Geotechnical Engineering

Environmental Engineering

Hydrogeology

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Materials Testing

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Archaeological Services

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Geotechnical Investigation

Proposed Quinn's Pointe Residential Development - Phase 2
Barnsdale Road
Ottawa, Ontario

Prepared For

Minto Communities

November 2, 2018

Report PG4748-1

Table of Contents

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Minto Communities to conduct a geotechnical investigation for the subject site located at the northwest corner of Barnsdale Road and Greenbank Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the current investigation were to:

- ❏ determine the subsoil and groundwater conditions at this site by means of boreholes.

- ❏ to provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

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

2.0 Proposed Development

Based on available design plans, it is understood that the proposed development will consist of residential dwellings with associated driveways, roadways and landscaped areas. A slab on grade school building is also anticipated as part of the proposed development. Installation of municipal services is expected as part of the proposed project.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

Several geotechnical field programs were conducted within the subject site and adjacent properties between 2003 and 2016. A total of nine (9) boreholes were advanced to a maximum depth of 12.8 m below existing grade. In addition, a total of 37 test pits were advanced within Phase 2 of the subject site, to a maximum depth of 4.6 m below existing grade. The test hole locations were distributed in a manner to provide general coverage of the subject site. The approximate locations of the boreholes are shown on Drawing PG4748-1 - 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 while the test pits were excavated using a hydraulic shovel. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from our geotechnical department. The drilling procedure consisted of advancing each test hole to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler or from the auger flights. The soil samples from the test pit locations were recovered from the test pit sidewalls at selected intervals. The depths at which the grab samples, auger and split spoon samples were recovered from the test holes are shown as G, AU and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

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

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Flexible polyethylene standpipes were installed in selected boreholes to permit the monitoring of groundwater levels subsequent to the completion of the field program. Monitoring wells, using 50 mm diameter PVC screen and risers were installed at BH 7-15, 11-15, 12-15, 21-15, 23-15, 24-15, 32-15, BH 32-16 and 35-16 across the site to provide the means to conduct in situ permeability testing for our hydrogeological investigation and long term groundwater level monitoring. The in-situ permeability testing results will be reported under separate cover.

Sample Storage

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

3.2 Field Survey

The test hole locations were selected by Paterson personnel in a manner to provide general coverage of the proposed development taking into consideration underground utilities and site features. The borehole locations and ground surface elevations at the borehole locations were provided by Stantec Geomatics and are referenced to geodetic datum. The test pit locations were located through the use of a handheld GPS device and elevation data inferred from City of Ottawa basemap ground surface contours (+/- 0.5 m). The locations and ground surface elevations of the test holes are presented on Drawing PG4748-1 - 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. A total of 14 samples were submitted for grain size analyses. The testing was performed in general accordance with ASTM C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates. The results of the grain size analysis testing are presented in Subsection 4.2 and in the Grain Size Distribution sheets in Appendix 1.

Soil samples from selected borehole locations were subjected to water content testing. The results of the moisture content testing are presented in the Soil Profile Test Data sheets in Appendix 1.

4.0 Observations

4.1 Surface Conditions

The subject site is a mix of undeveloped, former agricultural land and forested areas. The south portion of the site consists of former agricultural fields that are separated by mature trees. Fill piles of varying material have been placed at several locations across the subject site. Due to the existing fill piles scattered across the site, the ground surface varies in elevation between ±98 and ±108 m. The subject site is currently lower than Barnsdale Road.

Residential developments currently under construction followed by Greenbank Road are located to the east of the subject site. More agricultural lands followed by Barnsdale Road are located to the south and forested areas along the west of the site.

4.2 Subsurface Profile

Overburden

Generally, the soil profile at the borehole locations consists of topsoil/agricultural soils or fill consisting of silty sand with gravel, trace clay and rootlets. The upper layer is underlain by loose to dense silty sand and/or sandy silt followed by glacial till consisting of compact to dense brown silty sand with varying amounts of gravel, cobbles and boulders. Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

Over the previous investigations, a total of 14 samples were collected from the test holes within the subject site for grain size analysis. The results are presented on the Grain Size Distribution sheets in Appendix 1. The textural descriptions of the samples are indicated under the Classification heading, along with the Unified Soil Classification. Tested samples varied from SP to SM to ML.

Bedrock

Based on digital geological mapping produced by Natural Resources Canada, sourced from the Geological Survey of Canada, the bedrock in this area consists of dolomite of the Oxford formation with an overburden drift thickness of 15 to 25 m depth.

4.3 Groundwater

Groundwater levels were measured in the standpipes or monitoring wells installed in the boreholes in multiple occasions with the last readings taken on May 3 and July 28, 2016. The observed groundwater levels are summarized in Table 1.

Table 1: Summary of Groundwater Level Readings

Borehole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH 7-15	102.30	Damaged	-	May 3, 2016
BH 11-15	105.82	1.83	103.99	May 3, 2016
BH 12-15	105.26	Dry to 7.79	-	May 3, 2016
BH 20-15	107.88	Dry to 7.60	-	May 3, 2016
BH 21-15	102.47	6.03	96.44	May 3, 2016
BH 23-15	98.90	3.28	95.62	May 3, 2016
BH 24-15	98.36	3.60	94.76	May 3, 2016
BH 32-16	103.48	7.37	96.11	July 28, 2016
BH 35-16	105.41	9.36	96.05	July 28, 2016

It is important to note that groundwater readings at the piezometers can be influenced by water perched within the borehole backfill material. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at an approximate elevation of 96 to 97 m. The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary 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 expected that the proposed buildings will be founded over conventional shallow footings placed on an undisturbed, compact to dense silty sand or glacial till bearing surface.

Due to the absence of a silty clay deposit within the subject site, no permissible grade raise restrictions are required for the subject site.

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

5.2 Site 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. Care should be taken not to disturb adequate bearing soils below the founding level during site preparation activities.

Existing fill, free of deleterious materials, should be reviewed by the geotechnical consultant at the time of construction to confirm if the existing fill can remain in place or be re-used as select subgrade fill or to in-fill existing ditches. For areas where the existing fill is to remain in place, it is recommended that the existing fill, free of deleterious materials, should be proof-rolled by a vibratory roller making several passes and approved by the geotechnical perspective. Any poor performing areas should be removed and reinstated with a compacted engineered fill.

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. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the 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 used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If site excavated material, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the site excavated material, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Shallow Foundation

Footings placed on undisturbed, compact silty sand or glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **250 kPa**. A geotechnical resistance factor of 0.5 has been applied to the above noted bearing resistance at ULS value.

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.

Settlement

Footings designed using the above noted bearing resistance value at SLS given above will be subjected to potential post construction 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 a compact to dense silty sand or sandy silt above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for the foundations considered at this site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code (OBC) 2012 for a full discussion of the earthquake design requirements.

5.5 Basement Slab/Slab on Grade Construction

With the removal of all topsoil and fill, containing deleterious or organic materials, the native soil or existing granular fill approved by the geotechnical consultant at the time of excavation will be considered to be an acceptable subgrade surface on which to commence backfilling for basement floor slab or slab on grade construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

It is recommended that the upper 200 mm of sub-floor fill for basement slab construction to consist of 19 mm clear crushed stone. It is also recommended that the upper 300 mm sub-floor fill below slab on grade construction consist of OPSS Granular A crushed stone. All backfill materials within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas and local roadways.

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

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

Table 3 - Recommended Pavement Structure - Local Roadways	
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
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soils or OPSS Granular B Type I or II material placed over in situ soil	

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material.

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

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 150 mm diameter perforated 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 greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or an approved equivalent. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings 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.

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

6.3 Excavation Side Slopes

The side slopes of excavations in the 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 the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. 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 (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The 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 match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

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.

It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

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.

6.6 Winter Construction

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

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

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

6.7 Stormwater Management Facility

The stormwater management facility (SWMF) may consist of a wet pond with inlet and outlet control structures. Dependent upon the hydraulic conductivity of the underlying material, consideration may be given to providing a clay liner, HDPL geomembrane liner or other impermeable membrane for construction of a wet cell facility.

It is recommended for the preliminary pond design that side slopes be graded at 2.5H:1V, or shallower, above the permanent pond water level and at 3H:1V, or shallower, below the permanent pond water level.

7.0 Recommendations

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

- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available and our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

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 Minto Communities or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Minto Communities (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN SIZE DISTRIBUTION SHEETS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

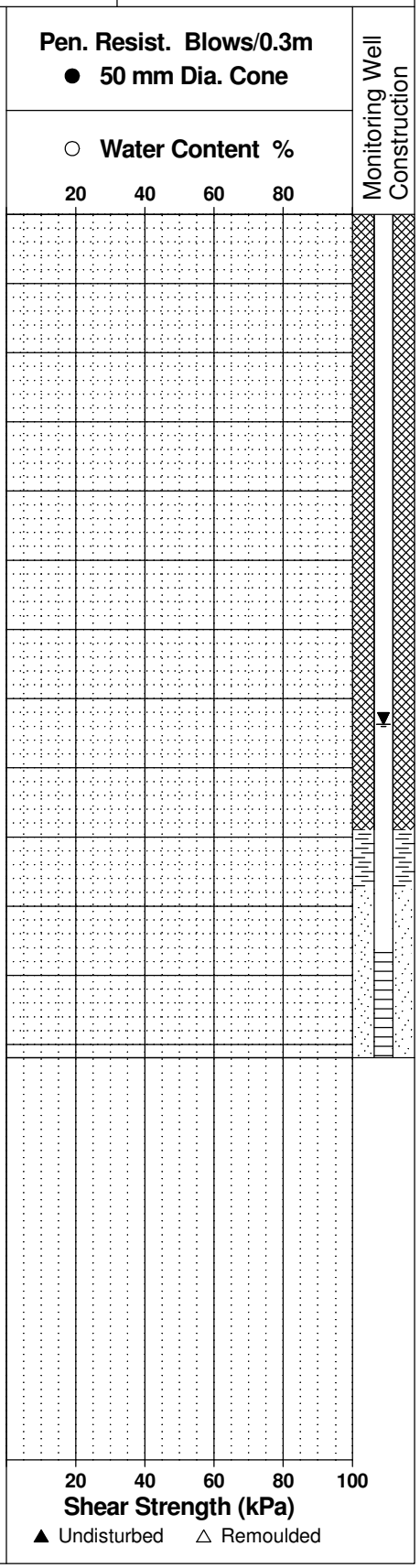
FILE NO. PG3607

REMARKS

HOLE NO. BH32-16

BORINGS BY CME 55 Power Auger **DATE** July 20, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.48
Compact, brown **SILTY SAND,** trace gravel, rootlets		SS	1	25	11		
1.22		SS	2	67	15	1	102.48
Compact to dense, brown **SILTY SAND,** some gravel, cobbles and boulders		SS	3	50	50+		
2.44		SS	4	50	31	2	101.48
Dense to very dense, grey **SILTY SAND,** some gravel		SS	5	71	17	3	100.48
- some boulders by 4.1m depth		SS	6	79	51	4	99.48
		SS	7	92	50+	5	98.48
		SS	8	75	35	6	97.48
		SS	9	79	70	7	96.48
		SS	10	100	50+	8	95.48
12.19						9	94.48
End of Borehole						10	93.48
(GWL @ 7.37m-July 28, 2016)						11	92.48
						12	91.48



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

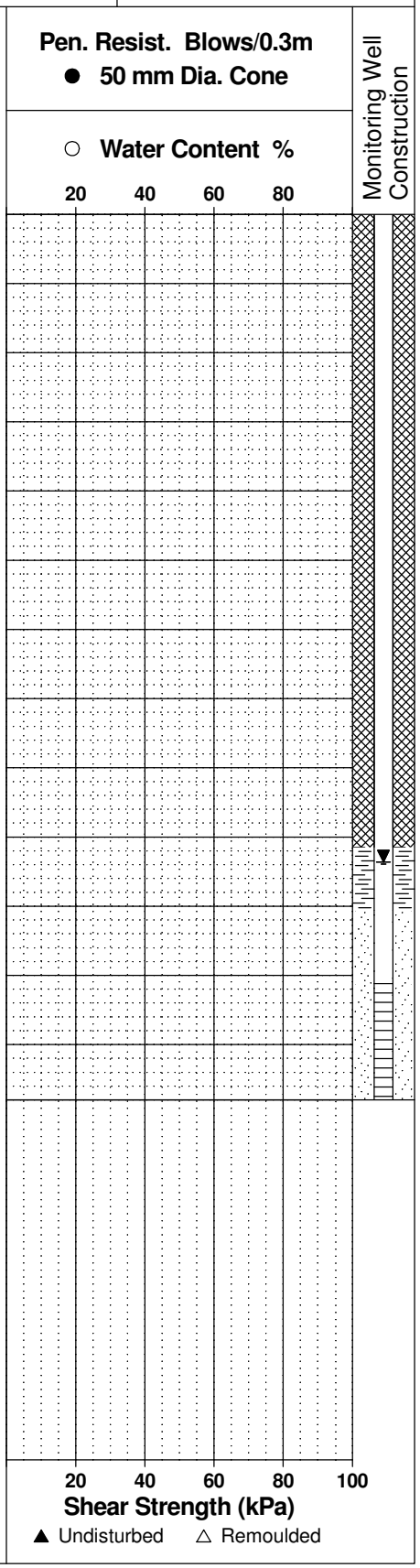
FILE NO. PG3607

REMARKS

HOLE NO. BH35-16

BORINGS BY CME 55 Power Auger **DATE** July 21, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.41
Brown **SILTY SAND**, trace gravel, organics and rootlets 0.76						1	104.41
Very dense to compact, brown **SILTY SAND** with gravel, cobbles and boulders						2	103.41
						3	102.41
						4	101.41
5.33						5	100.41
Compact, grey **SILTY SAND to SANDY SILT**						6	99.41
- trace gravel to 8.4m depth						7	98.41
						8	97.41
9.14						9	96.41
		SS	1	71	46	10	95.41
Dense to compact, brown **SILT,** some sand		SS	2	62	35	11	94.41
		SS	3	46	26	12	93.41
12.80							
End of Borehole							
(GWL @ 9.36m-July 28, 2016)							



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SOIL PROFILE AND TEST DATA

Hydrogeological Investigation
Residential Development - Half Moon Bay South
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

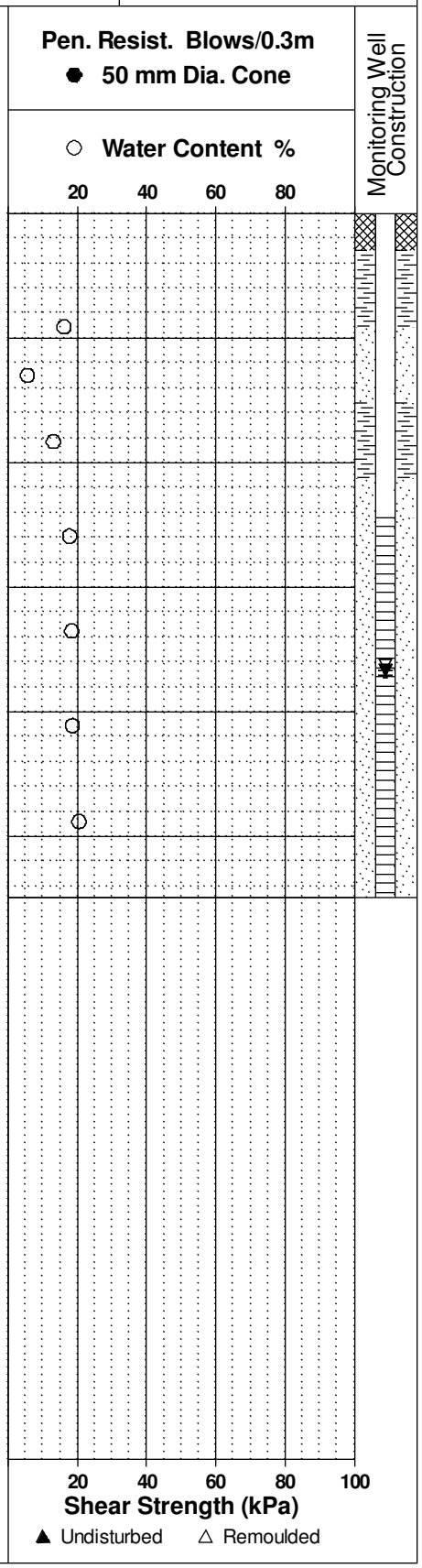
FILE NO. PG3450

REMARKS

HOLE NO. BH 7-15

BORINGS BY CME 55 Power Auger **DATE** March 5, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.16
FILL: Brown silty sand with gravel, trace clay and topsoil							
0.60							
		SS	1	50	14	1	99.16
		SS	2	96	25	2	98.16
Compact to dense, light brown **SILTY FINE SAND**		SS	3	92	37		
- brown by 2.9m depth		SS	4	100	33	3	97.16
		SS	5	92	20	4	96.16
		SS	6	88	38	5	95.16
5.49							
End of Borehole							
(GWL @ 4.43m-March 23, 2015)							
(GWL @ 3.67m-April 21, 2015)							
(GWL @ 3.71m-May 12, 2015)							
High groundwater infiltration rate							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Investigation
Residential Development - Half Moon Bay South
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG3450

REMARKS

HOLE NO. BH11-15

BORINGS BY CME 75 Power Auger **DATE** May 8, 2015

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 %	Monitoring Well Construction
GROUND SURFACE						0	98.24		
FILL: Brown silty sand, some gravel, cobbles and boulders		AU	1						
		SS	2	62	13	1	97.24		
1.42									
Compact, brown **SAND,** trace silt		SS	3	75	20	2	96.24		
		SS	4	79	22				
3.05						3	95.24		
Compact to loose, brown **SILTY SAND**		SS	5	92	22				
		SS	6	100	6	4	94.24		
4.57									
End of Borehole									
(GWL 2.19m-May 12, 2015)									
High groundwater infiltration rate									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Investigation
Residential Development - Half Moon Bay South
Ottawa, Ontario

DATUM Ground surface elevations provided by J.D. Barnes Limited.

FILE NO. PG3450

REMARKS

HOLE NO. BH12-15

BORINGS BY CME 75 Power Auger **DATE** May 8, 2015

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 %	Monitoring Well Construction
GROUND SURFACE						0	98.76		
FILL: Brown silty clay, some sand		AU	1						
0.46						1	97.76		
		SS	2	75	15				
		SS	3	79	37	2	96.76		
GLACIAL TILL: Compact to dense, brown silty sand, some gravel, cobbles and boulders		SS	4	75	60				
						3	95.76		
		SS	5	42	32				
3.96									
End of Borehole									
(GWL 2.51m-May 12, 2015)									
Moderate groundwater infiltration rate									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. BH21-15

BORINGS BY CME 75 Power Auger **DATE** December 9, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.47
		AU	1				
Very loose, brown **SILTY SAND** with gravel, cobbles and boulders		SS	2	54	3	1	101.47
- compact to dense by 2.3m depth		SS	3	50	3	2	100.47
		SS	4	67	14		
		SS	5	13	28	3	99.47
- grey-brown by 3.8m depth		SS	6	79	12	4	98.47
		SS	7	79	25	5	97.47
		SS	8	92	21		
		SS	9	63	19	6	96.47
		SS	10	29	33	7	95.47
		SS	11	58	12	8	94.47
		SS	12	79	31		
		SS	13	75	13	9	93.47
9.75							
End of Borehole							
(GWL @ 6.73m-July 28, 2016)							

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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. BH23-15

BORINGS BY CME 75 Power Auger **DATE** December 9, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.90
FILL: Brown clayey sand with silt		AU	1				
0.60							
		SS	2	100	15	1	97.90
		SS	3	75	20	2	96.90
		SS	4	75	21		
Compact, brown **SILTY SAND**		SS	5	75	25	3	95.90
		SS	6	75	20	4	94.90
		SS	7	75	12	5	93.90
		SS	8	75	30	6	92.90
		SS	9	100	25		
6.70							
		SS	10	50	30	7	91.90
Compact, grey **SILTY SAND** with gravel, cobbles and boulders		SS	11	75	23	8	90.90
		SS	12	50	30	9	89.90
		SS	13	75	23		
9.75							
End of Borehole							
(GWL @ 3.56m-July 28, 2016)							

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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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

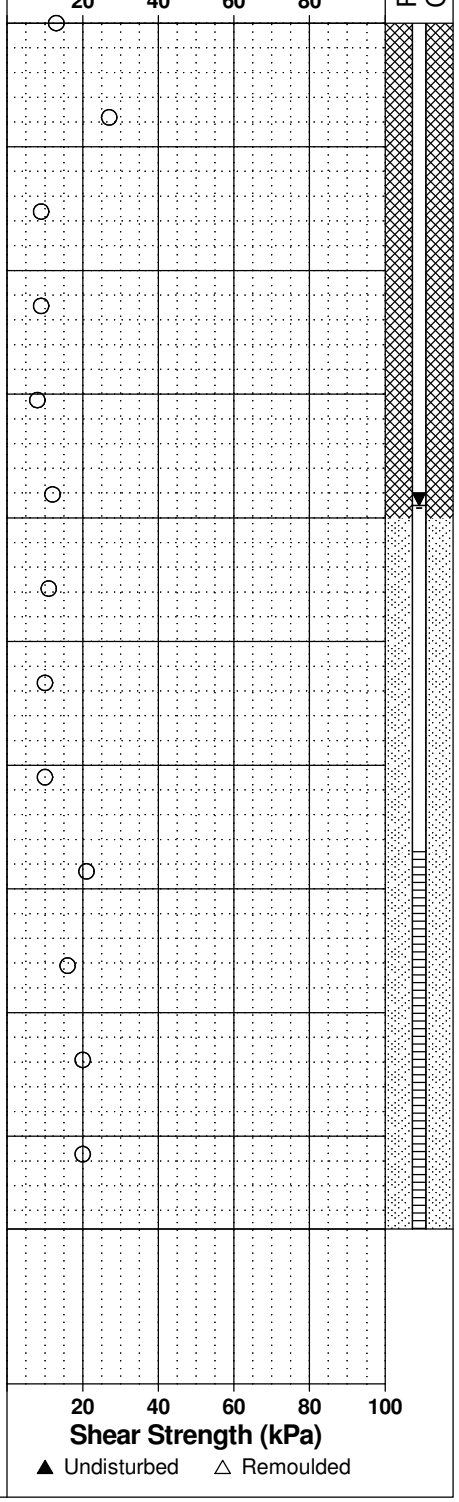
FILE NO. PG3607

REMARKS

HOLE NO. BH24-15

BORINGS BY CME 75 Power Auger **DATE** November 27, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.36
FILL: Brown silty sand with gravel, cobbles, boulders and clay		AU	1				
		SS	2	92	3	1	97.36
1.52							
Dense to compact, brown **SILTY SAND** with gravel, cobbles and boulders		SS	3	100	41	2	96.36
		SS	4	75	20		
3.05						3	95.36
Loose to compact, grey **SILTY SAND** with gravel		SS	5	63	7		
		SS	6	58	15	4	94.36
4.50							
Loose, grey **SILTY SAND** with gravel, cobbles and boulders		SS	7	50	8	5	93.36
		SS	8	75	10		
		SS	9	83	9	6	92.36
6.86							
Compact to very loose, grey **SILTY SAND**		SS	10	92	15	7	91.36
		SS	11	100	15		
		SS	12	100	1	8	90.36
		SS	13	100	1	9	89.36
9.75							
End of Borehole							
(GWL @ 3.90m-July 28, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 9-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.40		
TOPSOIL 0.20									
Brown **SILTY SAND**, trace cobbles		G	1			1	107.40		
						2	106.40		
3.00 End of Test Pit		G	2			3	105.40		
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
Water Content %: 20 40 60 80
Shear Strength (kPa): 20 40 60 80 100
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 10-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.00		
TOPSOIL with roots									
0.30									
Very dense, brown **SILTY SAND** with gravel, cobbles and oversized boulders		G	1			1	105.00		
1.70									
End of Test Pit									
Test pit terminated on oversized boulders									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; 20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 11-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.00		
Dark brown **SANDY SILT** with roots									
0.30									
		G	1			1	102.00		
Compact to very dense, brown **SILTY SAND**, some gravel and cobbles									
		G	2			2	101.00		
3.00									
End of Test Pit						3	100.00		
(TP dry upon completion)									

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 18-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	107.40		
Dense to very dense, brown **SILTY SAND,** some gravel and cobbles, trace to some boulders		G	1			1	106.40		
- rootlets in upper 100mm						2	105.40		
		G	2						
3.00						3	104.40		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 19-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.40		
Compact to very dense, brown **SILTY SAND** with gravel, some cobbles and boulders		G	1			1	103.40		
		G	2			2	102.40		
End of Test Pit (TP dry upon completion)						3	101.40		

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 20-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.90
TOPSOIL 0.20							
Loose, dark brown **SILTY SAND**, some gravel 0.70		G	1				
Stiff, light grey **SILTY CLAY**, some cobbles and boulders 1.50		G	2			1	100.90
Very dense, light grey **SILTY SAND** with gravel, cobbles and boulders 3.00		G	3			2	99.90
End of Test Pit						3	98.90
(TP dry upon completion)							

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

○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 31-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	105.50		
Very dense, brown **SILTY SAND** with gravel, cobbles and oversized boulders		G	1			1	104.50		
- rootlets in upper 100mm						2	103.50		
3.00		G	2			3	102.50		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 32-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.50		
Dense to very dense, brown **SILTY SAND** with gravel, cobbles and boulders		G	1			1	102.50		
		G	2			2	101.50		
3.00						3	100.50		
End of Test Pit (Open hole GWL @ 0.8m depth)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 33-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.00		
Very dense, light brown **SILTY SAND**, some gravel, cobbles and boulders - rootlets in upper 200mm		G	1			1	102.00		
						2	101.00		
2.80 Compact, brown **SILTY SAND**, trace gravel 3.00		G	2			3	100.00		
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 46-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	105.40		
Very dense, brown **SILTY SAND** with gravel, cobbles and boulders		G	1			1	104.40		
		G	2			2	103.40		
3.00						3	102.40		
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

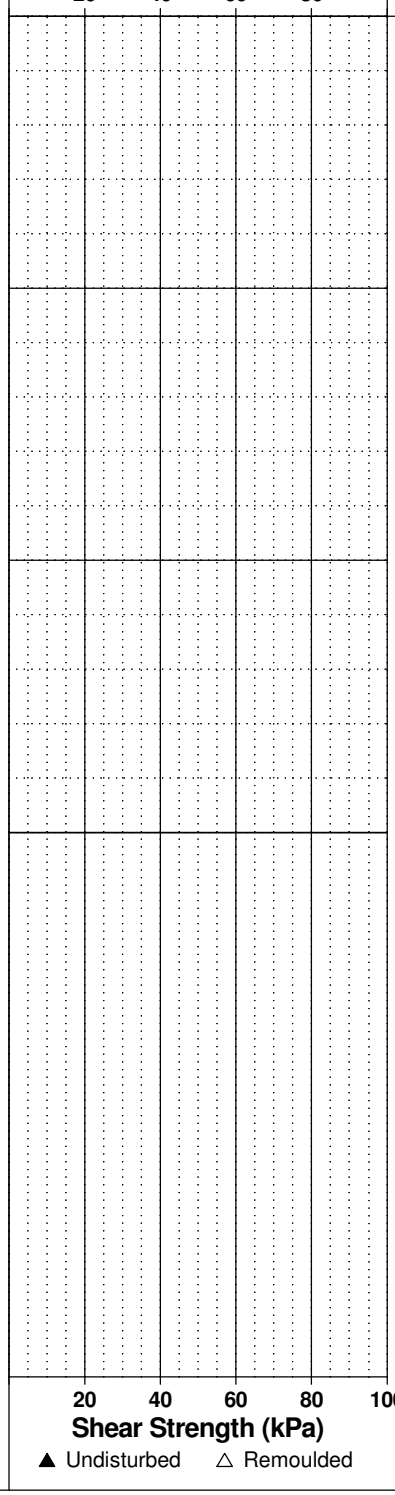
FILE NO. PG3607

REMARKS

HOLE NO. TP 47-15

BORINGS BY Backhoe **DATE** December 1, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.00		
Dense to very dense, brown **SILTY SAND** with gravel, cobbles and occasional large boulders		G	1			1	105.00		
- rootlets in upper 100mm		G	2			2	104.00		
3.00						3	103.00		
End of Test Pit									
(TP dry upon completion)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

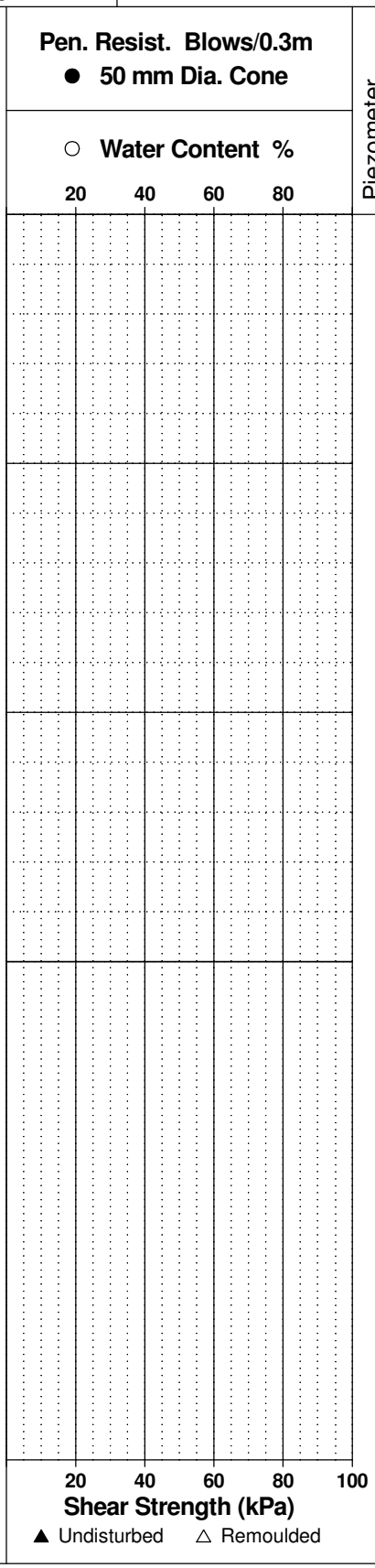
FILE NO. PG3607

REMARKS

HOLE NO. TP 48-15

BORINGS BY Backhoe **DATE** December 2, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.80		
Very dense, light brown **SILTY SAND** with gravel, cobbles and boulders - rootlets in upper 150mm		G	1			1	103.80		
						2	102.80		
2.00									
Compact, brown **SILTY SAND**, trace gravel		G	2						
3.00						3	101.80		
End of Test Pit (TP dry upon completion)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 59-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.20		
TOPSOIL 0.05		G	1						
		G	2			1	105.20		
Brown **SILTY SAND** with gravel, cobbles and boulders - grey by 0.5m depth						2	104.20		
		G	3						
3.00						3	103.20		
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 60-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.10		
Red-brown **SILTY SAND** with gravel, cobbles and boulders, trace organics		G	1						
0.56									
		G	2			1	103.10		
Loose, grey-brown **SILTY SAND**									
2.10						2	102.10		
		G	3						
Grey **SILTY SAND** with gravel, cobbles and boulders									
3.00						3	101.10		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 61-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.90		
Very dense, grey-brown **SILTY SAND** with gravel, cobbles and boulders		G	1			1	103.90		
						2	102.90		
2.20									
End of Test Pit (TP dry upon completion)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 68-15

BORINGS BY Backhoe **DATE** November 20, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.10						0	107.30		
Loose **SANDY SILT** 0.30		G	1						
		G	2			1	106.30		
Compact, brown **SILTY SAND**						2	105.30		
		G	3						
3.00 End of Test Pit						3	104.30		
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

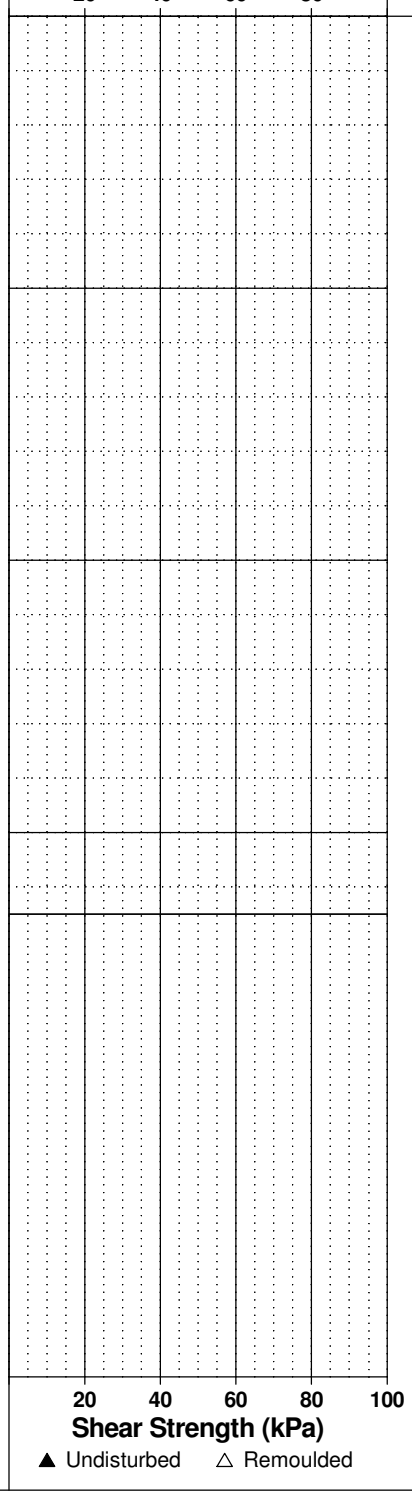
FILE NO. PG3607

REMARKS

HOLE NO. TP 69-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	105.00		
		G	1						
		G	2						
Brown **SILTY SAND** with gravel, cobbles and boulders.						1	104.00		
- grey by 1.1m depth									
						2	103.00		
						3	102.00		
3.30									
End of Test Pit									
(TP dry upon completion)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 70-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.60		
		G	1						
		G	2			1	102.60		
Dense, grey-brown **SILTY SAND** with gravel, cobbles and boulders									
		G	3			2	101.60		
2.50									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; scale 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

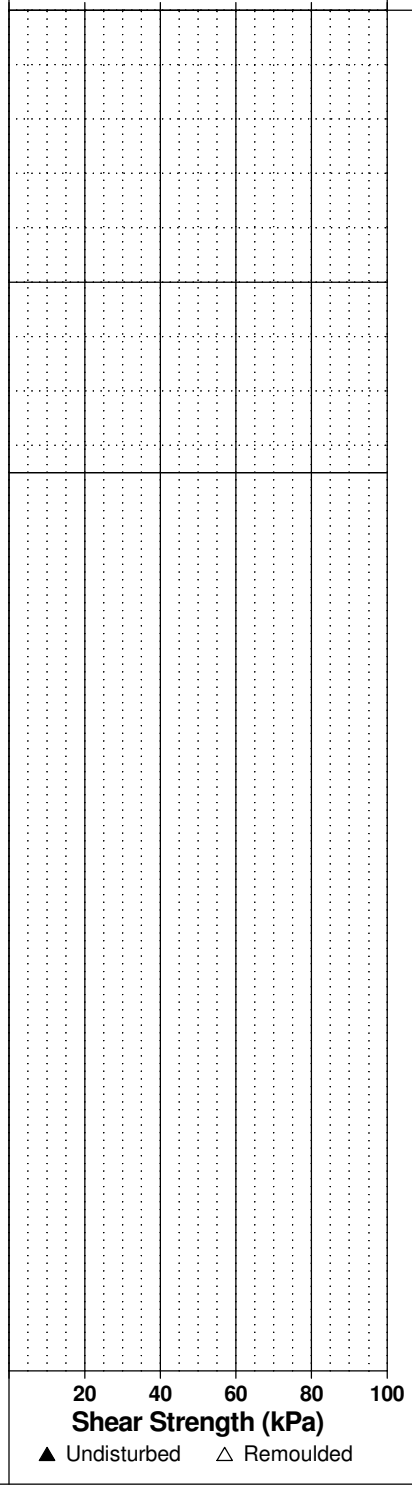
FILE NO. PG3607

REMARKS

HOLE NO. TP 71-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.10		
Dense, grey-brown **SILTY SAND** with gravel, cobbles and boulders		G	1						
		G	2			1	102.10		
1.70									
End of Test Pit (TP dry upon completion)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 72-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	101.70		
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay		G	1			1	100.70		
		G	2			2	99.70		
2.10									
Brown **SILTY SAND**		G	3			3	98.70		
3.30									
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; 20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 73-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	102.10		
		G	1						
		G	2			1	101.10		
Dark brown to grey-brown **SILTY SAND** with gravel, cobbles and boulders, trace clay									
		G	3			2	100.10		
3.00						3	99.10		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 74-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	101.00		
Compact, dark brown **SILTY SAND** with gravel, cobbles and boulders		G	1						
		G	2			1	100.00		
- grey by 1.2m depth		G	3						
		G	4			2	99.00		
3.10						3	98.00		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 75-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.00		
Dark brown **SILTY SAND** with gravel and cobbles, trace clay		G	1						
- grey by 1.1m depth		G	2			1	97.00		
						2	96.00		
2.90		G	3						
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 76-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	97.90		
Dense, brown **SILTY SAND** with gravel, cobbles and boulders									
1.00						1	96.90		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 77-15

BORINGS BY Backhoe **DATE** November 24, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.40		
		G	1						
		G	2			1	97.40		
Grey **SILTY SAND** with gravel, cobbles and boulders						2	96.40		
		G	3						
3.00						3	95.40		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 85-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15		G	1			0	106.20		
		G	2			1	105.20		
Grey-brown **SILTY SAND** with gravel, cobbles and boulders		G	3			2	104.20		
2.90 End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 86-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15						0	103.00		
Brown **SILTY SAND**, some gravel and cobbles 0.90		G	1						
		G	2			1	102.00		
Grey **SILTY SAND**						2	101.00		
		G	3						
3.10 End of Test Pit (TP dry upon completion)						3	100.00		

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 87-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.20						0	102.50		
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay 0.50		G	1						
		G	2						
						1	101.50		
Grey **SILTY SAND**									
		G	3			2	100.50		
3.00						3	99.50		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 88-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.12		G	1			0	102.10		
Grey-brown to grey **SILTY SAND** with gravel, cobbles and boulders		G	2			1	101.10		
1.30									
		G	3			2	100.10		
Grey **SILTY SAND**		G	4						
3.00						3	99.10		
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 89-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15						0	103.10		
Red-brown **SILTY SAND** with gravel, cobbles and boulders		G	1						
- grey by 0.7m depth		G	2			1	102.10		
						2	101.10		
2.80 End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; scale 20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 90-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.50		
		G	1						
		G	2			1	103.50		
Red-brown to grey **SILTY SAND** with gravel, cobbles and boulders, trace clay									
		G	3			2	102.50		
2.70									
Grey **SILTY SAND**						3	101.50		
3.10									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
Scale: 20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 91-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.60		
Brown to grey **SILTY SAND** with gravel, cobbles and boulders						1	99.60		
						2	98.60		
3.00						3	97.60		
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %; 20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 92-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.20		
		G	1						
		G	2			1	97.20		
Brown **SILTY SAND** with gravel, cobbles and boulders - grey by 1.0m depth		G	3			2	96.20		
3.00						3	95.20		
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Barrhaven South Urban Expansion
Ottawa, Ontario

DATUM Geodetic elevations interpolated from City of Ottawa basemap.

FILE NO. PG3607

REMARKS

HOLE NO. TP 93-15

BORINGS BY Backhoe **DATE** November 19, 2015

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	98.60		
FILL: Brown silty sand with gravel, cobbles and boulders, trace clay									
0.25									
TOPSOIL		G	1						
1.20						1	97.60		
Grey **SILTY SAND**, trace clay		G	2						
1.90									
Grey **SILTY SAND** with gravel, cobbles and boulders, trace clay		G	3			2	96.60		
2.60									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Aggregate Resource Investigation
Greenbank Road/Cedarview Road
Ottawa (Nepean), Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** Oct 23, 03

FILE NO. G9114

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.20						0	
Stiff, grey **SILTY CLAY**		G	1			1	
2.29						2	
GLACIAL TILL: Grey silty sand with gravel						3	
4.57		G	2			4	
End of Test Pit (Open hole GWL @ 2.1m depth)							

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

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Aggregate Resource Investigation
Greenbank Road/Cedarview Road
Ottawa (Nepean), Ontario

DATUM

REMARKS

FILE NO. G9114

HOLE NO. TP10

BORINGS BY Backhoe **DATE** Oct 29, 03

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.20									
Reddish brown **SAND-GRAVEL**		G	1			1			
2.13						2			
Fine to medium **SAND**		G	2			3			
3.96									
End of Test Pit									
(Open hole GWL @ 2.1m depth)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

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

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SOIL PROFILE AND TEST DATA

Aggregate Resource Investigation
Greenbank Road/Cedarview Road
Ottawa (Nepean), Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** Oct 29, 03

FILE NO. G9114

HOLE NO. TP11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15						0			
Red **SILTY SAND-GRAVEL**						1			
1.22									
GLACIAL TILL: Silty sand and gravel, some clay		G	1			2			
						3			
3.96									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Aggregate Resource Investigation
Greenbank Road/Cedarview Road
Ottawa (Nepean), Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** Oct 29, 03

FILE NO. G9114

HOLE NO. TP15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15						0			
GLACIAL TILL: Very dense silty sand-gravel, some clay		G	1			1			
2.74						2			
End of Test Pit Refusal to excavation @ 2.74m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

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

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

CONSOLIDATION TEST

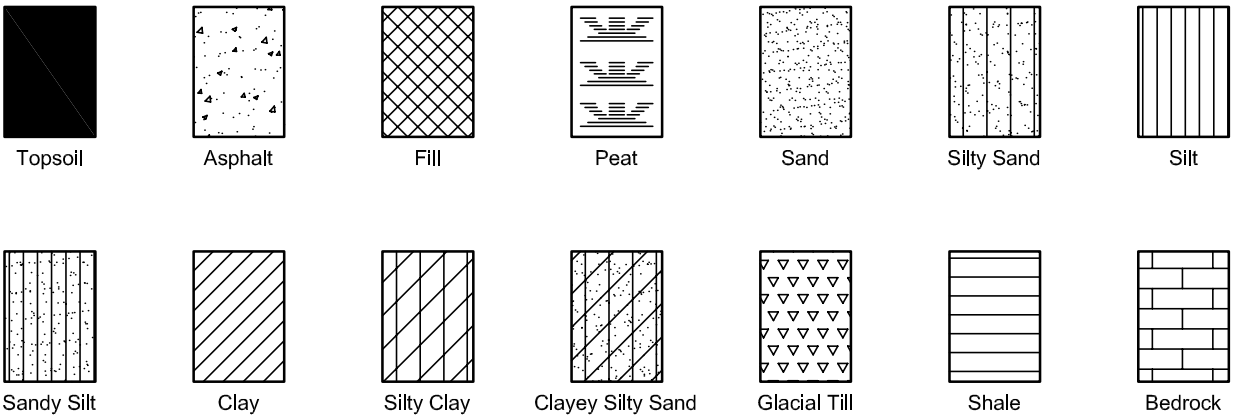
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

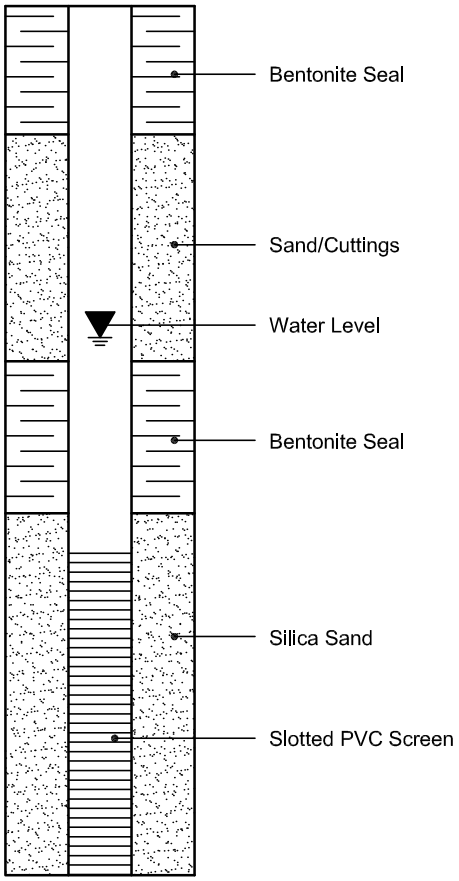
SYMBOLS AND TERMS (continued)

STRATA PLOT



MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



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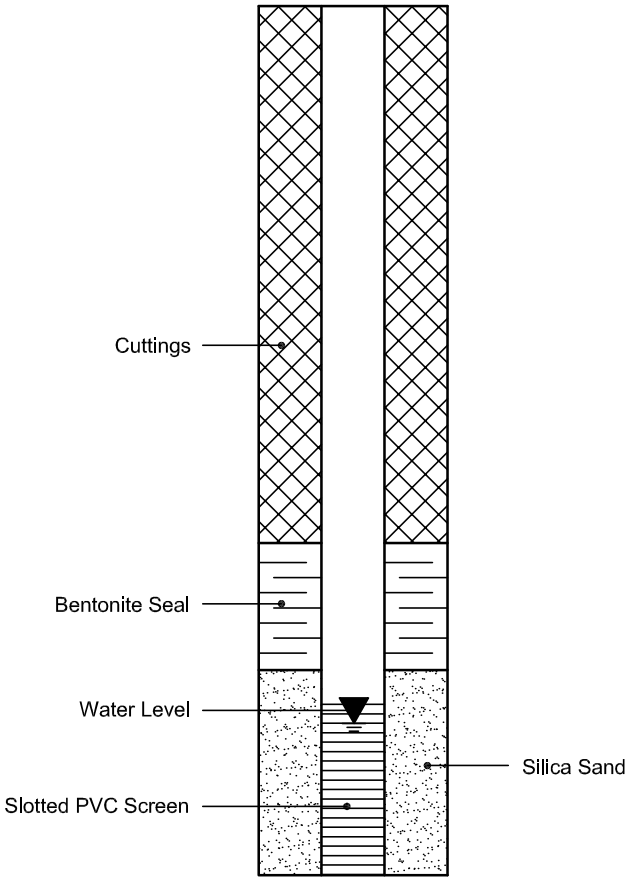

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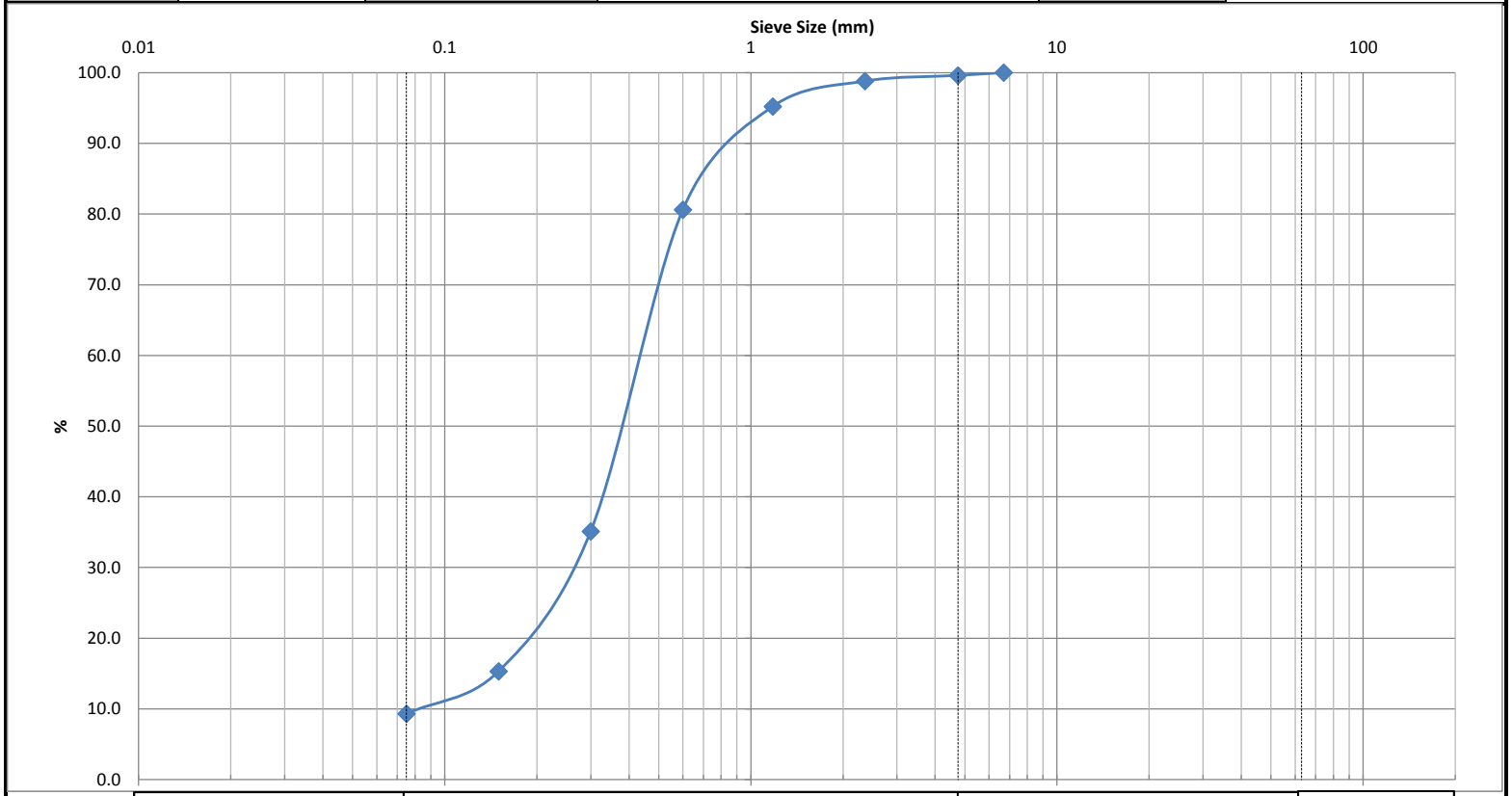
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Barrhaven	DESCRIPTION:	Granular	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	SAND	LAB NO:	85582
PROJECT:	CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	20-Jul-16
DATE SAMPLED:	15-Jul-16	SOURCE LOCATION:	-	DATE REPORTED:	23-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA3	TESTED BY:	0



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification							MC(%)	LL	PL	PI	Cc	Cu
												2.16	6.0
	D100		D60	D30	D10	Gravel (%)	Sand (%)			Silt (%)		Clay (%)	
	7.9		0.45	0.27	0.075	0.4	90.3			9.3			

Comments	

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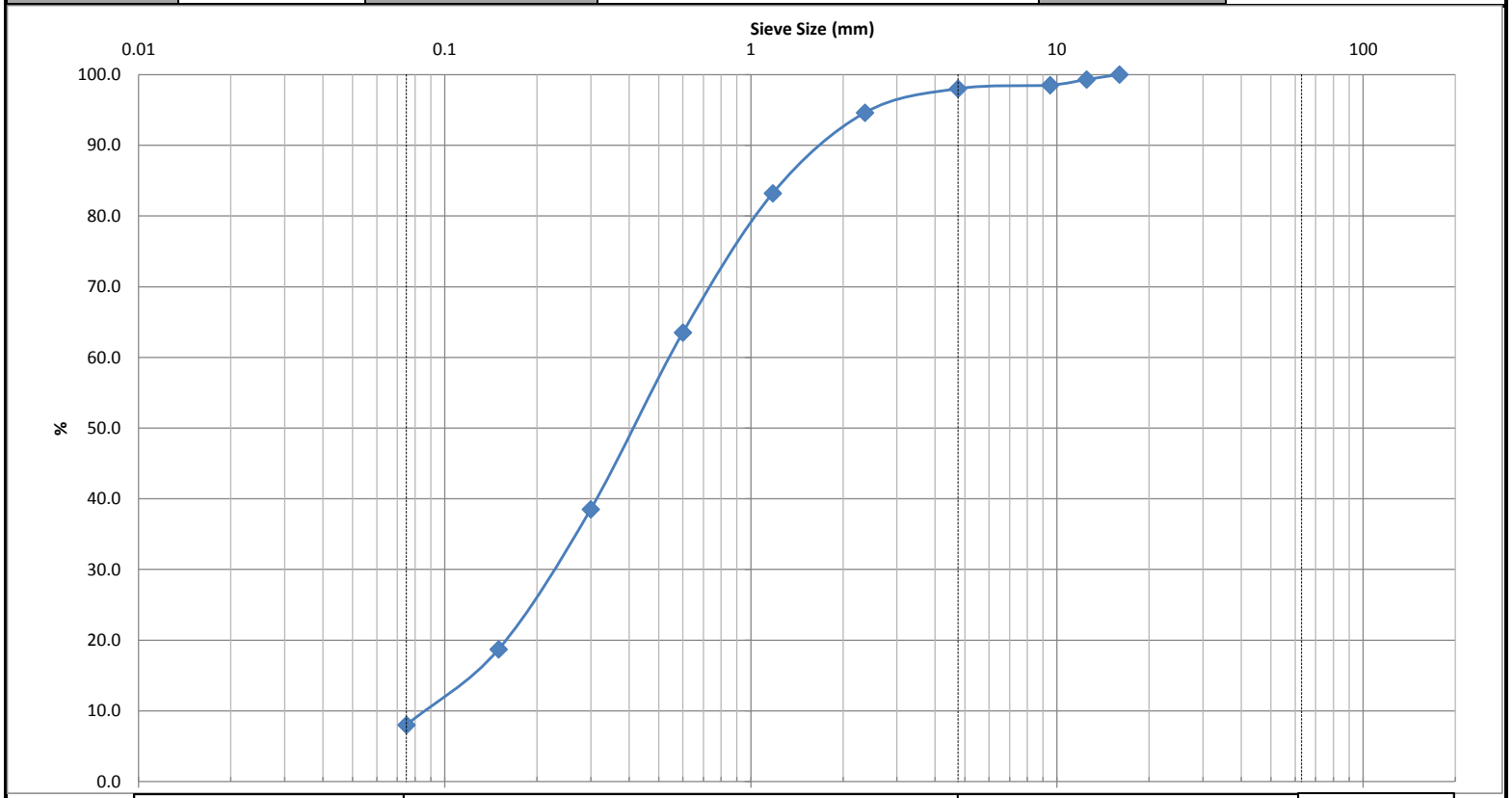
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Barrhaven	DESCRIPTION:	Granular	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	SAND	LAB NO:	85584
PROJECT:	CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	20-Jul-16
DATE SAMPLED:	15-Jul-16	SOURCE LOCATION:	-	DATE REPORTED:	23-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA5	TESTED BY:	0



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										1.28	7.3
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	16.5	0.55	0.23	0.075	2.0	90.0		8.0			

Comments	

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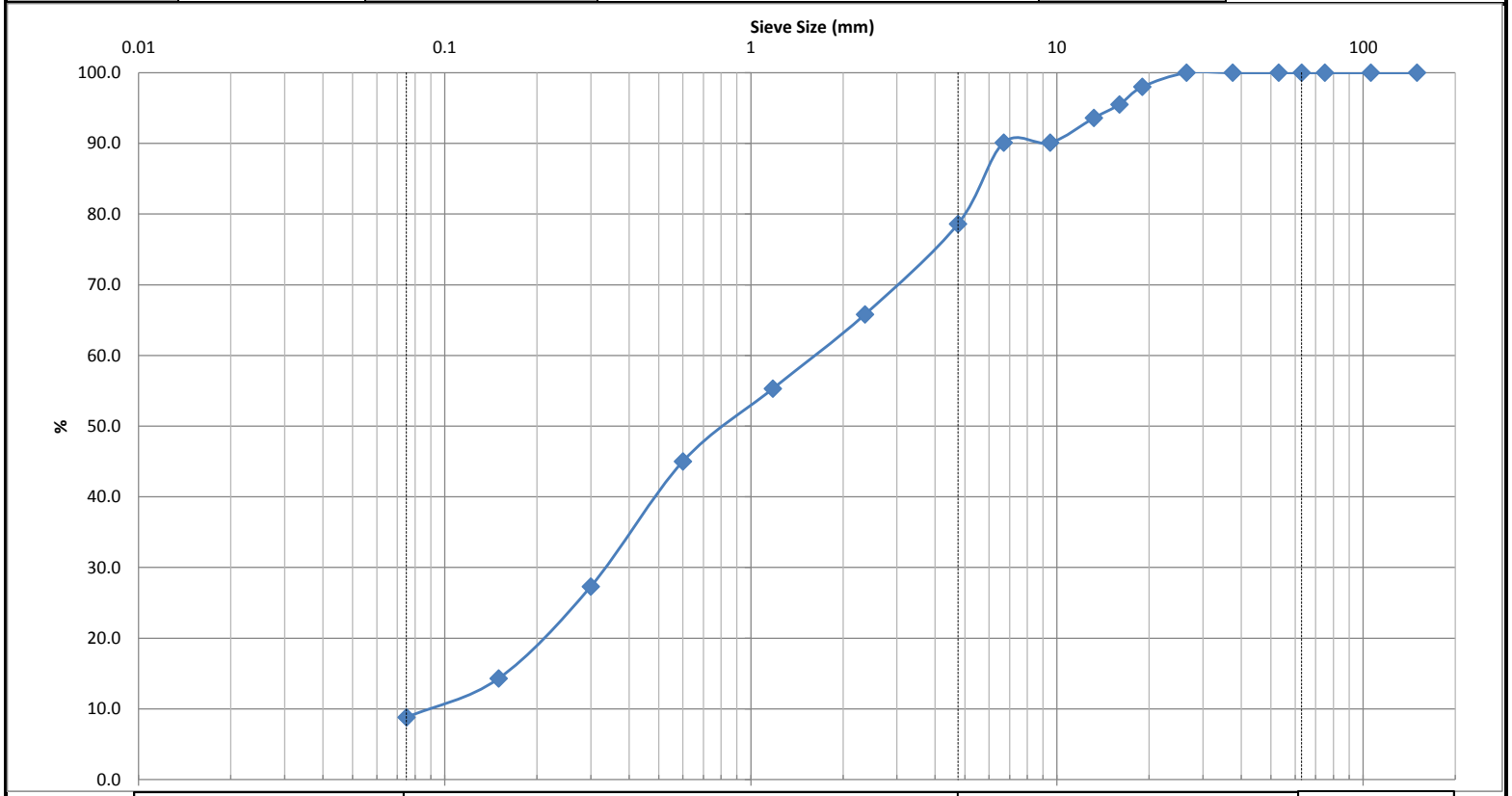
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Development	DESCRIPTION:	Native	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	85586
PROJECT:	Barrhaven South CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	15-Jul-16
DATE SAMPLED:	14-Jul-16	SOURCE LOCATION:	Borehole	DATE REPORTED:	18-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA7	TESTED BY:	CB/AK



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										0.91	21.3
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	28	1.6	0.33	0.075	21.4	69.8		8.8			

Comments	

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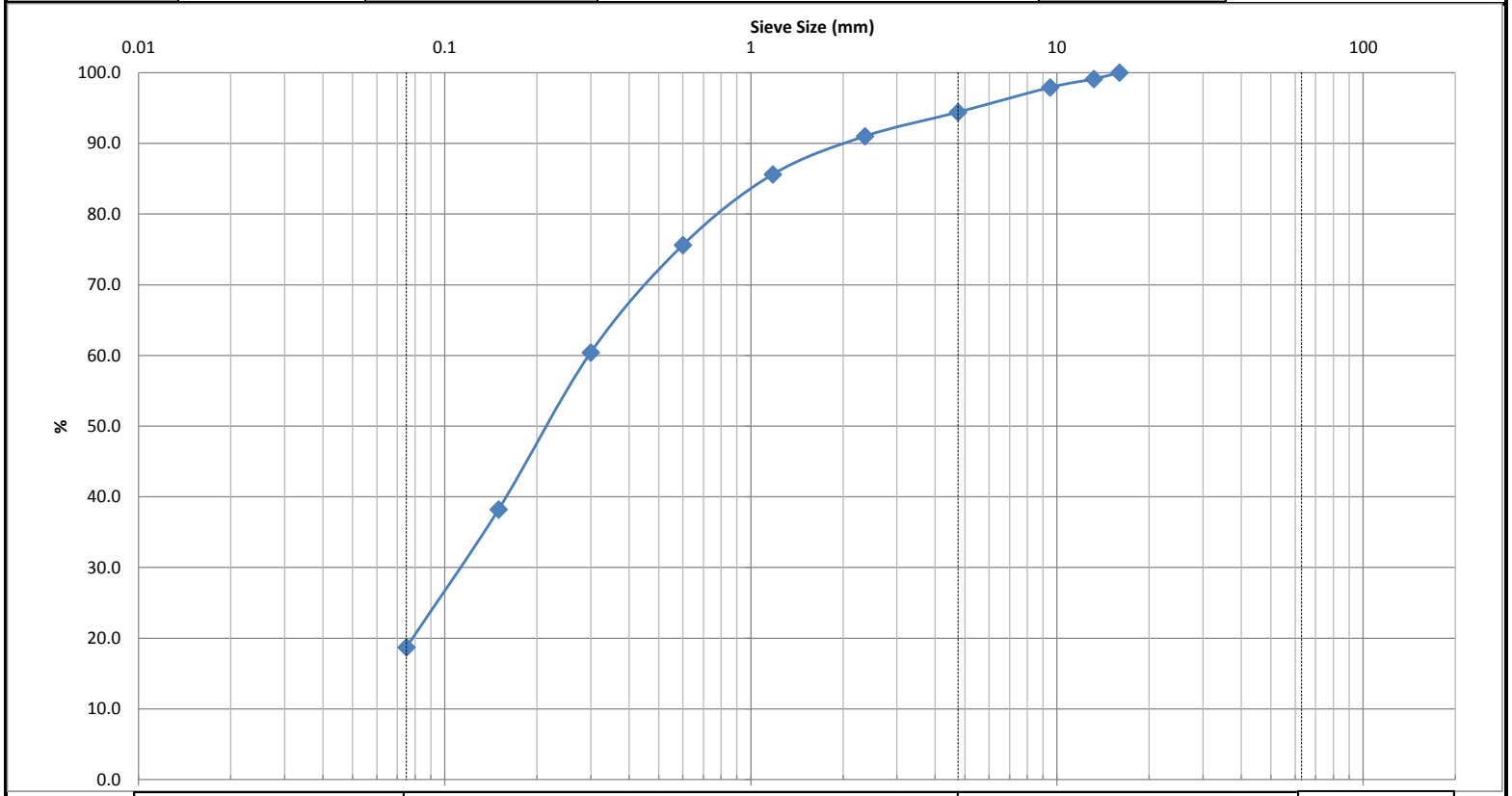
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Development	DESCRIPTION:	Native	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	85588
PROJECT:	Barrhaven South CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	15-Jul-16
DATE SAMPLED:	14-Jul-16	SOURCE LOCATION:	Borehole	DATE REPORTED:	18-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA8	TESTED BY:	CB/AK



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification							MC(%)	LL	PL	PI	Cc	Cu
												1.20	7.5
	D100		D60	D30	D10	Gravel (%)	Sand (%)			Silt (%)		Clay (%)	
	17.5		0.3	0.12	0.04	5.6	75.7			18.7			

Comments	

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Development	DESCRIPTION:	Native	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	85592
PROJECT:	Barrhaven South CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	15-Jul-16
DATE SAMPLED:	14-Jul-16	SOURCE LOCATION:	Borehole	DATE REPORTED:	18-Jul-16
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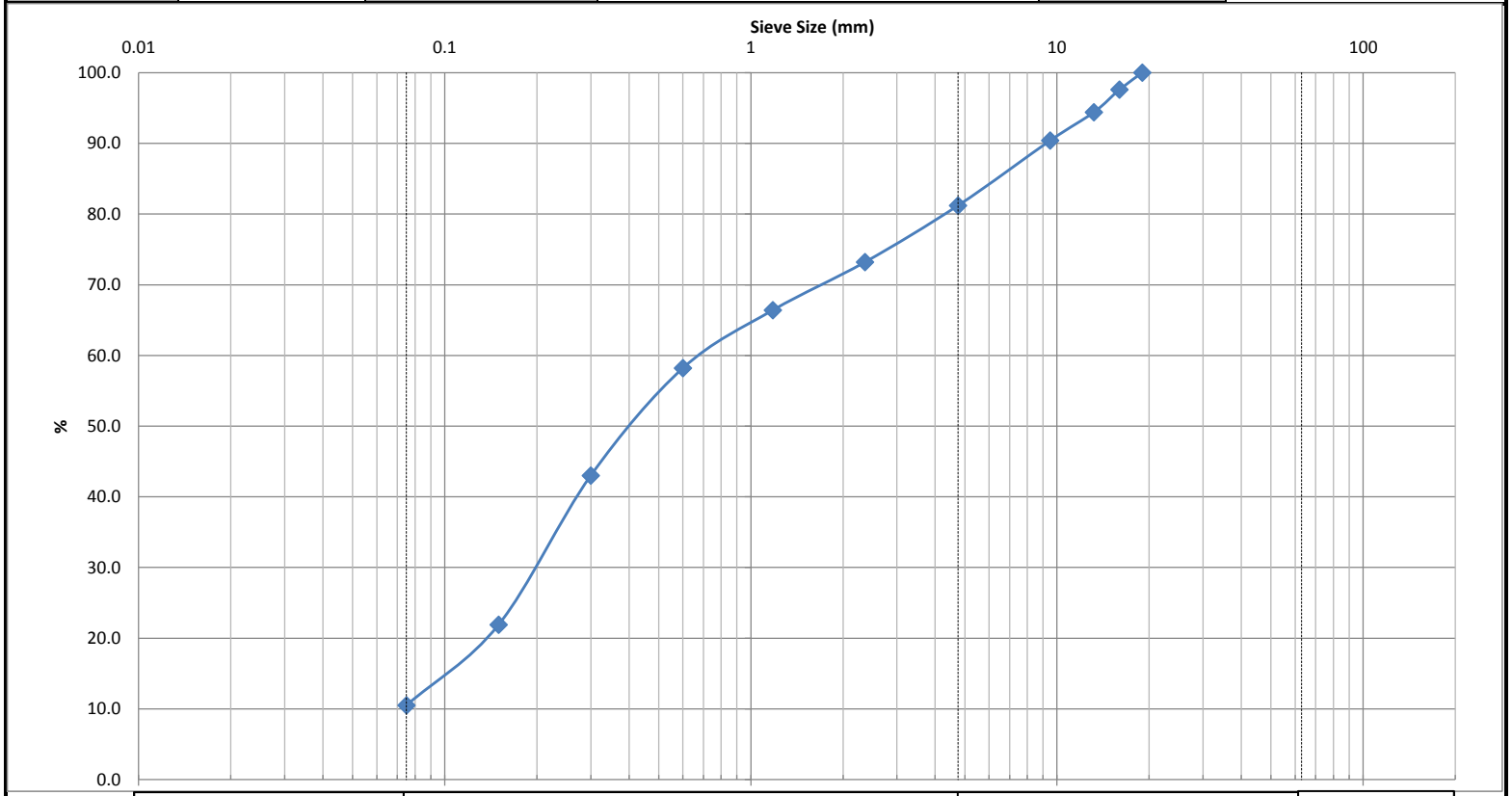

Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										0.82	8.7
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	19	0.65	0.2	0.075	18.8	70.7		10.5			

Comments	

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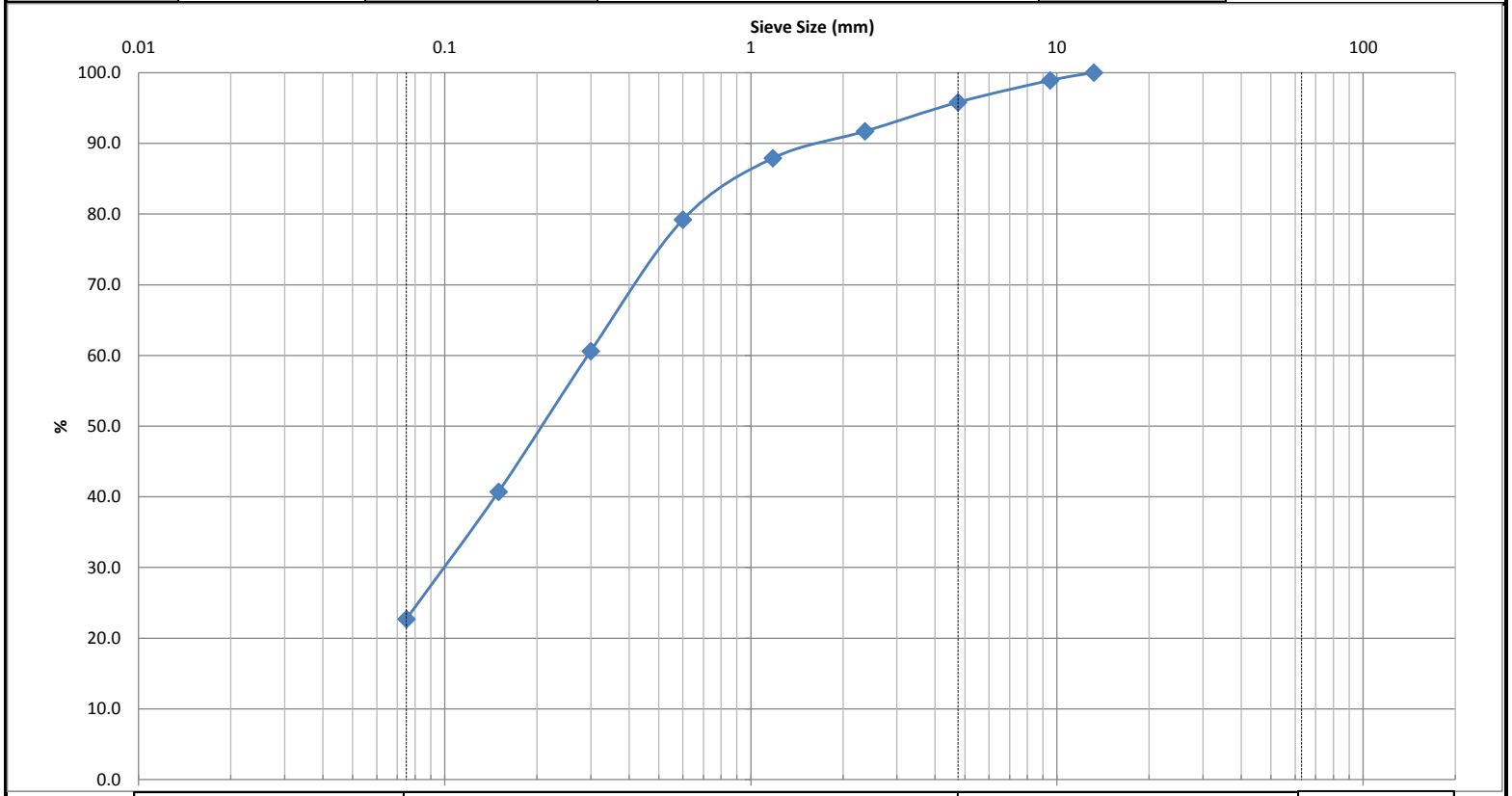
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Barrhaven	DESCRIPTION:	Granular	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	SAND	LAB NO:	85591
PROJECT:	CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	20-Jul-16
DATE SAMPLED:	15-Jul-16	SOURCE LOCATION:	-	DATE REPORTED:	23-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA11	TESTED BY:	0



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification							MC(%)	LL	PL	PI	Cc	Cu
												0.83	7.5
	D100		D60	D30	D10	Gravel (%)	Sand (%)			Silt (%)		Clay (%)	
	14		0.3	0.1	0.04	4.2	73.1			22.7			

Comments	

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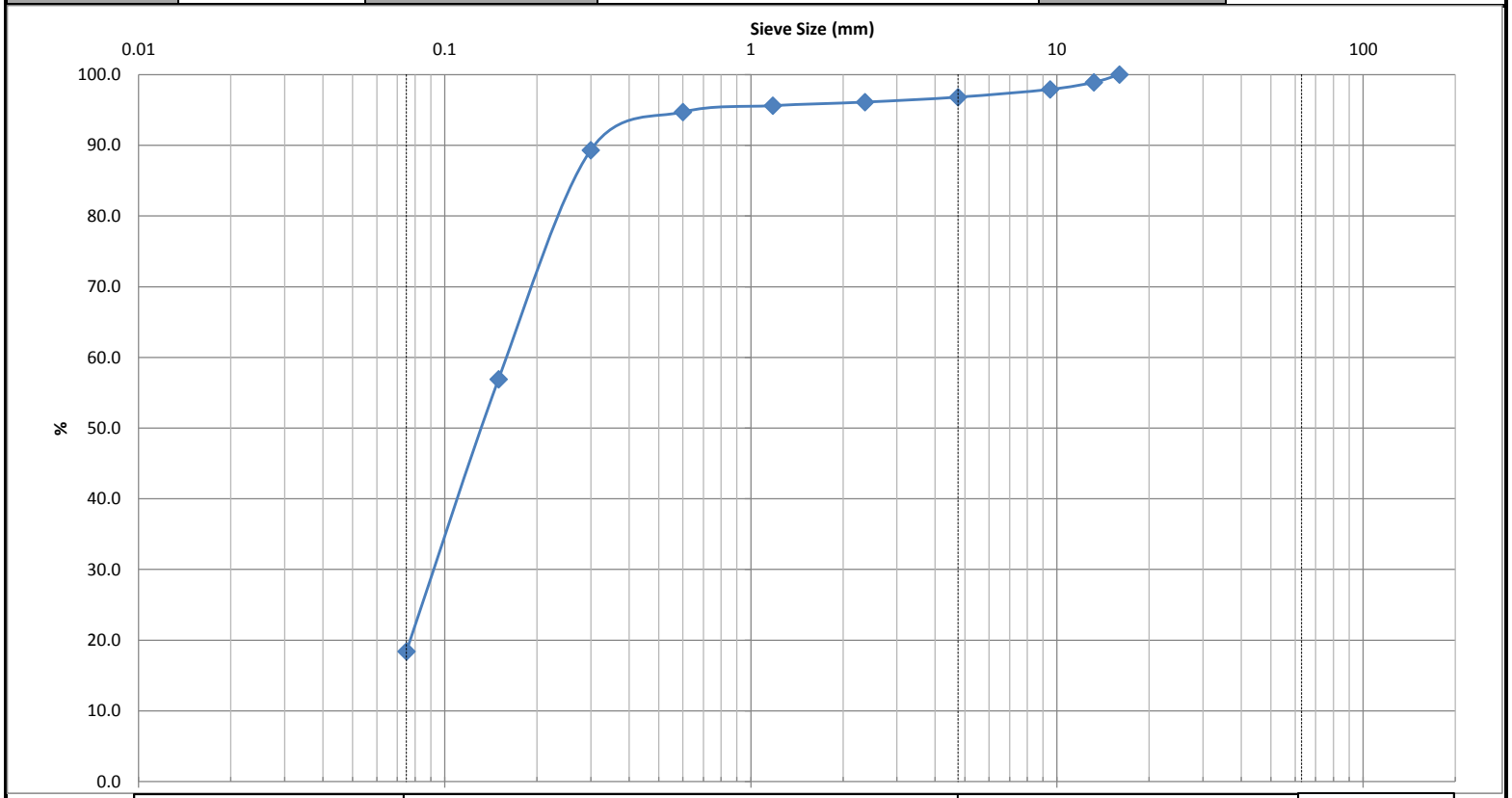
SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Development	DESCRIPTION:	Native	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	-	LAB NO:	85590
PROJECT:	Barrhaven South CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	15-Jul-16
DATE SAMPLED:	14-Jul-16	SOURCE LOCATION:	Borehole	DATE REPORTED:	18-Jul-16
SAMPLED BY:	NZ	SAMPLE LOCATION:	SA12	TESTED BY:	CB/AK



Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification								Cc	Cu
						MC(%)	LL	PL	PI	0.68	2.4
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	17	0.17	0.09	0.07	3.2	78.4		18.4			

Comments	

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SIEVE ANALYSIS
ASTM C136

CLIENT:	Minto Barrhaven	DESCRIPTION:	Granular	FILE NO:	PG3757
CONTRACT NO.:	-	SPECIFICATION:	SAND	LAB NO:	85589
PROJECT:	CDP	INTENDED USE:	-	DATE RECEIVED:	14-Jul-16
		PIT OR QUARRY:	-	DATE TESTED:	20-Jul-16
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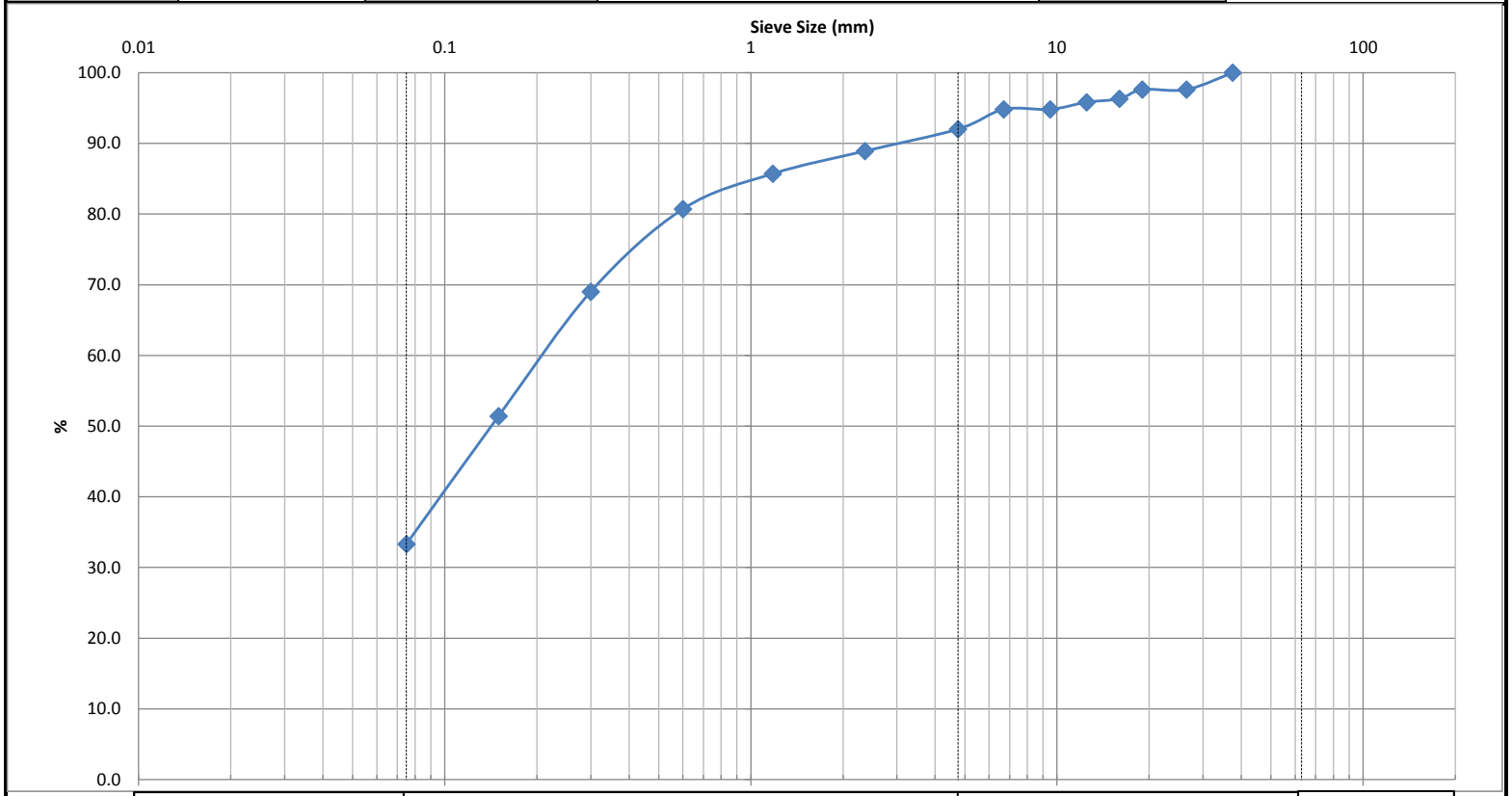
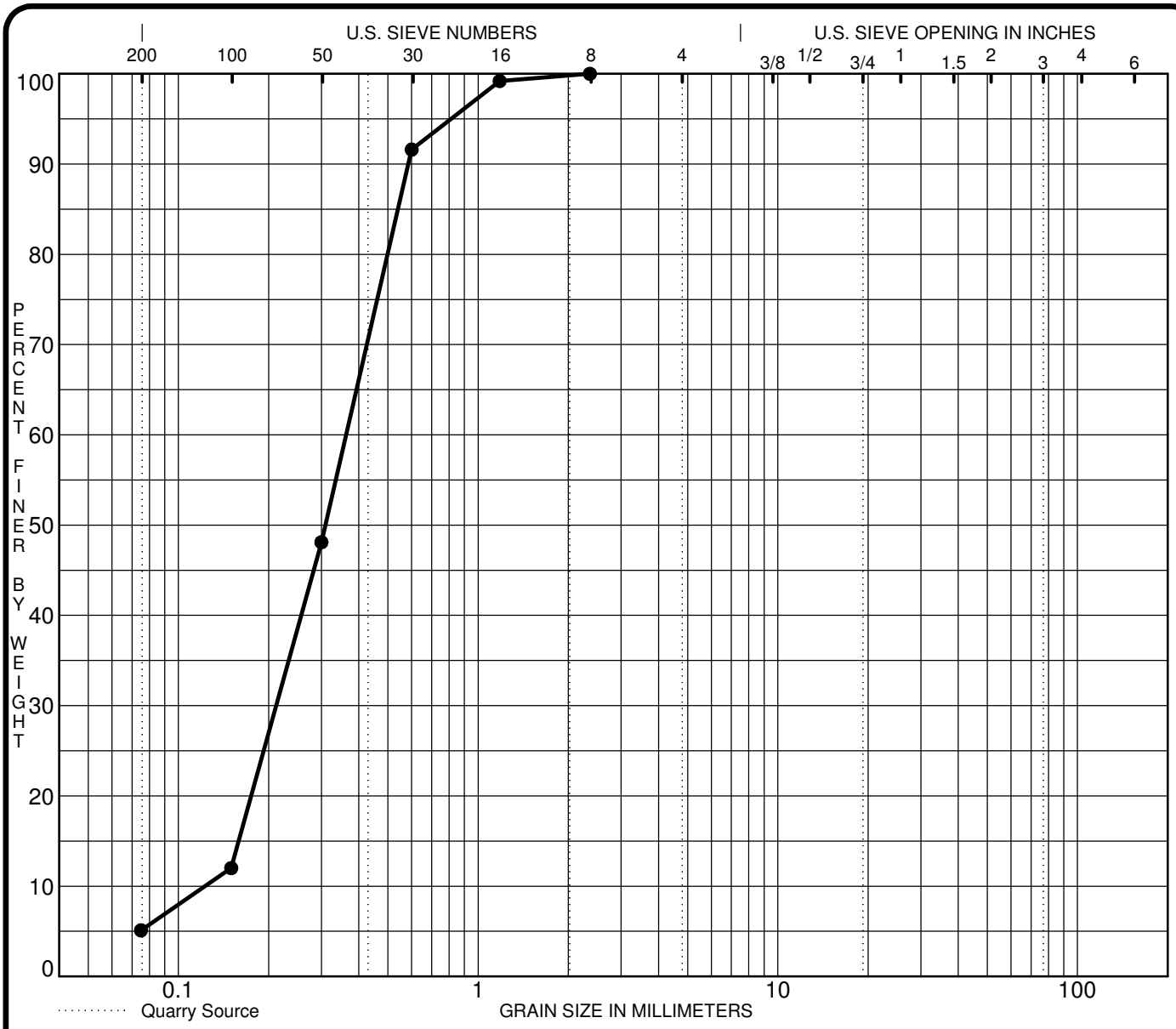


Silt and Clay	Sand			Gravel		Cobble
	Fine	Medium	Coarse	Fine	Coarse	

Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
										0.67	7.0
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
	38	0.21	0.065	0.03	8.0	58.7		33.3			

Comments	



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **BH 7-15 SS 6**	**(SP-SM) Poorly-graded SAND with silt**					**1.01**	**3.0**
⊠							
▲							
★							

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH 7-15 SS 6**	**2.36**	**0.36**	**0.212**	**0.1227**	**0.0**	**94.9**	**5.1**	
⊠								
▲								
★								

CLIENT **Regional Group of Companies** FILE NO. **PG3607**

PROJECT **Geotechnical Investigation - Barrhaven South** DATE **10 Dec 15**

Urban Expansion

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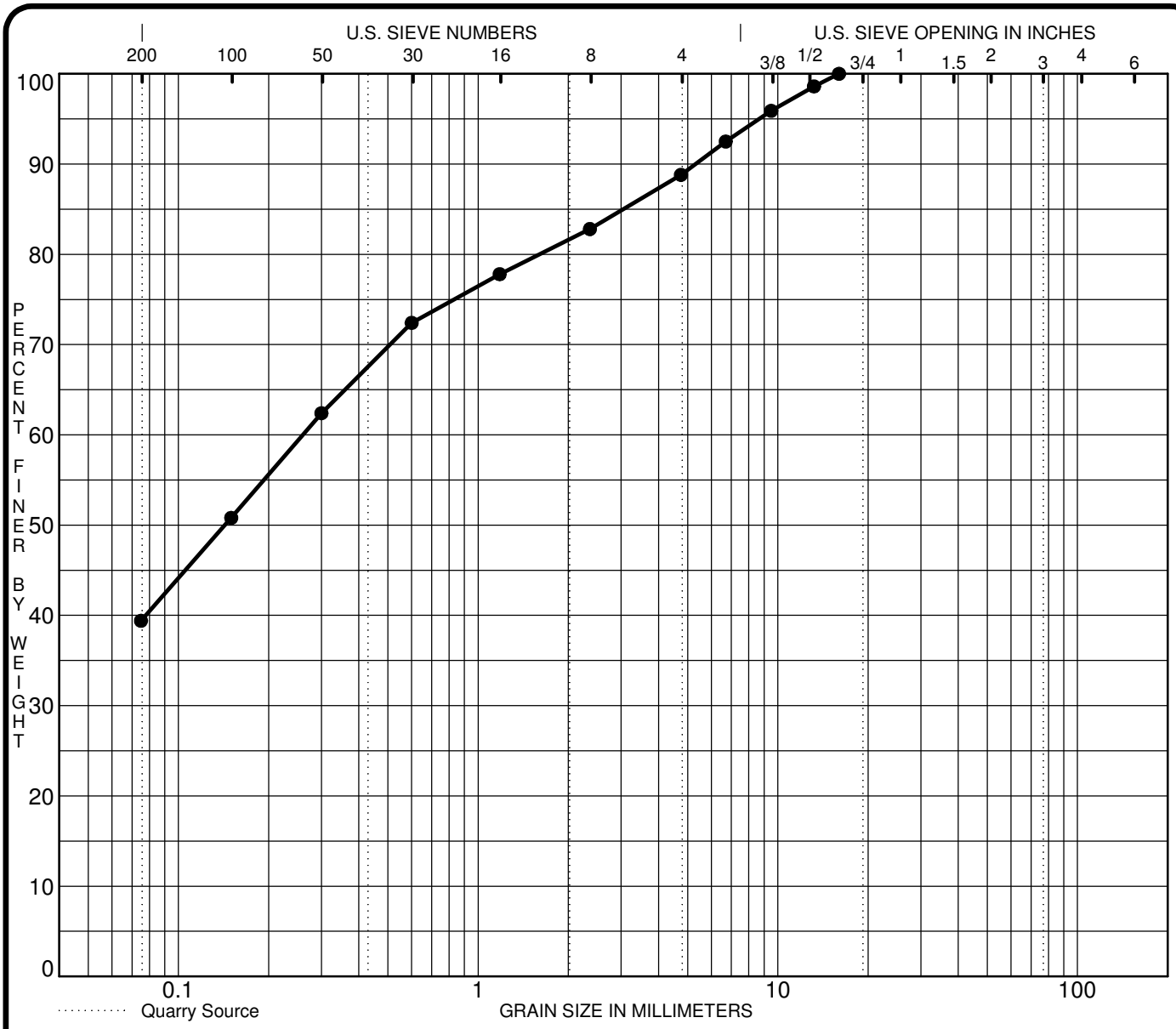
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH11-15 SS 8&9**	**(SM) SILTY SAND, some gravel**						
⊠								
▲								
★								

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH11-15 SS 8&9**	**16.00**	**0.26**			**11.2**	**49.4**	**39.4**	
⊠									
▲									
★									

CLIENT **Regional Group of Companies** FILE NO. **PG3607**

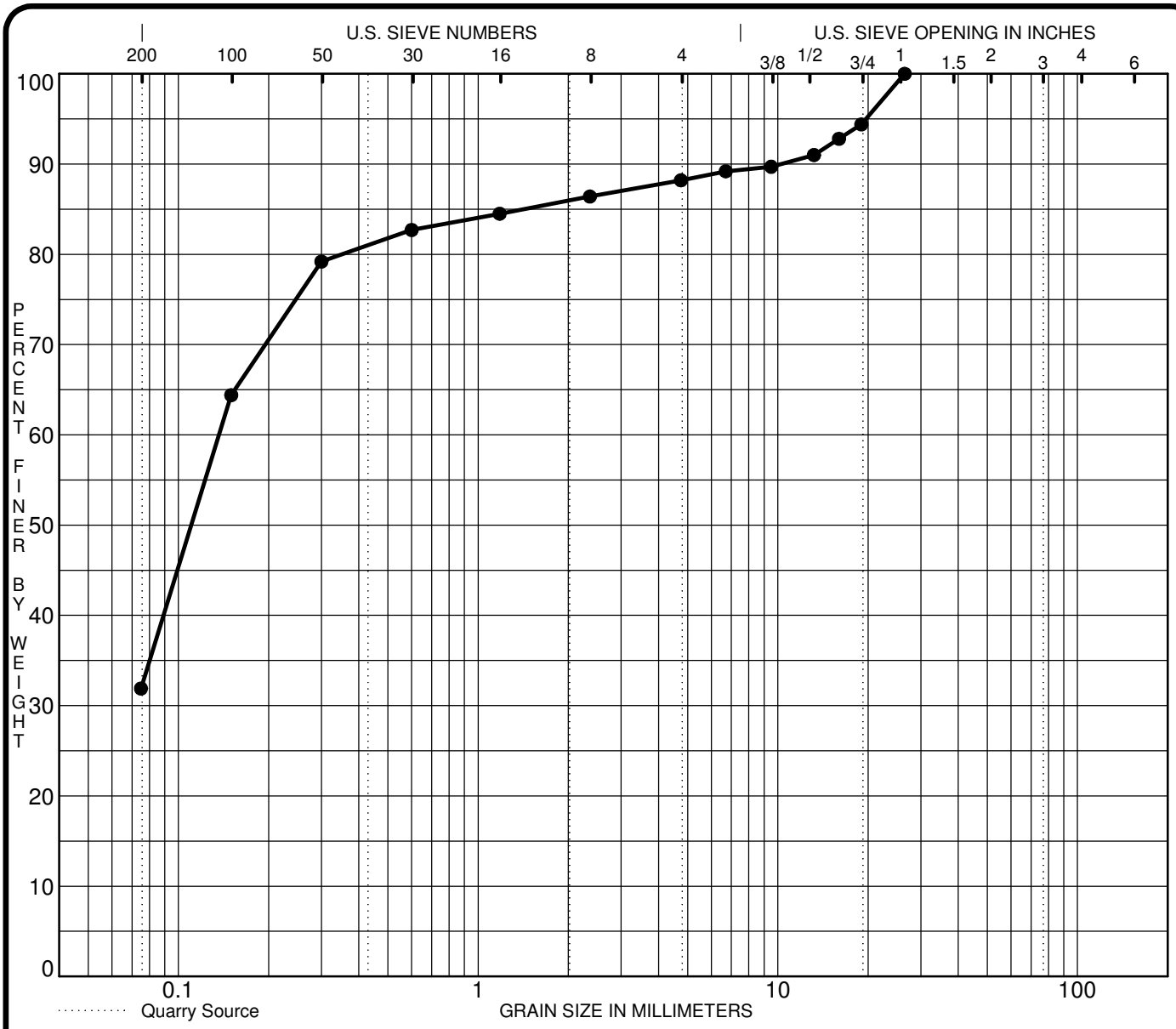
PROJECT **Geotechnical Investigation - Barrhaven South** DATE **3 Dec 15**

Urban Expansion

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **BH21-15 SS 10&11**	**(SM) SILTY SAND, some gravel**						
⊠							
▲							
★							

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **BH21-15 SS 10&11**	**26.50**	**0.14**			**11.8**	**56.3**	**31.9**	
⊠								
▲								
★								

CLIENT **Regional Group of Companies** FILE NO. **PG3607**

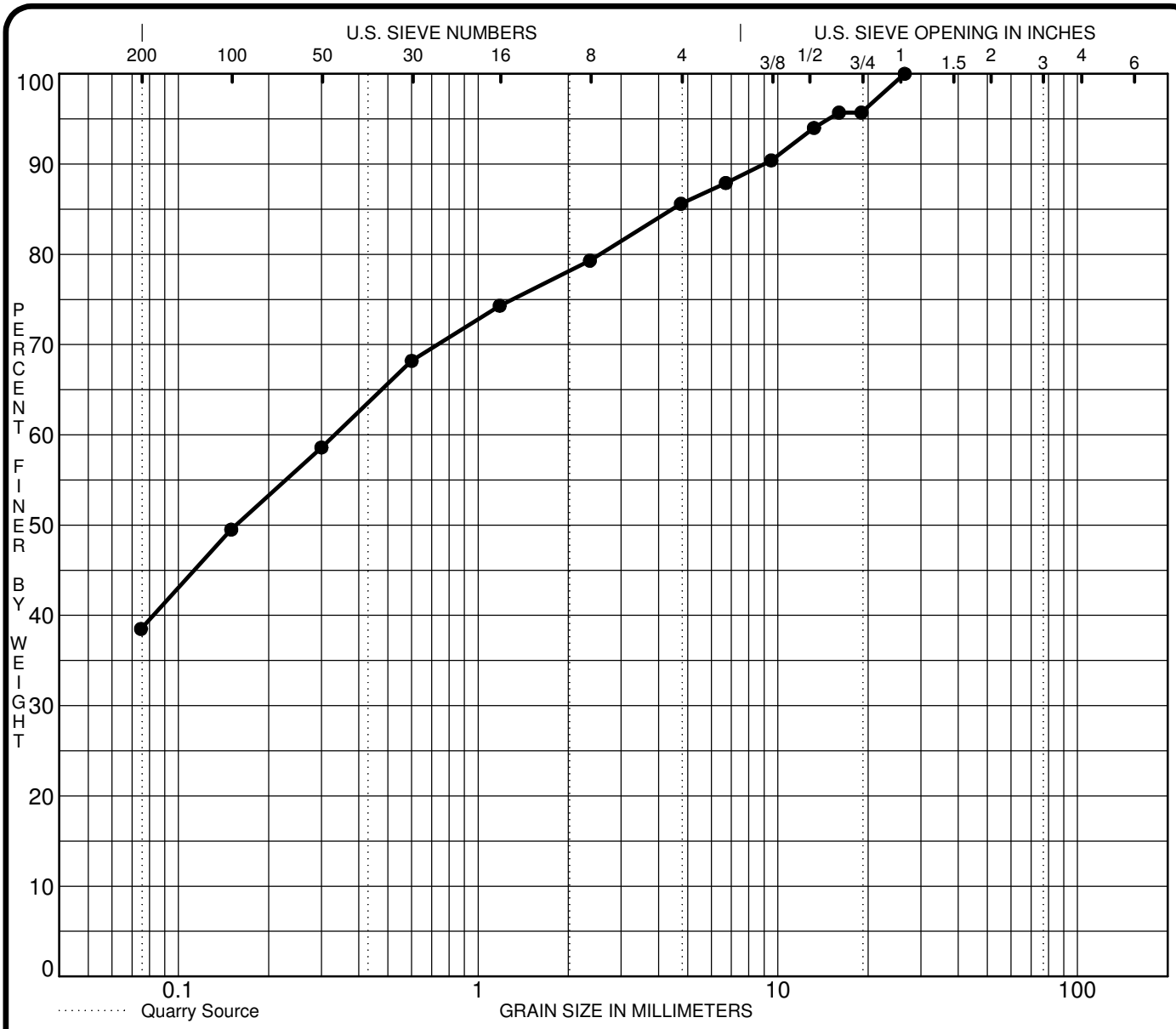
PROJECT **Geotechnical Investigation - Barrhaven South** DATE **9 Dec 15**

Urban Expansion

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH24-15 SS 5**	**(SM) SILTY SAND, some gravel**						
⊠								
▲								
★								

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH24-15 SS 5**	**26.50**	**0.33**			**14.4**	**47.1**	**38.5**	
⊠									
▲									
★									

CLIENT **Regional Group of Companies** FILE NO. **PG3607**

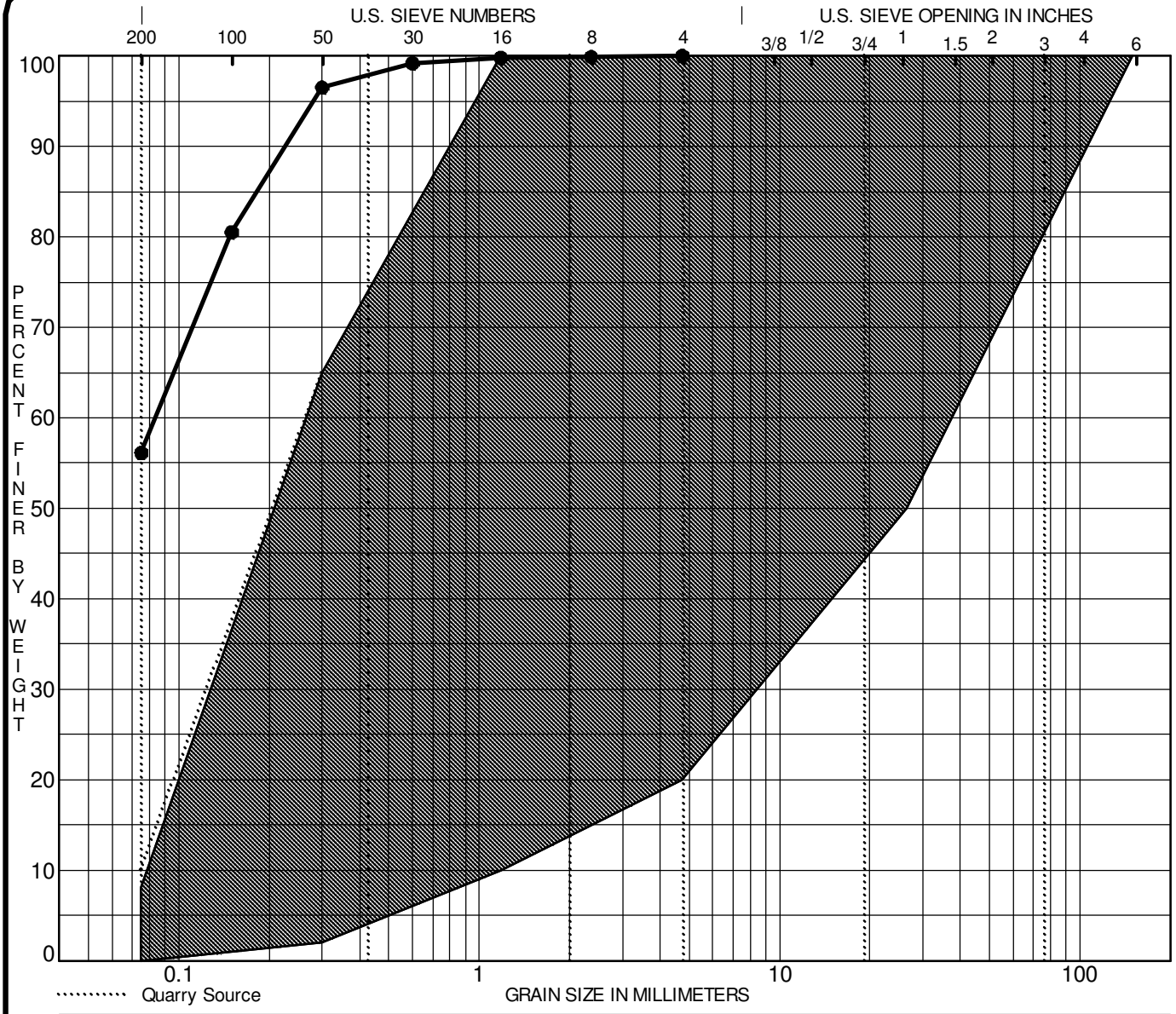
PROJECT **Geotechnical Investigation - Barrhaven South** DATE **27 Nov 15**

Urban Expansion

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP 7-11**	**G18**	**SANDY SILT/SILTY SAND**						
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP 7-11**	**G18**	**4.75**	**0.08**			**0.0**	**43.9**	**56.1**	
⊠										
▲										
★										

CLIENT **Minto Communities Inc.** FILE NO. **PH1893**

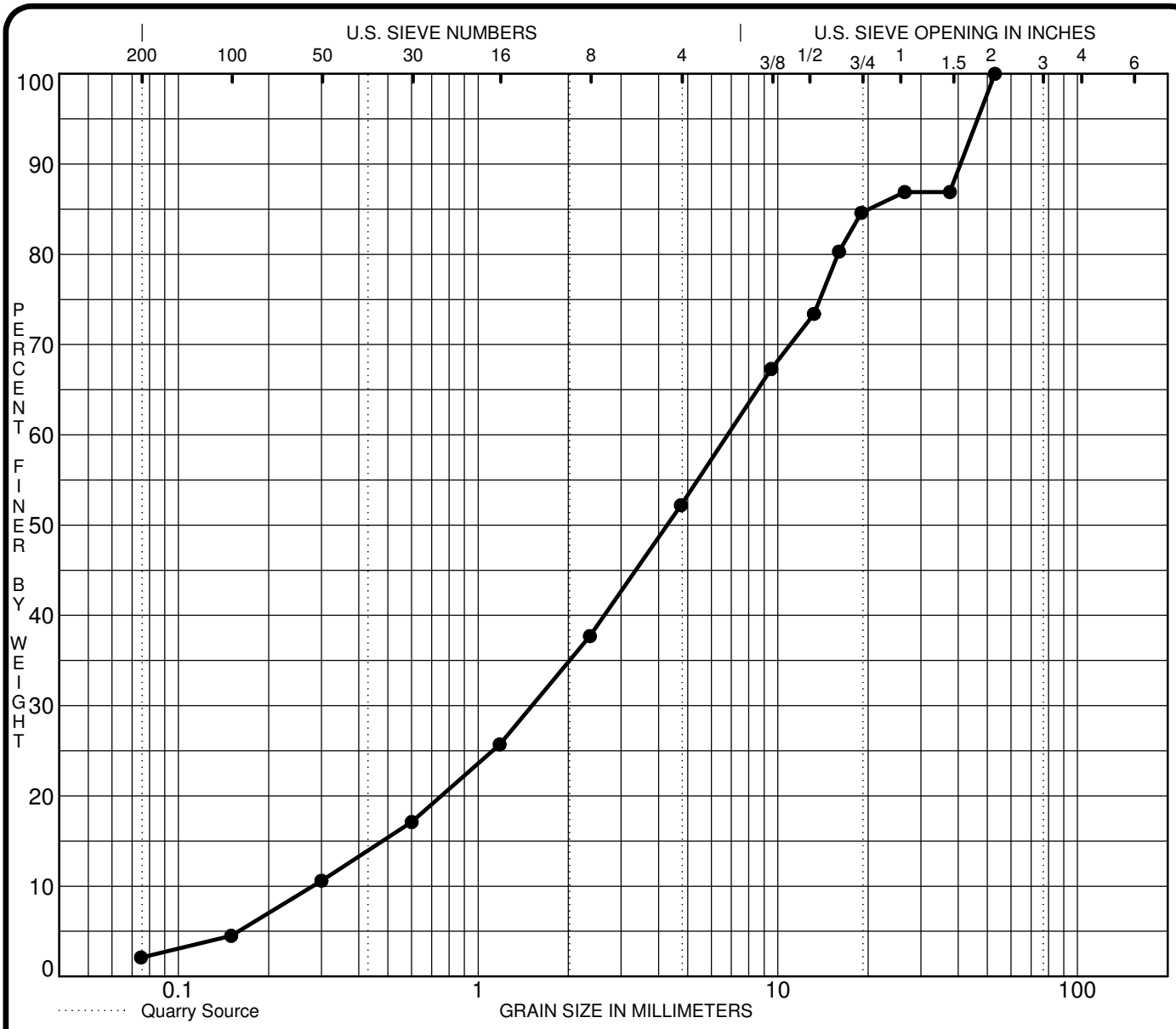
PROJECT **Mineral Resource Aggregate Assessment - 3882** DATE **16 Dec 11**

Barnsdale Road

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



SILT	SAND			GRAVEL		COBBLES
	fine	medium	coarse	fine	coarse	

Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
● **TP 31A-15 G 2**	**(SW) Well-graded SAND with gravel**					**1.20**	**24.2**
⊠							
▲							
★							

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **TP 31A-15 G 2**	**53.00**	**6.80**	**1.513**	**0.2802**	**47.8**	**50.1**	**2.1**	
⊠								
▲								
★								

CLIENT **Regional Group of Companies** FILE NO. **PG3607**

PROJECT **Geotechnical Investigation - Barrhaven South** DATE **1 Dec 15**

Urban Expansion

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG4748-1 - TEST HOLE LOCATION PLAN

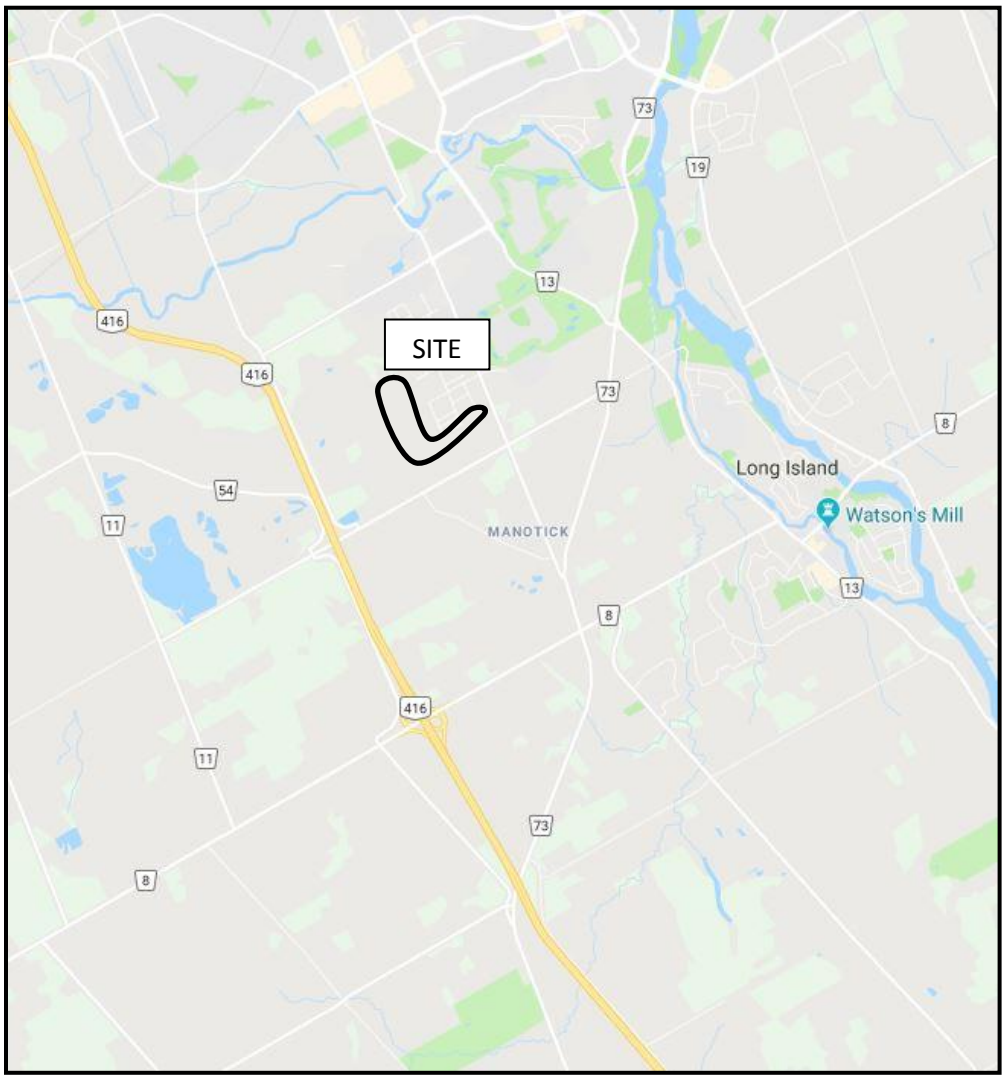

FIGURE 1

KEY PLAN

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NO.	REVISIONS	DATE	INITIAL
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MINTO COMMUNITIES INC.

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
QUINN'S POINTE , BARNSDALE ROAD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Stamp:

Scale:	1:1250
Drawn by:	RCG
Checked by:	FA
Approved by:	DJG
Date:	11/2018
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