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Geotechnical Engineering

Environmental Engineering

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Materials Testing

Building Science

Archaeological Services

Geotechnical Investigation

Proposed Residential Development
4623 & 4725 Spratt Road
Ottawa, Ontario

Prepared For

Claridge Homes

December 10, 2018

Report: PG4730-1

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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 4623 and 4725 Spratt Road in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation were to:

- ☐ determine the subsurface soil and groundwater conditions by means of boreholes.
- ☐ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect its design.

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

2.0 Proposed Development

Based on available drawings, it is understood that the proposed development will consist of low rise residential buildings with local roadways, parking and landscaped areas. It is also expected that the development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation consisted of 9 boreholes which were drilled to a maximum depth of 6.4 m on November 28 through 30, 2018. The test hole locations were determined in the field by Paterson personnel and distributed in a manner to provide general coverage of the proposed residential development taking into consideration site features and underground utilities. The test hole locations are presented on Drawing PG4730-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a track-mounted auger drill rig operated by a two-person crew. The borehole procedures consisted of augering to the required depths at the selected locations and sampling the overburden. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department.

Sampling and In Situ Testing

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

Standard Penetration Testing (SPT) was conducted and 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 sample 300 mm into the soil after a 150 mm initial penetration with a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was conducted at regular intervals in cohesive soils and completed using a MTO field vane apparatus.

The overburden thickness was evaluated by dynamic cone penetration tests (DCPTs) at boreholes BH 4 and BH 7. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

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

Groundwater

Flexible standpipes were installed in the boreholes during the field investigation to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples from the investigation will be stored in the laboratory for a period of one month after issuance of this report. The samples will then be discarded unless directed otherwise.

3.2 Field Survey

The test hole locations were selected by Paterson, and located and surveyed in the field by Annis, O'Sullivan, Vollebekk Limited. The ground surface elevations at the test hole locations are referenced to a geodetic datum. The test hole locations are presented on Drawing PG4730-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging. Gradation and Atterberg Limits testing were also completed on select samples obtained from the geotechnical investigation. The results of this testing are provided in Section 4.2.

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 sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site consists mostly of agricultural lands with some brush covered areas. The site is bordered by agricultural properties to the east and south, Spratt Road to the west, and a combination of residential and agricultural properties to the north. Existing ground surface across the site slope downward gradually from east to west, from approximately elevation 95 to 92 m.

Also, based on available aerial photos, structures were previously located in the southeast portion of the site.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test holes on the western and northern portions of the site (boreholes BH 1, BH 2, BH 7, BH 8, and BH 9) consists of a thin topsoil layer underlain by silty sand to clayey silt. Where encountered, the silty sand to clayey silt had a thickness of approximately 0.9 to 3.5 m.

A silty clay deposit was encountered directly underlying the topsoil in boreholes BH 3 and BH 4, and underlying the silty sand to clayey silt in boreholes BH 1, BH 2, BH 7, BH 8, and BH 9. The silty clay was observed to consist of a very stiff to firm, brown to grey silty clay, and, where penetrated, had an approximate thickness of 1.8 to 3.7 m.

A glacial till deposit was encountered underlying the silty sand, clayey silt, and/or silty clay at approximate depths ranging from 0.6 m at the southern end of the site to 5.3 m at the northern end of the site. The glacial till deposit was generally observed to consist of a compact to very dense, grey silty sand with gravel, cobbles, and boulders.

Practical refusal to the DCPTs was encountered at depths of 7.8 m and 7.9 m in boreholes BH 4 and BH 7, respectively. Practical refusal of the augers was also encountered at an approximate depth of 0.9 m in borehole BH 6, in the southeast portion of the site.

Refer to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of interbedded sandstone and dolomite of the March formation with drift thicknesses of 5 to 15 m.

Laboratory Testing

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples at selected locations throughout the subject site. The results of the Atterberg limits tests are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The tested silty clay samples classify as inorganic clays of high plasticity (CH) or inorganic clay of low plasticity (CL) in accordance with the Unified Soil Classification System.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 1	2.59	73.2	21.8	51.4	80.7	CH
BH 2	2.59	75.2	21.6	53.6	72.3	CH
BH 3	3.35	38.2	18.0	20.2	40.6	CH
BH 4	0.91	37.2	20.7	16.5	29.6	CL
BH 7	2.59	45.1	19.3	25.8	45.7	CL
BH 8	3.35	60.9	19.8	41.1	55.6	CH
BH 9	2.59	34.6	15.6	19.0	32.6	CL

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

The results of the shrinkage limit test indicate a shrinkage limit of 22% and a shrinkage ratio of 1.73. Grain size distribution (sieve and hydrometer analysis) was also completed on two (2) selected soil samples. The results of the grain size analysis are summarized in Table 2 and presented on the Grain Size Distribution Results sheets in Appendix 1.

Table 2 - Summary of Grain Size Distribution Analysis

Test Hole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 2	SS4	0	1.4	46.1	52.5
BH 8	SS5	0	36.5	34.0	29.5

4.3 Groundwater

The measured groundwater levels are summarized below in Table 1 and presented on the Soil Profile and Test Data sheets in Appendix 1. It should be noted that surface water can become perched within a backfilled borehole, which can lead to higher than normal groundwater level readings. The long-term groundwater level can also be estimated based on the recovered soil samples' moisture levels, colouring and consistency. Based on these observations, the long-term groundwater level is anticipated at a 2 to 3 m depth. Groundwater levels are subject to seasonal fluctuations and could vary at the time of construction.

Table 3 - Summary of Groundwater Level Readings

Test Hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Date
BH 1	92.23	1.19	91.04	December 7, 2018
BH 2	92.27	Piezometer Frozen	-	December 7, 2018
BH 3	93.02	2.80	90.22	December 7, 2018
BH 4	92.68	Piezometer Blocked	-	December 7, 2018
BH 5	94.29	0.98	93.31	December 7, 2018
BH 7	92.47	1.01	91.46	December 7, 2018
BH 8	93.20	2.73	90.47	December 7, 2018
BH 9	92.35	1.07	91.28	December 7, 2018

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed residential development. It is expected that low rise, wood framed buildings could be founded on conventional spread footings placed on an undisturbed, silty sand, silty clay, glacial till or surface-sounded bedrock bearing surface.

Should existing grades be raised at the site for the proposed development, it is expected that several options, such as engineered fill or well graded blast rock, would act as suitable subgrade material for the proposed buildings provided the material is adequately placed and approved by the geotechnical consultant at the time of placement.

A permissible grade raise restriction is required for grading around the proposed buildings where the silty clay layer is present.

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

5.2 Site Grading and Preparation

Stripping Depth

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

Fill Placement

Fill used 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 material. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts compacted by the tracks of the spreading equipment to minimize voids. If the material is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Bedrock Removal

In areas where shallow bedrock is encountered, and only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming. However, dependent on the quantity and condition of the bedrock, line-drilling in conjunction with hoe-ramming may be required to remove the bedrock.

Vibration Considerations

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

Two parameters determine the recommended vibration limit: the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people. A pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed building.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, silty sand, sandy silt, clayey silt or firm silty clay bearing surface 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**.

Footings placed on an undisturbed, very stiff to stiff silty clay or glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

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.

Footings placed on clean, surface-sounded bedrock can be designed using a bearing resistance value at SLS of **500 kPa** and a factored bearing resistance value at ULS of **750 kPa**. A clean, weathered bedrock surface consists of one from which all topsoil, soils, deleterious materials and loose rock have been removed prior to concrete placement.

Footings placed over an approved engineered fill bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

Footings designed using the bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support. Adequate lateral support is provided to a silty sand, silty clay or glacial till bearing medium when a plane extending down and out from the bottom edge of the footing, at a minimum of 1.5H:1V.

Permissible Grade Raise Restrictions

Consideration must also be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For buildings, a minimum value of 50% of the live load is often recommended by Paterson. A post-development groundwater lowering of 0.5 m was assumed.

Our permissible grade raise recommendations for the proposed residential development are presented in Drawing PG4730-2 - Permissible Grade Raise Plan in Appendix 2.

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 subject site can be taken as seismic site response **Class C** as defined in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012 for foundations considered at this site. A site specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed residential development.

The soils underlying the site are not susceptible to liquefaction. Reference should be made to the latest revision of the 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 from within the footprint of the proposed buildings, the native soil surface or approved engineered fill surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

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

For structures with basement slabs, it is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone.

For any structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

5.6 Pavement Structure

For design purposes, the following pavement structures, presented below, are recommended for the design of car parking areas, bus turning areas and access lanes. It is anticipated that the pavement structures for local road and bus routes would be adequate for use as a fire route.

Table 4 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course** - HL 3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II

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

Table 5 - Recommended Pavement Structure
Local Roads

Thickness (mm)	Material Description
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** 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

Table 6 - Recommended Pavement Structure - Bus Routes

Thickness (mm)	Material Description
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course** - Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course -** Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
600	**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

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.

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 I or Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping 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 its load carrying capacity.

Where silty clay is anticipated at subgrade level, consideration should be given to installing subdrains during the pavement construction. The sub-drain inverts should be approximately 300 mm below subgrade level and run longitudinal along the curblines. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated and corrugated plastic pipe surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a 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 materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as Miradrain G100N) connected to a drainage system is provided.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should 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 excavations to be undertaken by open-cut methods (i.e. unsupported excavations).

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

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should 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.

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.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with City of Ottawa standards and specifications.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extend at a minimum to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A crushed stone, should extend from the spring line of the pipe to a minimum of 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD.

Generally, it should be possible to re-use the moist (not wet) brown 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 re-used.

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 consist of the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

6.5 Groundwater Control

The groundwater infiltration into the excavations should be low to moderate depending on the subsurface soil conditions. The contractor should be prepared to collect and pump groundwater infiltration volumes from the excavation trenches.

A temporary MOECC permit to take water (PTTW) may be required if more than 50,000 L/day are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MOECC.

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 MOECC review of the PTTW application.

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.

6.6 Winter Construction

The subsurface soil conditions mostly consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and tarpaulins or other suitable means. 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.

The trench excavations should be constructed to avoid the introduction of frozen materials, snow or ice into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving during construction. Also, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure.

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 non-aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Paterson completed a soils review of the site to determine applicable tree planting setbacks, in accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines) for trees planted within a public right-of-way (ROW). 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 2 and 3 in Subsection 4.2 and in Appendix 1.

Based on the results of our review, two tree planting setback areas are present within the proposed development. The recommended tree planting setbacks should be reviewed by Paterson, once the proposed grading plan has been prepared. The two areas are detailed below and have been outlined on Drawing PG4730-3 - Tree Planting Setback Recommendations presented in Appendix 2.

Area 1 - Low to Medium Sensitivity Area

A low to medium sensitivity clay soil was encountered between the anticipated design underside of footing elevations and 3.5 m below finished grade as per City Guidelines in the areas outlined in Drawing PG4730-3 - Tree Planting Setback Recommendations in Appendix 2. Based on our Atterberg limits test results, the modified plasticity index does not exceed 40% in these areas. The following tree planting setbacks are recommended for the low to medium sensitivity area. 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 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.

❑ A small tree must be provided with a minimum of 25 m^3 of available soils 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), as noted on the subdivision Grading Plan.

Area 2 - High Sensitivity Area

High sensitivity clay soils were encountered between the anticipated design underside of footing elevations and 3.5 m below finished grade as per City Guidelines at the areas outlined in PG4730-3 - Tree Planting Setback Recommendations in Appendix 2. Based on our Atterberg limits test results, the modified plasticity index generally exceeds 40% in these areas. The following tree planting setbacks are recommended for these high sensitivity areas. 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 are **7.5 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 following conditions are met:

❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade 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.

❑ A small tree must be provided with a minimum of 25 m^3 of available soils 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), as noted on the subdivision Grading Plan.

Aboveground Swimming Pools

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

Aboveground Hot Tubs

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

Decks and Building Additions

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

7.0 Recommendations

The following is recommended to be completed once the site plan and development are determined:

☐ Review detailed grading plan(s) from a geotechnical perspective.

☐ Observation of all bearing surfaces prior to the placement of concrete.

☐ Observation of all subgrades prior to backfilling.

☐ Field density tests to ensure that the specified level of compaction has been achieved.

☐ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.

☐ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming the construction has been completed in general accordance with the recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our 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 hole locations, we request 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 its 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.

Scott Dennis

Scott S. Dennis, P.Eng.

LICENSED PROFESSIONAL ENGINEER
Dec. 17-2018
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution

☐ Claridge Homes (3 copies)
☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS RESULTS

GRAIN SIZE DISTRIBUTION ANALYSIS RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

BORINGS BY CME 55 Power Auger

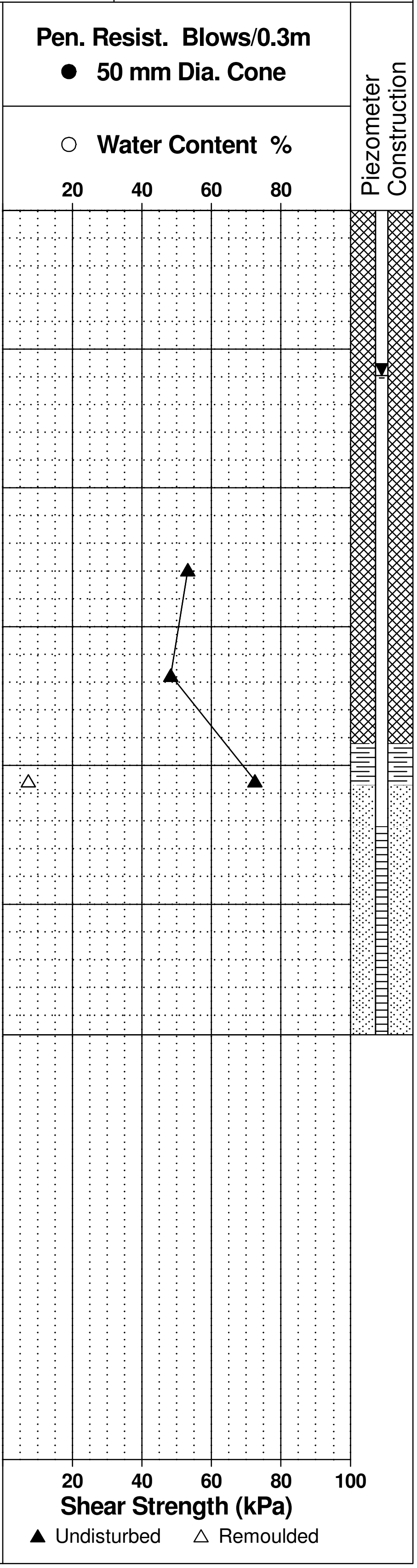
DATE November 29, 2018

FILE NO. PG4730

HOLE NO. BH 1

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE				
TOPSOIL 0.25	AU	1		
Very loose, brown **SANDY SILT**	SS	2	75	3
1.83	SS	3	100	W
Stiff to firm, grey **SILTY CLAY**	SS	4	100	P
4.27				
GLACIAL TILL: Dense to compact, grey silty sand with gravel, cobbles and boulders	SS	5	29	44
5.94	SS	6	0	29
End of Borehole (GWL @ 1.19m - Dec. 7, 2018)				

DEPTH (m)	ELEV. (m)
0	92.23
1	91.23
2	90.23
3	89.23
4	88.23
5	87.23



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

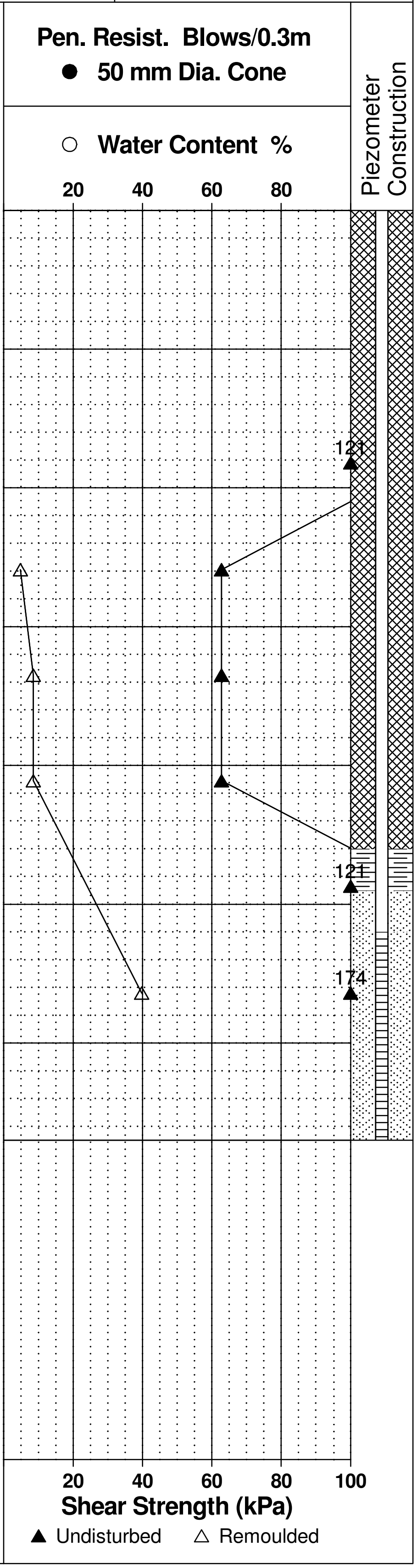
BORINGS BY CME 55 Power Auger

DATE November 29, 2018

FILE NO. PG4730

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	92.27
TOPSOIL 0.15							
Brown **CLAYEY SILT** 0.89		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	96	4	1	91.27
		SS	3		P		
- grey by 2.0m depth						2	90.27
		SS	4	50	P		
						3	89.27
4.60						4	88.27
GLACIAL TILL: Grey silty clay with sand and gravel		SS	5	96	P	5	87.27
						6	86.27
6.70		SS	6		14		
End of Borehole (Piezometer frozen - Dec. 7, 2018)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

FILE NO. **PG4730**

REMARKS

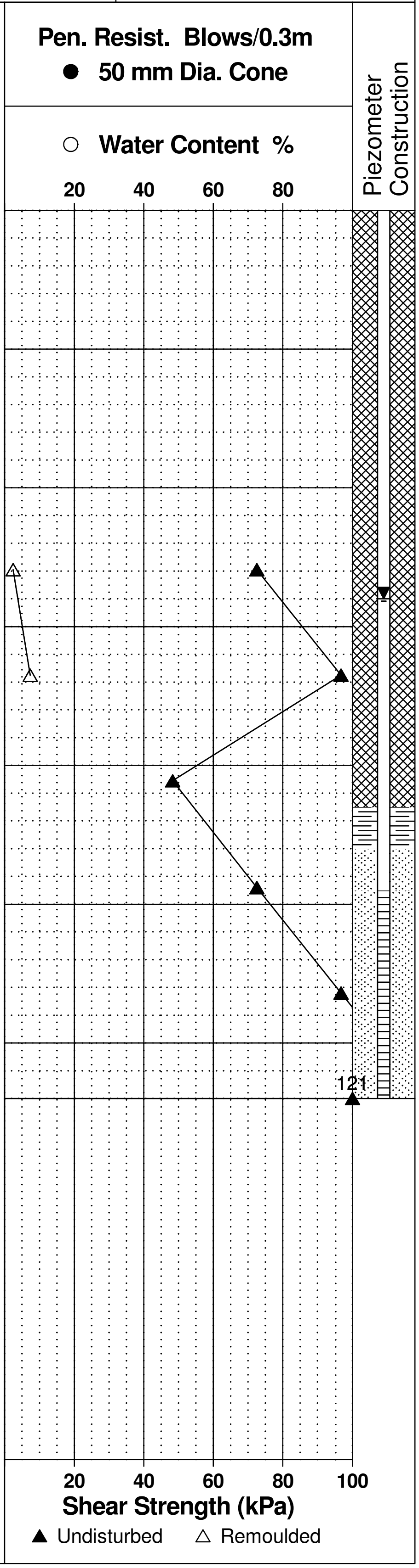
HOLE NO. **BH 3**

BORINGS BY CME 55 Power Auger

DATE November 29, 2018

SOIL DESCRIPTION	Depth to base (m)	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.30	AU	1		
Brown **SILTY CLAY,** trace sand	2.13	SS	2	71	3
		SS	3	100	2
Stiff to firm, grey **SILTY CLAY** - trace gravel below 4.6m depth	6.40	SS	4	54	P
		SS	5	100	P
End of Borehole (GWL @ 2.80m - Dec. 7, 2018)					

DEPTH (m)	ELEV. (m)
0	93.02
1	92.02
2	91.02
3	90.02
4	89.02
5	88.02
6	87.02



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 28, 2018

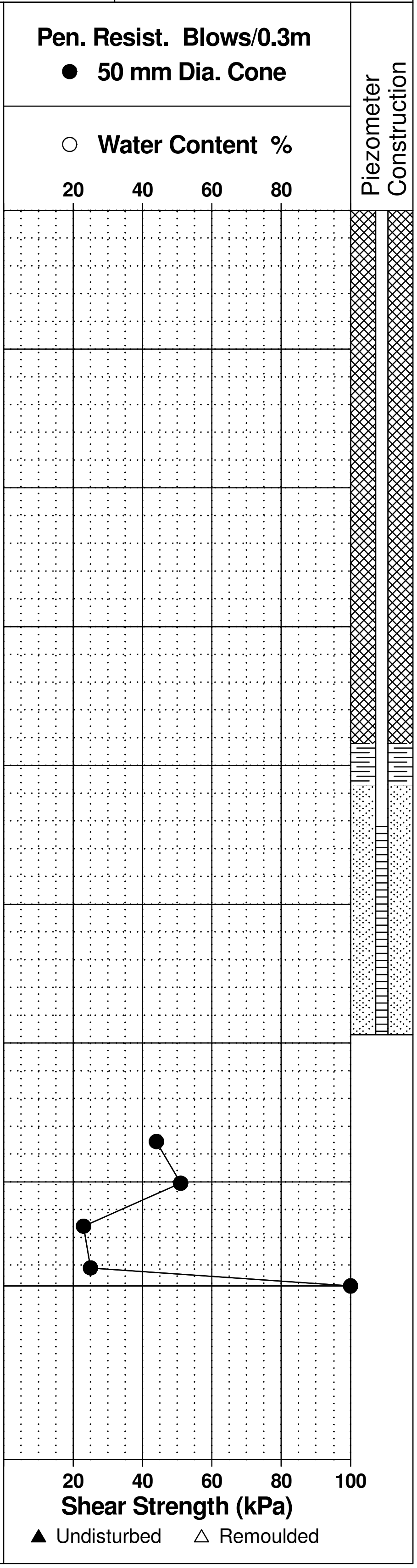
FILE NO. PG4730

HOLE NO. BH 4

SOIL DESCRIPTION	Bottom depth (m)
GROUND SURFACE	
TOPSOIL	0.30
Brown **CLAYEY SILT,** trace sand	1.37
GLACIAL TILL: Dense to compact, grey silty sand with gravel, cobbles and boulders	5.94
Dynamic Cone Penetration Test (DCPT) commenced at 5.94m depth. Inferred **GLACIAL TILL**	7.75
End of Borehole Practical DCPT refusal at 7.75m depth (Piezometer blocked - Dec. 7, 2018)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	62	2
SS	3	60	R
SS	4	100	26
SS	5	83	33
SS	6	54	23
SS	7	17	22
SS	8	38	15

DEPTH (m)	ELEV. (m)
0	92.68
1	91.68
2	90.68
3	89.68
4	88.68
5	87.68
6	86.68
7	85.68



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

BORINGS BY CME 55 Power Auger

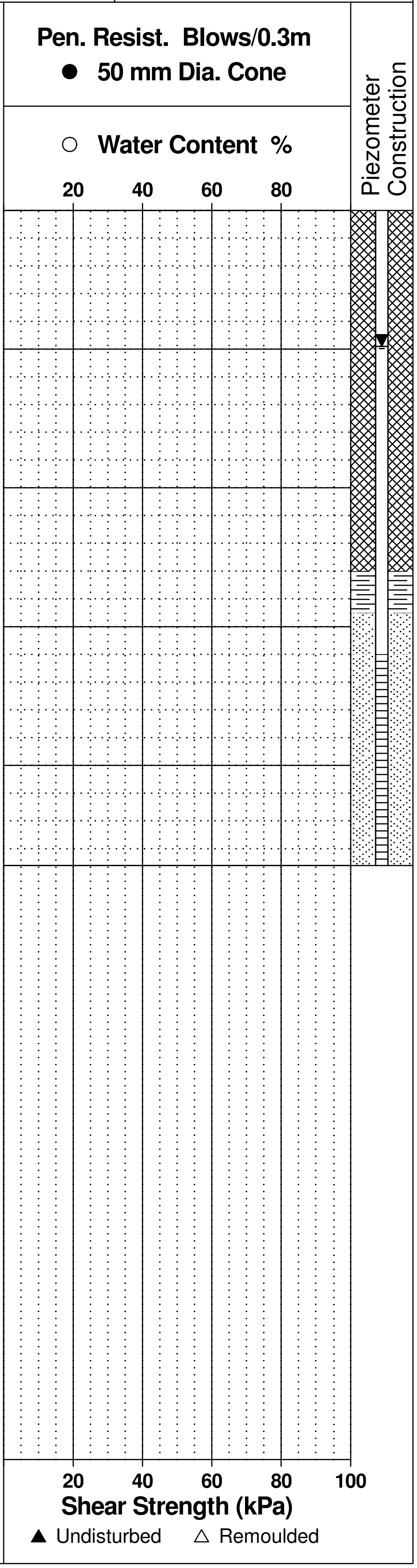
DATE November 28, 2018

FILE NO. PG4730

HOLE NO. BH 5

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.08				
FILL: Brown clayey silt, trace sand and gravel	0.60	AU	1		
GLACIAL TILL: Very dense, brown silty sand, some gravel	3.05	SS	2	67	58
		SS	3	38	33
		SS	4	88	30
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders	4.72	SS	5	75	7
		SS	6	82	6
		SS	7	100	50+
End of Borehole					
(GWL @ 0.98m - Dec. 7, 2018)					

DEPTH (m)	ELEV. (m)
0	94.29
1	93.29
2	92.29
3	91.29
4	90.29



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE November 28, 2018

FILE NO. PG4730

HOLE NO. BH 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	95.78		
TOPSOIL 0.15									
Brown **SANDY SILT,** trace clay		AU	1						
0.86		SS	2	0	50+				
End of Borehole Practical refusal to augering at 0.86m depth									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

BORINGS BY CME 55 Power Auger

DATE November 30, 2018

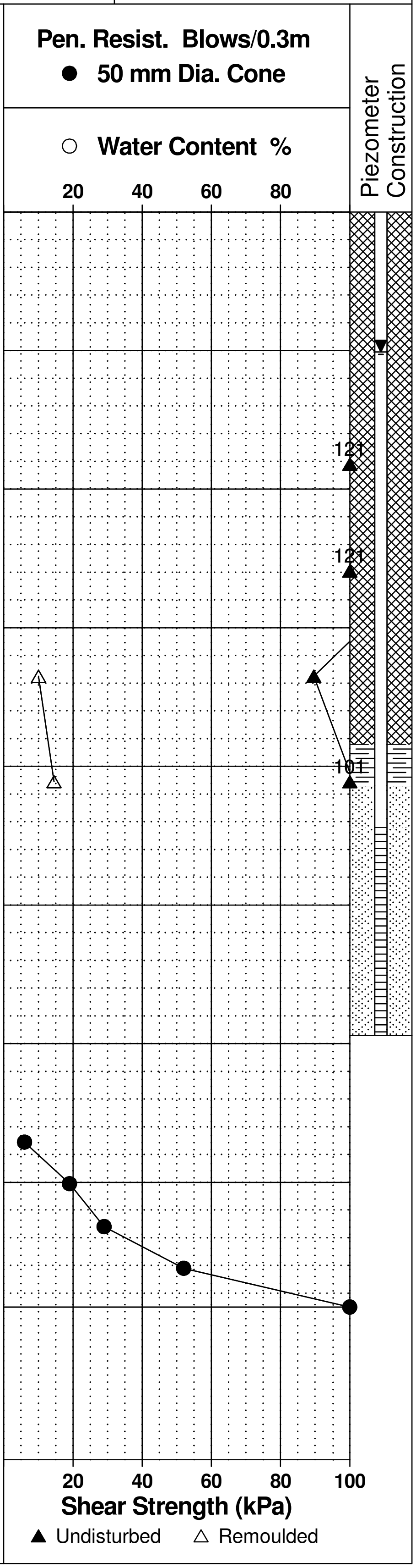
FILE NO. PG4730

HOLE NO. BH 7

SOIL DESCRIPTION	Depth to base (m)
GROUND SURFACE	
TOSPOIL	0.25
Brown **SILTY SAND** with organics	1.17
Very stiff to stiff, brown **SILTY CLAY** - grey by 2.4m depth	4.27
GLACIAL TILL: Grey clayey silt with sand and gravel	5.94
Dynamic Cone Penetration Test commenced at 5.94m depth. Inferred **GLACIAL TILL**	7.90
End of Borehole Practical DCPT refusal at 7.90m depth (GWL @ 1.01m - Dec. 7, 2018)	

SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	100	4
SS	3	67	P
SS	4	100	P
SS	5	42	17
SS	6	50	21

DEPTH (m)	ELEV. (m)
0	92.47
1	91.47
2	90.47
3	89.47
4	88.47
5	87.47
6	86.47
7	85.47



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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

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REMARKS

BORINGS BY CME 55 Power Auger

DATE November 29, 2018

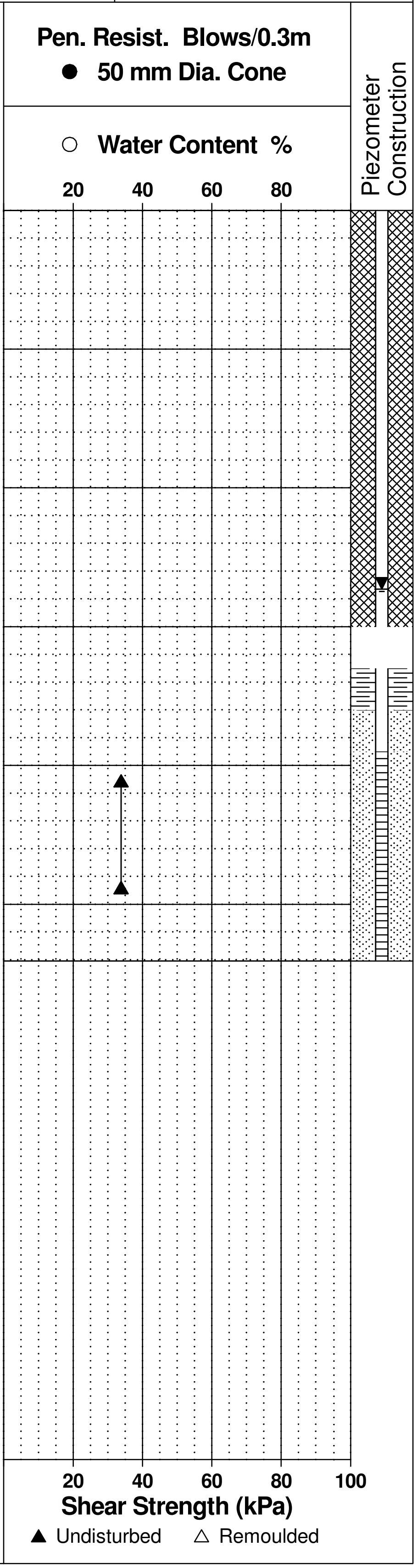
FILE NO. PG4730

HOLE NO. BH 8

SOIL DESCRIPTION	
GROUND SURFACE	
TOPSOIL	0.25
FILL: Brown silty clay with gravel	0.91
Loose, brown **SANDY SILT**	1.50
Firm to soft, brown **SILT,** some clay, trace sand	3.50
Firm, grey **SILTY CLAY**	5.33
GLACIAL TILL: Grey silty clay with gravel	5.41
End of Borehole	
(GWL @ 2.73m - Dec. 7, 2018)	

SAMPLE			
TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	54	4
SS	3	88	3
SS	4	100	2
SS	5	100	2
SS	6	100	50+

DEPTH (m)	ELEV. (m)
0	93.20
1	92.20
2	91.20
3	90.20
4	89.20
5	88.20



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 4623 & 4725 Spratt Rd.
Ottawa, Ontario

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

REMARKS

BORINGS BY CME 55 Power Auger

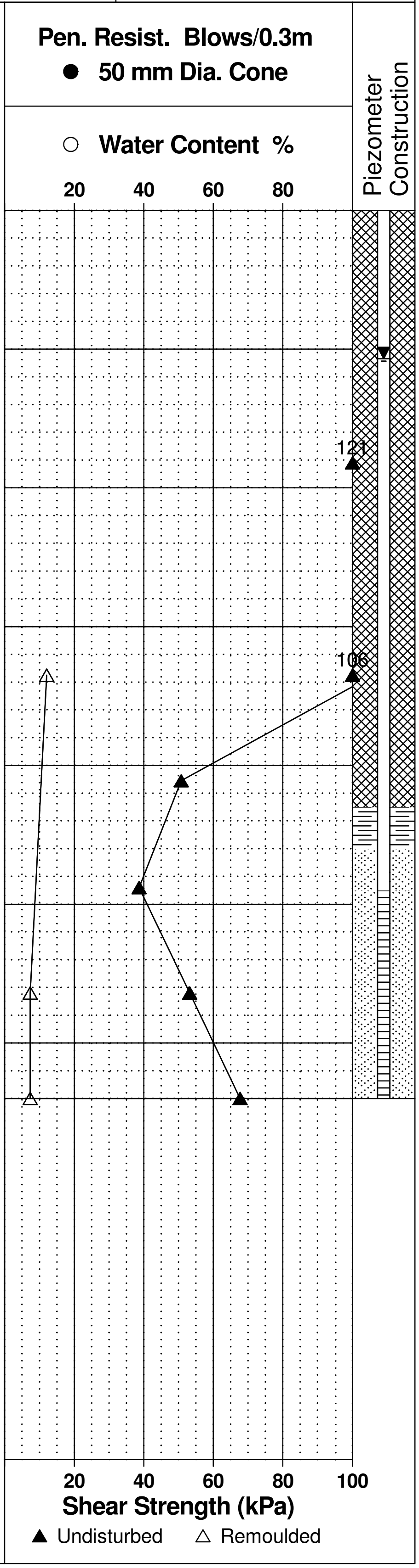
DATE November 29, 2018

FILE NO. PG4730

HOLE NO. BH 9

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.30	AU	1		
Brown **SILTY CLAY**	1.37	SS	2	62	6
Brown **SANDY SILT**	2.29	SS	3		P
Very stiff, grey **CLAYEY SILT** with sand	2.90	SS	4	100	2
Stiff to firm, grey **SILTY CLAY**	6.40				
End of Borehole (GWL @ 1.07m - Dec. 7, 2018)					

DEPTH (m)	ELEV. (m)
0	92.35
1	91.35
2	90.35
3	89.35
4	88.35
5	87.35
6	86.35



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)

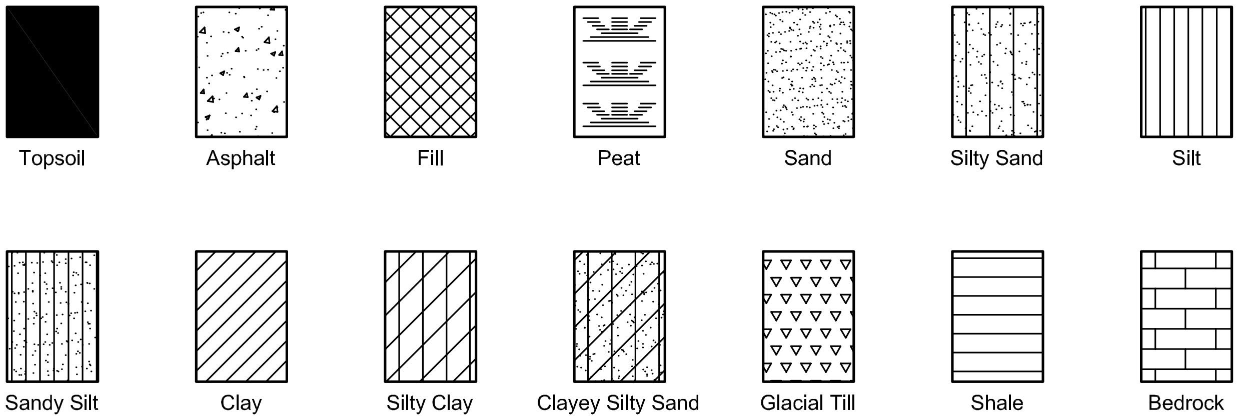
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

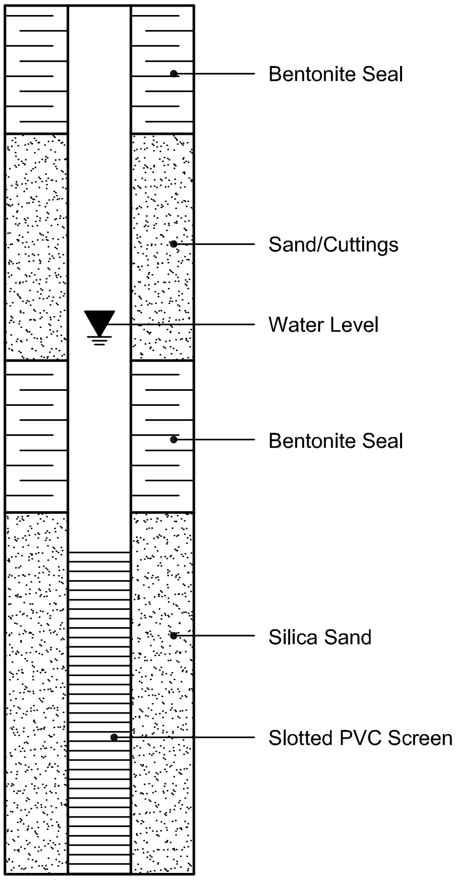
SYMBOLS AND TERMS (continued)

STRATA PLOT

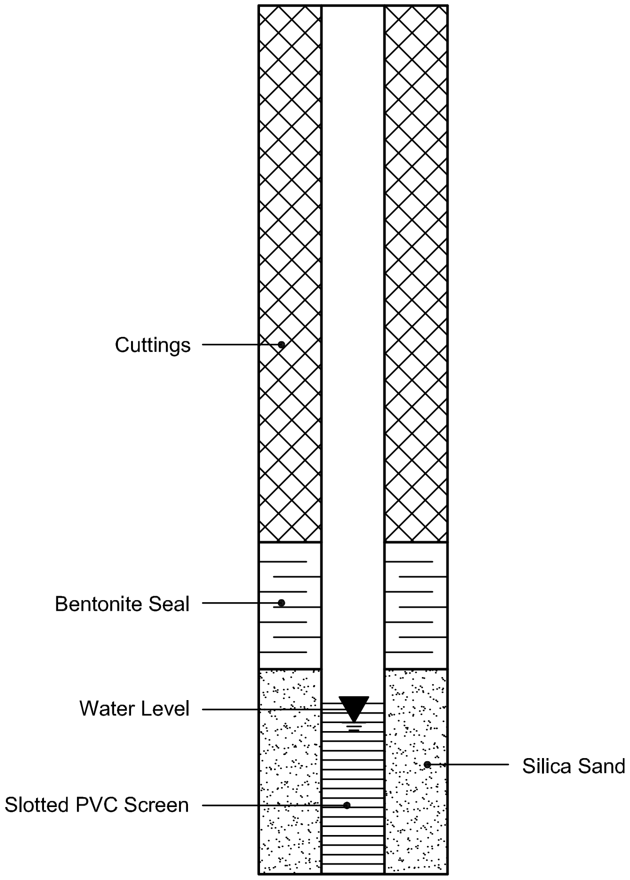


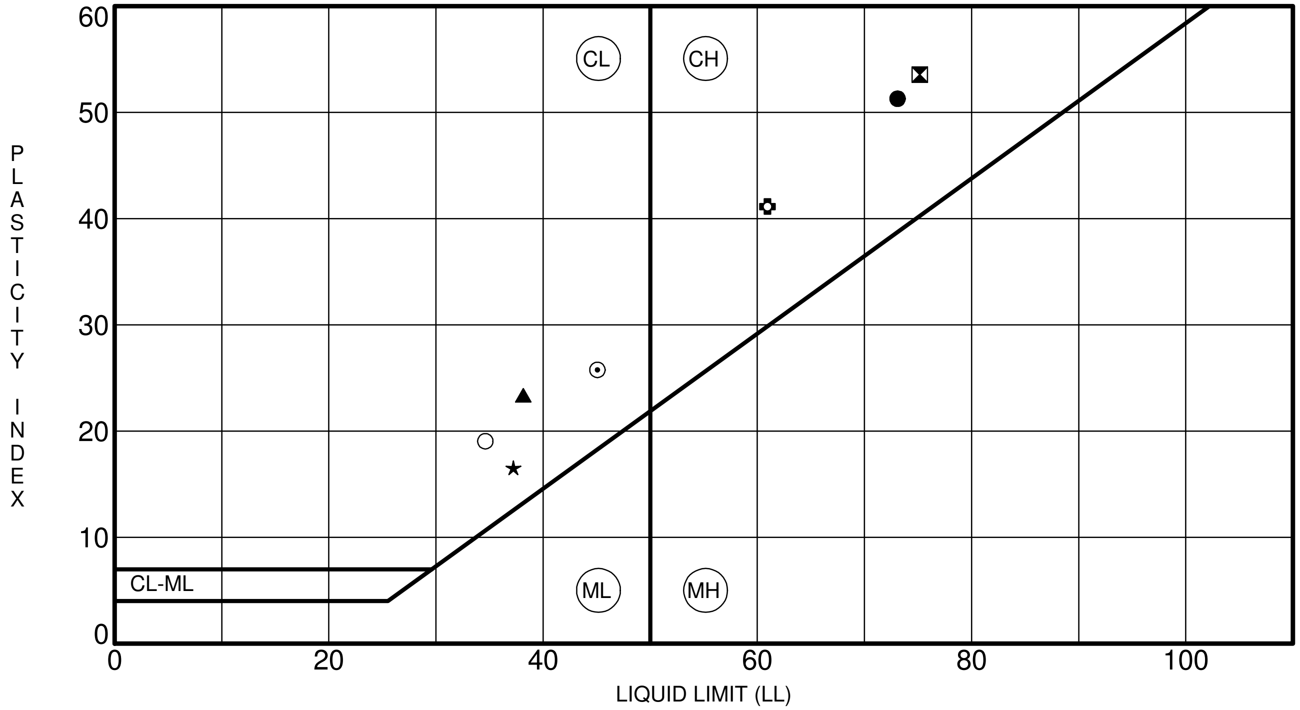
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1 SS 4**	**73**	**22**	**51**		**CH - Inorganic clays of high plasticity**
⧗	**BH 2 SS 4**	**75**	**22**	**54**		**CH - Inorganic clays of high plasticity**
▲	**BH 3 SS 5**	**38**	**15**	**23**		**CL - Inorganic clays of low plasticity**
★	**BH 4 SS 2**	**37**	**21**	**17**		**CL - Inorganic clays of low plasticity**
⊙	**BH 7 SS 4**	**45**	**19**	**26**		**CL - Inorganic clays of low plasticity**
✿	**BH 8 SS 5**	**61**	**20**	**41**		**CH - Inorganic clays of high plasticity**
○	**BH 9 SS 4**	**35**	**16**	**19**		**CL - Inorganic clays of low plasticity**

CLIENT

FILE NO. **PG4730**

PROJECT **Geotechnical Investigation - Prop. Residential Development - 4623 & 4725 Spratt Rd.**

DATE **29 Nov 18**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

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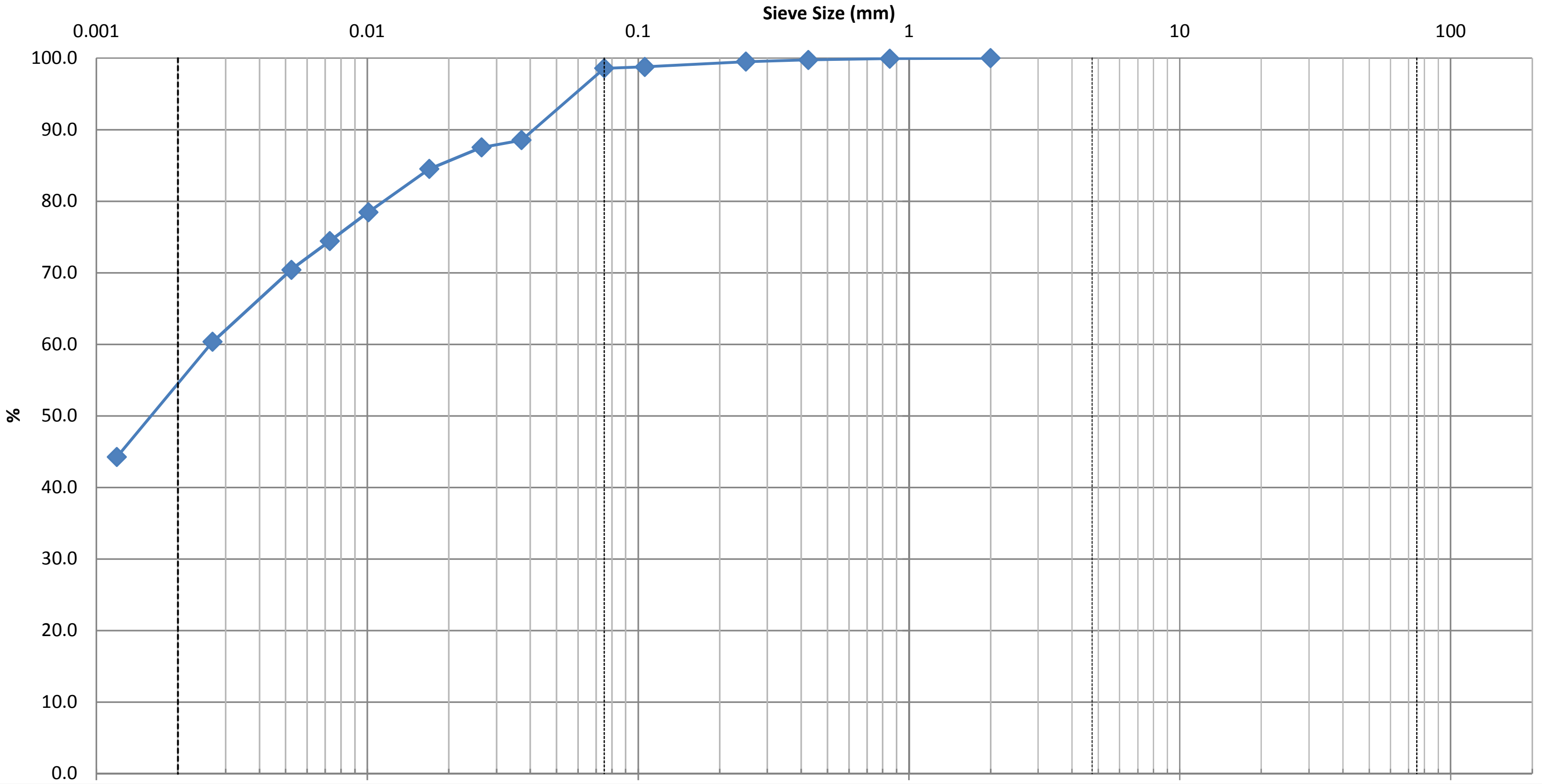
CLIENT:	Claridge Homes	DEPTH:	7.5 ' - 9.5'	FILE NO:	PG4730
CONTRACT NO.:		BH OR TP No.:	BH2 - SS4	LAB NO:	06499
PROJECT:	4725 Spratt Road			DATE RECEIVED:	3-Dec-18
				DATE TESTED:	6-Dec-18
DATE SAMPLED:	30-Nov-18			DATE REPORTED:	10-Dec-18
SAMPLED BY:	N. Giamberardino			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		40.8					

D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
				0.0	1.4	46.1	52.5

Comments

patersongroup
consulting engineers

HYDROMETER
LS-702 ASTM-422

CLIENT:	Claridge Homes	DEPTH:	7.5 ' - 9.5'	FILE NO.:	PG4730
PROJECT:	4725 Spratt Road	BH OR TP No.:	BH2 - SS4	DATE SAMPLED:	30-Nov-18
LAB No. :	06499	TESTED BY:	D. Bertrand	DATE RECEIVED:	03-Dec-18
SAMPLED BY:	N. Giamberardino	DATE REPT'D:	10-Dec-18	DATE TESTED:	06-Dec-18

SAMPLE INFORMATION

SAMPLE MASS	75.3	50.00
SPECIFIC GRAVITY (Gs)	2.700	
HYGROSCOPIC MOISTURE	Tare No.	
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	148.30	98.30
F=(Wo/Wa)	0.983	
INITIAL Wt. (Ma)	50.00	
Wt. CORRECTED	49.15	
Wt. AFTER WASH BACK SIEVE	0.72	
SOLUTION CONCENTRATION	40 g / L	

REMARKS

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5			
4.75			
2.0	**0.0**	0.0	100.0
Pan	**75.3**		
0.850	**0.04**	0.1	99.9
0.425	**0.13**	0.3	99.7
0.250	**0.25**	0.5	99.5
0.106	**0.61**	1.2	98.8
0.075	**0.71**	1.4	98.6
Pan	**0.72**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

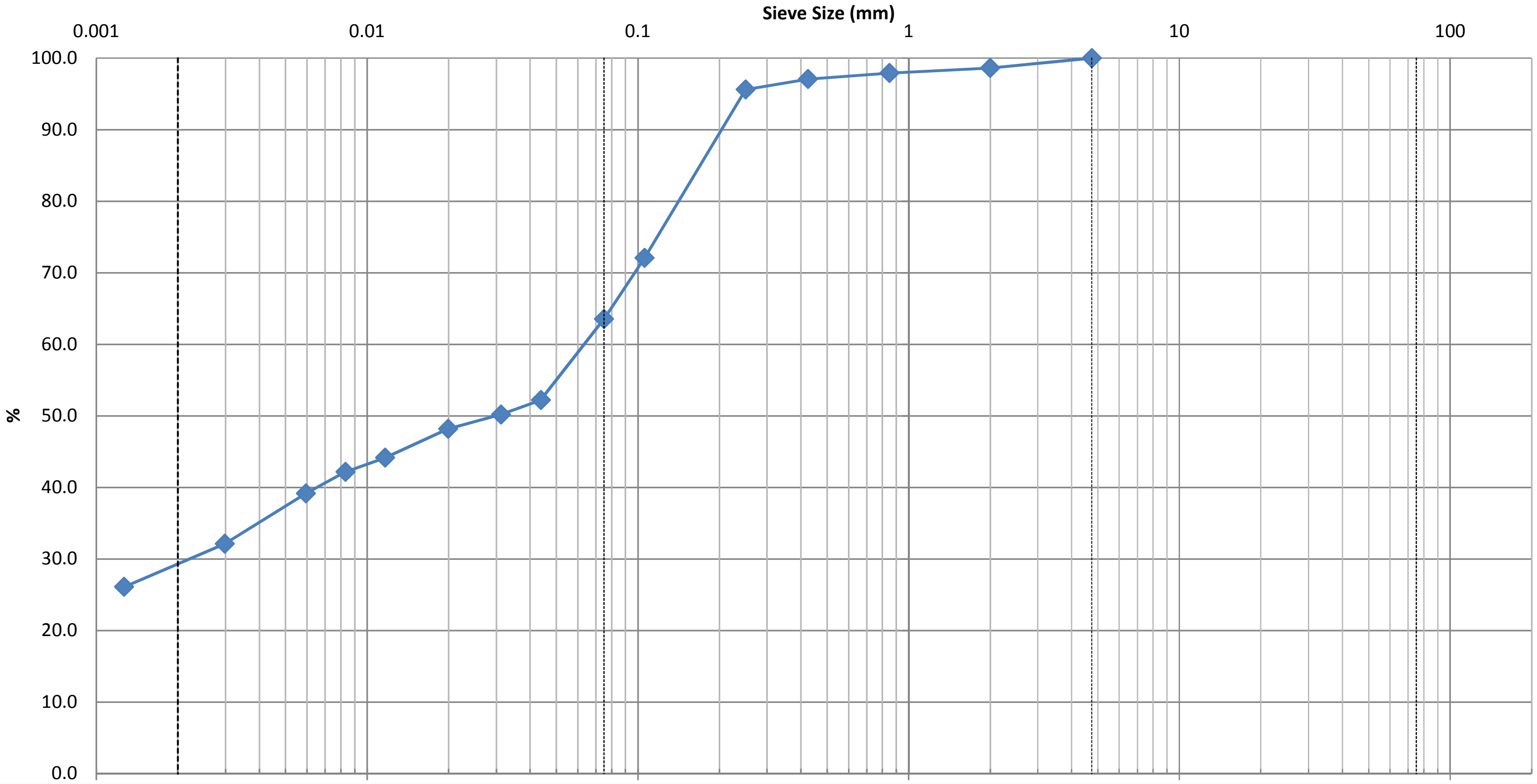
ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	8:50	50.0	6.0	21.0	0.0371	88.5	88.5
2	8:51	49.5	6.0	21.0	0.0264	87.5	87.5
5	8:54	48.0	6.0	21.0	0.0170	84.5	84.5
15	9:04	45.0	6.0	21.0	0.0101	78.5	78.5
30	9:19	43.0	6.0	21.0	0.0073	74.4	74.4
60	9:49	41.0	6.0	21.0	0.0052	70.4	70.4
250	12:59	36.0	6.0	21.0	0.0027	60.4	60.4
1440	8:49	28.0	6.0	21.0	0.0012	44.3	44.3

COMMENTS

Moisture Content = 40.8%

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

CLIENT:	Claridge Homes	DEPTH:	10 ' - 12'	FILE NO:	PG4730
CONTRACT NO.:		BH OR TP No.:	BH8 - SS5	LAB NO:	06500
PROJECT:	4725 Spratt Road			DATE RECEIVED:	3-Dec-18
				DATE TESTED:	6-Dec-18
DATE SAMPLED:	30-Nov-18			DATE REPORTED:	10-Dec-18
SAMPLED BY:	N. Giamberardino			TESTED BY:	D. Bertrand



	Clay	Silt	Sand			Gravel		Cobble
			Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification	MC(%)	LL	PL	PI	Cc	Cu
		26.9					

	D100	D60	D30	D10	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
					0.0	36.5	34.0	29.5

Comments	

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Claridge Homes	DEPTH:	10 ' - 12'	FILE NO.:	PG4730
PROJECT:	4725 Spratt Road	BH OR TP No.:	BH8 - SS5	DATE SAMPLED:	30-Nov-18
LAB No. :	06500	TESTED BY:	D. Bertrand	DATE RECEIVED:	03-Dec-18
SAMPLED BY:	N. Giamberardino	DATE REPT'D:	10-Dec-18	DATE TESTED:	06-Dec-18

SAMPLE INFORMATION

SAMPLE MASS	107.7	50.00
SPECIFIC GRAVITY (Gs)	2.700	REMARKS
HYGROSCOPIC MOISTURE	Tare No.	
TARE Wt.	50.00	ACTUAL Wt.
AIR DRY (Wa)	150.00	100.00
OVEN DRY (Wo)	147.10	97.10
F=(Wo/Wa)	0.971	
INITIAL Wt. (Ma)	50.00	
Wt. CORRECTED	48.55	
Wt. AFTER WASH BACK SIEVE	18.01	
SOLUTION CONCENTRATION	40 g / L	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
63.0			
53.0			
37.5			
26.5			
19.0			
16.0			
13.2			
9.5			
4.75	**0.0**	0.0	100.0
2.0	**1.5**	1.4	98.6
Pan	**106.2**		
0.850	**0.35**	2.1	97.9
0.425	**0.78**	2.9	97.1
0.250	**1.52**	4.4	95.6
0.106	**13.45**	27.9	72.1
0.075	**17.78**	36.5	63.5
Pan	**18.01**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	9:02	32.0	6.0	21.0	0.0438	53.0	52.2
2	9:03	31.0	6.0	21.0	0.0312	50.9	50.2
5	9:06	30.0	6.0	21.0	0.0199	48.9	48.2
15	9:16	28.0	6.0	21.0	0.0117	44.8	44.2
30	9:31	27.0	6.0	21.0	0.0083	42.8	42.2
60	10:01	25.5	6.0	21.0	0.0059	39.7	39.2
250	13:11	22.0	6.0	21.0	0.0030	32.6	32.1
1440	9:01	19.0	6.0	21.0	0.0013	26.5	26.1

COMMENTS

Moisture Content = 26.9%

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

Certificate of Analysis
Client: Paterson Group Consulting Engineers
Client PO: 25568

Report Date: 06-Dec-2018
Order Date: 30-Nov-2018
Project Description: PG8730

	Client ID:	BH4 12.5' - 14.5'	-	-	-
	Sample Date:	11/30/2018 09:00	-	-	-
	Sample ID:	1848575-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	91.6	-	-	-
General Inorganics					
pH	0.05 pH Units	8.09	-	-	-
Resistivity	0.10 Ohm.m	63.1	-	-	-
Anions					
Chloride	5 ug/g dry	10	-	-	-
Sulphate	5 ug/g dry	34	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4730-1 - TEST HOLE LOCATION PLAN

DRAWING PG4730-2 - PERMISSIBLE GRADE RAISE PLAN

DRAWING PG4730-3 - TREE SETBACK RECOMMENDATIONS

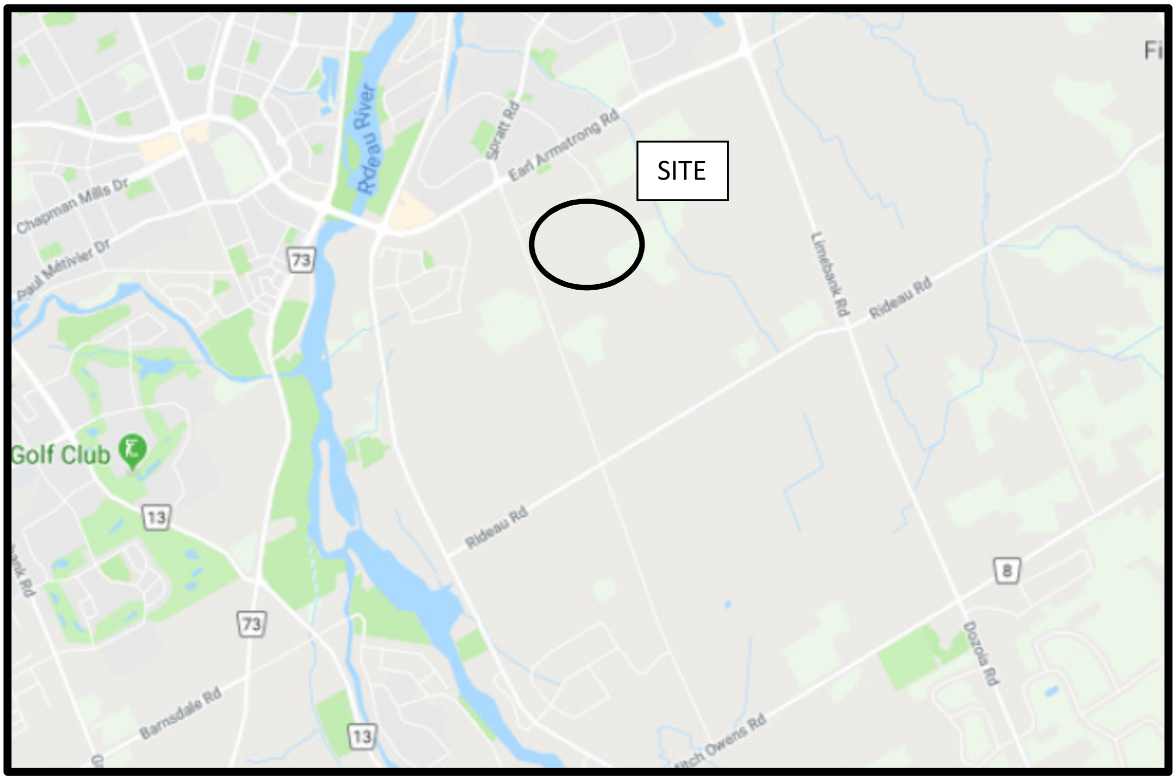
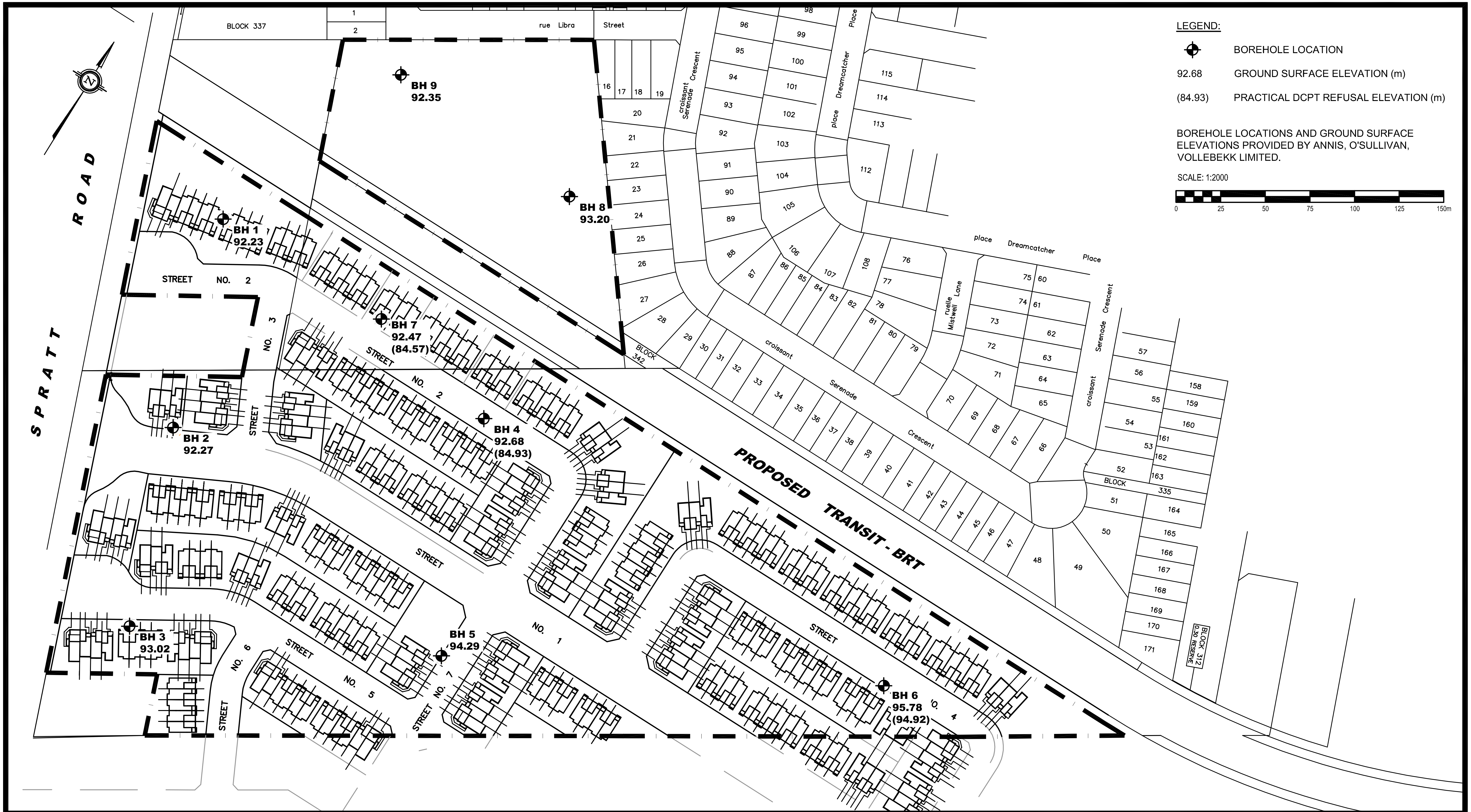


FIGURE 1

KEY PLAN



LEGEND:

⌖ BOREHOLE LOCATION

92.68 GROUND SURFACE ELEVATION (m)

(84.93) PRACTICAL DCPT REFUSAL ELEVATION (m)

BOREHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

SCALE: 1:2000

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

NO.	REVISIONS	DATE	INITIAL
0			

CLARIDGE HOMES
GEOTECHNICAL INVESTIGATION
PROP. RESIDENTIAL DEVELOPMENT - 4623 & 4725 SPRATT ROAD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:2000
Date: 12/2018
Drawn by: MPG
Report No.: PG4730-1
Checked by: SD
Dwg. No.: PG4730-1
Approved by: DJG
Revision No.: 0

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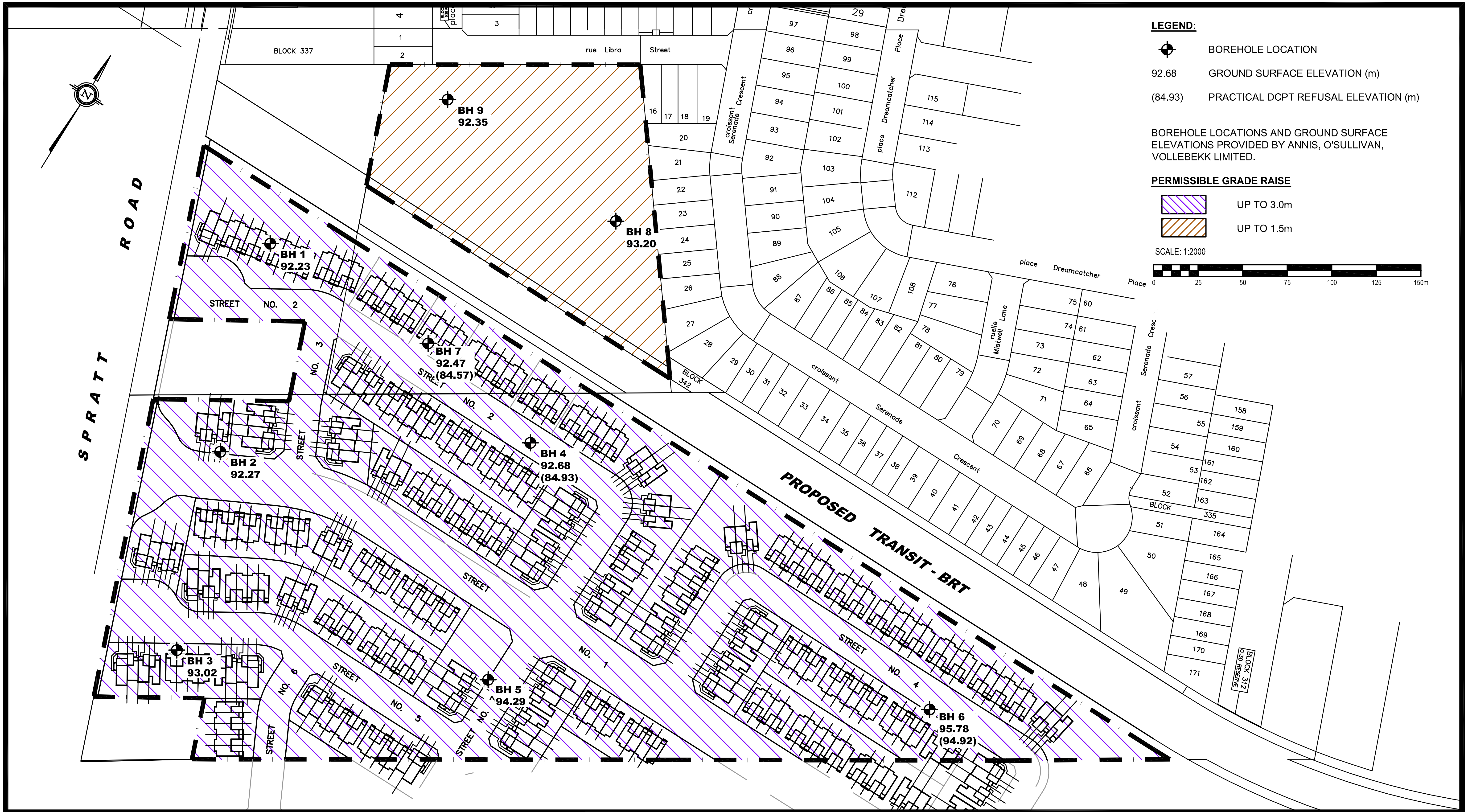

LEGEND:

⌖	BOREHOLE LOCATION
92.68	GROUND SURFACE ELEVATION (m)
(84.93)	PRACTICAL DCPT REFUSAL ELEVATION (m)

BOREHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

PERMISSIBLE GRADE RAISE

▨	UP TO 3.0m
▨	UP TO 1.5m

SCALE: 1:2000

0 25 50 75 100 125 150m

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NO.	REVISIONS	DATE	INITIAL
0			

CLARIDGE HOMES

GEOTECHNICAL INVESTIGATION

PROP. RESIDENTIAL DEVELOPMENT - 4623 & 4725 SPRATT ROAD

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:2000	Date: 12/2018
Drawn by: MPG	Report No.: PG4730-1
Checked by: SD	Dwg. No.: PG4730-2
Approved by: DJG	Revision No.: 0

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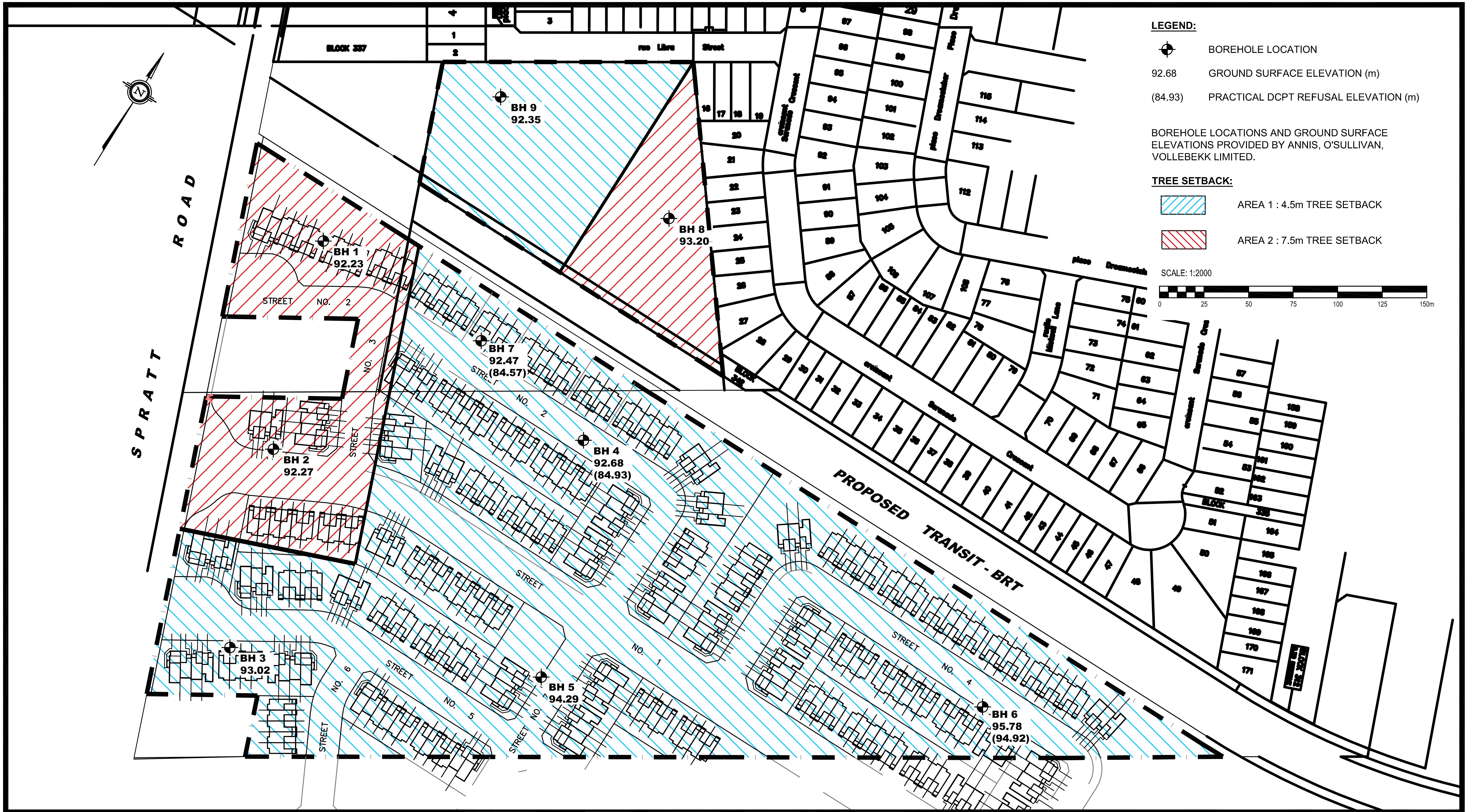

LEGEND:

⌖	BOREHOLE LOCATION
92.68	GROUND SURFACE ELEVATION (m)
(84.93)	PRACTICAL DCPT REFUSAL ELEVATION (m)

BOREHOLE LOCATIONS AND GROUND SURFACE ELEVATIONS PROVIDED BY ANNIS, O'SULLIVAN, VOLLEBEKK LIMITED.

TREE SETBACK:

▨	AREA 1 : 4.5m TREE SETBACK
▨	AREA 2 : 7.5m TREE SETBACK

SCALE: 1:2000

0 25 50 75 100 125 150m

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NO.	REVISIONS	DATE	INITIAL
0			

CLARIDGE HOMES
GEOTECHNICAL INVESTIGATION
PROP. RESIDENTIAL DEVELOPMENT - 4623 & 4725 SPRATT ROAD
OTTAWA, ONTARIO

Title:
TREE PLANTING SETBACK RECOMMENDATIONS

Scale: 1:2000
Date: 12/2018
Drawn by: MPG
Report No.: PG4730-1
Checked by: SD
Dwg. No.: PG4730-3
Approved by: DJG
Revision No.: 0

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