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July 28, 2014
PG3267-LET.01

Frank D'Amato c/o S. J. Lawrence Architect Inc.
18 Deakin Street, Suite 205
Ottawa, Ontario
K2E 8B7

Attention: **Mr. Ali Al-Amidi**

Subject: **Geotechnical Investigation**
Proposed Commercial Development
1290 Trim Road - Ottawa

Dear Sir,

Further to your request, Paterson Group (Paterson) was commissioned by S. J. Lawrence Architect Inc on behalf of Frank D'Amato to conduct a geotechnical investigation for the proposed commercial development to be located at the 1290 Trim Road in the City of Ottawa, Ontario. The following report presents the findings and recommendations.

1.0 Field Investigation

Field Program

The fieldwork for the current investigation was completed on June 11 and 12, 2014 and consisted of three boreholes. The boreholes were drilled with a track mounted drill rig, operated by a two person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel with direction from a senior engineer from Paterson's geotechnical division. The drilling procedure consisted of augering to the required depths, sampling and testing the overburden at selected locations.

The location and ground surface elevation at the test hole locations were surveyed by Paterson field personnel. Ground surface elevations at the borehole locations were referenced to a temporary benchmark (TBM), consisting of the a hydro pole nail. A geodetic elevation was noted on the hydro pole nail. The locations and ground surface elevations of the boreholes and the TBM are presented on Drawing PG3267-1 - Test Hole Location Plan.

2.0 Field Observations

The subject site is currently undeveloped and grass covered with trees scattered across the site. The subject side is approximately 0.5 to 1.0 m below the existing roadway. Trim Road is located to the east and commercial developments to the south, east and west of the subject site. The commercial development located to the south has an existing retaining wall along the south boundary. The retaining wall is supporting the existing parking lot and approximately 1.0 to 1.5 m above current grade of the subject site. The majority of the ground surface across the subject site slopes down towards the northwest.

Generally, the subsurface profile encountered at the borehole locations consists of topsoil and/or silty sand fill mixed with gravel and roots. A very stiff to stiff brown silty clay crust was encountered below the topsoil/fill layer followed by firm to stiff grey silty clay. Practical refusal to DCPT was encountered in BH 3 at a depth of 28.8 m. Refer to the Soil Profile and Test Data sheets attached for specific details of the soil profile encountered at the borehole locations.

Based on available geological mapping, interbedded limestone and dolomite bedrock of the Gull River formation is present in this area with an overburden thickness ranging between 15 to 50 m.

Based on the provided borehole logs, the long-term groundwater table is expected at a range between 4.0 to 5.0 m depth. Groundwater levels are subject to seasonal fluctuations and could vary at the time of construction.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed commercial building. The proposed slab on grade building is expected be constructed over conventional shallow foundations and placed on a stiff brown silty clay bearing surface.

Due to the presence of the sensitive silty clay layer, the proposed development will be subjected to a permissible grade raise restriction. If the grade raise restriction is exceeded, several options are available, such as a preload/surcharge program or the placement of lightweight fill below the proposed buildings.

Site Grading and Preparation

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Care should provided not to disturb adequate bearing soils at subgrade level during site preparation activities.

Backfill placed for grading beneath the proposed building footprint, unless otherwise specified, should consist of clean imported granular backfill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The backfill should be tested and approved prior to delivery to the site. The backfill should be placed in maximum lift thickness of 300 mm and compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where surface settlement is of minor concern. The existing materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If the existing materials are to be placed to increase the subgrade level for areas to be paved, the non-specified existing fill should be compacted in 300 mm lifts and compacted to a minimum density of 95% of the SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls, unless placed in conjunction with a composite drainage system.

Foundation Design

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, stiff brown silty clay bearing surface can be designed using a bearing resistance value at SLS of **110 kPa** and a factored bearing resistance value at ULS of **170 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance values at ULS.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings. The bearing resistance value at SLS given for footings will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

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 soil bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1.5H:1V, passing through in situ soil or engineered fill of equal or higher capacity as the soil.

Permissible Grade Raise Recommendations

Based on the existing borehole coverage and results of the undrained shear strength tests completed within the underlying cohesive soils, a **permissible grade raise restriction of 1.0 m** is recommended be implemented for areas where foundations are placed over the silty clay deposit. A post-development groundwater lowering of 0.5 m was considered in the permissible grade raise restriction calculations.

Design for Earthquakes

Foundation design for the proposed commercial development can utilize a seismic site response **Class E** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A).

Slab on Grade Construction

With the removal of all topsoil and deleterious materials, within the proposed building footprint, the native soil, free of organic and deleterious materials, and approved by the geotechnical consultant, at the time of construction is considered, to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 200 mm of sub-slab fill should consist of an OPSS Granular A crushed stone material. All backfill material within the proposed building footprint should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the SPMDD.

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.

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 access lanes.

Table 1 - 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 soils or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 2 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas

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

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

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the SPMDD.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the granular base in a dry condition.

Failure to provide adequate drainage under conditions of heavy wheel loading could result in the subgrade soil being pumped into the voids in the granular subbase, thereby reducing the load bearing capacity.

Due to the impervious nature of the subgrade materials consideration to installing subdrains during the pavement construction should be provided. These drains should be installed at each catch basin, be a minimum of 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be shaped to promote water flow to the drainage lines.

4.0 Design and Construction Precautions

Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended to be provided for the proposed structure. The system should consist of a 100 to 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 majority of the site excavated materials will be frost susceptible and are not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Otherwise, imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be placed for this purpose.

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.

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.

Excavation Side Slopes

The excavation side slopes in overburden materials should either be excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. Sufficient room should be available for the greater part of the excavation to be construction 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 excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soil is considered to be mainly Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

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

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

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.

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

The groundwater flow rate into the excavation through the overburden should be low for expected founding levels of the proposed building. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of the excavations.

Pipe Bedding and Backfill

A minimum of 150 mm of OPSS Granular A should be placed 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 a minimum of 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 300 mm thick lifts compacted to a minimum of 95% of the SPMDD.

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 SPMDD.

To reduce long-term groundwater lowering level, clay seals should be provided in the service trenches due to the underlying silty clay. The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry brown silty clay placed in maximum 200 mm thick loose layers and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations with a maximum of 60 m intervals in the service trenches.

Winter Construction

If winter construction is considered for this project, precautions should be provided for frost protection. The subsurface soil conditions mainly consist of frost susceptible materials. In 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 excavation base 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 completed in a manner to avoid the introduction of frozen materials, snow or ice into the trenches. Where excavations are constructed in proximity of existing structures precaution to adversely affecting the existing structure due to the freezing conditions should be provided.

Corrosion Potential and Sulphate

The analytical test results indicate the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement would be appropriate. The chloride content of the sample indicates a non-significant factor in creating a corrosive environment for exposed ferrous metals, whereas the pH and resistivity is indicative of an aggressive to very aggressive corrosive environment.

Table 3 - Corrosion Potential

Parameter	Laboratory Results	Threshold	Commentary
	TP6 - G1		
Chloride	375 µg/g	Chloride content greater than 400 mg/g	Negligible concern
pH	7.67	pH value less than 5.0	Neutral Soil
Resistivity	15.7 ohm.m	Resistivity greater than 1,500 ohm.cm	High Corrosion Potential
Sulphate	86 µg/g	Sulphate value greater than 1 mg/g	Negligible Concern

5.0 RECOMMENDATIONS

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

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

☐ 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 construction has been conducted in general accordance with the recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

6.0 Statement of Limitations

The recommendations are in accordance with the present understanding of the project. Paterson requests permission to review the grading plan once available and the 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 the test locations, Paterson requests notification immediately in order to permit reassessment of the 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 Frank D'Amato, S J Lawrence Architects or their agent(s) is not authorized without review by Paterson Group for the applicability of the recommendations to the altered use of the report.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
J. A. FORSYTH
100176378
PROVINCE OF ONTARIO

Faisal Abou-Seido, B. Eng.

Joe Forsyth P. Eng.

Attachments

☐ Soil Profile and Test Data sheets
☐ Analytical Testing Results
☐ Figure 1 - Key Plan
☐ Drawing PG3267-1 - Test Hole Location Plan

Report Distribution

❏ Frank D'Amato c/o S. J. Lawrence Architect Inc. (3 copies)
❏ Paterson Group (1 copy)

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building - 1290 Trim Road
Ottawa, Ontario

DATUM TBM - Nail in hydro pole located in front of subject site, west side of Trim Road. Geodetic elevation = 62.802m.

REMARKS

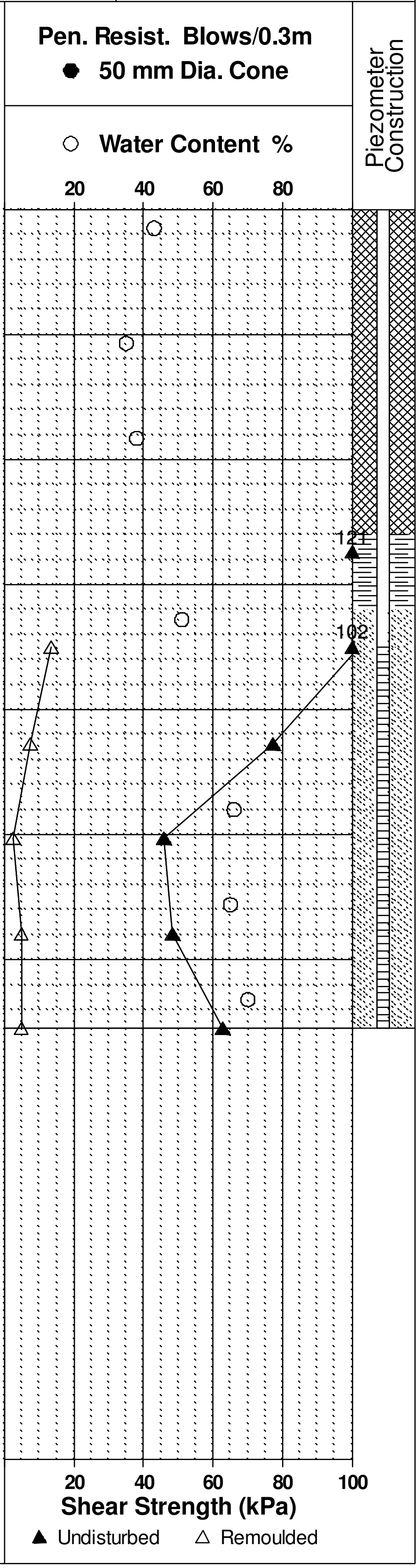
BORINGS BY CME 55 Power Auger

DATE June 12, 2014

FILE NO. PG3267

HOLE NO. BH 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	61.36
FILL: Brown silty sand with gravel and roots 0.30		AU	1				
		SS	2	100	10	1	60.36
		SS	3	100	8		
						2	59.36
Very stiff to stiff, brown **SILTY CLAY**							
						3	58.36
		G	4				
						4	57.36
- firm to stiff and grey by 4.6m depth		G	5				
						5	56.36
		G	6				
						6	55.36
		G	7				
6.55							
End of Borehole							
(Piezometer damaged - July 3, 2014)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building - 1290 Trim Road
Ottawa, Ontario

DATUM TBM - Nail in hydro pole located in front of subject site, west side of Trim Road. Geodetic elevation = 62.802m.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 12, 2014

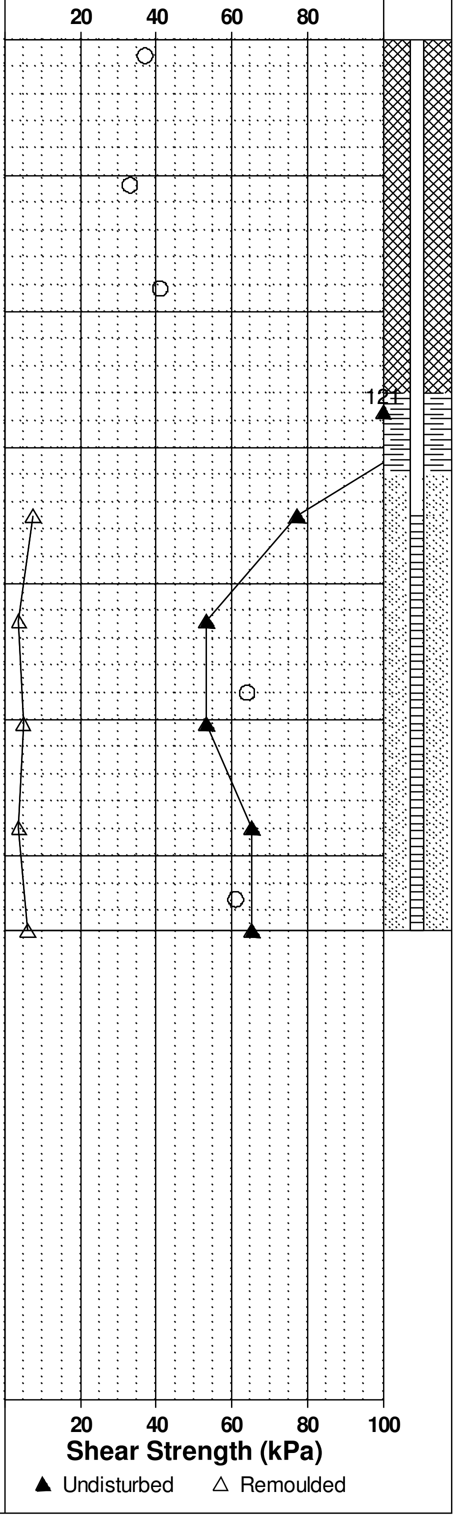
FILE NO. PG3267

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	62.30
TOPSOIL 0.30		AU	1				
		SS	2	100	8	1	61.30
		SS	3	100	8	2	60.30
Very stiff to stiff, brown **SILTY CLAY**						3	59.30
						4	58.30
- grey by 4.6m depth		G	4			5	57.30
						6	56.30
6.55		G	5				
End of Borehole (Piezometer damaged - July 3, 2014)							

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

○ **Water Content %**



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building - 1290 Trim Road
Ottawa, Ontario

DATUM TBM - Nail in hydro pole located in front of subject site, west side of Trim Road. Geodetic elevation = 62.802m.

REMARKS

BORINGS BY CME 55 Power Auger

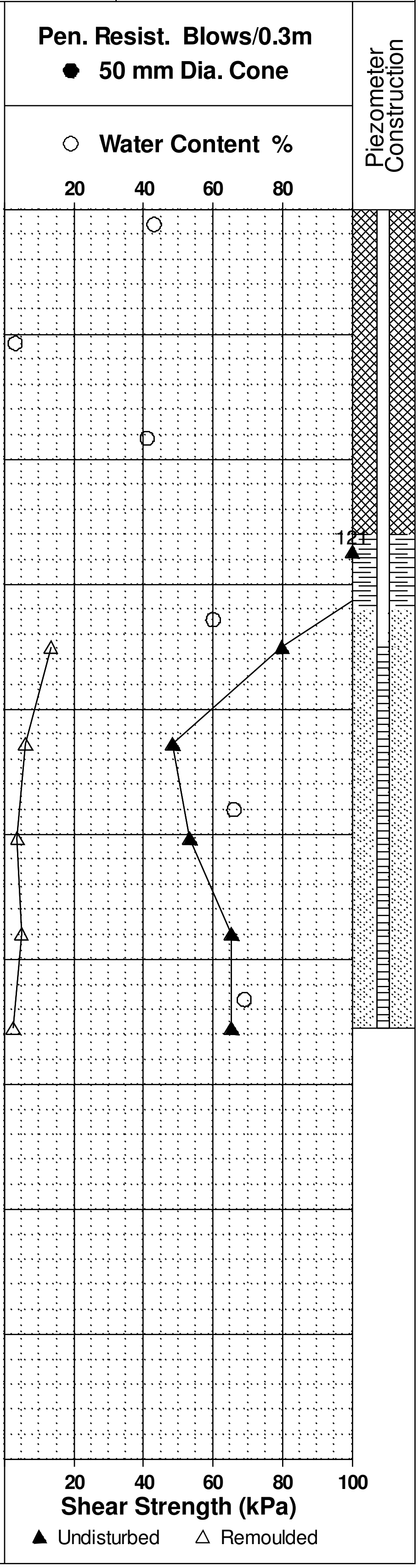
DATE June 11, 2014

FILE NO. PG3267

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.30		AU	1		
Very stiff to stiff, brown **SILTY CLAY**		SS	2	100	6
		SS	3	100	7
- grey by 3.0m depth		G	4		
		G	5		
6.55		G	6		
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 20.4m depth.					

DEPTH (m)	ELEV. (m)
0	61.56
1	60.56
2	59.56
3	58.56
4	57.56
5	56.56
6	55.56
7	54.56
8	53.56
9	52.56
10	51.56



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Building - 1290 Trim Road
Ottawa, Ontario

DATUM TBM - Nail in hydro pole located in front of subject site, west side of Trim Road. Geodetic elevation = 62.802m.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 11, 2014

FILE NO. PG3267

HOLE NO. BH 3

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
GROUND SURFACE		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
						10	51.56		
						11	50.56		
						12	49.56		
						13	48.56		
						14	47.56		
						15	46.56		
						16	45.56		
						17	44.56		
						18	43.56		
						19	42.56		
						20	41.56	20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded	

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REMARKS

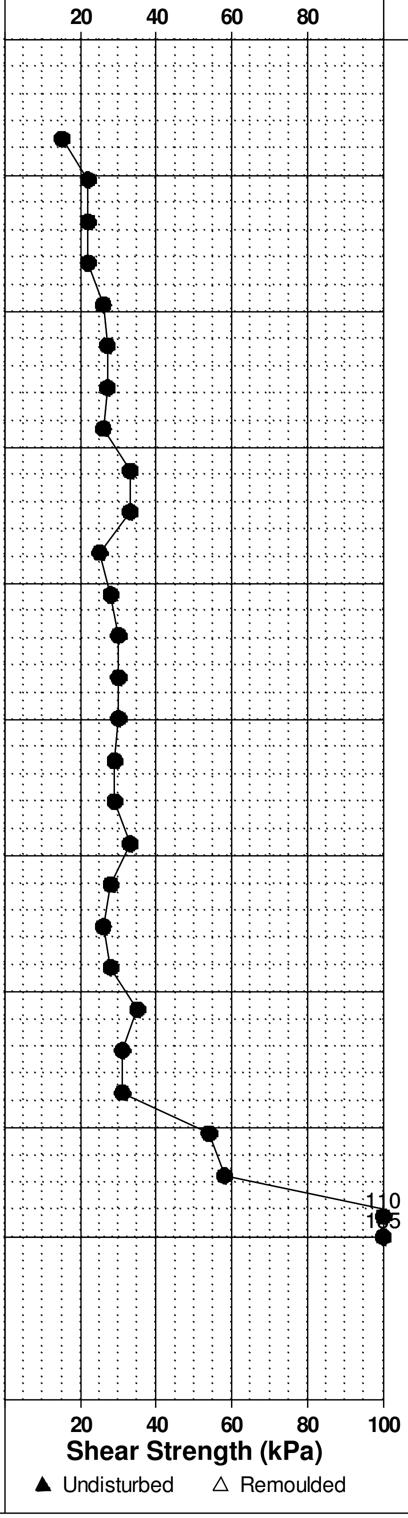
BORINGS BY CME 55 Power Auger

DATE June 11, 2014

FILE NO. PG3267

HOLE NO. BH 3

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								20 40 60 80	
						20	41.56		
						21	40.56		
						22	39.56		
						23	38.56		
						24	37.56		
						25	36.56		
						26	35.56		
						27	34.56		
						28	33.56		
28.80									
End of Borehole Practical DCPT refusal at 28.80m depth (Piezometer damaged - July 3, 2014)									



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture content or water content of sample, %
LL - Liquid Limit, % (water content above which soil behaves as a liquid)
PL - Plastic limit, % (water content above which soil behaves plastically)
PI - Plasticity index, % (difference between LL and PL)

Dxx - Grain size which xx% of the soil, by weight, is of finer grain sizes
These grain size descriptions are not used below 0.075 mm grain size
D10 - Grain size at which 10% of the soil is finer (effective grain size)
D60 - Grain size at which 60% of the soil is finer

Cc - Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu - Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

p'_o - Present effective overburden pressure at sample depth
p'_c - Preconsolidation pressure of (maximum past pressure on) sample
Ccr - Recompression index (in effect at pressures below p'_c)
Cc - Compression index (in effect at pressures above p'_c)

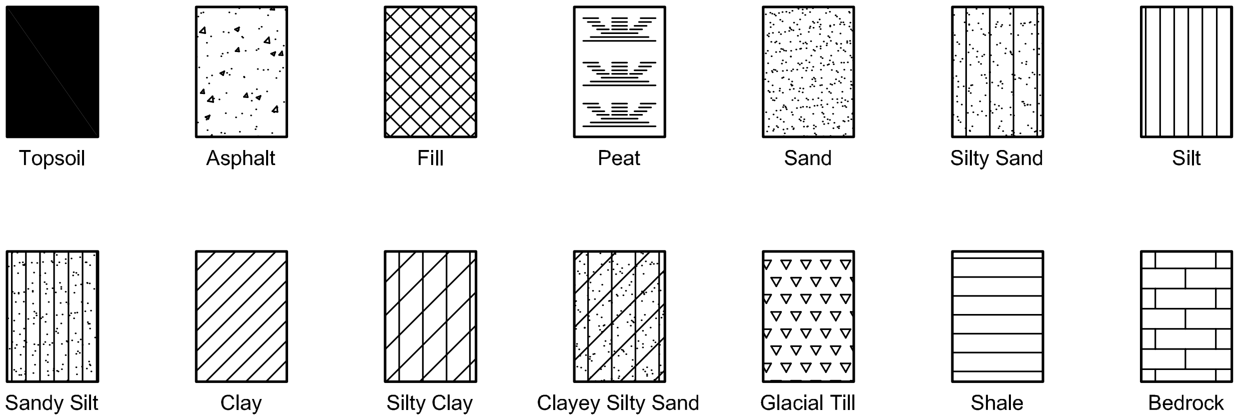
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

PERMEABILITY TEST

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

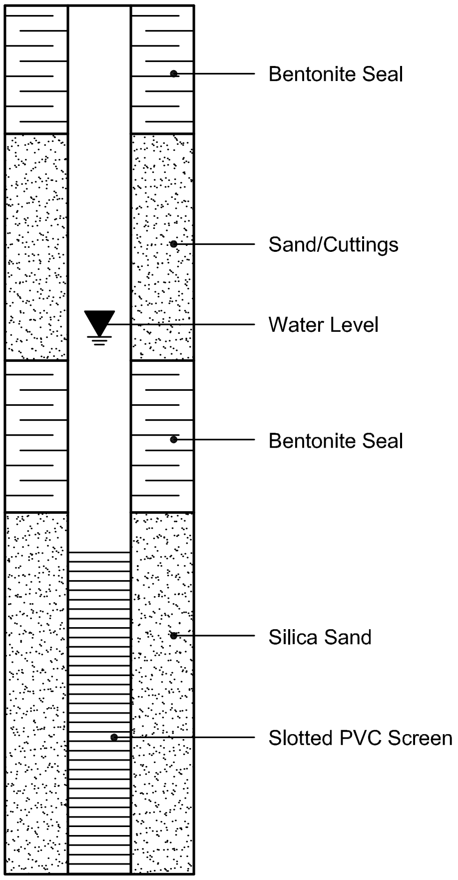
SYMBOLS AND TERMS (continued)

STRATA PLOT

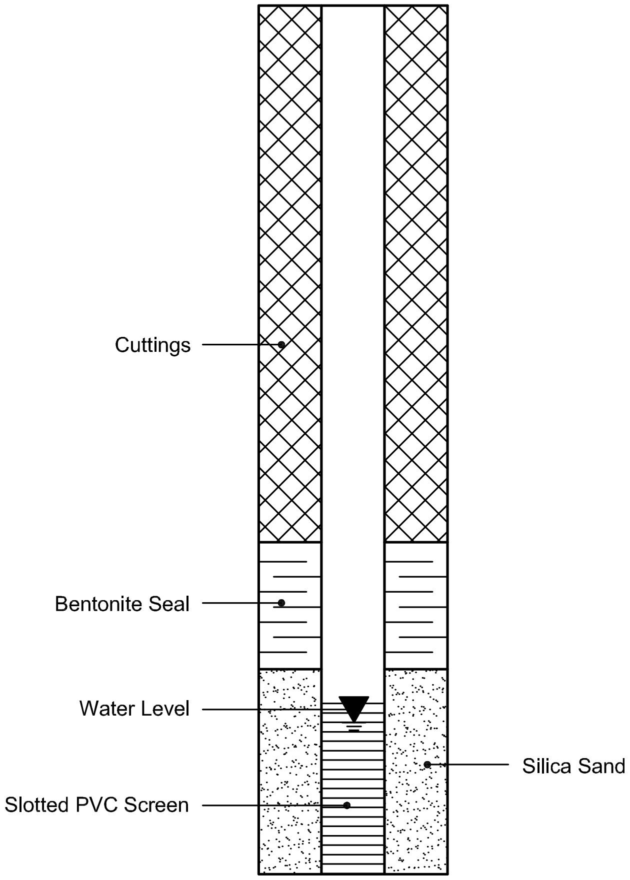


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: **Paterson Group Consulting Engineers**
Client PO: 16390
Project Description: PG3267

Report Date: 08-Jul-2014
Order Date:30-Jun-2014

	Client ID:	BH2-SS3	-	-	-
	Sample Date:	14-Jun-14	-	-	-
	Sample ID:	1427048-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	73.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.67	-	-	-
Resistivity	0.10 Ohm.m	15.7	-	-	-
Anions					
Chloride	5 ug/g dry	375	-	-	-
Sulphate	5 ug/g dry	86	-	-	-

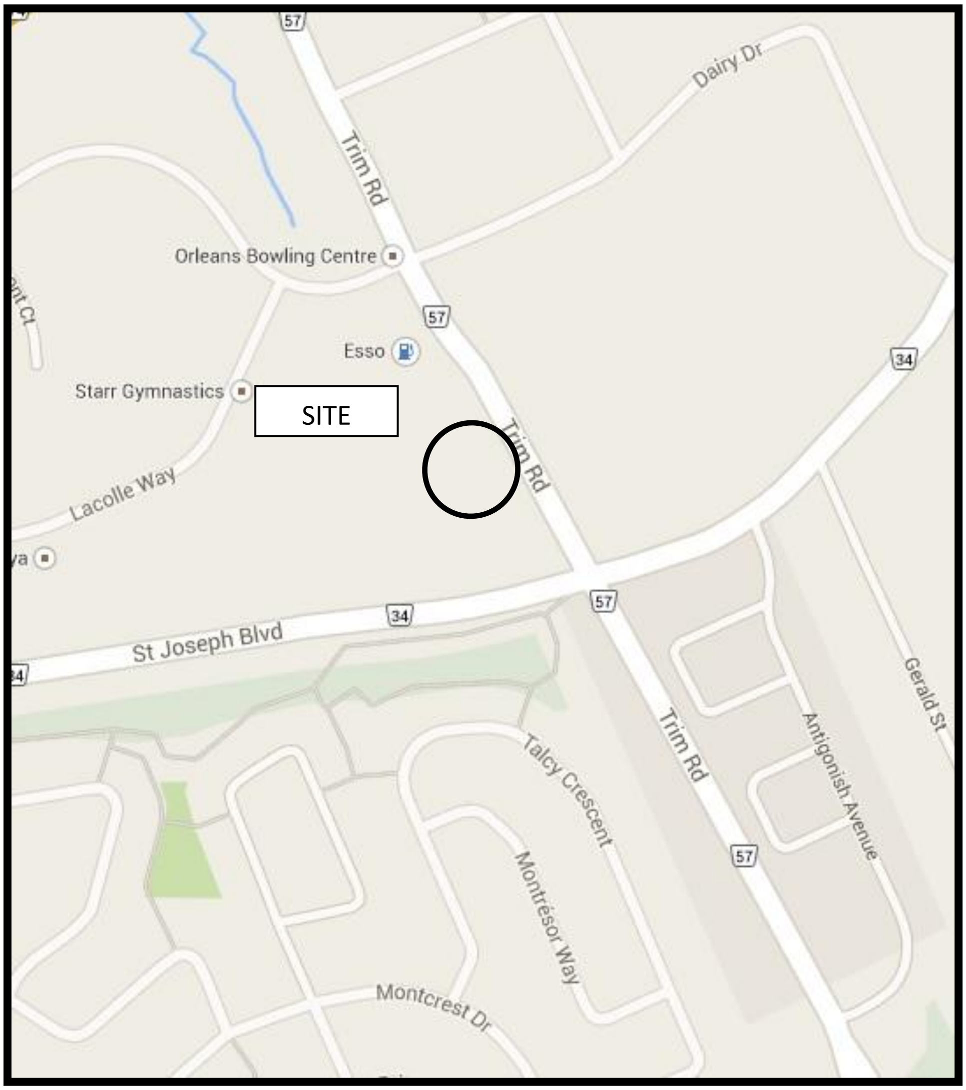
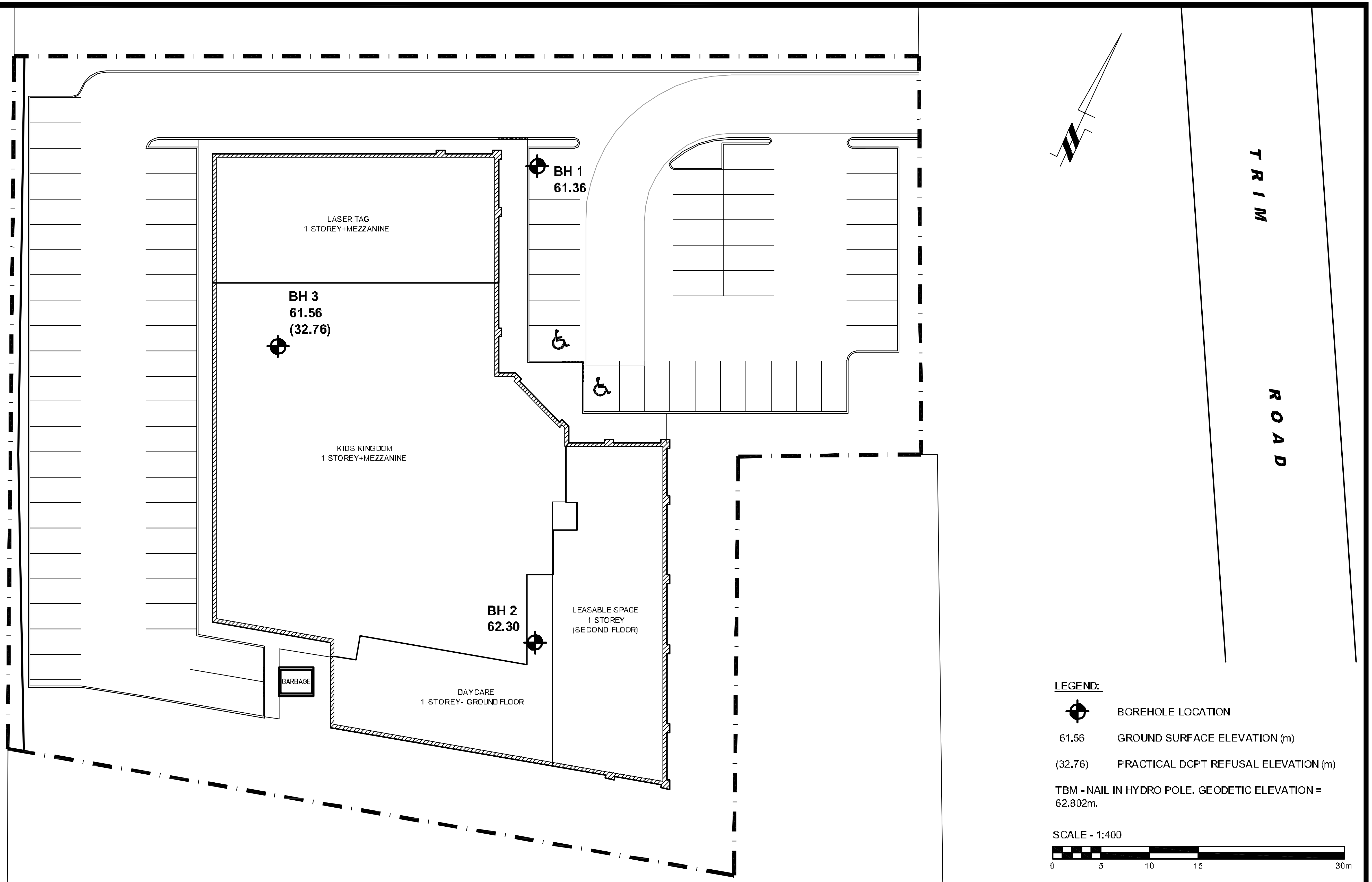


FIGURE 1

KEY PLAN



paterson group
consulting engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

Scale:	1:400
Des.:	FA
Dwn:	CB
Chkd:	DG

FRANK D'AMATO C/O S.J. LAWRENCE ARCHITECT INC.

GEOTECHNICAL INVESTIGATION
PROP. COMMERCIAL BUILDING - 1290 TRIM ROAD
OTTAWA, ONTARIO

TEST HOLE LOCATION PLAN

Dwg. No.	**PG3267-1**
Report No.:	PG3267-1
Date:	07/2014

11x17