/-/ 50/0.05				96
			RC 2	40				3.9 m 2024-09-26	
		4	SS 6	57	24-50-/-/ 50/0.03	10.12			95
			RC 3	42					
		5	RC 4	31					94
5.89m [93.41m]									
End of Borehole		6							93
(GWL at 3.88 m - September 26, 2024)		7							92
		8							91
		9							90
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376195.45 **NORTHING:** 5019280.99 **ELEVATION:** 100.52

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 16, 2024

FILE NO. : PG7262

HOLE NO. : BH 8-24

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE	0					100
FILL: Crushed stone and gravel 0.10m [100.42m]		AU 1			2.61	
FILL: Loose to very loose silty sand, trace gravel 0.69m [99.83m]		AU 2			3.02	
GLACIAL TILL: Very dense, brown silty sand, with gravel, cobbles and boulders	1	SS 3	79	15-25-35-40 60	8.95	99
		SS 4	73	16-50-/-/ 50/0.13	7.82	
	2	RC 1	24			98
- Trace clay between 2.3 m to 2.6 m depth		SS 5	82	13-50-/-/ 50/0.13	12.25	
- Coring was completed through out boulders	3	SS 6	82	10-21-25-50 46/0.1	9.38	97
	4	RC 2	23			96
	5	RC 3	49			95
6.02m [94.50m]						
End of Borehole	6					94
(GWL at 5.38 m - September 26, 2024)	7					93
	8					92
	9					91
	10					

PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80

△ REMOULDED SHEAR STRENGTH, Cur (kPa)

▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80

PL (%) WATER CONTENT (%) LL (%) 20 40 60 80

MONITORING WELL CONSTRUCTION

5.4 m 2024-09-26

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376167.81 **NORTHING:** 5019263.12 **ELEVATION:** 101.15

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 16, 2024

FILE NO. : PG7262

HOLE NO. : BH 9-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Crushed stone and gravel 0.10m [101.05m]		0	AU 1			9.85			101
FILL: Loose, brown silty sand, trace gravel 0.69m [100.46m]									
GLACIAL TILL: Very dense, brown silty sand, trace gravel		1	SS 2	100	12-31-50-/ 81/0.13	8.12			100
1.68m [99.47m]			SS 3	71	29-50-/-/ 50/0.03	7.83			
End of Borehole		2							99
Practical Refusal to auger at 1.68 m depth		3							98
		4							97
		5							96
		6							95
		7							94
		8							93
		9							92
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376167.81 **NORTHING:** 5019263.12 **ELEVATION:** 101.15

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 16, 2024

FILE NO. : PG7262

HOLE NO. : BH 9A-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Crushed stone 0.10m [101.05m]		0							101
FILL: Loose, brown silty sand, trace gravel 0.69m [100.46m]									
GLACIAL TILL: Very dense, brown silty sand, trace gravel 1.55m [99.60m]		1							100
End of Borehole		2							99
Practical Refusal to auger at 1.55 m depth		3							98
(Borehole dry - September 26, 2024)		4							97
		5							96
		6							95
		7							94
		8							93
		9							92
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376135.93 **NORTHING:** 5019308.57 **ELEVATION:** 100.35

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 16, 2024

FILE NO. : PG7262

HOLE NO. : BH10-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							100
FILL: Crushed stone and gravel 0.13m [100.22m]			AU 1			5.08			
FILL: Loose, brown silty sand, trace gravel 0.69m [99.66m]		1	SS 2	79	16-20-35-43 55	9.16			99
GLACIAL TILL: Very dense, brown silty sand, with cobbles and boulders, trace gravel			SS 3	100	14-39-50-/ 89/0.03	8.63			
		2	SS 4	82	29-50-/-/ 50/0.13	7.69			98
- Coring was completed through out boulders			RC 1	25					
		3	SS 5	54	10-12-27-43 39	9.44			97
		4	SS 6	20	21-50-/-/ 50/0.1			4.1 m 2024-09-26	
- Rock fragments below 4.4 m depth			SS 7	39	50-/-/-/ 50/0.13				96
6.07m [94.28m]		5	RC 2	32					95
End of Borehole		6							94
(GWL at 4.07 m - September 26, 2024)		7							
		8							93
		9							92
		10							91

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376179.45 **NORTHING:** 5019314.49 **ELEVATION:** 99.92

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 17, 2024

FILE NO. : PG7262

HOLE NO. : BH11-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH, Cur (kPa) PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0									99.92
FILL: Crushed stone and gravel 0.10m [99.82m]			AU 1			1.32					
SILTY SAND, trace gravel 0.69m [99.23m]											
GLACIAL TILL: Dense, brown silty sand, with gravel, cobbles and boulders		1	SS 2	83	6-21-21-50 42	8.33					99
1.78m [98.14m]			SS 3	40	50-/-/-/ 50/0.13	6.21					
End of Borehole		2									98
Practical Refusal to auger at 1.78 m depth											
(Borehole dry - September 26, 2024)		3									97
		4									96
		5									95
		6									94
		7									93
		8									92
		9									91
		10									90

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376163.47 **NORTHING:** 5019346.65 **ELEVATION:** 98.54

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 17, 2024

FILE NO. : PG7262

HOLE NO. : BH12-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL and organics 0.08m [98.46m]		0	AU 1			19.15			98
Loose, brown **SILTY SAND**, trace clay		1	SS 2	83	4-7-3-3 10	22.83			97
1.45m [97.09m]			SS 3	71	2-2-10-33 12	19.64 11.55			
GLACIAL TILL: Dense to very dense, brown silty sand, with gravel, cobbles and boulders		2	RC 1	45					96
- Coring was completed through out boulders		3	SS 4	100	50-/-/-/ 50/0.08	12.77			95
3.58m [94.96m]									
BEDROCK: good quality, interbedded grey sandstone and dolostone		4	RC 2	100	RQD 88			4.2 m 2024-09-26	94
		5	RC 3	97	RQD 86				93
6.10m [92.44m]		6							92
End of Borehole		7							91
(GWL at 4.17 m - September 26, 2024)		8							90
		9							89
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376107.94 **NORTHING:** 5019374.85 **ELEVATION:** 99.11

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 17, 2024

FILE NO. : PG7262

HOLE NO. : BH13-24

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE						99
FILL: Loose, brown silty sand, trace gravel and cobbles	0	AU 1			12.61	
	1	SS 2	71	3-4-4-12 8	26.45	98
1.45m [97.66m]						
GLACIAL TILL: Very dense, brown silty sand, trace gravel and cobbles	2	SS 3	91	15-30-37-50 67	9.26 6.86	97
		SS 4	100	47-42-50-/ 92/0.1	7.1	
	3	SS 5	100	30-38-39-50 77	7.89	96
	4	SS 6	71	18-30-50-/ 80/0.13	7.36	95
		SS 7	91	16-50-/-/ 50/0.13	6.61	
- Brown sand seam between 5.3 m to 5.4 m depth - Grey below 5.4 m depth	5					94
5.41m [93.70m]		SS 8	100	50-/-/-/ 50/0.08	12.03	
End of Borehole	6					93
(GWL at 5.28 m - September 26, 2024)	7					92
	8					91
	9					90
	10					

PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) — 20 40 60 80

△ REMOULDED SHEAR STRENGTH, Cur (kPa)

▲ PEAK SHEAR STRENGTH, Cu (kPa) — 20 40 60 80

PL (%) WATER CONTENT (%) LL (%) — 20 40 60 80

MONITORING WELL CONSTRUCTION

5.3 m 2024-09-26

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376121.38 **NORTHING:** 5019328.50 **ELEVATION:** 100.63

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH14-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) / PL (%) WATER CONTENT (%) LL (%)	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE							20 40 60 80		
FILL: Loose, brown silty sand, with crushed stone, trace gravel		0	AU 1			7.66			100
1.02m [99.61m]		1	SS 2	21	3-3-2-4	8.65		1.0 m 2024-09-26	
GLACIAL TILL: Compact to very dense, brown silty sand, some gravel and cobbles, trace clay - Clay content decreases with depth					5	12.34			99
1.75m [98.88m]			SS 3	64	4-50-/-/ 50/0.13	7.96			
End of Borehole		2							98
Practical Refusal to auger at 1.75 m depth		3							97
(GWL at 1.01 m - September 26, 2024)		4							96
		5							95
		6							94
		7							93
		8							92
		9							91
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376143.40 **NORTHING:** 5019388.87 **ELEVATION:** 97.68

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH15-25

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL and organics 0.05m [97.63m]		0	AU 1			14.24			97
Loose, brown **SILTY SAND**, trace clay and gravel 0.69m [96.99m]			SS 2	43	21-50-/-/ 50/0.08	8.36			
GLACIAL TILL: Very dense, brown silty sand, with gravel, cobbles and boulders 1.98m [95.70m]		1	SS 3	80	50-50-/-/ 50/0.1	7.05			96
End of Borehole		2							95
Practical Refusal to auger at 1.98 m depth		3							94
(Borehole dry - September 26, 2024)		4							93
		5							92
		6							91
		7							90
		8							89
		9							88
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376170.56 **NORTHING:** 5019394.51 **ELEVATION:** 97.42

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH16-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL and organics 0.13m [97.29m]		0	AU 1			19.0			97
Loose, brown **SILTY SAND**, trace clay 0.69m [96.73m]									
GLACIAL TILL: Dense to very dense, brown silty sand, with gravel, cobbles and boulders		1	SS 2	83	6-16-21-36 37	10.17			96
1.78m [95.64m]			SS 3	100	30-50-/-/ 50/0.05	8.18			
End of Borehole		2							95
Practical Refusal to auger at 1.78 m depth									
(Borehole dry - September 26, 2024)		3							94
		4							93
		5							92
		6							91
		7							90
		8							89
		9							88
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376243.01 **NORTHING:** 5019438.17 **ELEVATION:** 96.08

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH17-27

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / △ REMOULDED SHEAR STRENGTH, Cur (kPa) ▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE		0							96
Loose, brown **SILTY SAND**, trace clay			AU 1			9.58			
0.69m [95.39m]									
GLACIAL TILL: Very dense, brown silty clay, with gravel, cobbles and boulders		1	SS 2	31	4-18-50-/ 68/0.03	25.01			95
1.12m [94.96m]									
End of Borehole		2							94
Practical Refusal to auger at 1.12 m depth		3							93
(Borehole dry - September 26, 2024)		4							92
		5							91
		6							90
		7							89
		8							88
		9							87
		10							

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376244.36 **NORTHING:** 5019291.25 **ELEVATION:** 99.82

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH18-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE: TYPE AND NO.	SAMPLE: RECOVERY (%)	SAMPLE: N, Nc OR RQD	SAMPLE: WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80	REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80	PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE											
FILL: Brown silty sand, with cobbles and boulders 0.51m [99.31m]		0									99
End of Borehole Practical Refusal to auger at 0.51 m depth		1									98
		2									97
		3									96
		4									95
		5									94
		6									93
		7									92
		8									91
		9									90
		10									

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376256.13 **NORTHING:** 5019297.30 **ELEVATION:** 99.73

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 18, 2024

FILE NO. : PG7262

HOLE NO. : BH18A-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
FILL: Crushed stone, cobbles and boudlers 0.13m [99.60m]		0	AU 1			7.22			99
FILL: Loose, brown silty sand, trace gravel, cobbles and organics 1.07m [98.66m]		1	SS 2	46	2-3-16-23 19	19.55 8.64			98
GLACIAL TILL: Dense to very dense, brown silty sand, with gravel, cobbles and boulders 2.18m [97.55m]		2	SS 3	83	17-37-46-50 83	7.23			97
End of Borehole Practical Refusal to auger at 2.18 m depth (Borehole dry - September 26, 2024)		3 4 5 6 7 8 9 10							96 95 94 93 92 91 90

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376167.66 **NORTHING:** 5019279.22 **ELEVATION:** 100.42

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 19, 2024

FILE NO. : PG7262

HOLE NO. : BH19-24

SAMPLE DESCRIPTION	DEPTH (m)	SAMPLE TYPE AND NO.	RECOVERY (%)	N, Nc OR RQD	WATER CONTENT (%)	ELEVATION (m)
GROUND SURFACE	0					100
FILL: Crushed stone 0.08m [100.34m] Loose, brown **SILTY SAND**, trace gravel		AU 1			8.84	
0.69m [99.73m]	1	SS 2	70	24-50-/-/ 50/0.1	5.68	99
GLACIAL TILL: Very dense to compact, brown to grey silty sand, with cobbles and boulders - Coring was completed through out cobbles and boulders		RC 1	59			
	2	RC 2	50			98
	3	RC 3	0			97
- Trace clay and rock fragments from 3.4 m to 5.7 m depth		SS 3	25	22-23-18-23 41	9.83	
	4	SS 4	29	13-9-11-50 20	9.68	96
5.77m [94.65m]	5					95
BEDROCK: Fair to excellent quality interbedded grey sandstone and dolomite	6	RC 4	100	RQD 73		94
	7	RC 5	100	RQD 93		
7.42m [93.00m]						93
End of Borehole (GWL at 4.85 m - September 26, 2024)	8					92
	9					91
	10					

PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80

△ REMOULDED SHEAR STRENGTH, Cur (kPa)

▲ PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80

PL (%) WATER CONTENT (%) LL (%) 20 40 60 80

PIEZOMETER CONSTRUCTION

4.8 m 2024-09-26

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

4828 Bank Street, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 376115.17 **NORTHING:** 5019351.94 **ELEVATION:** 100.65

PROJECT: Proposed Residential and Commercial Developments

BORINGS BY: CME-55 Low Clearance Drill

REMARKS:

DATE: September 19, 2024

FILE NO. : PG7262

HOLE NO. : BH20-24

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N, Nc OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH, Cur (kPa) / PEAK SHEAR STRENGTH, Cu (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
Overburden		0							100
		1							
		2							99
		3							98
3.84m [96.81m]									97
GLACIAL TILL: Brown, silty sand and gravel, with rock fragments, occasional cobbles and boulders		4	SS 1	33	15-30-50-/ 80/0.05	13.87	○		96
- Coring was completed through out boulders		5	RC 2	46					95
		6							94
6.73m [93.92m]								7.3 m 2024-09-26	
BEDROCK: Excellent quality interbedded grey sandstone and dolomite		7	RC 3	100	RQD 100				93
		8	RC 4	100	RQD 100				92
9.04m [91.61m]		9							91
End of Borehole (GWL at 7.27 m - September 26, 2024)		10							

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

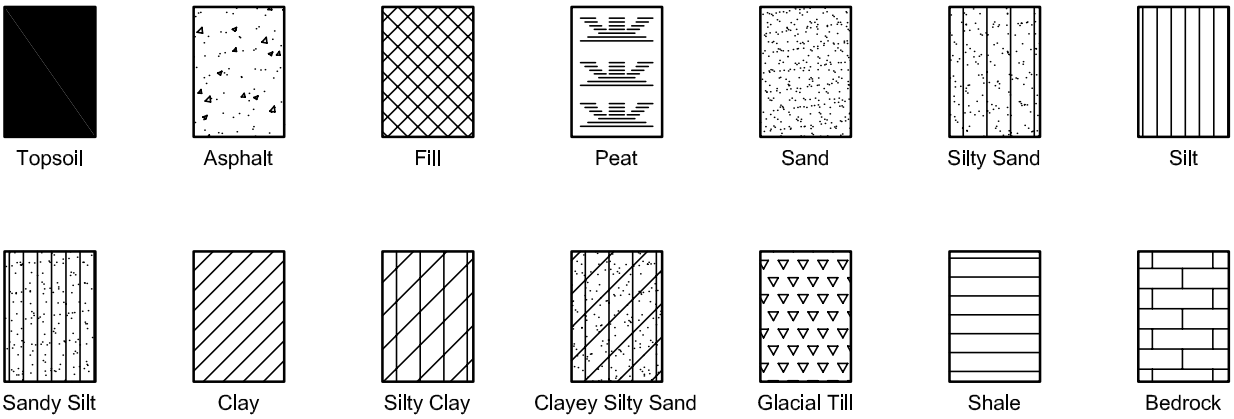
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

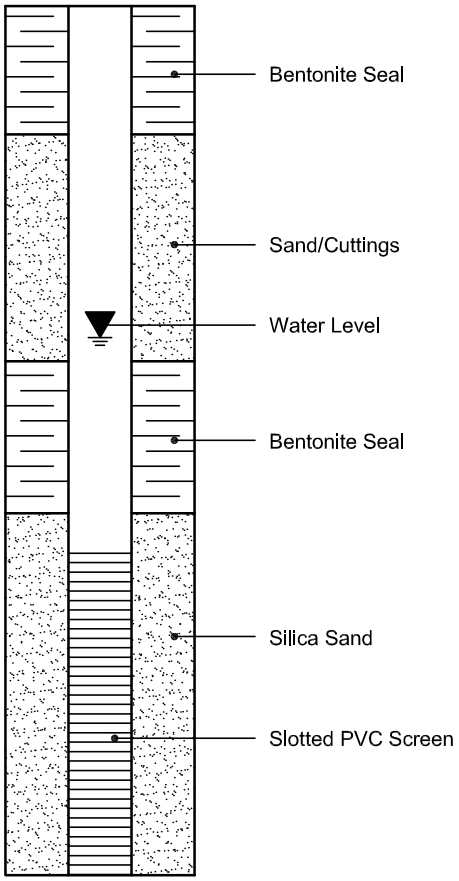
SYMBOLS AND TERMS (continued)

STRATA PLOT

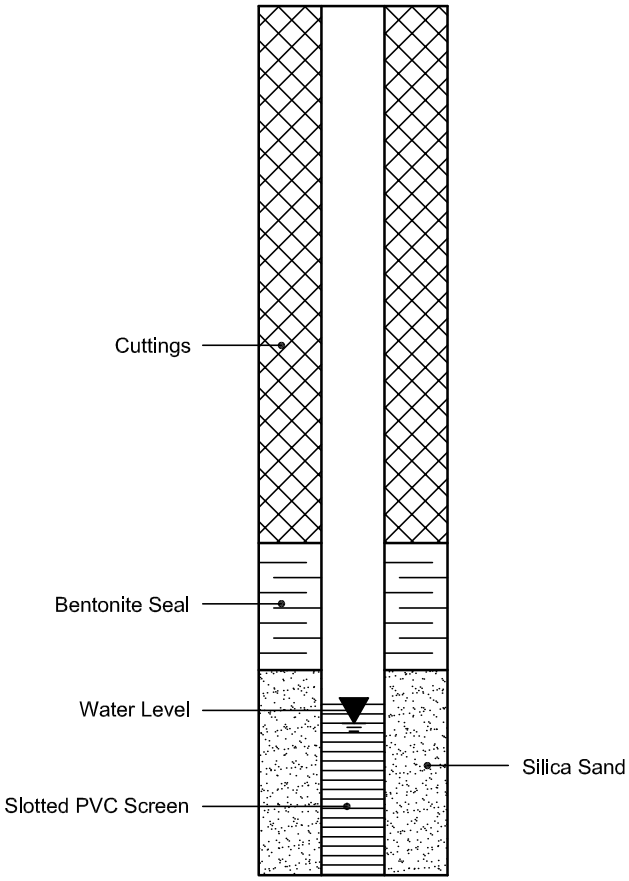


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

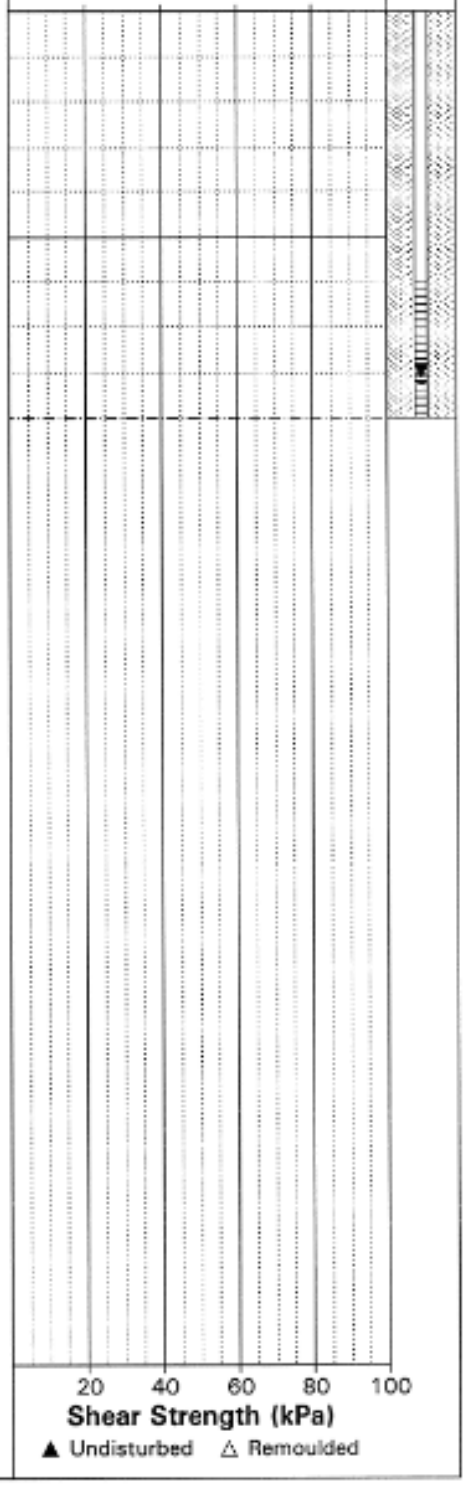
FILE NO. PG0627

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	97.80		
TOPSOIL 0.28									
GLACIAL TILL: Very dense, brown sandy silt with gravel, cobbles and boulders		SS	1	73	73+	1	96.80		
		SS	2	100	50+				
1.80									
End of Borehole									
Practical refusal to augering @ 1.80m depth									
(GWL @ 1.62m-Sep. 6/05)									



patersongroup

Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

FILE NO. PG0627

REMARKS

HOLE NO. PH 4

BORINGS BY CME 55 Power Auger DATE 21 JUL 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.64		
TOPSOIL 0.28									
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders						1	97.64		
						2	96.64		
2.37		SS	1		50+				
End of Borehole									
Practical refusal to augering @ 2.37m depth									
(BH dry-Sep. 6/05)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa) scale: 20 40 60 80 100

▲ Undisturbed △ Remoulded

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-6

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-27 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-6

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	99.70	Ground Surface					mm	
0	99.4	Dark brown, TOPSOIL and ROOTMAT						
		Brown and grey, fine to medium, SAND, trace silt						
1	98.1							
		Very dense, brown, silty sand, some gravel and rock fragments at top of bedrock, TILL			SS	1	250	*
2	97.4	End of Borehole (Bedrock)						
3		* Split spoon refusal						
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

Photograph of Rock Cores – BH6-24 – RC1 to RC3

Photograph of Rock Core obtained from BH 6-24 from intervals RC1, RC2, and RC3

Rock Core RC1 interval ranged between 6’ to 9’8”; Rock Core RC2 interval ranged between 9’8” to 13’2”; Rock Core RC3 interval ranged between 13’2” to 15’3”

Recovery RC1 (%) = 19; Recovery RC2 (%) = 100; Recovery RC3 (%) = 100

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = 100; Rock Quality Designation RC3 (RQD - %) = 89

Photograph of Rock Cores – BH6-24 – RC4

Photograph of Rock Core obtained from BH 6-24 from interval RC4

Rock Core interval ranged between 15’3” to 20’2”

Recovery (%) = 100

Rock Quality Designation (RQD - %) = 100

Photograph of Rock Cores – BH7-24 – RC1 to RC4

Photograph of Rock Core obtained from BH 7-24 from intervals RC1, RC2, RC3, and RC4

Rock Core RC1 interval ranged between 8’10” to 11’; Rock Core RC2 interval ranged between 11’ to 14’1”; Rock Core RC3 interval ranged between 14’1” to 16’1”; Rock Core RC4 interval ranged between 16’1” to 19’4”

Recovery RC1 (%) = 61; Recovery RC2 (%) = 40; Recovery RC3 (%) = 42; Recovery RC4 (%) = 31

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = N/A - Boulder; Rock Quality Designation RC3 (RQD - %) = N/A - Boulder; Rock Quality Designation RC4 (RQD - %) = N/A - Boulder

Photograph of Rock Cores – BH8-24 – RC1 to RC3

Photograph of Rock Core obtained from BH 8-24 from intervals RC1, RC2, and RC3

Rock Core RC1 interval ranged between 5'4" to 9'5"; Rock Core RC2 interval ranged between 9'5" to 14'5"; Rock Core RC3 interval ranged between 14'5" to 19'9"

Recovery RC1 (%) = 24; Recovery RC2 (%) = 23; Recovery RC3 (%) = 49

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = N/A - Boulder; Rock Quality Designation RC3 (RQD - %) = N/A - Boulder

Photograph of Rock Cores – BH10-24 – RC1 and RC2

Photograph of Rock Core obtained from BH 10-24 from intervals RC1, and RC2

Rock Core RC1 interval ranged between 8’10” to 10’2”; Rock Core RC2 interval ranged between 14’ to 19’11”

Recovery RC1 (%) = 25; Recovery RC2 (%) = 32

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = N/A - Boulder

Photograph of Rock Cores – BH12-24 – RC1 and RC2

Photograph of Rock Core obtained from BH 12-24 from intervals RC1, and RC2

Rock Core RC1 interval ranged between 7’6” to 10’2”; Rock Core RC2 interval ranged between 10’2” to 15’1”

Recovery RC1 (%) = 45; Recovery RC2 (%) = 100

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = 88

Photograph of Rock Cores – BH12-24 – RC3

Photograph of Rock Core obtained from BH 12-24 from interval RC3

Rock Core interval ranged between 15’1” to 20’

Recovery (%) = 97

Rock Quality Designation (RQD) = 86

Photograph of Rock Cores – BH19-24 – RC1 to RC4

Photograph of Rock Core obtained from BH 19-24 from intervals RC1, RC2, RC3, and RC4

Rock Core RC1 interval ranged between 3’7” to 5’; Rock Core RC2 interval ranged between 5’ to 10’; Rock Core RC3 interval ranged between 10’ to 11’6”; Rock Core RC4 interval ranged between 14’11” to 19’10”

Recovery RC1 (%) = 59; Recovery RC2 (%) = 50; Recovery RC3 (%) = 0; Recovery RC4 (%) = 100

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = N/A - Boulder; Rock Quality Designation RC3 (RQD - %) = N/A - Boulder; Rock Quality Designation RC4 (RQD - %) = 73

Photograph of Rock Cores – BH19-24 – RC5

Photograph of Rock Core obtained from BH 19-24 from interval RC5

Rock Core interval ranged between 19’10” to 24’4”

Recovery (%) = 94

Rock Quality Designation (RQD) = 93

Photograph of Rock Cores – BH20-24 – RC1 and RC2

Photograph of Rock Core obtained from BH 20-24 from intervals RC1, and RC2

Rock Core RC1 interval ranged between 14’10” to 20’1”; Rock Core RC2 interval ranged between 19’6” to 24’10”

Recovery RC1 (%) = 46; Recovery RC2 (%) = 100

Rock Quality Designation RC1 (RQD - %) = N/A - Boulder; Rock Quality Designation RC2 (RQD - %) = 100

Photograph of Rock Cores – BH20-24 – RC3

Photograph of Rock Core obtained from BH 20-24 from interval RC3

Rock Core RC3 interval ranged between 24’10” to 29’8”

Recovery RC3 (%) = 100

Rock Quality Designation RC3 (RQD - %) = 100

Certificate of Analysis

Report Date: 24-Sep-2024

Client: **Paterson Group Consulting Engineers (Ottawa)**

Order Date: 18-Sep-2024

Client PO: 61301

Project Description: PG7262

	Client ID:	BH5-24 SS3	-	-	-		
	Sample Date:	12-Sep-24 09:00	-	-	-	-	-
	Sample ID:	2438281-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	92.0	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.48	-	-	-	-	-
Resistivity	0.1 Ohm.m	78.1	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	11	-	-	-	-	-

	Client ID:	BH7-24 SS3	-	-	-		
	Sample Date:	18-Sep-24 09:00	-	-	-	-	-
	Sample ID:	2438284-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	92.8	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.43	-	-	-	-	-
Resistivity	0.1 Ohm.m	29.3	-	-	-	-	-
Anions							
Chloride	10 ug/g	<10	-	-	-	-	-
Sulphate	10 ug/g	225	-	-	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURES 2 & 3 – SEISMIC SHEAR WAVE VELOCITY PROFILES

DRAWING PG7262-2 - TEST HOLE LOCATION PLAN

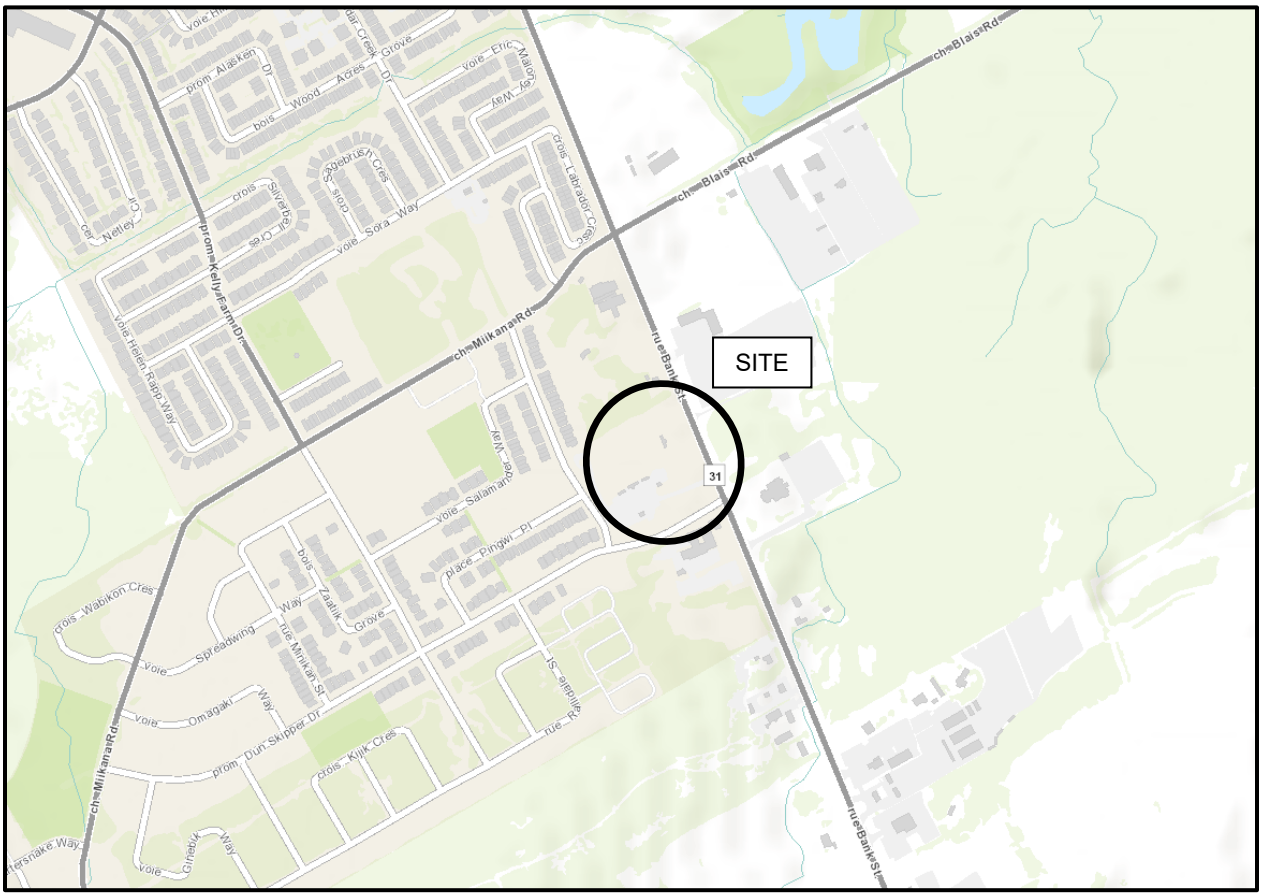


FIGURE 1

KEY PLAN

PATERSON GROUP

Figure 2 – Shear Wave Velocity Profile at Shot Location -3.5 m

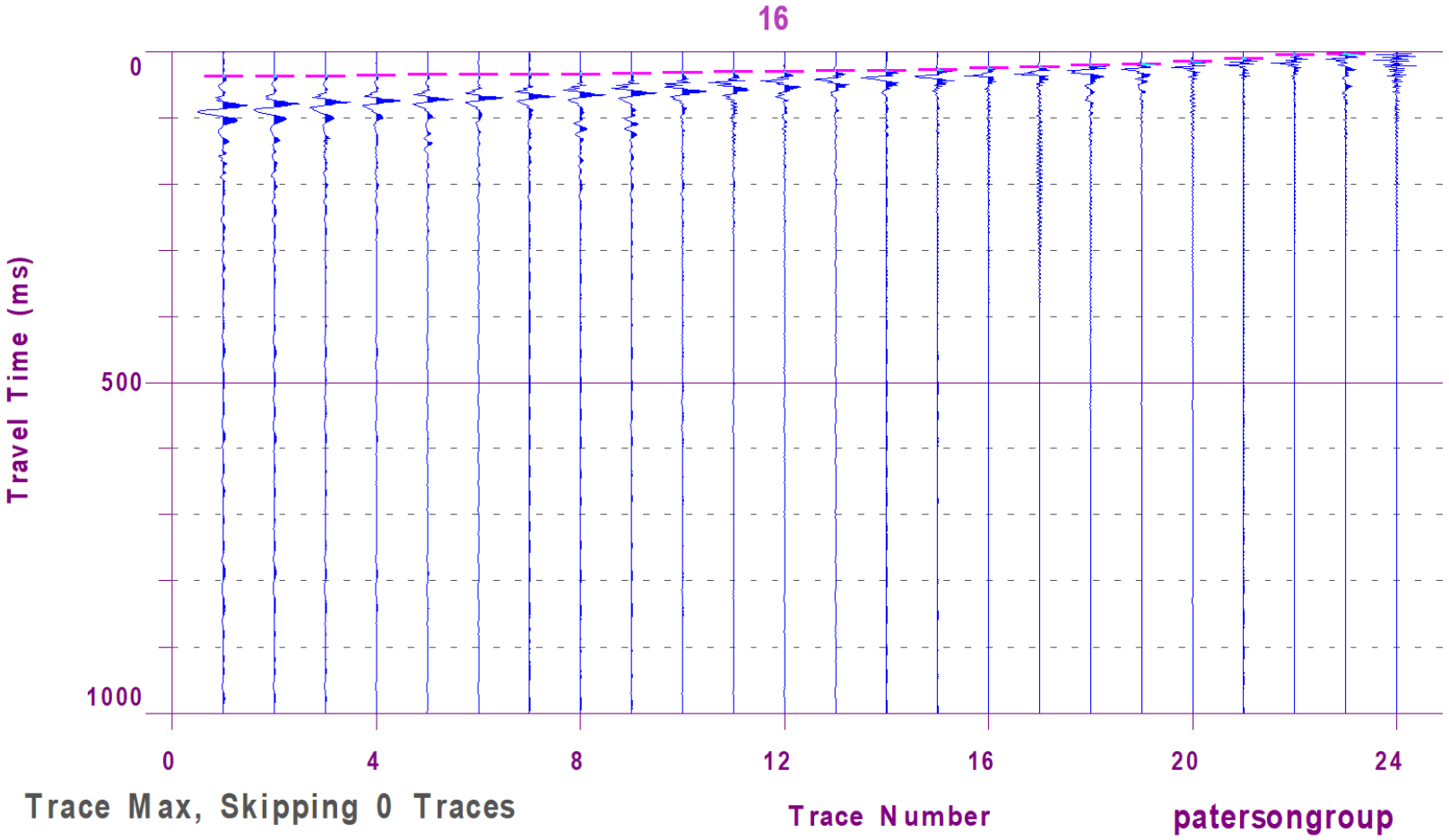
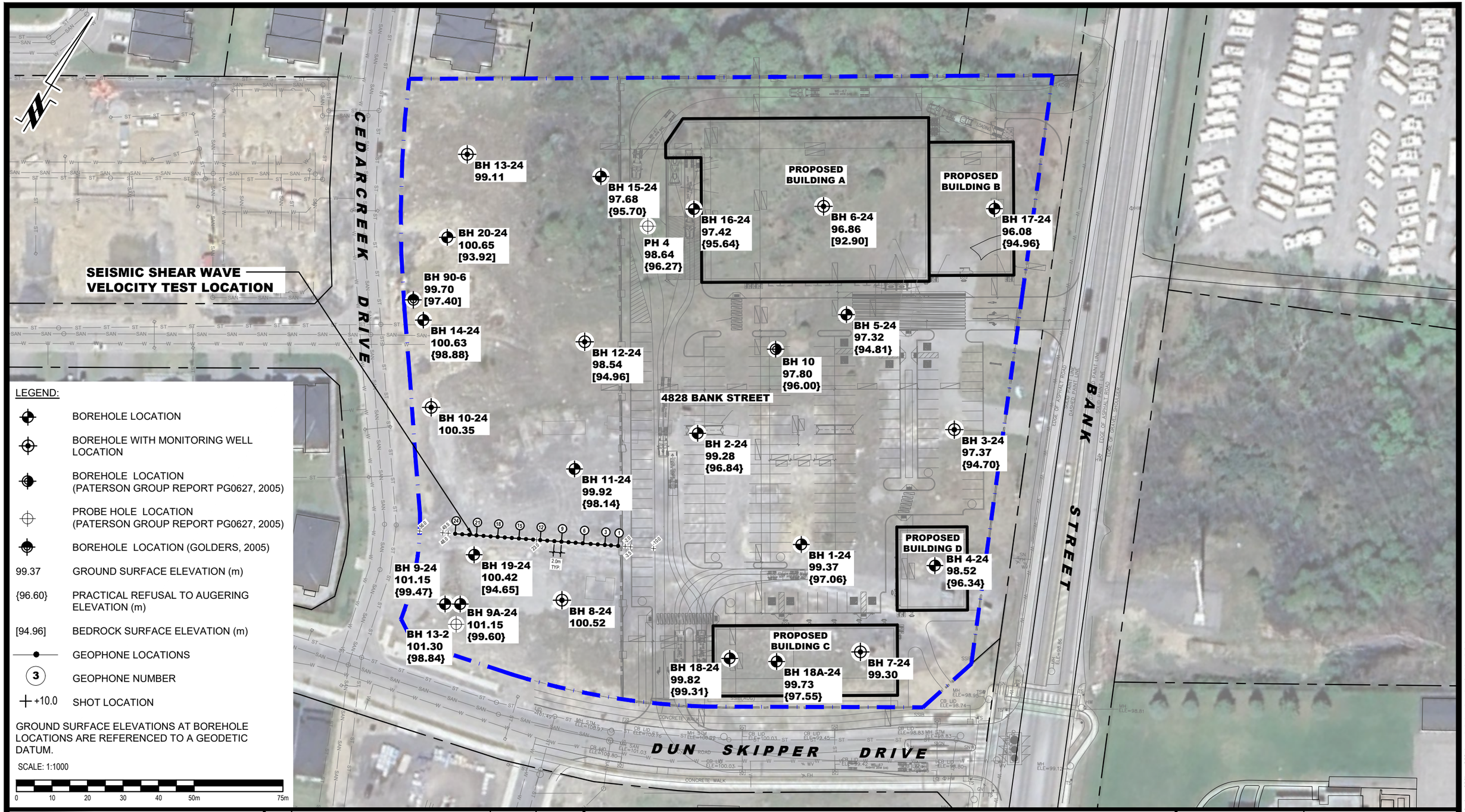


Figure 3 – Shear Wave Velocity Profile at Shot Location 48 m



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE WITH MONITORING WELL LOCATION
- BOREHOLE LOCATION (PATERSON GROUP REPORT PG0627, 2005)
- PROBE HOLE LOCATION (PATERSON GROUP REPORT PG0627, 2005)
- BOREHOLE LOCATION (GOLDERS, 2005)
- 99.37 GROUND SURFACE ELEVATION (m)
- {96.60} PRACTICAL REFUSAL TO AUGERING ELEVATION (m)
- [94.96] BEDROCK SURFACE ELEVATION (m)
- GEOPHONE LOCATIONS
- 3 GEOPHONE NUMBER
- +10.0 SHOT LOCATION

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1000

0 10 20 30 40 50m 75m

PATERSON GROUP
9 AURIGA DRIVE
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TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL

BANK & DUN DEVELOPMENTS INC.
GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
4828 BANK STREET
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:1000	Date: 10/2024
Drawn by: GK	Report No.: PG7262-2
Checked by: YZ	Dwg. No.: PG7262-2
Approved by: JV	Revision No.:

p:\autocad drawings\geotechnical\pg72xx\pg7262\pg7262-1 test hole location plan (residential).dwg

11x17