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Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

Building Science

Noise and Vibration Studies

Geotechnical Investigation

Proposed Development

1890, 1900 & 1920 Walkley Road,
2502 & 2510 St. Laurent Boulevard,
2990 & 3000 Conroy Road,
and 2425 Don Reid Drive

Ottawa, Ontario

Prepared For

Claridge Homes

April 7, 2022

Report: PG6149-1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes to conduct a geotechnical investigation for the proposed development to be located at 1890, 1900 & 1920 Walkley Road, 2502 & 2510 St. Laurent Boulevard, 2990 & 3000 Conroy Road, and 2425 Don Reid Drive, located in the City of Ottawa (refer 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 test holes.

- Provide geotechnical recommendations pertaining to 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.

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist primarily of a series of townhouse-style residential dwellings. A multi-storey retirement home building, which is anticipated to have 1 or 2 underground parking levels, is also proposed in the northwest corner of the site. Furthermore, a public park is proposed in the southwest corner of the site.

The proposed buildings will generally be surrounded by asphalt-paved access lanes and parking areas.

It is expected that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

A field investigation program was completed at the subject site by Paterson on March 4, 7, 8 and 9, 2022. At that time, a total of fourteen (14) boreholes were advanced to a maximum depth of 13.5 m below ground surface. Previous investigations were also conducted at the subject site between July 2002 and May 2003 by others, and consisted of a total of 20 boreholes which were advanced to a maximum depth of 12.6 m below ground surface. The borehole locations were distributed in a manner to provide general coverage of the site. The borehole locations are shown on Drawing PG6149-1 - Test Hole Location Plan, included in Appendix 2.

The boreholes of the current geotechnical investigation were drilled using a track-mounted auger drill rig operated by a two-person crew. The fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden soils.

Sampling and In Situ Testing

Soil samples were recovered using a 50 mm diameter split-spoon sampler or from the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are shown as SS and AU, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Testing (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.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The subsurface conditions observed in the boreholes 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 Monitoring Wells

Monitoring wells were installed at boreholes BH 1-22, BH 4-22, and BH 6-22 to BH 12-22, and flexible polyethylene standpipes were installed within the remaining boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program. Groundwater level observations are discussed in Section 4.3 and are presented in the Soil Profile and Test Data Sheets in Appendix 1.

3.2 Field Survey

The borehole locations were selected in the field by Paterson personnel in a manner to provide general coverage of the proposed development, taking into consideration site features. The test hole locations along with ground surface elevations were surveyed by Paterson and referenced to a geodetic datum. The locations of the boreholes and the ground surface elevations for each borehole location are presented on Drawing PG6149-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were collected from the subject site during the investigation and were visually examined in our laboratory to review the results of the field logging. A total of one (1) shrinkage test, one (1) grain size distribution analysis, and four (4) Atterberg limit tests were completed on selected soil samples. The results are presented in Section 4.2 and on Grain Size Distribution and Hydrometer Testing, and Atterberg Limit Results and Shrinkage Test Results presented in Appendix 1.

3.4 Analytical Testing

One (1) soil sample was 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 consists of several contiguous properties, and is currently undeveloped and generally covered with a grassed surface and small trees, with localized patches of gravel and asphalt. However, based on available aerial photos, the site was previously occupied by 4 structures located along the western, southern, and eastern boundaries of the site. Reference should be made to the aerial photographs in Figure 2 - Aerial Photograph – 1976, Figure 3 - Aerial Photograph – 2002, Figure 4 - Aerial Photograph – 2007, Figure 5 – Aerial Photograph – 2019, which illustrate the former and present site conditions.

The site is bordered by Walkley Road to the north, Conroy Road to the east, Saint Laurent Boulevard to the south, and Don Reid Drive to the west. The northeast, southeast and southwest corners of the site are also bordered by commercial properties with one- or two-storey buildings. The site is relatively flat and at grade with the surrounding roadways and properties at approximate geodetic elevation 85 to 86 m.

4.2 Subsurface Profile

Generally, the subsurface soil profile at the test hole locations consists of topsoil or a thin layer of asphaltic pavement, followed by a layer of fill and further by successive deposits of silty clay and glacial till.

The fill layer was generally observed to consist of brown silty sand and/or clay with varying amounts of gravel and cobbles. The fill was observed to extend to depths ranging between about 0.4 to1.4 m below ground surface.

Underlying the fill, the silty clay deposit generally consists of a hard to stiff brown weathered crust, extending to depths ranging between approximately 2.2 to 3.8 m below ground surface. The brown silty clay was observed to be underlain by a stiff to firm grey silty clay.

The glacial till deposit, encountered underlying the silty clay, consists of a compact to dense, brown to grey silty sand to sandy silt with clay, gravel, cobbles and boulders. The glacial till deposit was observed at depths ranging between approximately 11.2 to 12.3 m below ground surface.

Practical refusal to augering was encountered at approximate depths ranging between 13.2 and 13.5 m at the locations of boreholes BH 1-22, BH 3-22 and BH 11-22.

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

Based on available geological mapping, the bedrock in the subject area consists of Paleozoic Shale of the Carlsbad formation.

Atterberg Limit and Shrinkage Tests

Atterberg limits testing was completed on the recovered silty clay samples at selected locations across the subject site. The results of the Atterberg limits tests are presented in Table 1 and on the Atterberg Limits Testing Results sheet in Appendix 1.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 1-22 SS4	3.05	77	38	39	76.6	CH
BH 4-22 SS3	2.29	82	42	40	78.2	CH
BH 5-22 SS3	3.05	86	43	43	88.9	CH
BH 11-22 SS3	3.05	82	42	40	68.9	CH

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
CH: Inorganic Clay of High Plasticity

The results of the shrinkage limit test indicate a shrinkage limit of 25.3% and a shrinkage ratio of 1.67 at BH 1-22.

Grain Size Distribution and Hydrometer Testing

Grain size distribution (sieve and hydrometer analysis) was also completed on one (1) selected soil sample. The results of the grain size analysis are summarized in Table 2 and presented on the Grain-Size Distribution and Hydrometer Testing Results sheet in Appendix 1.

Table 2 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 4-22	SS5	0	1.4	98.6	

4.3 Groundwater

Groundwater levels were measured at the recent borehole locations on March 11, 2022, and from July 2002 to May 2003 for the boreholes by others. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1 and presented in Table 3 below.

Table 3 – Summary of Groundwater Levels

Test Hole Number	Ground Surface Elevation (m)	Measured Groundwater Level / Groundwater Infiltration for Test Pits		Dated Recorded
		Depth (m)	Elevation (m)	
Current Investigation PG6149-1				
BH 1-22	86.19	5.15	81.04	March 11, 2022
BH 2-22	85.35	0.91	84.44	
BH 3-22	85.66	5.18	80.48	
BH 4-22	85.37	10.90	74.47	
BH 6-22	85.34	4.54	80.80	
BH 7-22	85.43	1.55	83.88	
BH 8-22	85.36	1.24	84.12	
BH 9-22	85.31	3.77	81.54	
BH 10-22	85.26	0.93	84.33	
BH 11-22	85.00	12.28	72.72	
BH 12-22	85.59	0.60	84.99	
Investigation by Others				
BH 2	-	3.00	-	July 10, 2002
BH 9	-	5.50	-	July 12, 2002
BH 101	-	9.00	-	September 11, 2002
BH 201	-	4.00	-	October 23, 2002
BH 202	-	5.50	-	October 23, 2002
BH 402	-	2.40	-	May 31, 2003
BH 403	-	2.70	-	May 31, 2003
BH 404	-	2.40	-	May 31, 2003
BH 405	-	2.70	-	May 31, 2003

Note: The ground surface elevation at each borehole location of the current investigation was surveyed using a handheld GPS and are referenced to a geodetic datum.

The groundwater level readings may be influenced by surface water infiltrating the backfilled boreholes. The groundwater table depth can also be estimated based on the moisture levels and colour of the recovered soil samples. Based on these observations at the borehole locations, the groundwater table is expected at an approximate depth between 2.5 and 3.5 m below ground surface.

However, it should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could be different at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is recommended that the proposed townhouse-style residential dwellings be supported on conventional spread footings bearing on the undisturbed, stiff silty clay. For the multi-storey retirement home building, due to the anticipated structural loads, it is recommended that foundation support consist of a raft foundation bearing on the undisturbed, stiff to firm silty clay.

Due to the presence of the silty clay layer, the subject site will have a permissible grade raise restriction. The permissible grade raise recommendations are discussed in Section 5.3.

Further, due to the demolished structures which previously occupied the site, foundation remains and other construction debris from these structures may be encountered during the proposed building and servicing excavations.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas and other settlement sensitive structures.

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

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The imported fill material should be tested and approved prior to delivery. The fill should be placed in 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 where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids.

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 Drain 6000.

If excavated brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, it is recommended that the material be placed under dry conditions and above freezing temperatures. The silty clay should be compacted in thin lifts to at least 95% of the material's SPMDD.

Protection of Subgrade (Raft Foundation)

Since the subgrade material will most likely consist of a silty clay deposit, it is recommended that a minimum 75 mm thick lean concrete mud slab be placed on the undisturbed silty clay subgrade shortly after the completion of any raft foundation excavations. The main purpose of the mud slab is to reduce the risk of disturbance of the subgrade under the traffic of workers and equipment.

The final excavation to the raft bearing surface level and the placing of the mud slab should be done in smaller sections to avoid exposing large areas of the silty clay to potential disturbance due to drying.

5.3 Foundation Design

Conventional Spread Footings – Townhouse-Style Residential Dwellings

Pad footings, up to 5 m wide, and strip footings up to 3 m wide, placed on an undisturbed, stiff silty clay subgrade can be designed using a bearing resistance value at serviceability limit states (SLS) of **100 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **150 kPa**. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

The bearing resistance value at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

An undisturbed soil bearing surface consists of a surface 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 concrete for footings.

Raft Foundation – Multi-Storey Building with 1 Underground Parking Level

As noted above, it is expected that a raft foundation will be required to support the proposed multi-storey retirement home building. For 1 underground parking level, it is anticipated that the excavation will extend to 3.5 to 4 m below existing ground surface.

The maximum SLS contact pressure can be taken to be **125 kPa** for the raft foundation bearing on the undisturbed, stiff to firm silty clay. It should be noted that the weight of the raft slab and everything above has to be included when designing with the aforementioned SLS values. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load.

The factored bearing resistance (contact pressure) at ULS can be taken as **180 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

The modulus of subgrade reaction was calculated to be **5 MPa/m** for a contact pressure of 125 kPa. The design of the raft foundation is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium. A common method of modeling the soil structure interaction is to consider the bearing medium to be elastic and to assign a subgrade modulus. However, silty clay is not elastic and limits have to be placed on the stress ranges of a particular modulus.

The proposed building can be designed using the above parameters and total and differential settlements of 25 and 20 mm, respectively.

Raft Foundation - Multi-Storey Building with 2 Underground Parking Levels

Where 2 levels of underground parking underlie the proposed multi-storey building, it is anticipated that the excavation will extend to 6 to 7 m below existing ground surface. For this case, the maximum SLS contact pressure can be taken as **160 kPa** for the raft foundation bearing on the undisturbed, stiff to firm silty clay. The factored bearing resistance (contact pressure) at ULS can be taken as **240 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

The modulus of subgrade reaction was calculated to be **6 MPa/m** for a contact pressure of 160 kPa.

The proposed building can be designed using the above parameters and total and differential settlements of 25 and 20 mm, respectively.

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 the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil or engineered fill of the same or higher capacity as that of the bearing medium.

Permissible Grade Raise Recommendations

Due to the presence of a silty clay deposit, a permissible grade raise restriction of **2.0 m** is recommended for the grading at the subject site.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D**. A higher seismic site class, such as Class C, may be achievable for this site. However, a site specific shear wave velocity test would be required to accurately determine the applicable seismic site classification for foundation design of the proposed buildings, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

The soils underlying the proposed foundations are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-Grade Construction

With the removal of all topsoil and deleterious fill within the footprints of the proposed buildings, the native soils, reviewed and approved by the geotechnical consultant, will be considered an acceptable subgrade upon which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Types I or II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slabs (outside the zones of influence of the footings).

For the multi-storey retirement home building, the recommended pavement structure noted in Table 4 in Section 5.7 below will be applicable for the founding level of the proposed parking garage. However, when storage or other uses of the lower level will involve the construction of a concrete floor slab, it is recommended that the upper 200 mm of subfloor fill consists of 19 mm clear crushed stone. It is also recommended to install an underslab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, below lowest level slab of the multi-storey retirement home buildings. This is discussed further in Section 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a bulk (drained) unit weight of 20 kN/m3.

Where undrained conditions are anticipated (i.e. below the groundwater level), the applicable effective (undrained) unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Lateral Earth Pressures

The static horizontal earth pressure (p_o) can be calculated using a triangular earth pressure distribution equal to Ko γ H where:

K_o = at-rest earth pressure coefficient of the applicable retained soil (0.5)
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to Ko q and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall.

The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}).

The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

$a_c = (1.45 - a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to the latest revision of the OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:
$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the lowest level of the underground parking structure should consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 4 below.

Table 4 - Recommended Rigid Pavement Structure – Retirement Home Lowest Parking Level

Thickness (mm)	Material Description
150	**Exposure Class C2 – 32 MPa Concrete** (5 to 8 % Air Entrainment)
300	**BASE** - OPSS Granular A Crushed Stone
SUBGRADE Top of Raft Foundation	

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example, a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hours after the concrete has been poured during warm temperatures and up to 12 hours during cooler temperatures.

The following flexible pavement structures presented in Tables 5 and 6 should be used for exterior, at-grade parking areas and access lanes, respectively.

Table 5 – Recommended Pavement Structure – Driveways and at-grade car 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 fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil or fill.	

Table 6 – Recommended Pavement Structure – Local Residential Roadways and Access Lanes

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 fill, in-situ soil, or OPSS Granular B Type I or II material placed over in-situ soil or fill.	

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 geotextile, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. For residential driveways and car only parking areas, an Ontario Traffic Category A will be used. For local roadways, an Ontario traffic Category B should be used for design purposes.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 99% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

A perimeter foundation drainage system is recommended for each proposed structure. Each system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated and corrugated plastic pipe which is surrounded by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of each structure. Each pipe should have a positive outlet, such as gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free draining, non-frost susceptible granular materials. The site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as system Miradrain G100N or Delta Drain 6000) connected to a drainage system is provided. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material should otherwise be used for this purpose.

Groundwater Suppression – Building with Two Underground Parking Level

Proposed buildings with 2 levels of underground parking should be provided with a groundwater suppression system below the groundwater level (approximately 3 m below the existing ground surface). The groundwater suppression system would consist of installing a waterproofing membrane as the outermost layer from the face of the foundation wall and over a geocomposite drainage board installed on the exterior portion of the foundation wall. In this case, the perimeter drainage would consist of an interior perimeter drainage pipe, mechanically connected to the drainage board using sleeves extending through the foundation wall at approximate 3 m centres.

Waterproofing membranes are also recommended for structures located below the level of the underslab drainage (i.e., elevator shafts, etc).

Underslab Drainage

Underslab drainage will be required to control water infiltration below the lowest underground parking level slab. For preliminary design purposes, we recommend that 150 or 100 mm diameter perforated pipes be placed at approximate 6 m centres. The spacing of the underslab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Raft Slab Construction Joints

It is expected that the raft slab, where utilized, will be poured in sections. For the construction joint at each pour, a rubber water stop along with a chemical grout (Xypex or equivalent) should be applied to the entire vertical joint of the slab.

Furthermore, a rubber water stop should be incorporated in the horizontal interface between the foundation wall and the raft slab.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required 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.

Other exterior unheated footings are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover, or an equivalent combination of soil cover and foundation insulation.

However, the foundations are generally not expected to require protection against frost action due to the founding depth. Unheated structures such as the access ramp may require insulation for protection against the deleterious effects of frost action.

6.3 Excavation Side Slopes

The side slopes of shallow excavations anticipated at this site should either be cut back at acceptable slopes or be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations), although a temporary shoring system may be required for the proposed multi-storey retirement home building, depending on the depth of the foundation and the proximity of the building to the property lines.

Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of approximately 3 m should be stable cut back at 1H:1V. Flatter slopes could be required for deeper excavations or for excavations below the groundwater level. Where such side slopes are not permissible or practical, temporary shoring systems should be used.

The subsoil at this site is considered to be mainly a Type 2 or 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 be kept away 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.

Excavation side slopes around the building excavation should be protected from erosion by surface water and rainfall events by the use of secured tarpaulins spanning the length of the side slopes, or other means of erosion protection along their footprint. Efforts should also be made to maintain dry surfaces at the bottom of the excavation footprints and along the bottom of side slopes. Additional measures may be recommended at the time of construction by the geotechnical consultant.

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.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods, such as potentially for the multi-storey retirement building. The shoring requirements will depend on the depth of the excavation and the proximity of the adjacent structures.

If a temporary shoring is considered, the design and approval of the shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures and include dewatering control measures.

Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes.

The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's representative prior to implementation.

The temporary shoring system, where required, may generally consist of a soldier pile and lagging system which could be cantilevered, anchored or braced. Consideration should be to the implementation of closed-wall and rigid systems (i.e., sheet piling or secant walls) where the system will retain non-cohesive soils such as sand and silts.

The shoring system is recommended to be adequately supported to resist toe failure. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. The earth pressures acting on the temporary shoring system may be calculated using the following parameters.

Table 7 – Soil Parameters for Shoring System Design

Parameters	**Values**
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-rest Earth Pressure Coefficient (K_o)	0.5
Total Unit Weight (γ), kN/m^3	20
Submerged Unit Weight (γ'), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be used above the groundwater level while the effective unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the effective unit weights are used for earth pressure calculations. If the groundwater level is lowered, the dry unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component. For design purposes, the minimum factor of safety of 1.5 should be calculated.

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.

The pipe bedding for sewer and water pipes placed on a relatively dry, undisturbed subgrade surface should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The bedding should extend to the spring line of the pipe.

Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the upper portion of the dry to moist (not wet) silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being reused. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement.

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 reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD.

The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Groundwater Control for Building Construction

Due to the relatively impervious nature of the silty clay materials, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps.

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.

Permit to Take Water

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. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Impacts on Neighbouring Structures

Any structures which extend below the groundwater level will be constructed with a groundwater suppression system to minimize any long-term lowering of the groundwater table. Therefore, no adverse effects from short term and/or long term dewatering are expected for the surrounding structures.

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 using 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 (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a low to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

Paterson completed a soils review of the site to determine the applicable tree planting setbacks, in accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines). Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Sieve analysis testing was also completed on selected soil samples. The above-noted test results were completed on samples taken at depths between the anticipated underside of footing elevation and a 3.5 m depth below finished grade. The results of our testing are presented in Tables 1 and 2 in Section 4.2 and in Appendix 1.

Based on the results of our review, the plasticity index was found to be generally less than or equal to 40% for the tested silty clay samples, and is therefore considered to be low to medium sensitivity clay and not a sensitive marine clay.

The following tree planting setbacks are therefore recommended for the low to medium sensitivity silty clay deposit throughout the subject site.

Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space). Tree planting setback limits may be reduced to **4.5 m** for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the conditions noted below are met.

☐ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

☐ A small tree must be provided with a minimum 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

☐ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

☐ The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

☐ Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree).

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

Aboveground Swimming Pools

The in-situ soils are considered to be acceptable for swimming pools. Above ground swimming pools must be placed at least 5 m away from the residence foundation and neighboring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

Aboveground Hot Tubs

Additional grading around the hot tub should not exceed permissible grade raises. Otherwise, hot tub construction is considered routine, and can be constructed in accordance with the manufacturer's specifications.

Installation of Decks or Additions

Additional grading around proposed deck or addition should not exceed permissible grade raises. Otherwise, standard construction practices are considered acceptable.

7.0 Recommendations

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

- Review detailed grading plan(s) from a geotechnical perspective, once available.
- Review of geotechnical aspects of the excavation contractor's shoring design, if required, prior to construction.
- Review of waterproofing details for the elevator shaft.
- Review and inspection of the foundation waterproofing system and all 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 placing backfilling material.
- Sampling and testing of the concrete and fill materials.
- Observation of clay seal placement at specified locations.
- Field density tests to determine the level of compaction achieved.
- Sampling and testing of the bituminous concrete including mix design reviews.

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

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 Paterson.

8.0 Statement of Limitations

The recommendations provided 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 Claridge Homes 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.

LICENSED PROFESSIONAL ENGINEER
April 7, 2022
S. S. DENNIS
100519516
Scott Dennis
PROVINCE OF ONTARIO

Scott Dennis

Fernanda Carozzi, PhD. Geoph.

Scott S. Dennis, P.Eng.

Report Distribution:

☐ Claridge Homes (e-mail copy)
☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

BOREHOLE LOGS BY OTHERS

GRAIN-SIZE DISTRIBUTION AND HYDROMETER TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

SHRINKAGE TESTING RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 4, 2022

FILE NO. PG6149

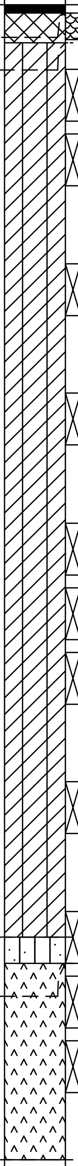
HOLE NO. BH 1-22

SOIL DESCRIPTION	Depth to base (m)	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.10	AU	1		
FILL: Brown silty sand, trace clay	0.45				
Hard to very stiff, brown **SILTY CLAY** - stiff to firm and grey by 3.7m depth	10.97	SS	2	8	8
		SS	3	67	8
		SS	4	75	2
		SS	5	75	P
		SS	6	33	P
		SS	7	67	P
		SS	8	0	P
		SS	9	33	P
Compact, grey **SILTY SAND** to **SANDY SILT,** trace gravel	11.28	SS	10	75	27
GLACIAL TILL: Compact to dense, grey silty sand to sandy silt with gravel, trace clay, cobbles and boulders	13.59	SS	11	33	17
		SS	12	100	35

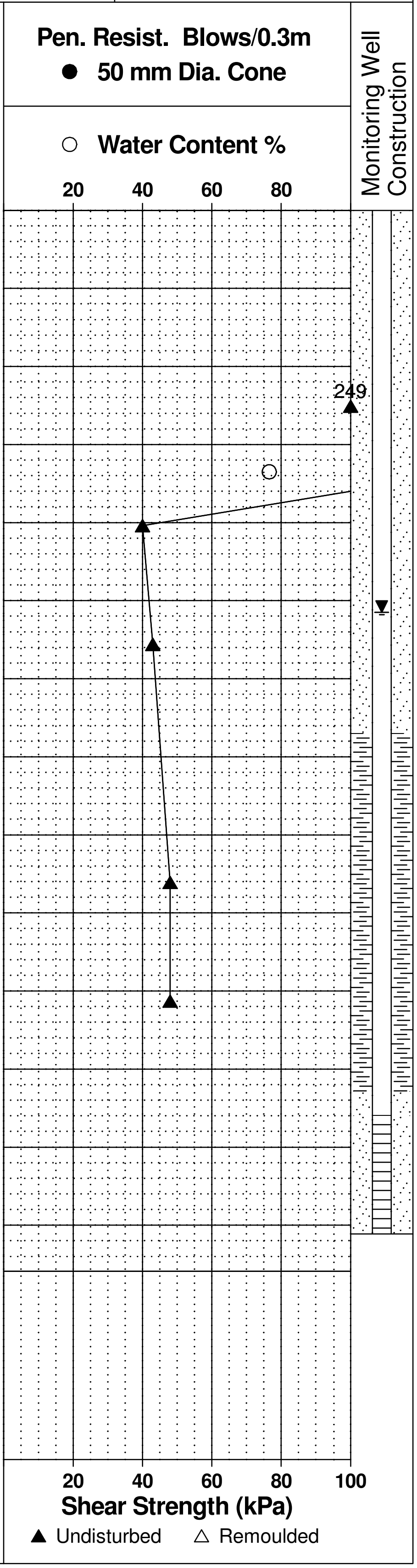
End of Borehole

Practical refusal to augering at 13.59m depth.

(GWL @ 5.15m - March 11, 2022)



DEPTH (m)	ELEV. (m)
0	86.19
1	85.19
2	84.19
3	83.19
4	82.19
5	81.19
6	80.19
7	79.19
8	78.19
9	77.19
10	76.19
11	75.19
12	74.19
13	73.19



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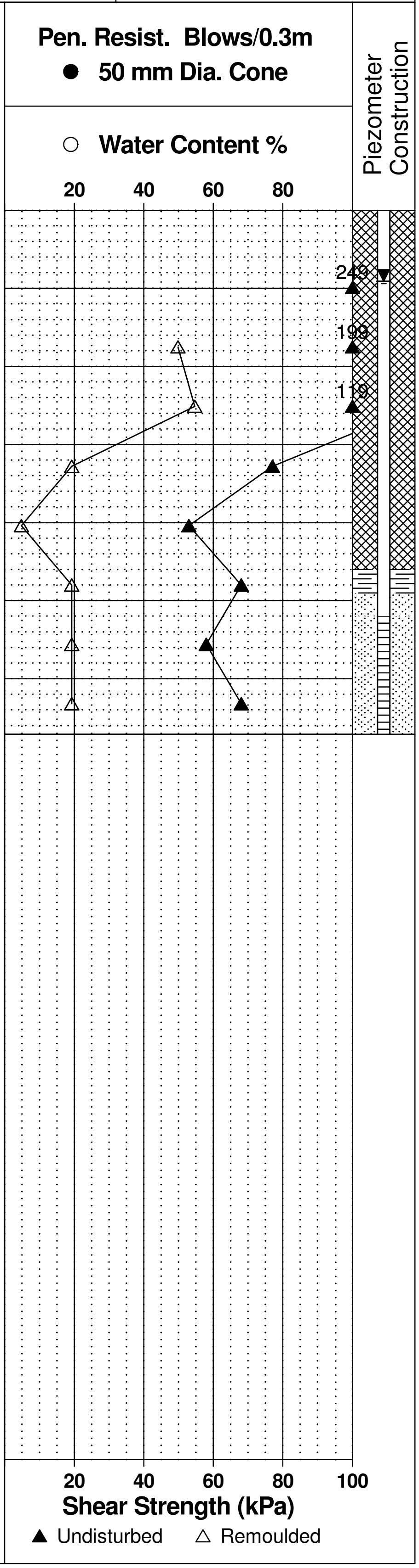
BORINGS BY CME 55 Power Auger

DATE March 4, 2022

FILE NO. PG6149

HOLE NO. BH 2-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.35
TOPSOIL 0.08		AU					
FILL: Brown silty sand trace clay 0.41							
						1	84.35
						2	83.35
Hard to very stiff, brown **SILTY CLAY**						3	82.35
- stiff and grey by 3.7m depth						4	81.35
						5	80.35
						6	79.35
6.71							
End of Borehole							
(GWL @ 0.91m - March 11, 2022)							



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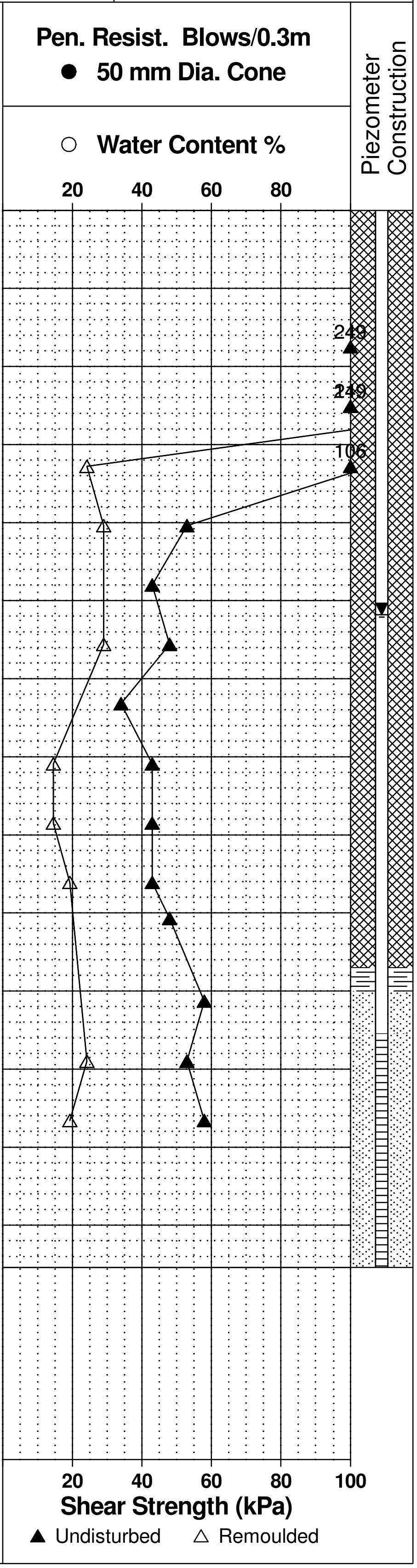
DATE March 7, 2022

FILE NO. PG6149

HOLE NO. BH 3-22

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE				
TOPSOIL 0.15				
FILL: Brown silty clay trace sand 0.69	AU	1		
Hard to very stiff, brown **SILTY CLAY** - stiff to firm and grey by 3.8m depth	SS	2	33	11
12.34 **GLACIAL TILL:** Compact, grey silty sand to sandy silt with gravel, trace clay, cobbles and boulders 13.54	SS	3	75	17
End of Borehole Practical refusal to augering at 13.54m depth. (GWL @ 5.18m - March 11, 2022)				

DEPTH (m)	ELEV. (m)
0	85.66
1	84.66
2	83.66
3	82.66
4	81.66
5	80.66
6	79.66
7	78.66
8	77.66
9	76.66
10	75.66
11	74.66
12	73.66
13	72.66



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BORINGS BY CME 55 Power Auger

DATE March 7, 2022

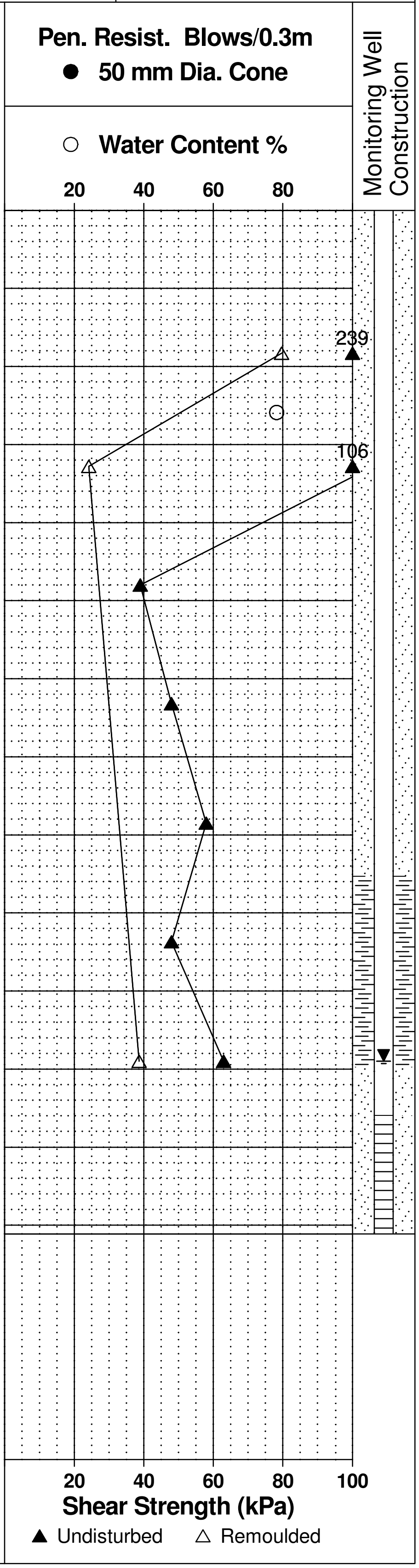
FILE NO. **PG6149**

HOLE NO. **BH 4-22**

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOPSOIL	0.13
FILL: Brown silty clay with sand and gravel	0.69
Hard to very stiff brown **SILTY CLAY** - firm to stiff and grey by 3.8m depth	11.43
GLACIAL TILL: Compact grey silty sand to sandy silt with gravel, trace clay, cobbles and boulders	13.11
End of Borehole (GWL @ 10.90m - March 11, 2022)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	58	11
SS	3	58	2
SS	4	67	1
SS	5	33	1
SS	6	100	38

DEPTH (m)	ELEV. (m)
0	85.37
1	84.37
2	83.37
3	82.37
4	81.37
5	80.37
6	79.37
7	78.37
8	77.37
9	76.37
10	75.37
11	74.37
12	73.37
13	72.37



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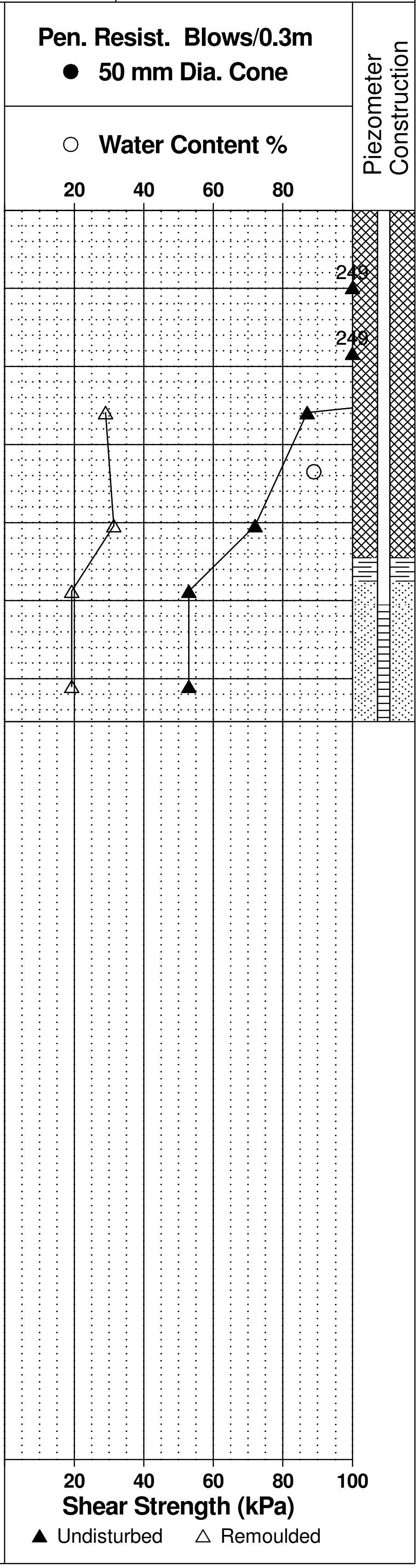
DATE March 7, 2022

FILE NO. PG6149

HOLE NO. BH 5-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.59
TOPSOIL 0.13							
FILL: Brown silty clay with sand and gravel 0.69		AU	1				
						1	84.59
						2	83.59
Hard to stiff, brown **SILTY CLAY**							
						3	82.59
- grey by 3.0m depth		SS	2	42	2		
						4	81.59
						5	80.59
		SS	3	8	1		
						6	79.59
6.55							
End of Borehole							



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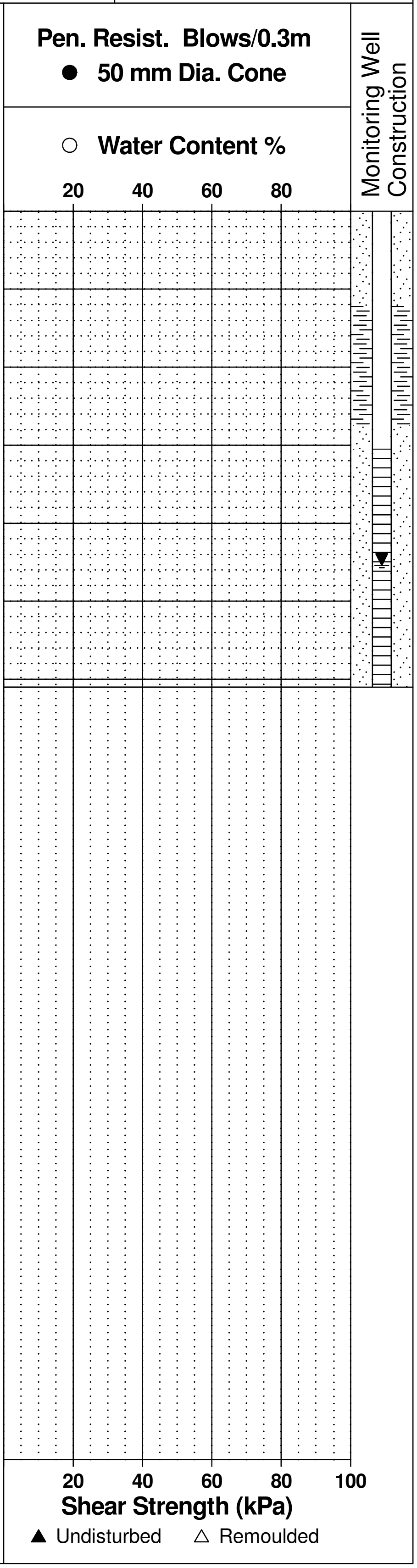
FILE NO. PG6149

HOLE NO. BH 6-22

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	85.34
TOPSOIL 0.15 **FILL:** Brown silty clay with sand and gravel 0.69	AU	1				
FILL: Brown silty sand with gravel, crushed stone and cobbles 1.44	SS	2	17	47	1	84.34
Very stiff to stiff, brown **SILTY CLAY**	SS	3	4	5	2	83.34
	SS	4	67	2		
- firm and grey by 3.0m depth	SS	5	75	1	3	82.34
	SS	6	75	1	4	81.34
	SS	7	67	1	5	80.34
6.10	SS	8	67	1	6	79.34

End of Borehole

(GWL @ 4.54m - March 11, 2022)



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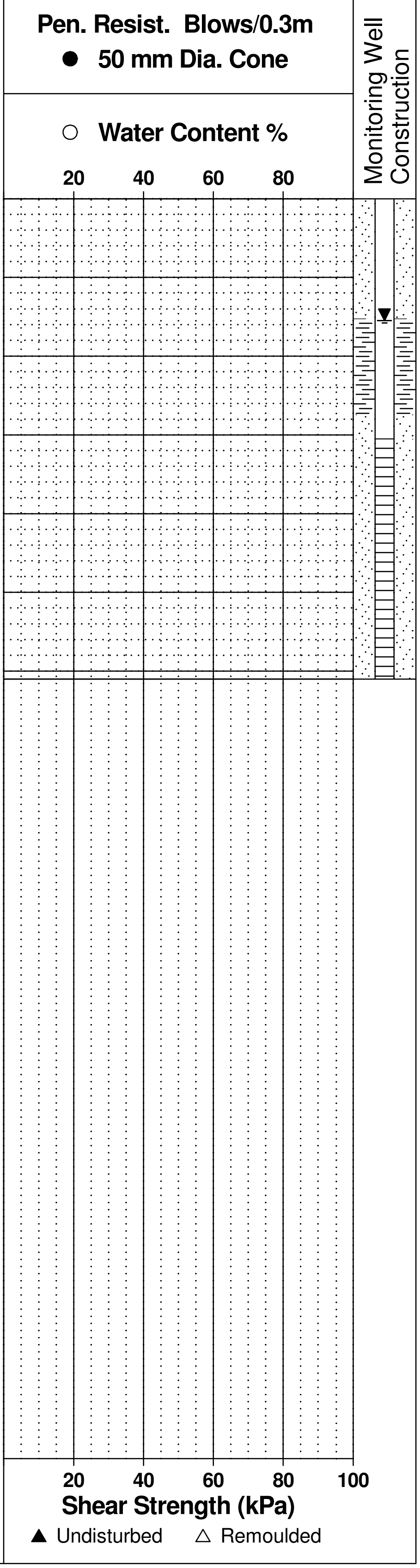
DATE March 8, 2022

FILE NO. PG6149

HOLE NO. BH 7-22

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.43
TOPSOIL	0.13	AU	1				
FILL: Brown silty clay with sand, some gravel	0.61	SS	2	67	9	1	84.43
		SS	3	67	4	2	83.43
Very stiff to stiff, brown **SILTY CLAY**		SS	4	67	2		
						3	82.43
- firm and grey by 3.0m depth		SS	5	67	1		
		SS	6	67	1	4	81.43
		SS	7	67	1	5	80.43
	6.10	SS	8	67	1	6	79.43
End of Borehole							
(GWL @ 1.55m - March 11, 2022)							



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DATE March 8, 2022

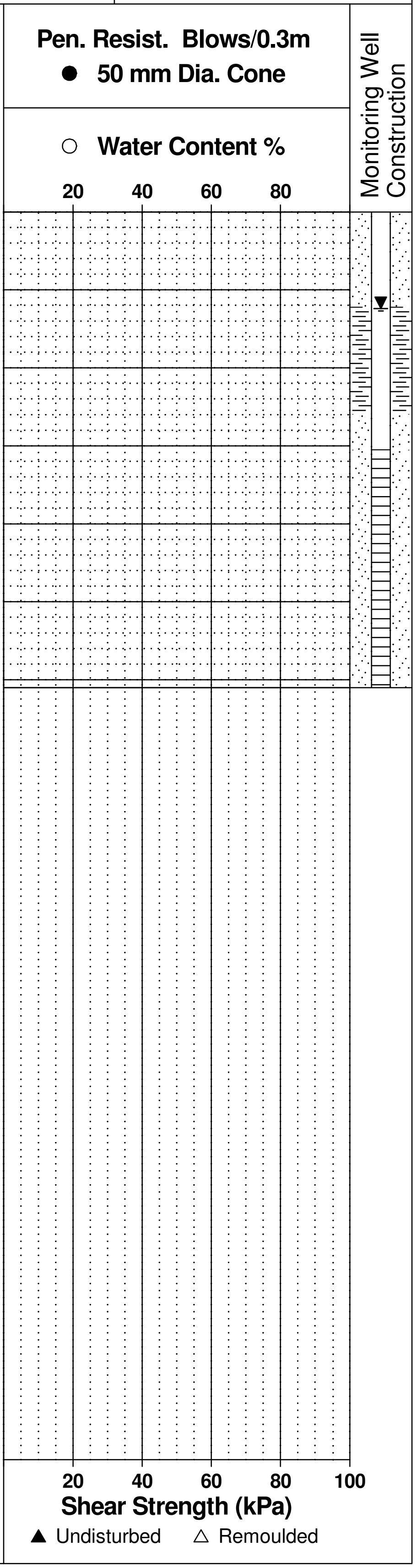
FILE NO. PG6149

HOLE NO. BH 8-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.36
TOPSOIL 0.13		AU	1				
FILL: Brown silty sand with crushed stone 1.22		SS	2	25	35	1	84.36
Very stiff to stiff, brown **SILTY CLAY**		SS	3	33	5	2	83.36
		SS	4	67	2		
- firm and grey by 3.0m depth		SS	5	33	1	3	82.36
		SS	6	58	1	4	81.36
		SS	7	67	1	5	80.36
6.10		SS	8	67	1	6	79.36

End of Borehole

(GWL @ 1.24m - March 11, 2022)



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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger

DATE March 8, 2022

FILE NO. PG6149

HOLE NO. BH 9-22

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.31
TOPSOIL	0.13	AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	50	7	1	84.31
		SS	3	67	4	2	83.31
- firm and grey by 2.2m depth		SS	4	67	2		
		SS	5	75	1	3	82.31
		SS	6	50	1	4	81.31
		SS	7	67	1	5	80.31
		SS	8	50	1		
End of Borehole	6.10					6	79.31

(GWL @ 3.77m - March 11, 2022)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %
20 40 60 80

Monitoring Well Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

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REMARKS

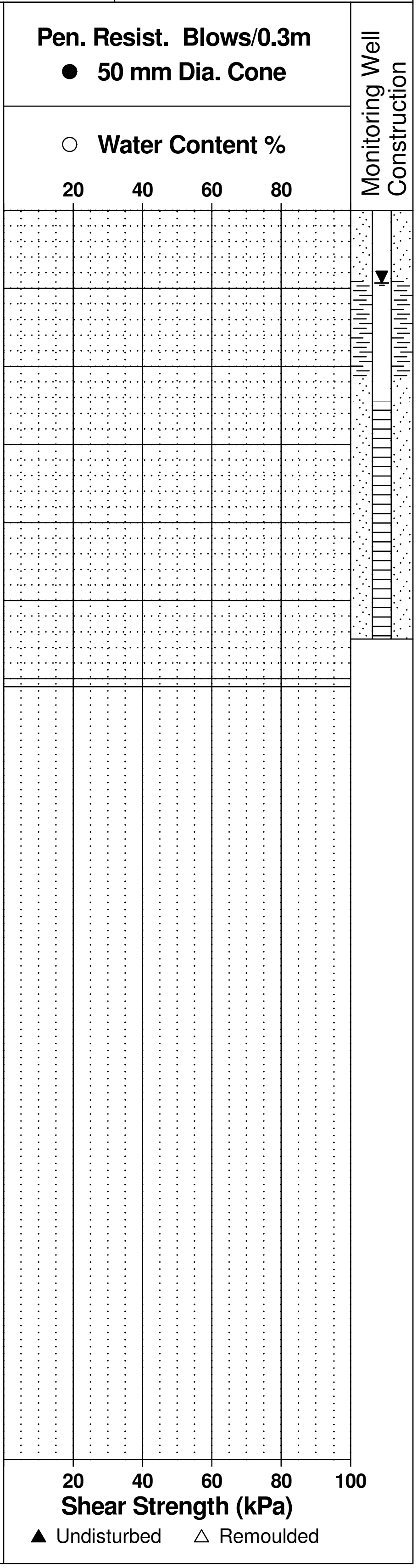
BORINGS BY CME 55 Power Auger

DATE March 8, 2022

FILE NO. PG6149

HOLE NO. BH10-22

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	85.26
TOPSOIL 0.10	AU	1				
FILL: Brown silty sand with gravel, trace clay 0.69	SS	2	50	10	1	84.26
Very stiff to stiff, brown **SILTY CLAY**	SS	3	67	6	2	83.26
	SS	4	67	2	3	82.26
- firm and grey by 3.0m depth	SS	5	67	1	4	81.26
	SS	6	67	1	5	80.26
	SS	7	25	1		
6.10	SS	8	67	1	6	79.26
End of Borehole						
(GWL @ 0.93m - March 11, 2022)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 9, 2022

FILE NO. **PG6149**

HOLE NO. **BH11-22**

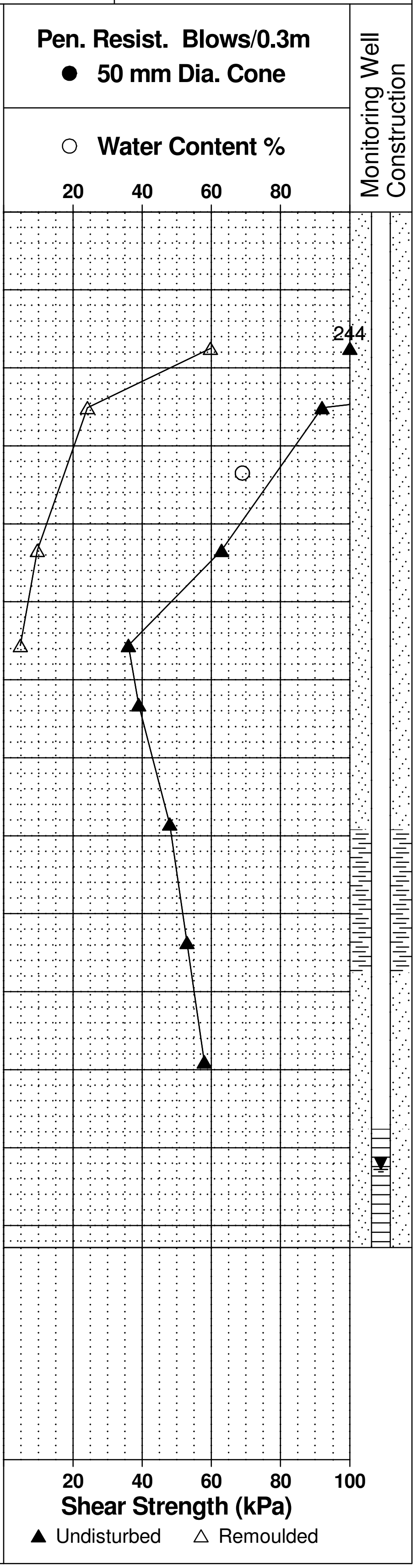
SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.10				
FILL: Brown silty sand with gravel, trace clay and cobbles	0.69	AU	1		
		SS	2	4	8
Hard to stiff, brown **SILTY CLAY** - grey by 3.0m depth		SS	3	75	2
		SS	4	4	1
	11.43				
GLACIAL TILL: Grey silty sand to sandy silt with gravel, cobbles, trace clay and boulders		SS	5	25	10
	13.28	G	6		

End of Borehole

Practical refusal to augering at 13.28m depth

(GWL @ 12.28m - March 11, 2022)

DEPTH (m)	ELEV. (m)
0	85.00
1	84.00
2	83.00
3	82.00
4	81.00
5	80.00
6	79.00
7	78.00
8	77.00
9	76.00
10	75.00
11	74.00
12	73.00
13	72.00



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 9, 2022

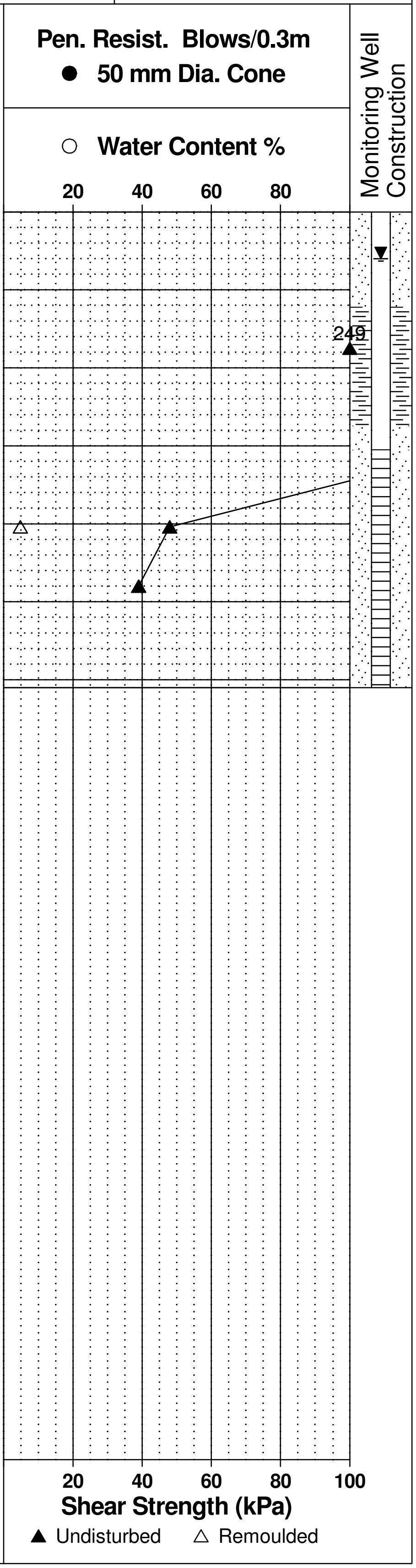
FILE NO. PG6149

HOLE NO. BH12-22

SOIL DESCRIPTION	Depth (m)
GROUND SURFACE	
TOPSOIL	0.10
FILL: Brown silty sand some clay	0.69
Hard to very stiff, brown **SILTY CLAY** - stiff to firm and grey 3.0m depth	6.10
End of Borehole (GWL @ 0.60m - March 11, 2022)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	33	8
SS	3	67	3
SS	4	75	1
SS	5	75	1

DEPTH (m)	ELEV. (m)
0	85.59
1	84.59
2	83.59
3	82.59
4	81.59
5	80.59
6	79.59



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME 55 Power Auger

DATE March 9, 2022

FILE NO. PG6149

HOLE NO. BH13-22

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	85.94		
TOPSOIL 0.13									
FILL: Brown silty sand with gravel, trace clay 0.69		AU	1						
		SS	2	17	11	1	84.94		
Hard to very stiff, brown **SILTY CLAY** 2.13		SS	3	67	6	2	83.94		
End of Borehole									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Development - Walkley Lands
Ottawa, Ontario

DATUM Geodetic

REMARKS

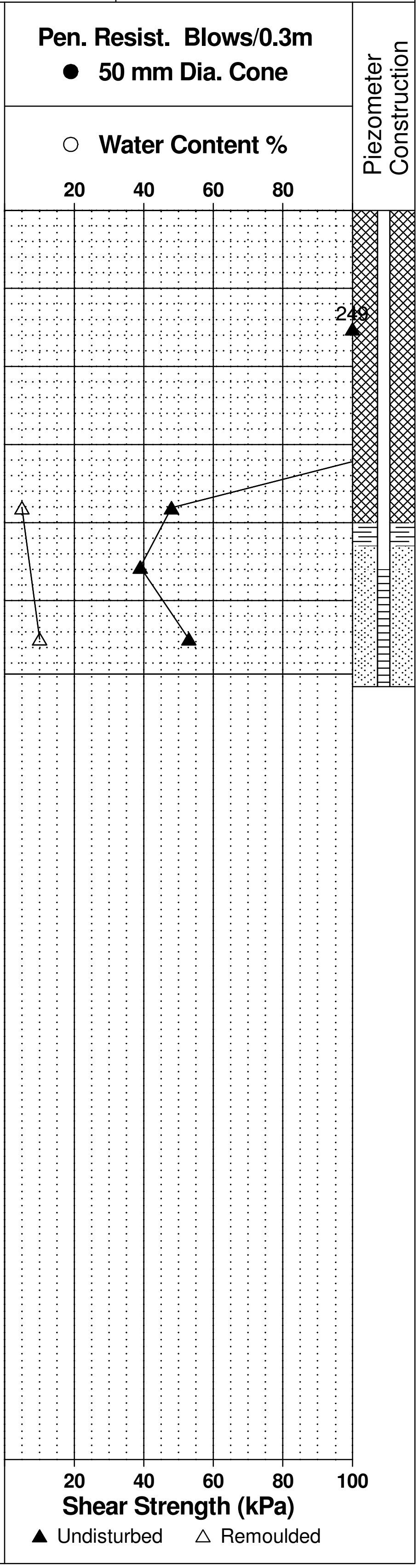
BORINGS BY CME 55 Power Auger

DATE March 9, 2022

FILE NO. PG6149

HOLE NO. BH14-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.56
TOPSOIL 0.10		AU	1				
FILL: Brown silty sand with crushed stone 0.69							
		SS	2	42	8	1	84.56
						2	83.56
Hard to very stiff, brown **SILTY CLAY**		SS	3	67	2		
						3	82.56
- firm to stiff and grey by 3.0m depth		SS	4	67	2		
						4	81.56
						5	80.56
5.94		SS	5	67	P		
End of Borehole							



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 = $(D30)^2 / (D10 \times D60)$
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)

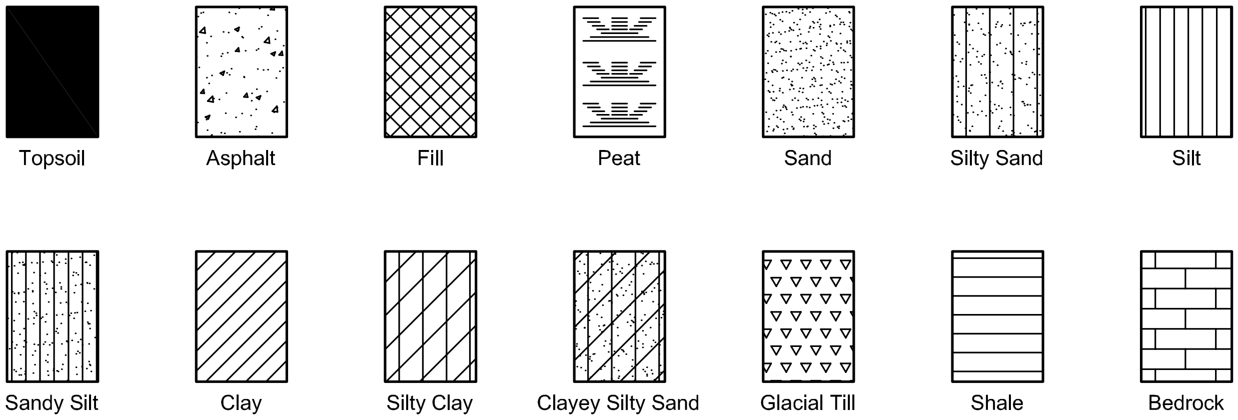
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

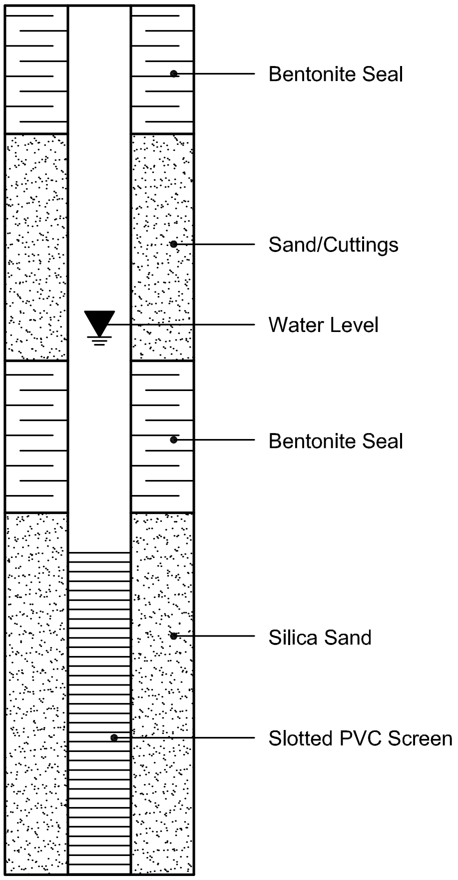
SYMBOLS AND TERMS (continued)

STRATA PLOT

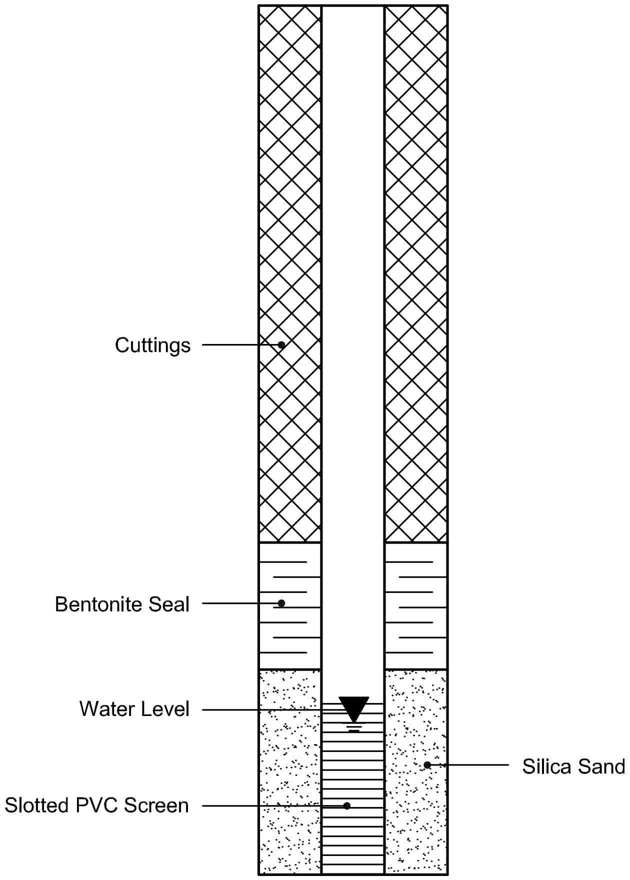


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Project No: 02 LPL 642

Log of Borehole 1

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Drawing No.: A1

Location: Walkley Road & Conroy Road, Ottawa

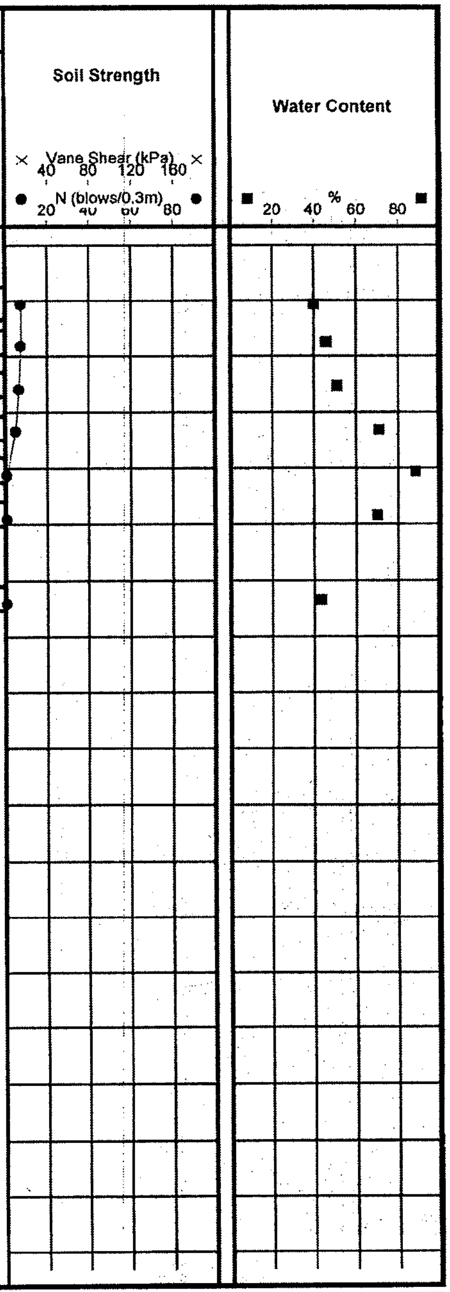
Field Technician: AL

SUBSURFACE PROFILE		SAMPLE		
Description	Elevation (m)	Number	Type	N-values
Ground Surface	0			
PAVEMENT - 70mm asphalt over granular bases.	-0.661			
FILL - grey silty clay, - scattered topsoil, moist.	-1.42	1	SS	8
		2	SS	8
SILTY CLAY - stiff to firm, very soft below 3.5m, - grey, low to medium plasticity, - wet.		3	SS	7
		4	SS	5
		5	SS	1
		6	SS	1
	-6.55	7	SS	1
End of Borehole				

Depth (m): 0–18

Upon completion of drilling:

- No free water in borehole.



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 10, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 2

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Drawing No.: A2

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL

SUBSURFACE PROFILE

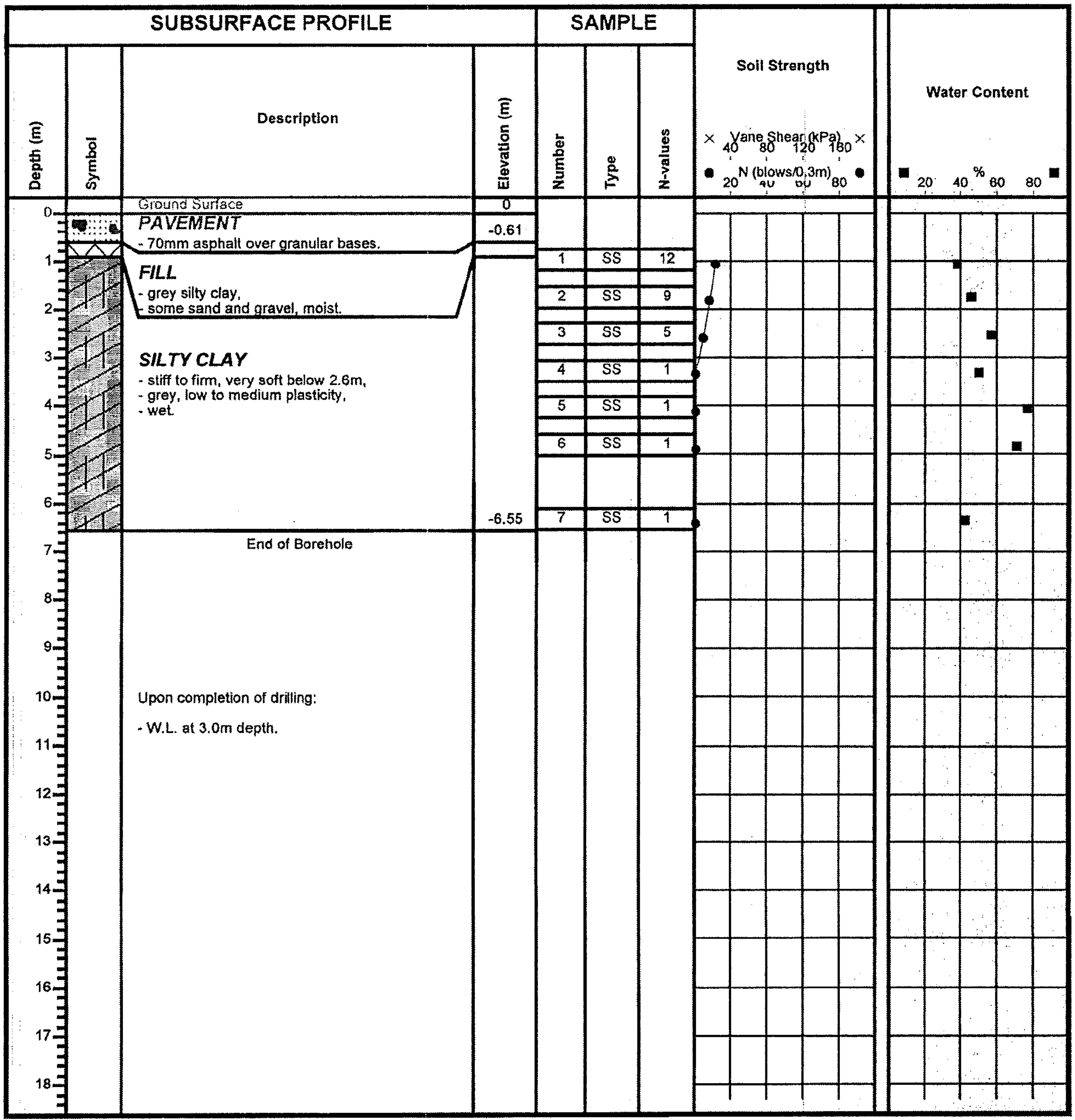
Depth (m)	Description	Elevation (m)
0	Ground Surface	0
	PAVEMENT - 70mm asphalt over granular bases.	-0.61
	FILL - grey silty clay, - some sand and gravel, moist.	
	SILTY CLAY - stiff to firm, very soft below 2.6m, - grey, low to medium plasticity, - wet.	-6.55
	End of Borehole	

Upon completion of drilling:

- W.L. at 3.0m depth.

SAMPLE

Number	Type	N-values
1	SS	12
2	SS	9
3	SS	5
4	SS	1
5	SS	1
6	SS	1
7	SS	1



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 10, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

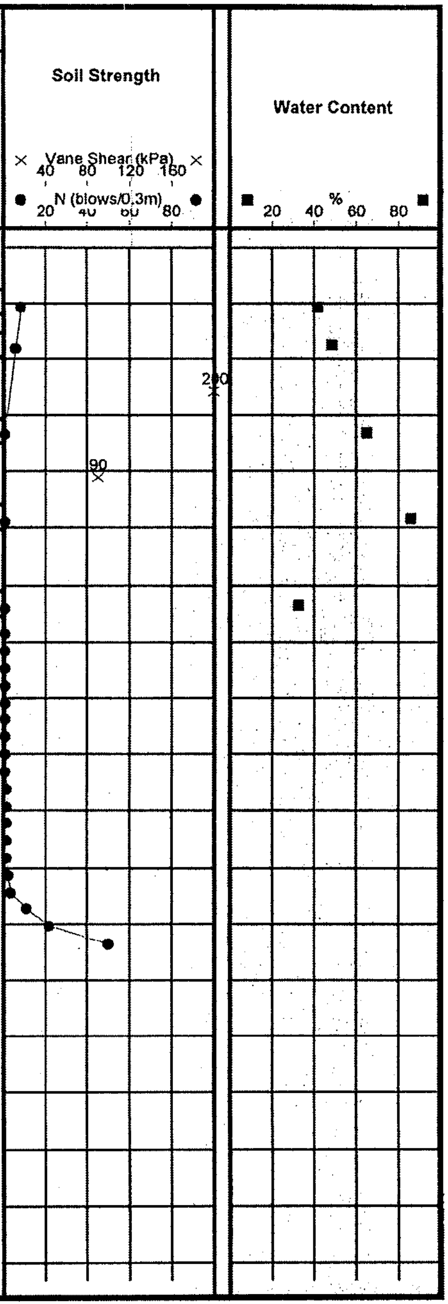
Project No: 02 LPL 642

Log of Borehole 3

Toronto Inspection Ltd.

Project: Proposed Commercial Development
Client: Loblaw Properties Limited
Location: Walkley Road & Conroy Road, Ottawa
Drawing No.: A3
Field Technician: AL

SUBSURFACE PROFILE				SAMPLE		
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		PAVEMENT - 70mm asphalt over granular bases.	-0.585			
1		*SILTY CLAY* - stiff to soft, very soft below 3.3m, - grey, low to medium plasticity, - thin layers of silty sand, - wet.		1	SS	9
2				2	SS	6
3				3	SS	1
5				4	SS	1
6			-6.55	5	SS	1
7		*NOT SAMPLED*				
12		End of Borehole Upon completion of drilling: - No free water in borehole.	-12			



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering
Drill Date: July 10, 2002
Hole Size: 210mm
Driller: Marathon
Checked by: BS
Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 4

Toronto Inspection Ltd.

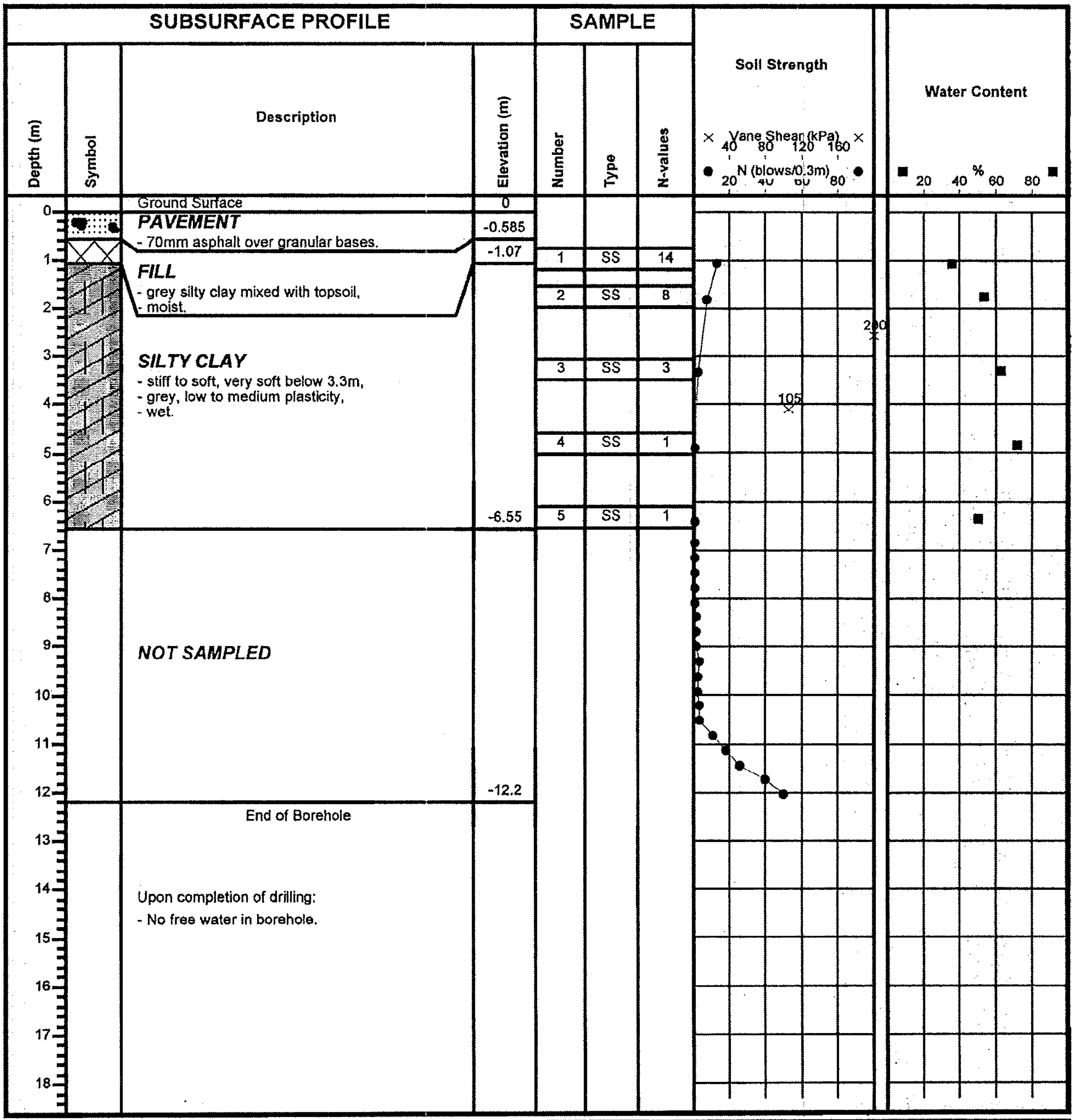
Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Drawing No.: A4

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL



SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0
	PAVEMENT - 70mm asphalt over granular bases.	-0.585
	FILL - grey silty clay mixed with topsoil, - moist.	-1.07
	SILTY CLAY - stiff to soft, very soft below 3.3m, - grey, low to medium plasticity, - wet.	-6.55
	NOT SAMPLED	-12.2
	End of Borehole	

Upon completion of drilling:
- No free water in borehole.

SAMPLE

Number	Type	N-values
1	SS	14
2	SS	8
3	SS	3
4	SS	1
5	SS	1

Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 10, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 5

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Drawing No.: A5

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL

SUBSURFACE PROFILE

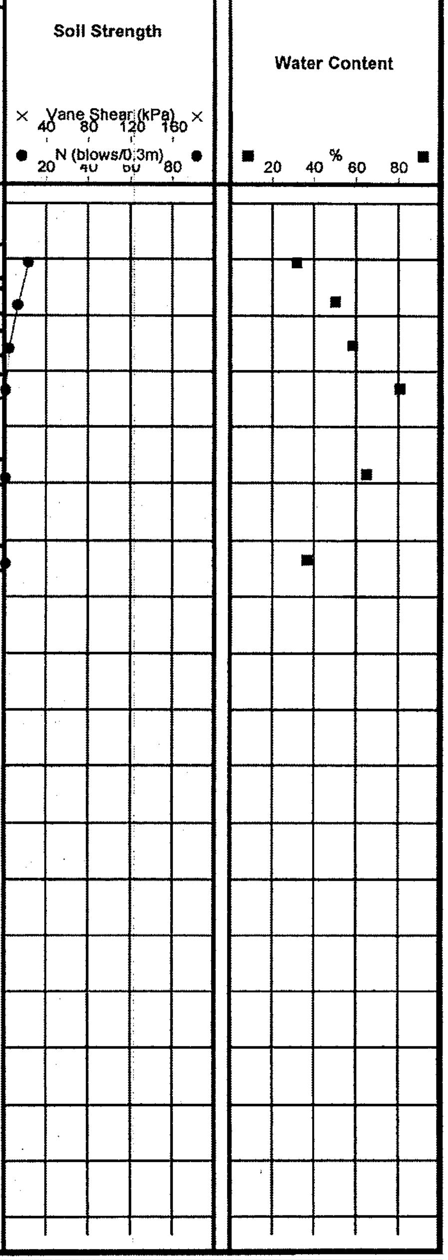
Depth (m)	Description	Elevation (m)
0	Ground Surface	0
0 – ~0.7	***PAVEMENT*** - 70mm asphalt over granular bases.	-0.661
~0.7 – ~1.1	***FILL*** - grey silty clay, - scattered topsoil, moist.	-1.07
~1.1 – 6.55	***SILTY CLAY*** - stiff to soft, very soft below 2.6m, - grey, low to medium plasticity, - wet.	-6.55
	End of Borehole	

Upon completion of drilling:

- No free water in borehole.

SAMPLE

Number	Type	N-values
1	SS	12
2	SS	7
3	SS	3
4	SS	1
5	SS	1
6	SS	1



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 10, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 6

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Drawing No.: A6

Location: Walkley Road & Conroy Road, Ottawa

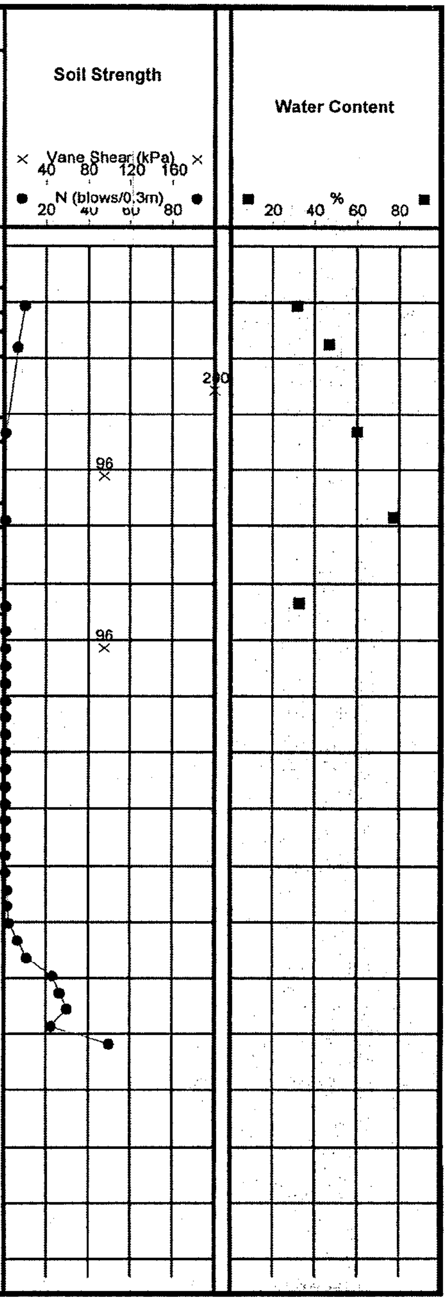
Field Technician: AL

SUBSURFACE PROFILE

Depth (m)	Description	Elevation (m)
0	Ground Surface	0
0–0.914	*FILL* - 0.5m topsoil over grey silty clay, - wood pieces, moist.	-0.914
0.914–7.32	*SILTY CLAY* - stiff to firm, very soft below 3.0m, - grey, low to medium plasticity, - wet.	-7.32
7.32–14.3	*NOT SAMPLED*	-14.3
14.3	End of Borehole Upon completion of drilling: - No free water in borehole.	

SAMPLE

Number	Type	N-values
1	SS	10
2	SS	7
3	SS	1
4	SS	1
5	SS	1



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 12, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 7

Toronto Inspection Ltd.

Project: Proposed Commercial Development

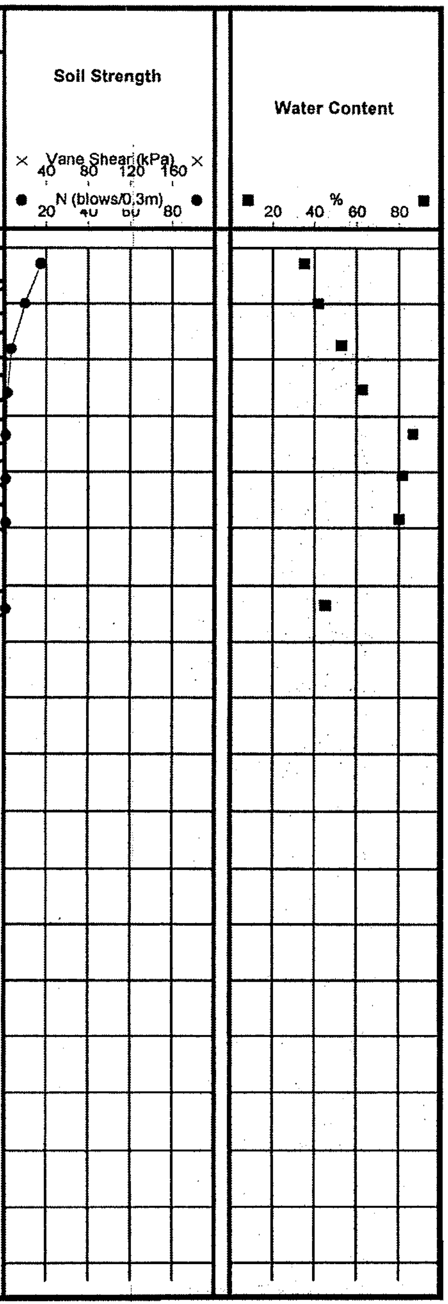
Client: Loblaw Properties Limited

Drawing No.: A7

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL

SUBSURFACE PROFILE				SAMPLE		
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
	☒	*FILL* - 0.2m topsoil over brown silty sand, - some gravel, moist.	-0.61	1	SS	18
1	▨			2	SS	10
2	▨			3	SS	4
3	▨	*SILTY CLAY* - stiff to soft, very soft below 1.5m, - grey, low to medium plasticity, - wet.		4	SS	2
	▨			5	SS	1
4	▨			6	SS	1
5	▨			7	SS	1
6	▨		-6.55	8	SS	1
7		End of Borehole				
10		Upon completion of drilling: - No free water in borehole.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 12, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Toronto Inspection Ltd.

Project No: 02 LPL 642

Log of Borehole 8

Project: Proposed Commercial Development

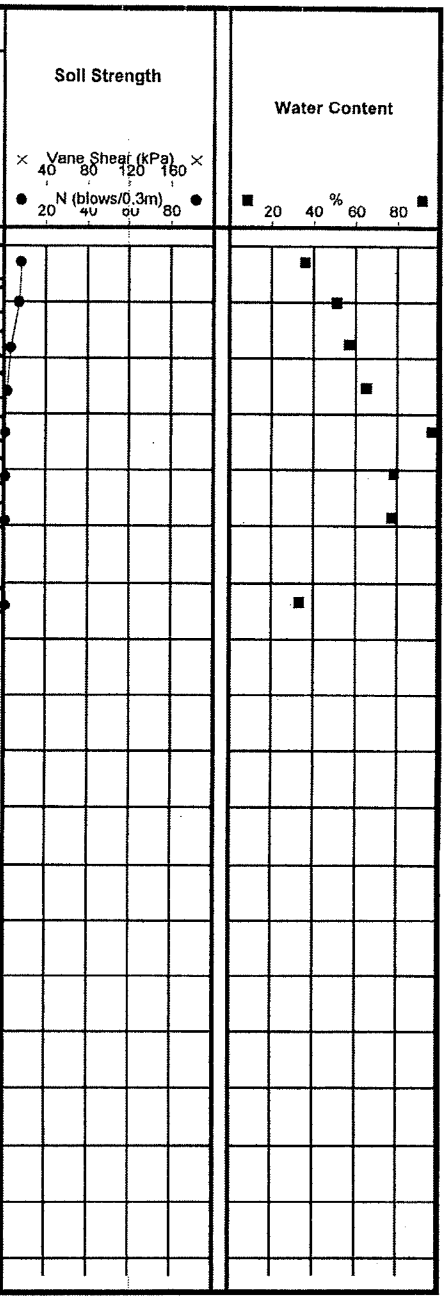
Client: Loblaw Properties Limited

Drawing No.: A8

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL

SUBSURFACE PROFILE				SAMPLE		
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
	╳	***FILL*** - 0.2m topsoil over brown silty sand, - some clay, moist.	-0.457	1	SS	9
1	▨			2	SS	8
2	▨	***SILTY CLAY*** - stiff to soft, very soft below 2.2m, - grey, low to medium plasticity, - wet.		3	SS	4
3	▨			4	SS	2
4	▨			5	SS	1
	▨			6	SS	1
5	▨			7	SS	1
6	▨		-6.55	8	SS	1
7		End of Borehole				
10		Upon completion of drilling: - No free water in borehole.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 12, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 9

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

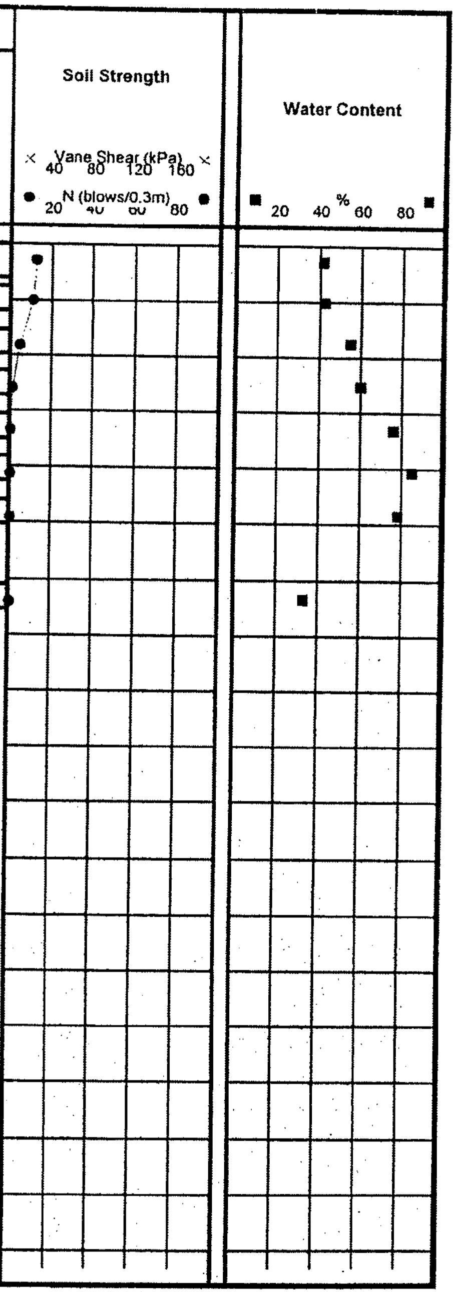
Drawing No.: A9

Location: Walkley Road & Conroy Road, Ottawa

Field Technician: AL

SUBSURFACE PROFILE / SAMPLE

Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		TOPSOIL		1	SS	13
1				2	SS	11
2				3	SS	5
3		***SILTY CLAY*** - stiff to firm, very soft below 2.4m, - grey, low to medium plasticity, - wet.		4	SS	2
				5	SS	1
4				6	SS	1
5				7	SS	1
6			-6.55	8	SS	1
7		End of Borehole				
10		Upon completion of drilling: - W.L. at 5.5m depth.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Driller: Marathon

Drill Date: July 12, 2002

Checked by: BS

Hole Size: 210mm

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 101

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Location: 2425 Don Reid Drive, Ottawa

Drawing No.: B1

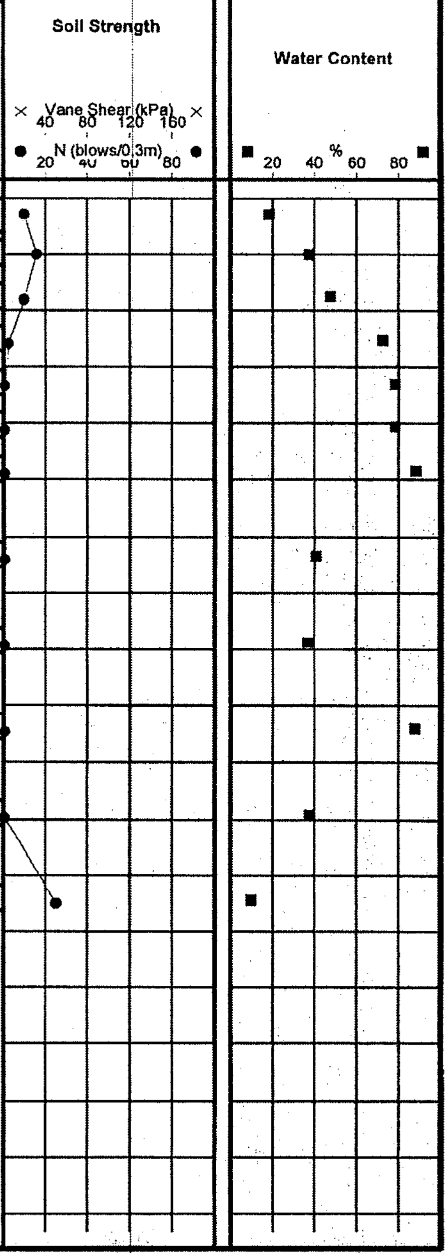
Field Technician: AL

SUBSURFACE PROFILE / SAMPLE

Description	Elevation (m)	Number	Type	N-values
Ground Surface	0			
FILL - 0.3m topsoil over dark brown silty sand, moist.	-0.61	1	SS	10
SILTY CLAY - very stiff to stiff, soft to very soft below 2.3m, - grey, low to medium plasticity, - thin layers of silty fine sand. - moist to wet.		2	SS	16
		3	SS	10
		4	SS	3
		5	SS	1
		6	SS	1
		7	SS	1
		8	SS	1
		9	SS	1
		10	SS	1
		11	SS	1
	-11.9			
SANDY SILT TILL - compact, grey, - some fine gravel, moist.	-12.6	12	SS	25
End of Borehole				

Upon completion of drilling:

- W.L. at 9.0m depth.



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Drill Date: September 11, 2002

Hole Size: 210mm

Driller: Marathon

Checked by: BS

Sheet: 1 of 1

Project No: 02 LPL 642

Log of Borehole 102

Toronto Inspection Ltd.

Project: Proposed Commercial Development

Client: Loblaw Properties Limited

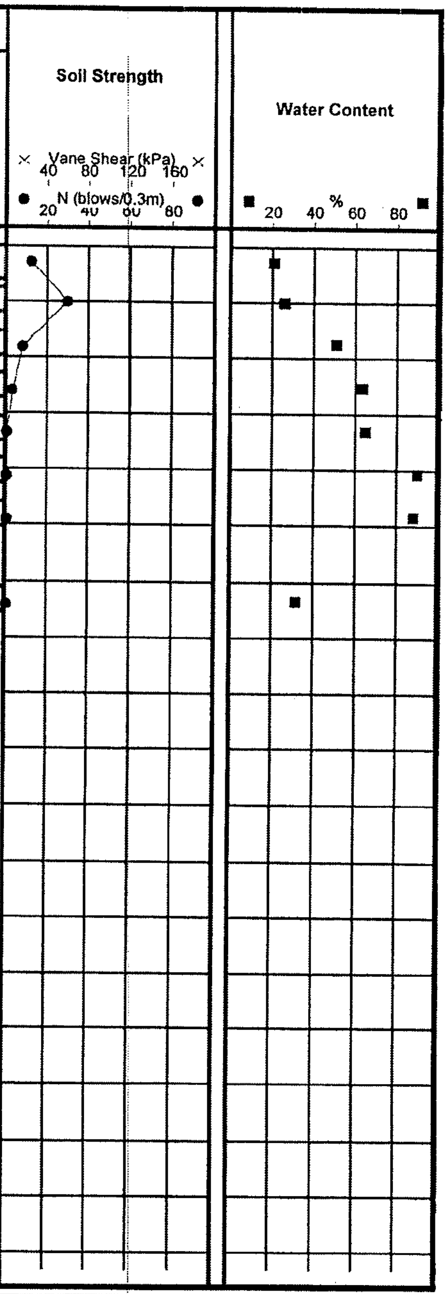
Location: 2425 Don Reid Drive, Ottawa

Drawing No.: B2

Field Technician: AL

SUBSURFACE PROFILE

Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		FILL - 0.3m topsoil over dark brown silty sand, moist.	-0.914	1	SS	13
				2	SS	30
		SILTY CLAY - very stiff to firm, soft to very soft below 2.6m, - grey, low to medium plasticity, - thin layers of sandy silt, - moist to wet.		3	SS	9
				4	SS	4
				5	SS	1
				6	SS	1
				7	SS	1
			-6.55	8	SS	1
		End of Borehole				
		Upon completion of drilling: - No free water in borehole.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Drill Date: September 11, 2002

Hole Size: 210mm

Driller: Marathon

Checked by: BS

Sheet: 1 of 1

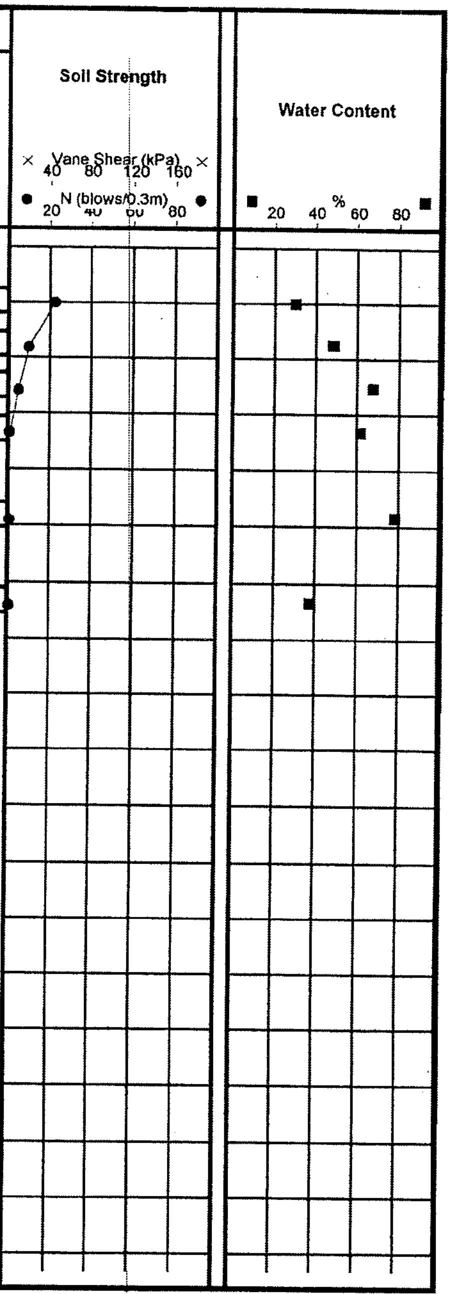
Project No: 02 LPL 642

Log of Borehole 103

Toronto Inspection Ltd.

Project: Proposed Commercial Development
Client: Loblaw Properties Limited
Location: 2425 Don Reid Drive, Ottawa
Drawing No.: B3
Field Technician: AL

SUBSURFACE PROFILE		SAMPLE		
Description	Elevation (m)	Number	Type	N-values
Ground Surface	0			
PAVEMENT - 60mm asphalt over granular bases.	-0.61			
SILTY CLAY - very stiff to firm, soft to very soft below 2.8m, - grey, low to medium plasticity. - thin layers of sandy silt, - moist to wet.		1	SS	23
		2	SS	10
		3	SS	5
		4	SS	1
		5	SS	1
	-6.55	6	SS	1
End of Borehole Upon completion of drilling: - No free water in borehole.				



Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering
Drill Date: September 11, 2002
Hole Size: 210mm
Driller: Marathon
Checked by: BS
Sheet: 1 of 1

Project No. 03 LPL 789

Log of Borehole 301

Dwg No. D1

Sheet No. 1 of 1

Project: Proposed Commercial Development

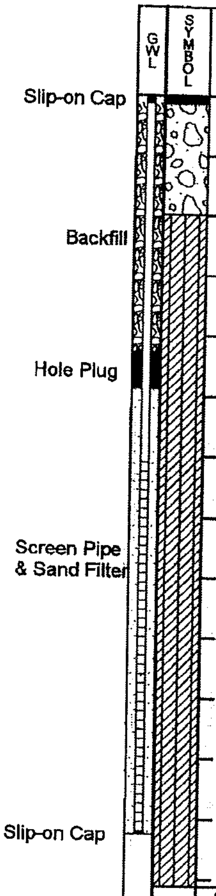
Location: 2510 St. Laurent Blvd., Ottawa

Date Drilled: 05/03/03

Drill Type:

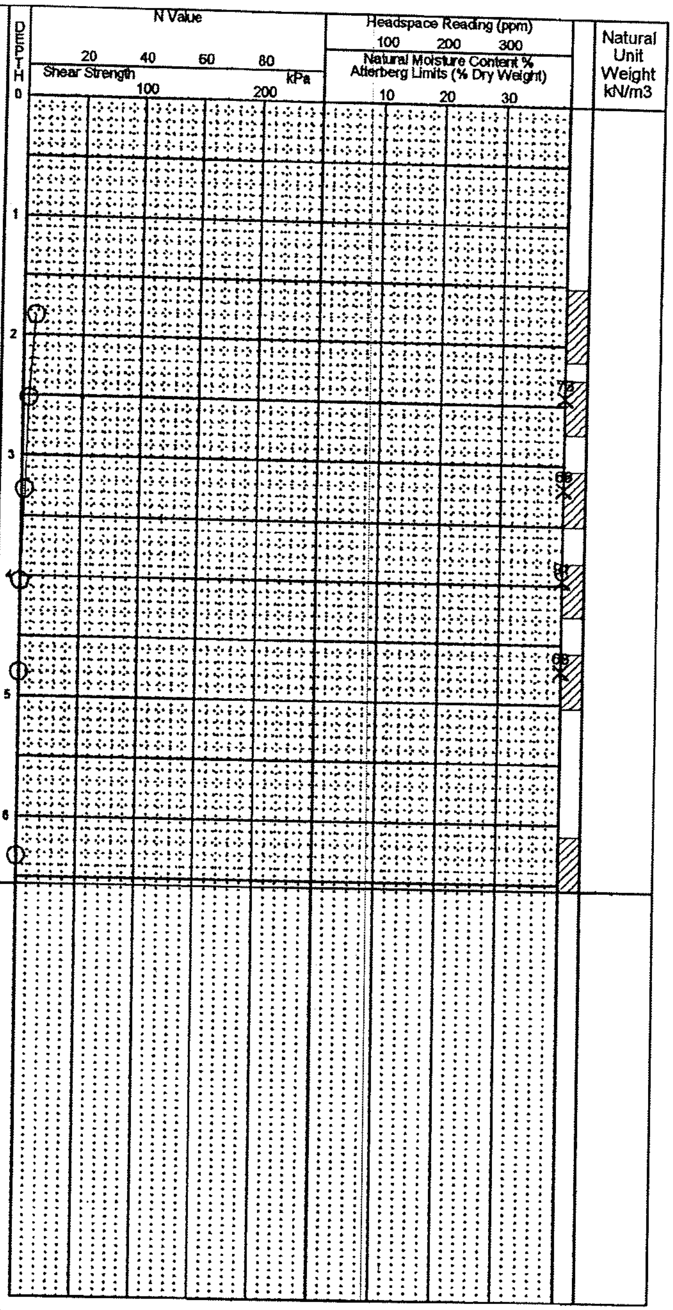
Datum:

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S
Headspace Reading (ppm) •
Natural Moisture ×
Plastic and Liquid Limit ⊢—⊣
Unconfined Compression % Strain at Failure ⊗
Penetrometer ▲



Soil Description	ELEV. m
Ground Surface	100.00
PAVEMENT - 60mm asphalt over granular bases.	99.93
SILTY CLAY - firm to soft, - very soft below 3.0m, - grey, - thin layers of silty sand, - moist, wet below 2.0m.	99.01
END OF BOREHOLE	93.45

NOTE:
On completion, no free water in borehole.



LGBE3 2510 ST LAURAN1.GPJ 06/02/04

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Time	Water Level (m)	Depth to Cave (m)

Project No. 03 LPL 789

Log of Borehole 302

Dwg No. D2

Sheet No. 1 of 1

Project: Proposed Commercial Development

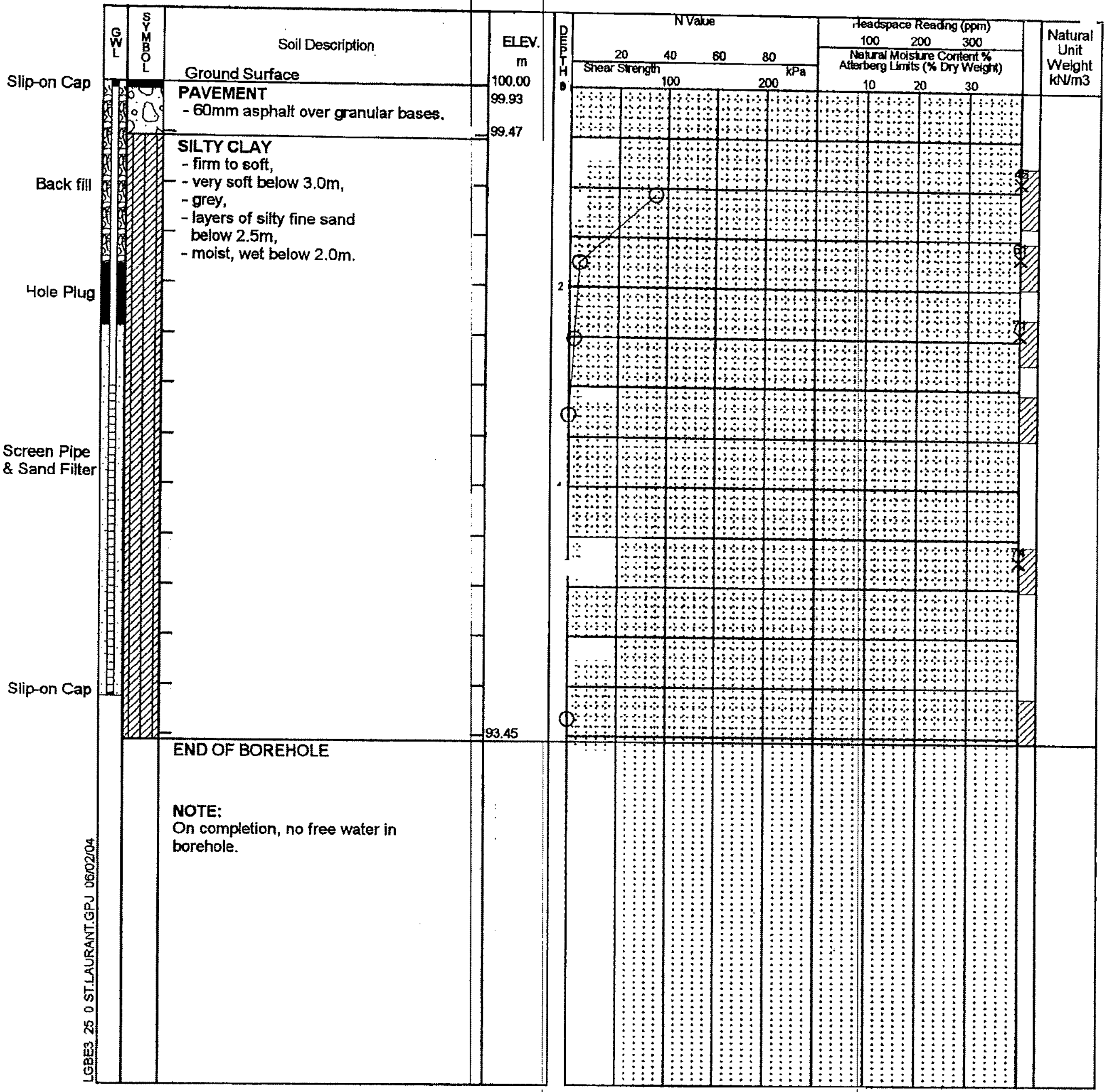
Location: 2510 St. Laurent Blvd., Ottawa

Date Drilled: 05/03/03

Drill Type:

Datum:

Auger Sample	☒	Headspace Reading (ppm)	
SPT (N) Value	○ ▨	Natural Moisture	×
Dynamic Cone Test	—	Plastic and Liquid Limit	├─┤
Shelby Tube	■	Unconfined Compression % Strain at Failure	⊗
Field Vane Test	✚ S	Penetrometer	▲



PAVEMENT
- 60mm asphalt over granular bases.

SILTY CLAY
- firm to soft,
- very soft below 3.0m,
- grey,
- layers of silty fine sand below 2.5m,
- moist, wet below 2.0m.

END OF BOREHOLE

NOTE:
On completion, no free water in borehole.

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Time	Water Level (m)	Depth to Cave (m)

Project No. 03 LPL 789

Log of Borehole 303

Dwg No. D3

Sheet No. 1 of 1

Project: Proposed Commercial Development

Location: 2510 St. Laurent Blvd., Ottawa

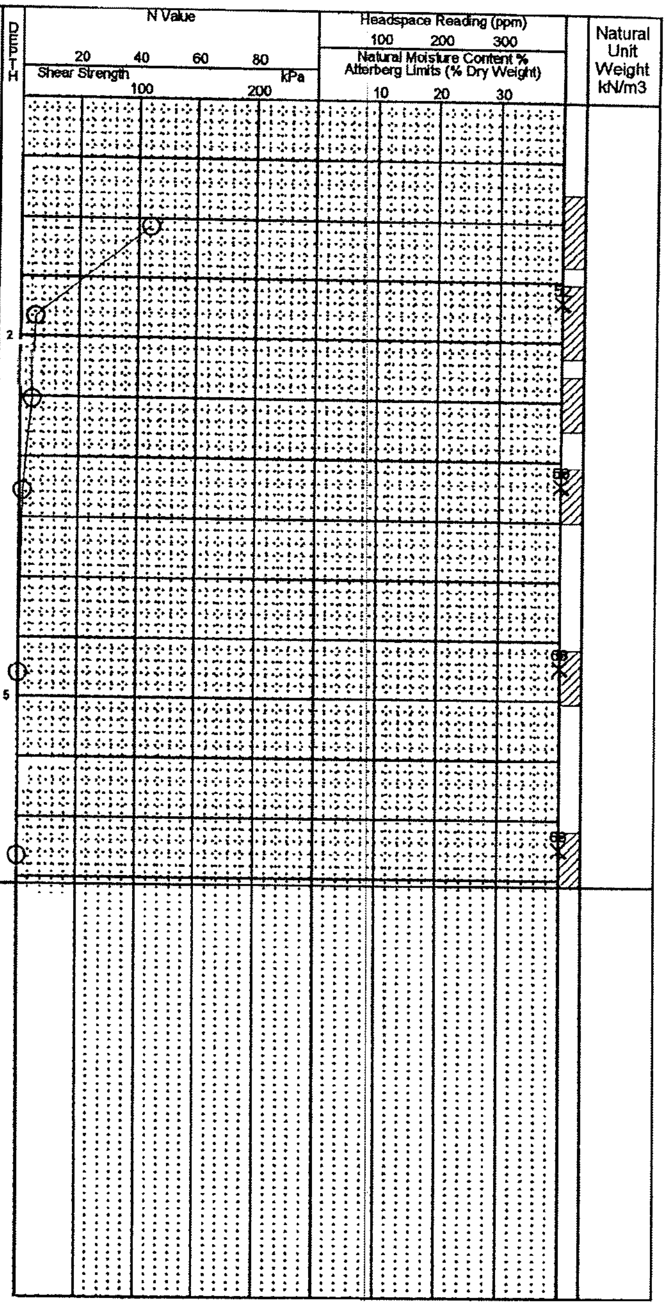
Date Drilled: 05/03/03

Drill Type:

Datum:

Auger Sample	☒	Headspace Reading (ppm)	•
SPT (N) Value	○ ▨	Natural Moisture	×
Dynamic Cone Test	—	Plastic and Liquid Limit	├─┤
Shelby Tube	■	Unconfined Compression % Strain at Failure	⊗
Field Vane Test	✚ S	Penetrometer	▲

GWL	SYMBOL	Soil Description	ELEV. m
		Ground Surface	100.00
		PAVEMENT - 50mm asphalt over granular bases.	99.95
		SILTY CLAY - firm to soft, - very soft below 3.0m, - grey, - layers of silty fine sand below 4.0m, - moist, wet below 3.0m.	99.34
		END OF BOREHOLE NOTE: On completion, borehole caved-in at 6.1m.	93.45



LGBE3 2510 S. LAURANT.GPJ 06/02/04

NOTE: THE BOREHOLE DATA NEEDS INTERPRETATION ASSISTANCE BY TORONTO INSPECTION LTD. BEFORE USE BY OTHERS

Toronto Inspection Ltd.

Time	Water Level (m)	Depth to Cave (m)

'oject 03 LPL 789

Log o Boreho e 304

Dwg D4

No.

Project: Proposed Commercial Development

Location: 2510 St Laurent Blvd , Ottawa

Date Drilled: 05/03/03

Drill Type ruck mounted

Ground Surface

Auger Sample

Dynamic Cone ○

Field Vane

Headspace Reading (ppm)

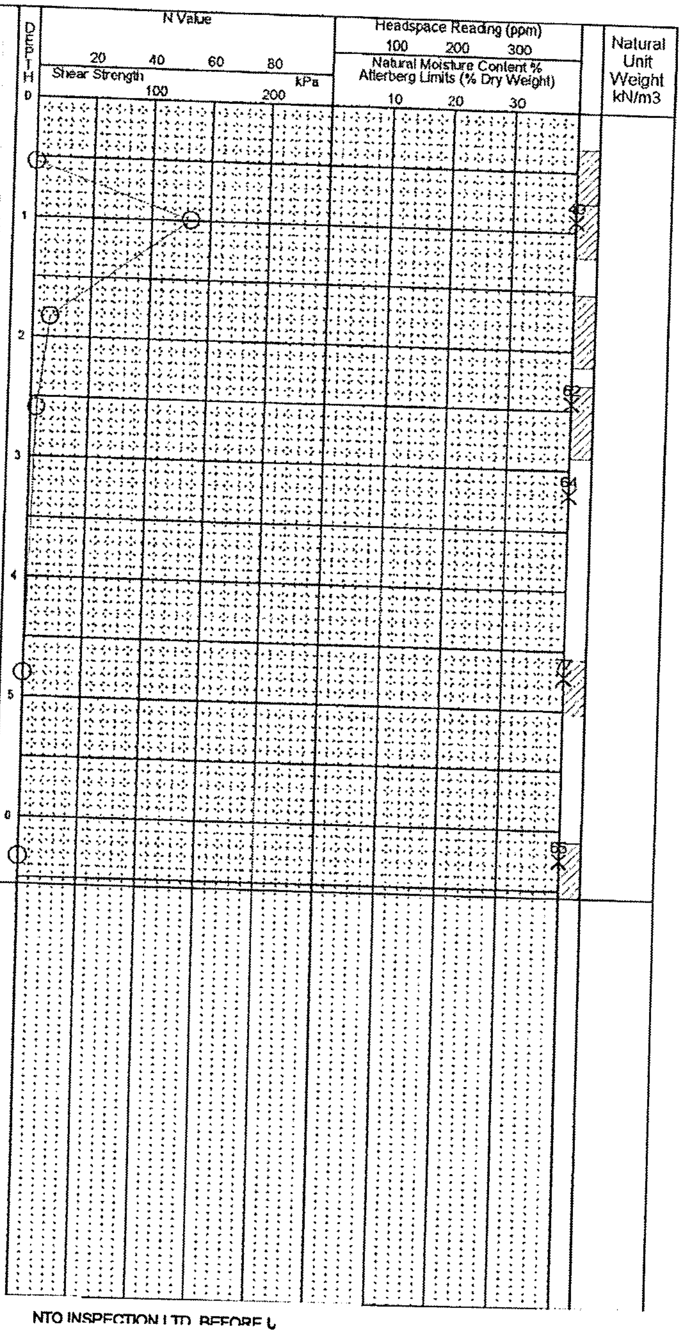
Natural Moisture

Liquid Limit

Unconfined Compression
% Strain at Failure

Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m
		Ground Surface	100.00
		PAVEMENT - 60mm asphalt over granular bases.	99.93
		SILTY CLAY - firm to soft, - very soft below 3.0m, - grey, - layers of silty fine sand below 4.0m, - moist, wet below 2.5m.	99.39
		END OF BOREHOLE NOTE: On completion, borehole caved-in at 6.1m depth.	93.45



LGBE3 2510 ST.LAURANT.GPJ

NEEDS INTERPRETATION ASSISTANCE

NTO INSPECTION LTD BEFORE U

To on o n pection Ltd

Project No: 02 LPL 841

Log of Borehole 402

Toronto Inspection Ltd.

Project: Proposed Commercial Development

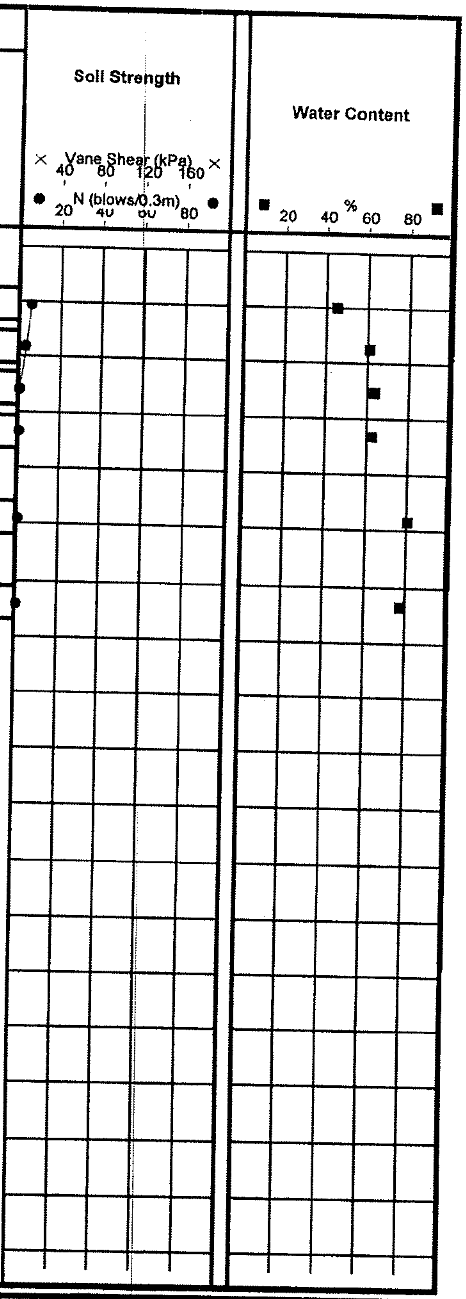
Client: Loblaw Properties Limited

Location: 3000 Conroy Road, Ottawa

Drawing No.: E2

Field Technician: BS

SUBSURFACE PROFILE				SAMPLE		
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		SAND AND GRAVEL				
		SILTY CLAY - firm to soft, very soft below 2.2m, - brownish grey, grey below 3.0m, - low to medium plasticity, - wet.		1	SS	5
				2	SS	3
				3	SS	1
				4	SS	1
				5	SS	1
			-6.71	6	SS	1
		End of Borehole				
		Upon completion of drilling: - W.L. at 2.4m depth.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Drill Date: May 31, 2003

Hole Size: 210mm

Driller: George Downing

Checked by: BS

Sheet: 1 of 1

Toronto Inspection Ltd.

Project No: 02 LPL 841

Log of Borehole 403

Project: Proposed Commercial Development

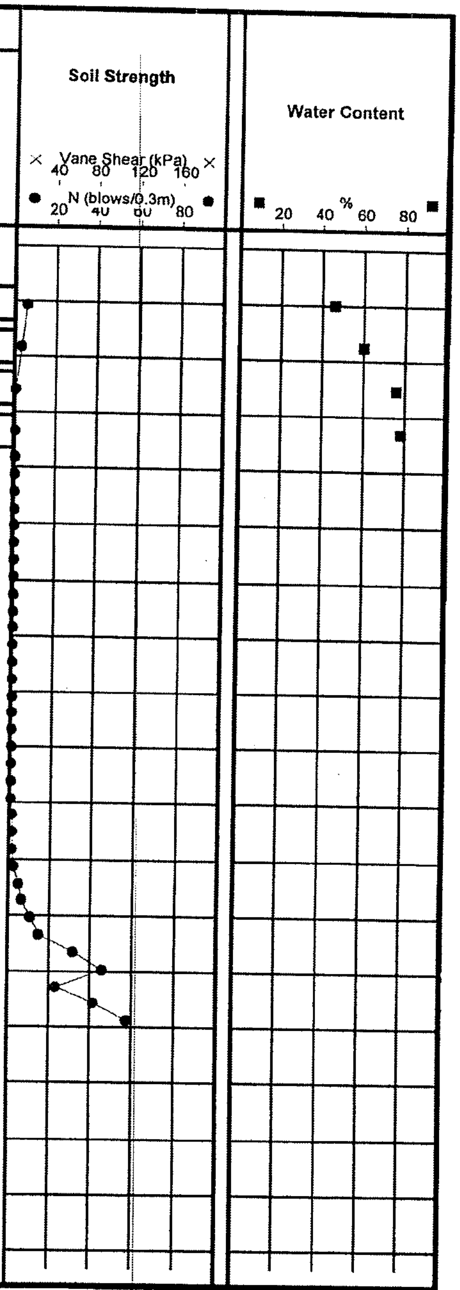
Client: Loblaw Properties Limited

Location: 3000 Conroy Road, Ottawa

Drawing No.: E3

Field Technician: BS

SUBSURFACE PROFILE				SAMPLE		
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		SAND AND GRAVEL				
1		*SILTY CLAY* - firm to soft, very soft below 2.2m, - brownish grey, grey below 3.0m, - low to medium plasticity, - wet.		1	SS	6
2				2	SS	4
3				3	SS	1
			-3.66	4	SS	1
4–13		*NOT SAMPLED*				
14		End of Borehole	-14			
15–18		Upon completion of drilling: - W.L. at 2.7m depth.				



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Drill Date: May 31, 2003

Hole Size: 210mm

Driller: George Downing

Checked by: BS

Sheet: 1 of 1

Toronto Inspection Ltd.

Project No: 02 LPL 841

Log of Borehole 404

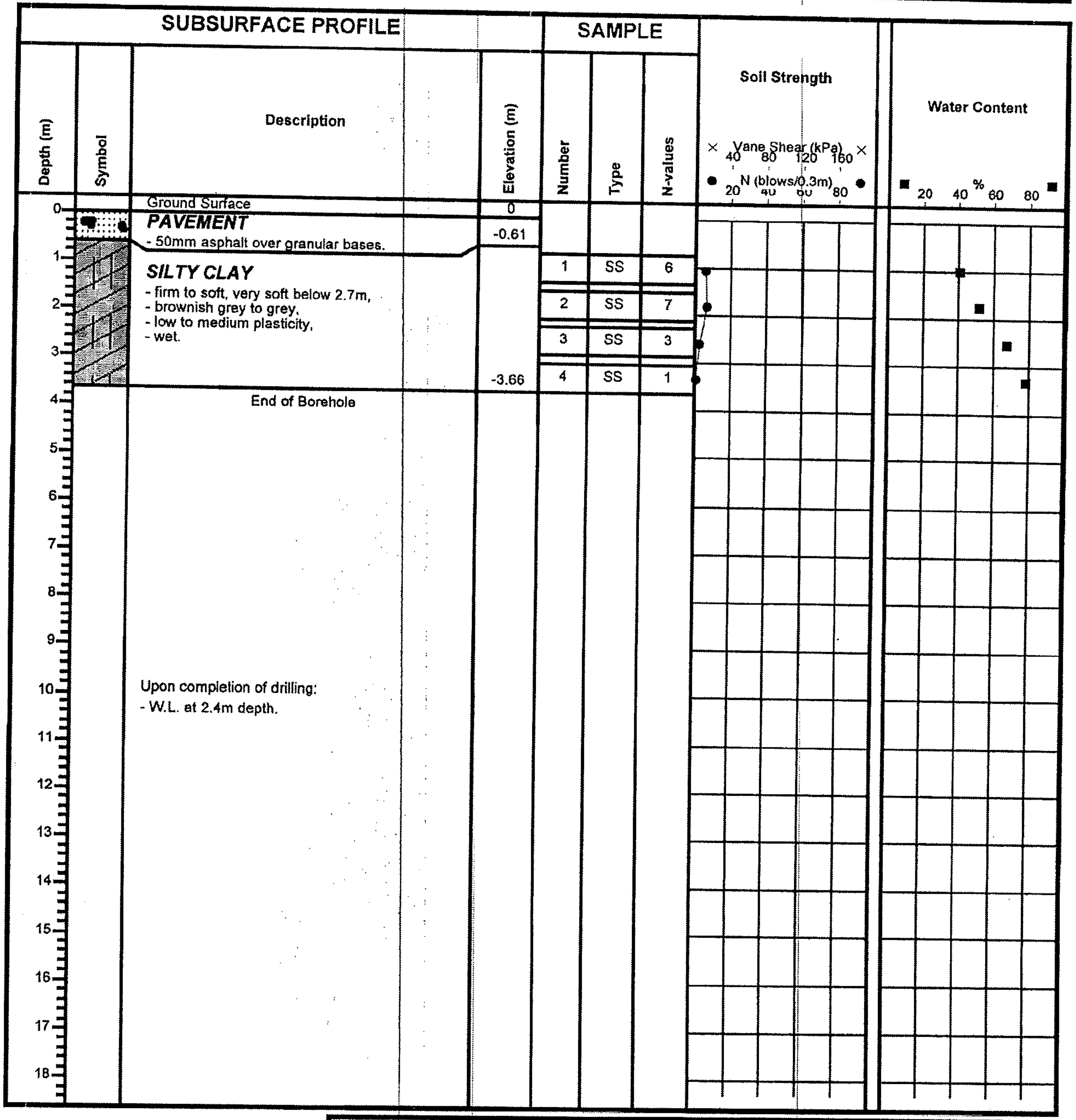
Project: Proposed Commercial Development

Client: Loblaw Properties Limited

Location: 3000 Conroy Road, Ottawa

Drawing No.: E4

Field Technician: BS



Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		PAVEMENT - 50mm asphalt over granular bases.	-0.61			
		SILTY CLAY - firm to soft, very soft below 2.7m, - brownish grey to grey, - low to medium plasticity, - wet.		1	SS	6
				2	SS	7
				3	SS	3
			-3.66	4	SS	1
4		End of Borehole				

Upon completion of drilling:
- W.L. at 2.4m depth.

Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering

Drill Date: May 31, 2003

Hole Size: 210mm

Driller: George Downing

Checked by: BS

Sheet: 1 of 1

Toronto Inspection Ltd.

Project No: 02 LPL 841

Log of Borehole 405

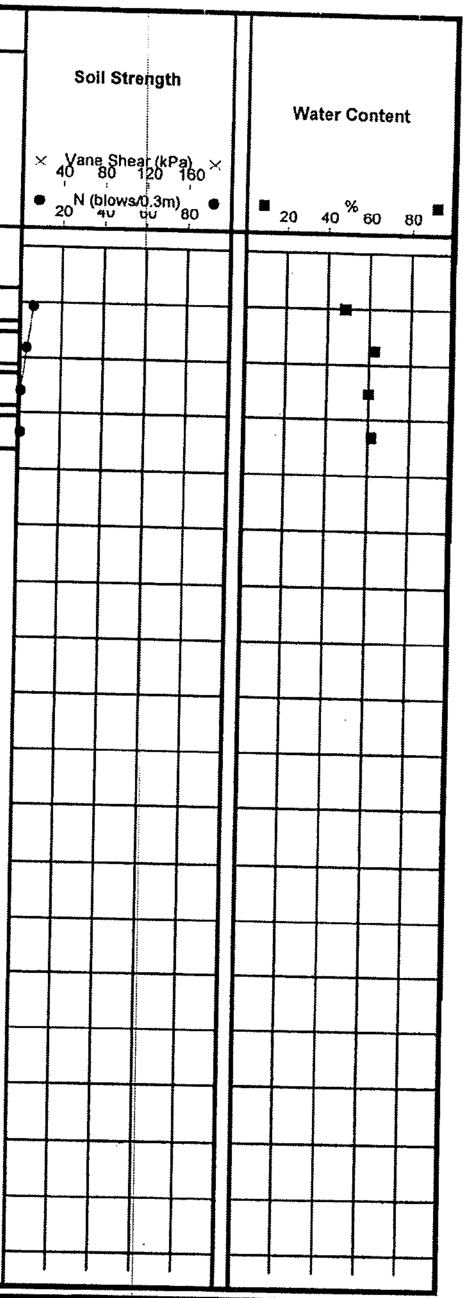
Project: Proposed Commercial Development
Client: Loblaw Properties Limited
Location: 3000 Conroy Road, Ottawa

Drawing No.: E5
Field Technician: BS

SUBSURFACE PROFILE / SAMPLE

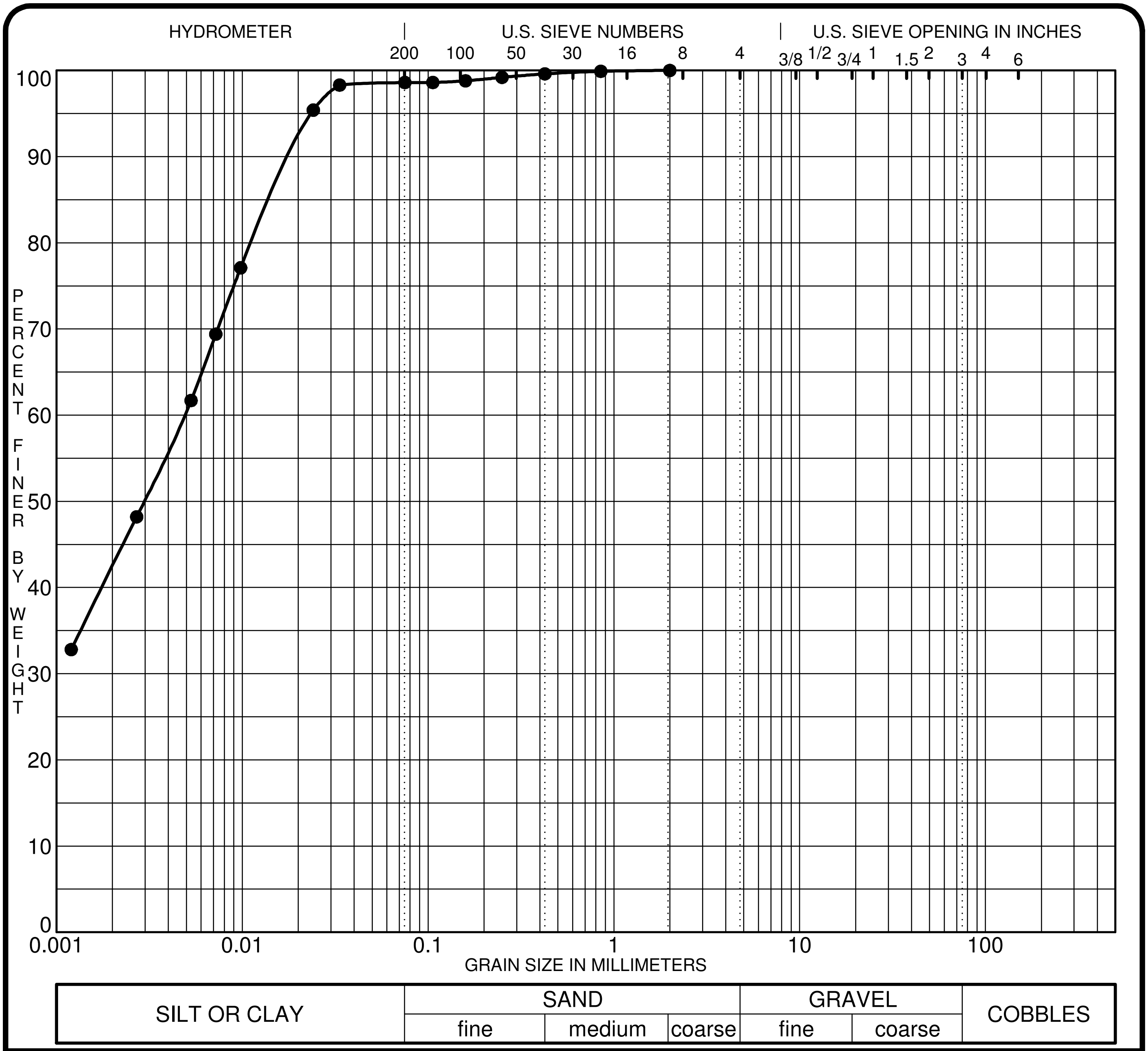
Depth (m)	Symbol	Description	Elevation (m)	Number	Type	N-values
0		Ground Surface	0			
		SAND AND GRAVEL	-0.457			
		SILTY CLAY - firm to soft, very soft below 2.4m, - brownish grey to grey, - low to medium plasticity, - wet.		1	SS	7
				2	SS	4
				3	SS	1
			-3.66	4	SS	1
		End of Borehole				

Upon completion of drilling:
- W.L. at 2.7m depth.



Toronto Inspection Ltd.
110 Konrad Cr., Unit 16
Markham, Ont. L3R 9X2
Tel.: 905 940-8509
Fax: 905 940-8192

Drill Method: Hollow stem augering
Drill Date: May 31, 2003
Hole Size: 210mm
Driller: George Downing
Checked by: BS
Sheet: 1 of 1



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 4-22**	**SS5**	**CH - Inorganic clays of high plasticity**						
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 4-22**	**SS5**	**2.00**	**0.00**			**0.0**	**1.4**	**98.6**	
⊠										
▲										
★										

CLIENT

PROJECT **Geotechnical Investigation - Proposed Development - Walkley Lands**

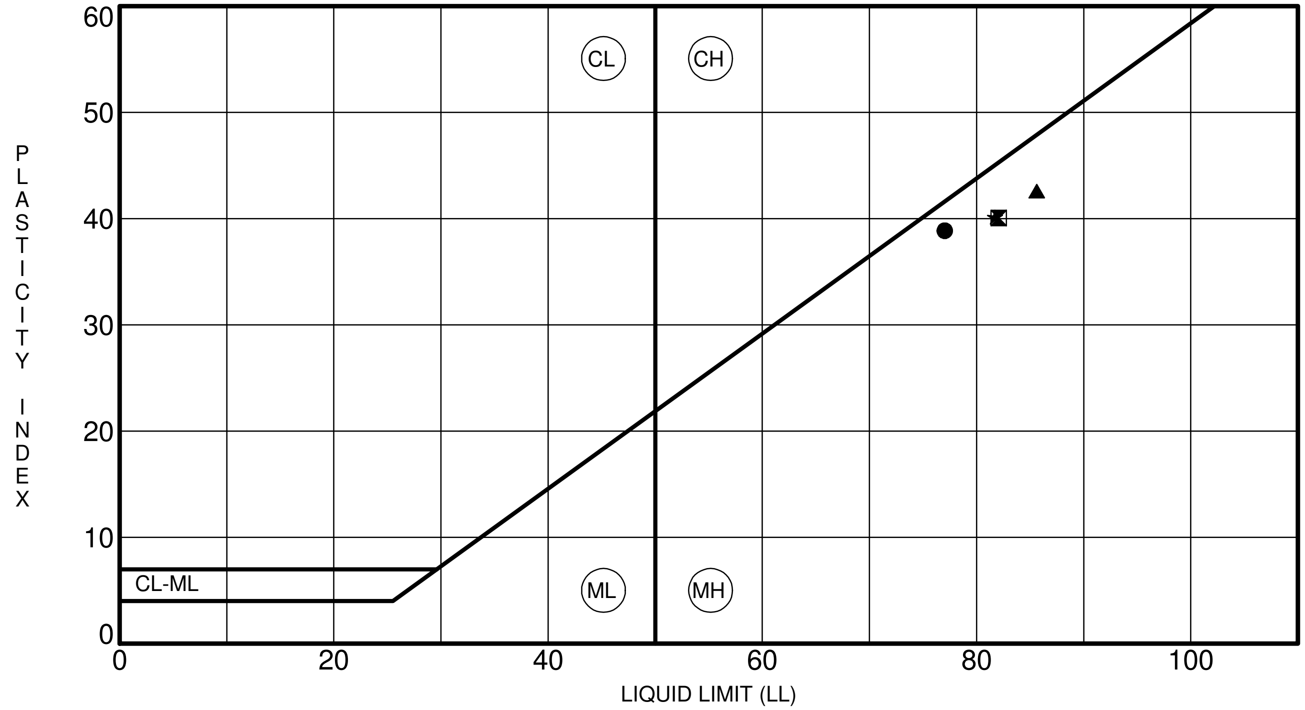
FILE NO. **PG6149**

DATE **7 Mar 22**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-22**	**SS4**	**77**	**38**	**39**		**CH - Inorganic clays of high plasticity**
⧗	**BH 4-22**	**SS3**	**82**	**42**	**40**		**CH - Inorganic clays of high plasticity**
▲	**BH 5-22**	**SS3**	**86**	**43**	**43**		**CH - Inorganic clays of high plasticity**
★	**BH11-22**	**SS3**	**82**	**42**	**40**		**CH - Inorganic clays of high plasticity**

CLIENT

PROJECT **Geotechnical Investigation - Proposed Development - Walkley Lands**

FILE NO. **PG6149**

DATE **9 Mar 22**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Claridge Homes	DEPTH	10'-0" to 12'-0"	FILE NO.:	PG6149
PROJECT:	1890 Walkley Road	BH OR TP No:	BH1-22 SS4	DATE SAMPLED	9-Mar
LAB No:	31930	TESTED BY:	DJ / CP / CS	DATE RECEIVED	11-Mar
SAMPLED BY:	DI	DATE REPORTED:		DATE TESTED	14-Mar

LABORATORY INFORMATION & TEST RESULTS

Moisture	**No. of Blows(8)**	**Calibration (Two Trials)**	**Tin NO.(x22)**	
Tare	4.98	Tin	4.87	4.87
Soil Pat Wet + Tare	60.33	Tin + Grease	4.99	4.99
Soil Pat Wet	55.35	Glass	48.97	48.97
Soil Pat Dry + Tare	32.34	Tin + Glass + Water	91.41	91.34
Soil Pat Dry	27.36	Volume	37.45	37.38
Moisture	**102.30**	**Average Volume**	**37.42**	

Soil Pat + String	27.48
Soil Pat + Wax + String in Air	30.69
Soil Pat + Wax + String in Water	10.73
Volume Of Pat (Vdx)	19.96

RESULTS:

Shrinkage Limit	**25.32**
Shrinkage Ratio	**1.673**
Volumetric Shrinkage	**128.792**
Linear Shrinkage	**24.108**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33932

Report Date: 14-Mar-2022

Order Date: 9-Mar-2022

Project Description: PG6149

	Client ID:	BH1-22 SS3	-	-	-
	Sample Date:	08-Mar-22 09:00	-	-	-
	Sample ID:	2211343-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	68.6	-	-	-
General Inorganics					
pH	0.05 pH Units	7.19	-	-	-
Resistivity	0.10 Ohm.m	57.2	-	-	-
Anions					
Chloride	5 ug/g dry	9	-	-	-
Sulphate	5 ug/g dry	88	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURES 2 TO 5 – AERIAL PHOTOGRAPHS (1976, 2002, 2007, and 2019)

DRAWING PG6149-1 – TEST HOLE LOCATION PLAN

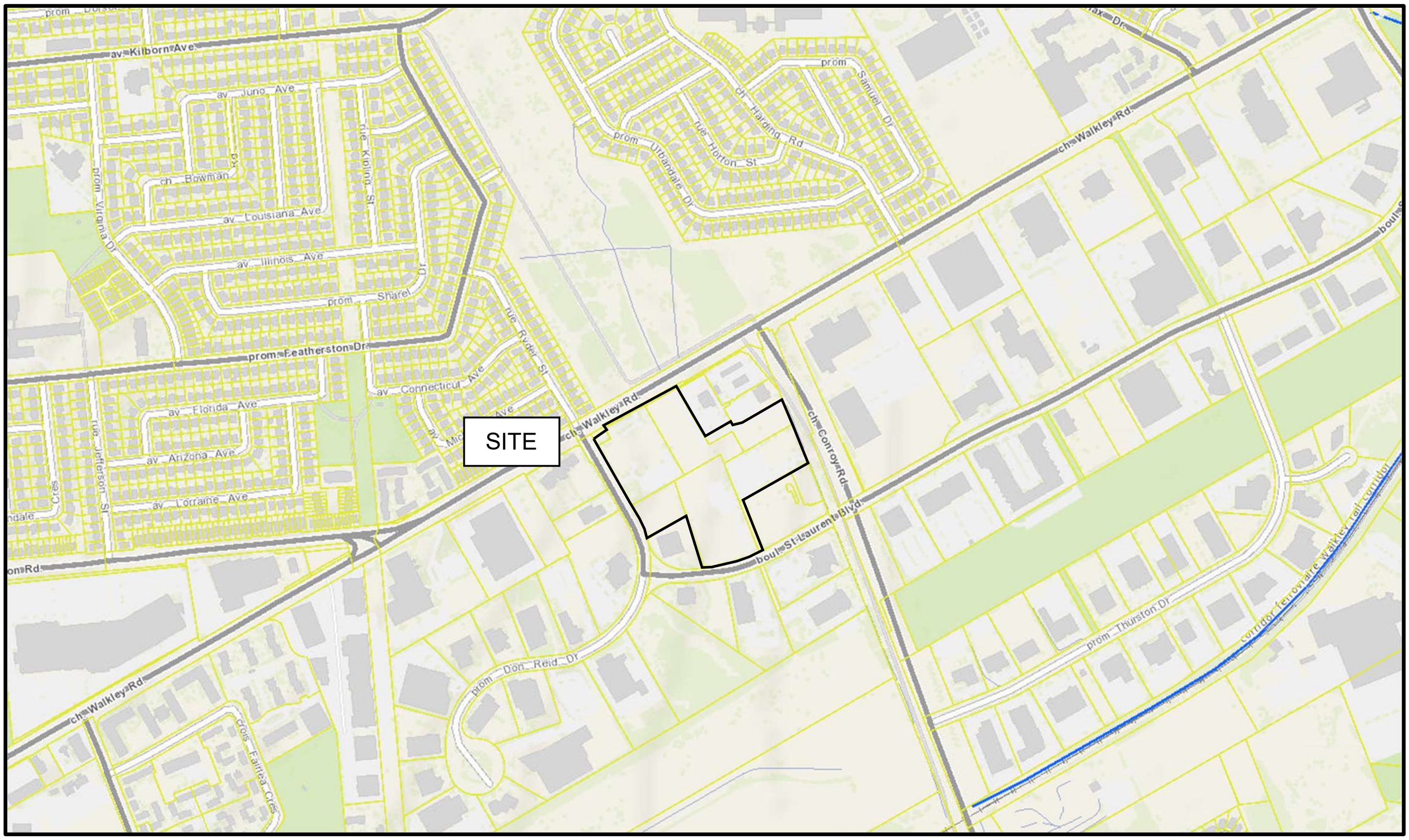


FIGURE 1

KEY PLAN

FIGURE 2

Aerial Photograph - 1976

FIGURE 3

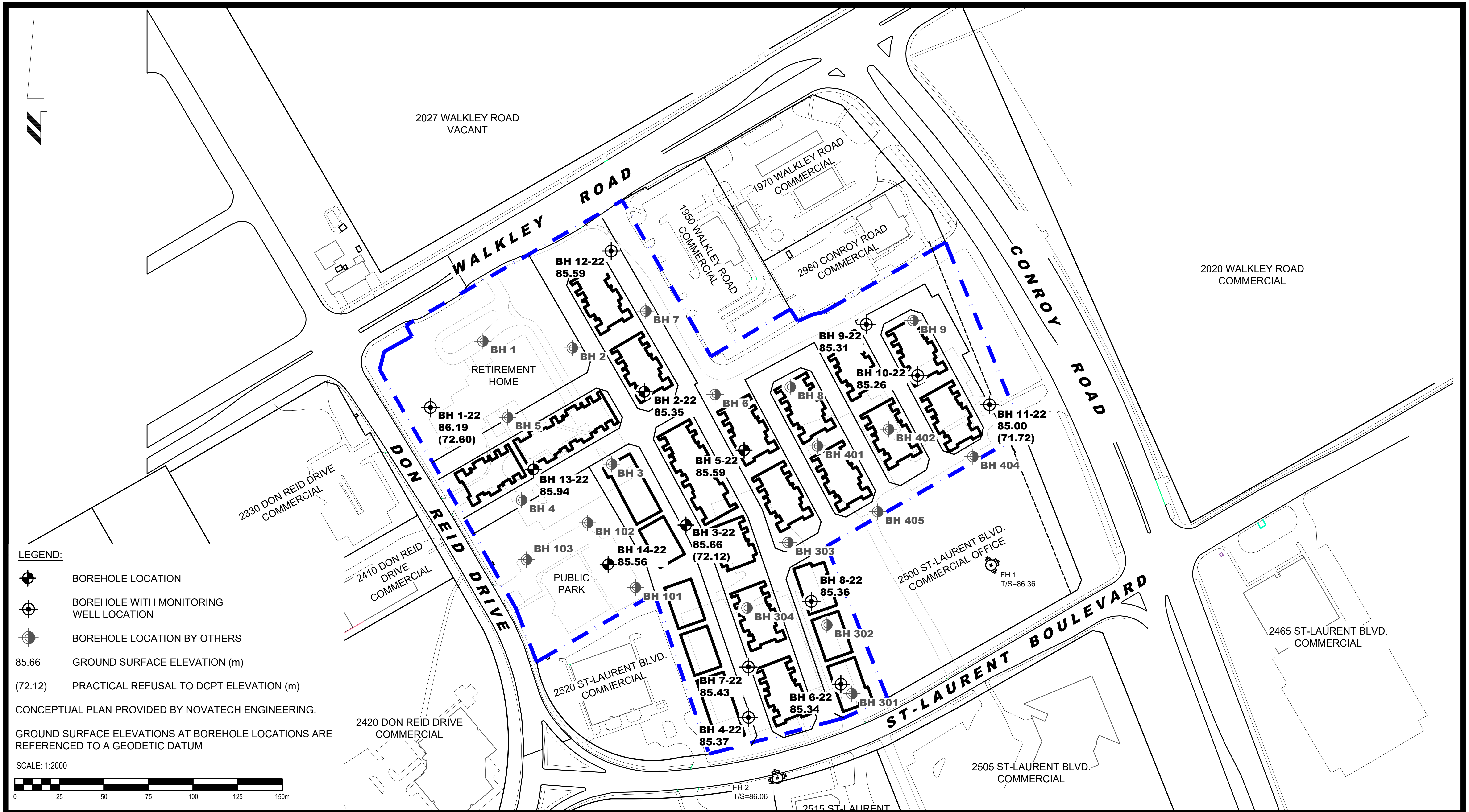
Aerial Photograph - 2002

FIGURE 4

Aerial Photograph - 2007

FIGURE 5

Aerial Photograph - 2019



LEGEND:

⊕	BOREHOLE LOCATION
⊕	BOREHOLE WITH MONITORING WELL LOCATION
◐	BOREHOLE LOCATION BY OTHERS
85.66	GROUND SURFACE ELEVATION (m)
(72.12)	PRACTICAL REFUSAL TO DCPT ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY NOVATECH ENGINEERING.

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

SCALE: 1:2000

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

CLARIDE HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
WALKLEY LANDS

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:2000	Date: 04/2022
Drawn by: YA	Report No.: PG6149-1
Checked by: FC	Dwg. No.: PG6149-1
Approved by: SD	Revision No.:

p:\autocad drawings\geotechnical\pg61xx\pg6149\pg6149-1-test hole location plan.dwg