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November 8, 2017
PG2119-LET.02

Campanale Homes
200-1187 Bank Street
Ottawa, ON
K1S 3X7

Attention: **Mr. Tony Campanale**

Subject: **Geotechnical Investigation**
Proposed Commercial Building - Block 13
605 Longfields Drive - Ottawa

Dear Sir,

Paterson Group (Paterson) was commissioned by Campanale Homes to conduct a geotechnical investigation for the proposed commercial building within Block 13 of the Longfields Station development located at 605 Longfields Drive, in the City of Ottawa, Ontario.

The current phase of the Longfields Station development is understood to consist of slab on grade commercial building comprised of fifteen units. It is also expected that parking areas and landscape areas are to be constructed for the proposed development.

1.0 Field Investigation

The fieldwork for the original geotechnical investigations were conducted on February 15, 2013 and May 20, 2010. Four (4) test pits from these investigations are located just outside the vicinity of the proposed Block 13. The test pits were excavated to a maximum depth of 5.3 m below ground surface using a hydraulic shovel. The test pits were reviewed in the field by Paterson personnel under the direction of a senior engineer from the geotechnical division. The field procedure consisted of reviewing the excavation, sampling and testing the overburden at selected locations.

The test holes completed by Paterson in 2013 were surveyed and located in the field by Paterson personnel, while test holes completed in 2010 were surveyed and located by Stantec Geomatics. It is understood that all elevations at the test pit locations are referenced to a geodetic datum. The approximate location of the test hole is shown on Drawing PG2119-5 - Test Hole Location Plan attached to the present report.

2.0 Field Observations

The ground surface across the eastern portion of the subject site is predominantly grass covered with some trees, while the western portion of the site has been stripped of the topsoil and is covered with construction debris. An asphalt pathway with associated lighting also runs along the north property boundary. The subject site is relatively flat and is generally at grade with Longfields Drive and Modugno Place, as well as adjacent properties.

Generally, the subsurface profile encountered at the test pit locations consists of topsoil underlain by a very stiff silty clay crust. The above noted layers are underlain by a stiff grey silty clay followed by a dense glacial till. Refer to the Soil Profile and Test Data sheets attached for specific details of the soil profile encountered at the test pit locations.

Based on available geological mapping, interbedded sandstone and dolomite from the March formation is present in this area with an overburden thickness ranging between 5 to 10 m depth.

Based on field observations during excavation, groundwater infiltration was observed in TP 8 and TP 9 at a depth of 1.8 and 3.2 m depth, respectively. However, based on the recovered soil samples' moisture levels, consistency and colouring of the excavated layers, the long-term groundwater is expected to be between 2.5 to 3.5 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations and therefore, the groundwater levels could vary at the time of construction.

3.0 Geotechnical Assessment

Due to the consistency of the subsoil profile throughout the overall development, no additional test holes were required to provide a site specific geotechnical assessment for the proposed Block 13.

From a geotechnical perspective, the subject site is suitable for the proposed commercial building. It is expected that the proposed building will be founded on conventional style footings placed on an undisturbed, very stiff to stiff silty clay bearing surface.

Due to the presence of a silty clay layer, the subject site will be subjected to permissible grade raise restrictions. The permissible grade raise recommendations will be discussed in the following sections.

Site Grading and Preparation

Topsoil and fill, containing deleterious or organic materials, should be stripped from under any buildings and other settlement sensitive structures. Other settlement sensitive structures include, but are not limited to, underground services and paved areas.

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

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where 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 excavated stiff brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, 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.

Foundation Design

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, very stiff to stiff silty clay 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 **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the reported 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.

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 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

A permissible grade raise restriction of **2 m** is recommended for areas where silty clay is encountered below underside of footing level.

Design for Earthquakes

A seismic site response **Class C** is applicable for foundation design at the subject site. Refer to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

It should be noted that the site is not susceptible to liquefaction based on the soil consistency and type encountered, which include a stiff silty clay and compact to dense glacial till deposit. Both of these soil types are not susceptible to liquefaction based on design earthquake data for the Ottawa area.

Slab on Grade Construction

With the removal of all topsoil and fill, such as those containing organic materials, within the footprint of the proposed building, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 200 mm thick loose layers and compacted to at least 98% of its SPMDD.

Pavement Structure

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

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

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

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and backfilled 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 keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials, consideration should be given to installing subdrains in the silty clay during the pavement construction. These drains should be installed at each catch basin as per City of Ottawa standards and specifications. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned 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 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 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 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 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. The drainage geocomposite should be connected to the perimeter foundation drainage system. Otherwise, imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be placed for foundation backfill.

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 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 be retained by shoring systems from the beginning of the excavation until the structure is backfilled. If sufficient room is unavailable due to existing structures or property boundaries, a shoring system may be required.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsurface soil is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects. Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should maintain safe working distance from the excavation sides.

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

A trench box is recommended to be installed at all times to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not remain exposed for extended periods of time.

Pipe Bedding and Backfill

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

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

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

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.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches which are within the silty clay layer. 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 and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

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. Infiltration levels are anticipated to be low through the excavation face. The groundwater infiltration will be controllable with open sumps and pumps.

A temporary Ministry of the Environment and Climate Change (MOECC) 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 MOECC.

For typical ground or surface water volumes, being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MOECC review of the PTTW application.

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 results of analytical testing show that the sulphate content is less than 0.1%. These results are indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The results of the chloride content, pH and resistivity indicate the presence of an unlikely corrosion potential environment for exposed ferrous metals at this site.

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 the construction have been conducted in general accordance with Paterson's recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

6.0 Statement of Limitations

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

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

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

The present report applies only to the project described in the report. The use of the report for purposes other than those described above or by person(s) other than Campanale Homes or their agents is not authorized without review by Paterson.

Best Regards,

Paterson Group Inc.

Nicholas Zulinski, P.Geo.

David J. Gilbert, P.Eng.

Attachments

- ❑ Soil Profile and Test Data sheets
- ❑ Analytical Testing Results
- ❑ Figure 1 - Key Plan
- ❑ Drawing PG2119-5 - Test Hole Location Plan

Report Distribution

- ❑ Campanale Homes (3 copies)
- ❑ Paterson Group (1 copy)

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

FILE NO. PG2119

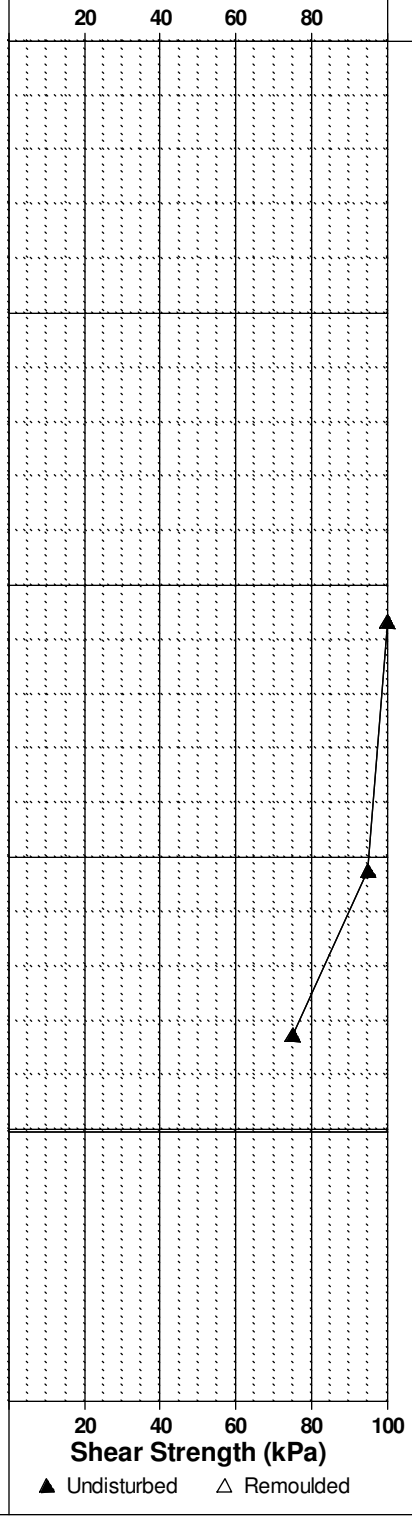
REMARKS N 5014835; E 441573

HOLE NO. TP 1-13

BORINGS BY Hydraulic Shovel **DATE** February 15, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.72
FILL: Brown silty clay with gravel and cobbles, trace topsoil		G	1				
		G	2			1	92.72
1.83							
Very stiff to stiff, brown **SILTY CLAY** with sand seams		G	3			2	91.72
		G	4			3	90.72
- firm and grey by 3.5m depth		G	5				
		G	6				
3.66							
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, boulders		G	7				
4.01						4	89.72
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

FILE NO. PG2119

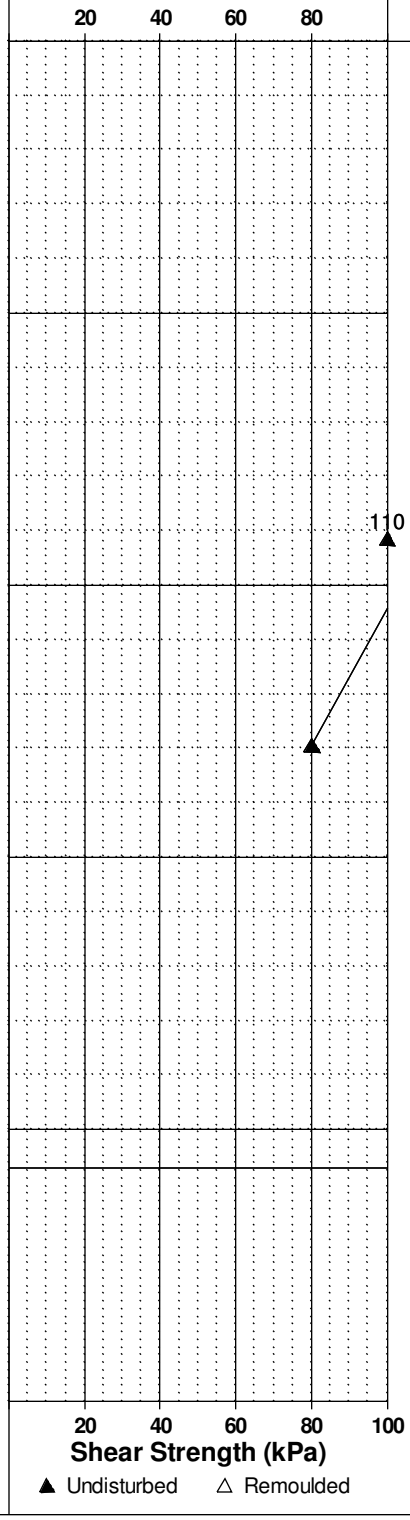
REMARKS N 5014843; E 441539

HOLE NO. TP 2-13

BORINGS BY Hydraulic Shovel **DATE** February 15, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.69
FILL: Brown silty clay with sand, gravel and cobbles							
0.40							
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	92.69
		G	2			2	91.69
3.20						3	90.69
GLACIAL TILL: Compact to dense, brown silty sand with gravel and cobbles		G	3				
4.14						4	89.69
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

FILE NO. PG2119

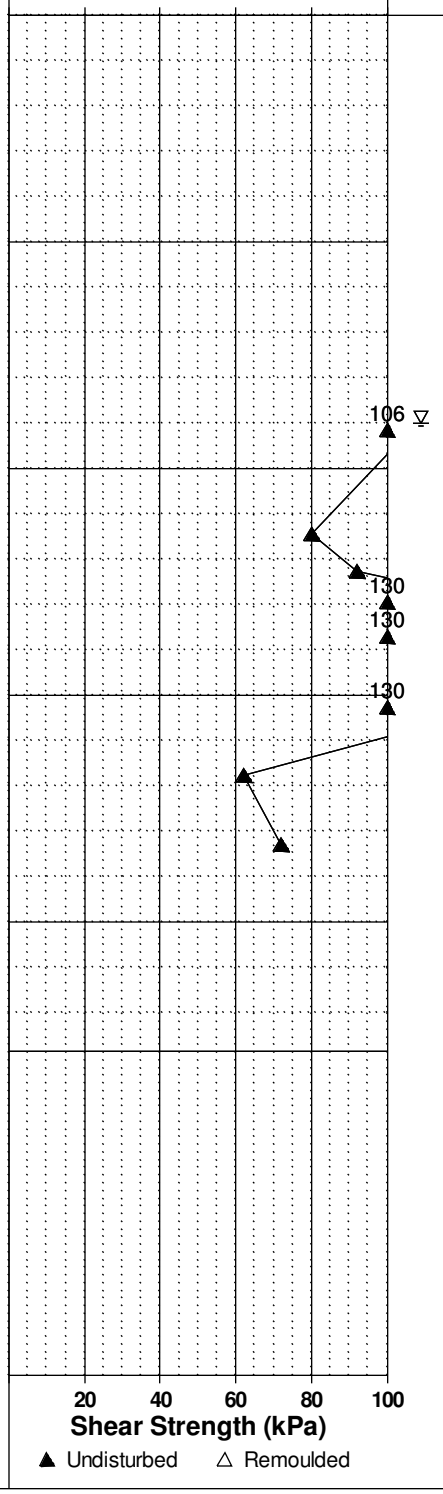
REMARKS N 5016531.674; E 364013.968

HOLE NO. TP 8

BORINGS BY Excavator **DATE** May 20, 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.64
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY,** some sand 1.22						1	91.64
Very stiff to stiff, brown **SILTY CLAY** - grey by 2.4m depth		G	1			2	90.64
4.17						3	89.64
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay 4.57						4	88.64
End of Test Pit (GWL @ 1.8m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Longfields Drive
Ottawa, Ontario

DATUM Ground surface at test pit locations provided by Stantec Geomatics

FILE NO. PG2119

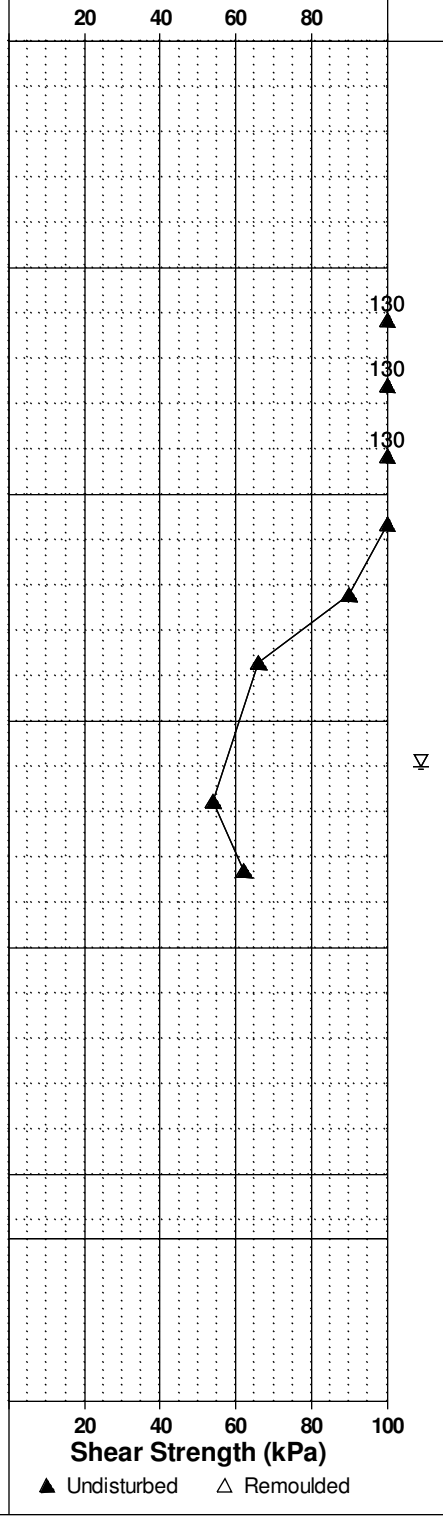
REMARKS N 5016426.508; E 363955.493

HOLE NO. TP 9

BORINGS BY Excavator **DATE** May 20, 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.70
TOPSOIL							
0.30							
Very stiff, brown **SILTY CLAY** with sand						1	91.70
1.22		G	1				
Very stiff to stiff, brown **SILTY CLAY**						2	90.70
- grey by 3.0m depth						3	89.70
		G	2			4	88.70
4.88							
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders, trace clay						5	87.70
5.28							
End of Test Pit							
(GWL @ 3.2m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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

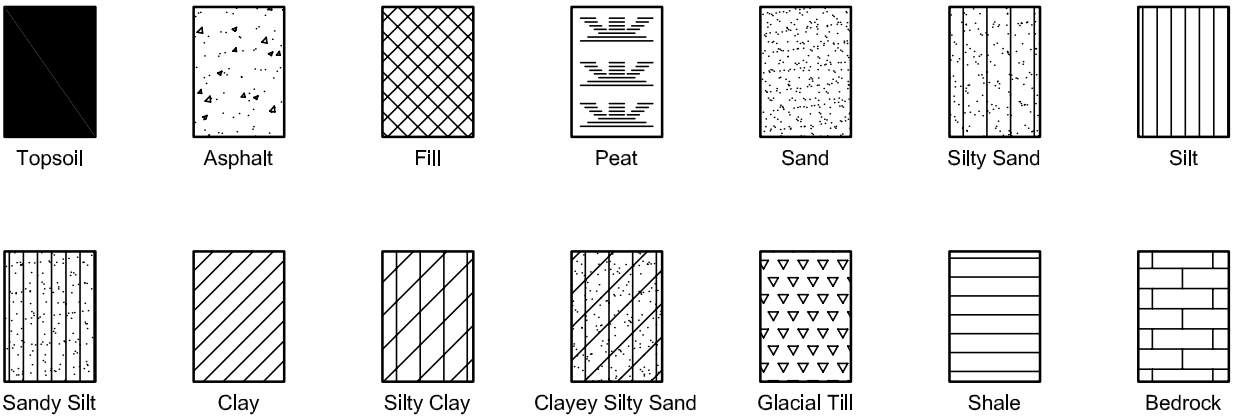
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

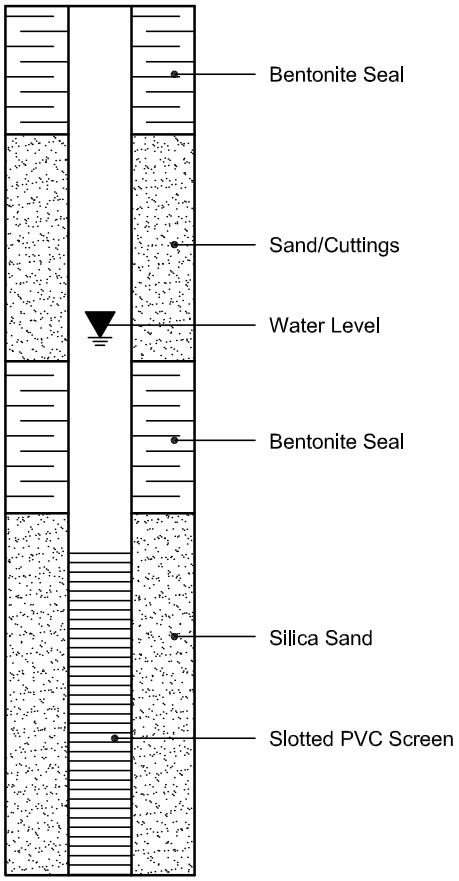
SYMBOLS AND TERMS (continued)

STRATA PLOT

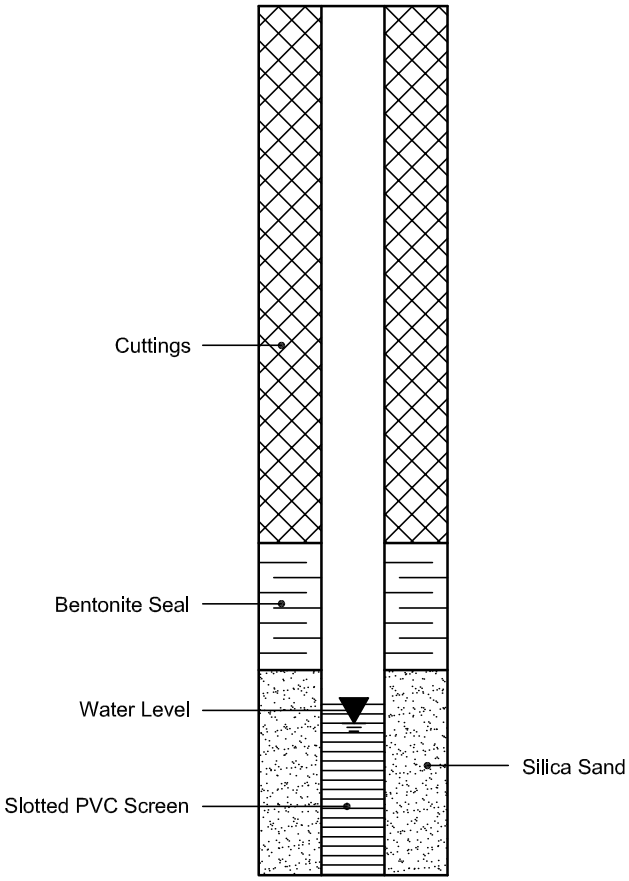


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PARACEL LABORATORIES LTD.

Order #: 1022053

Certificate of Analysis

Report Date: 31-May-2010
Order Date:25-May-2010

Client: **Paterson Group Consulting Engineers**
Client PO: 9734 Project Description: PG2119

	Client ID:	TP9-G1	-	-	-
	Sample Date:	20-May-10	-	-	-
	Sample ID:	1022053-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	74.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.37	-	-	-
Resistivity	0.10 Ohm.m	222	-	-	-
Anions					
Chloride	5 ug/g dry	<5	-	-	-
Sulphate	5 ug/g dry	7	-	-	-

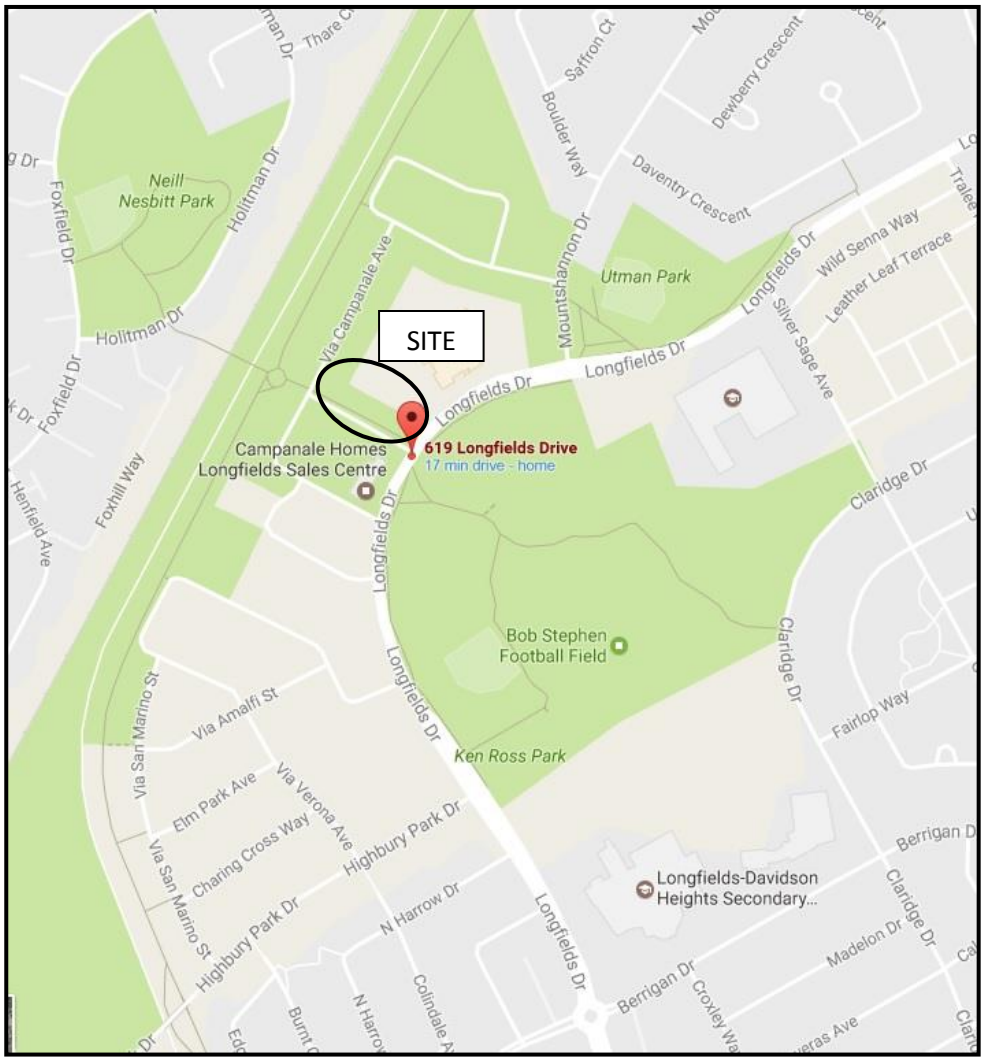
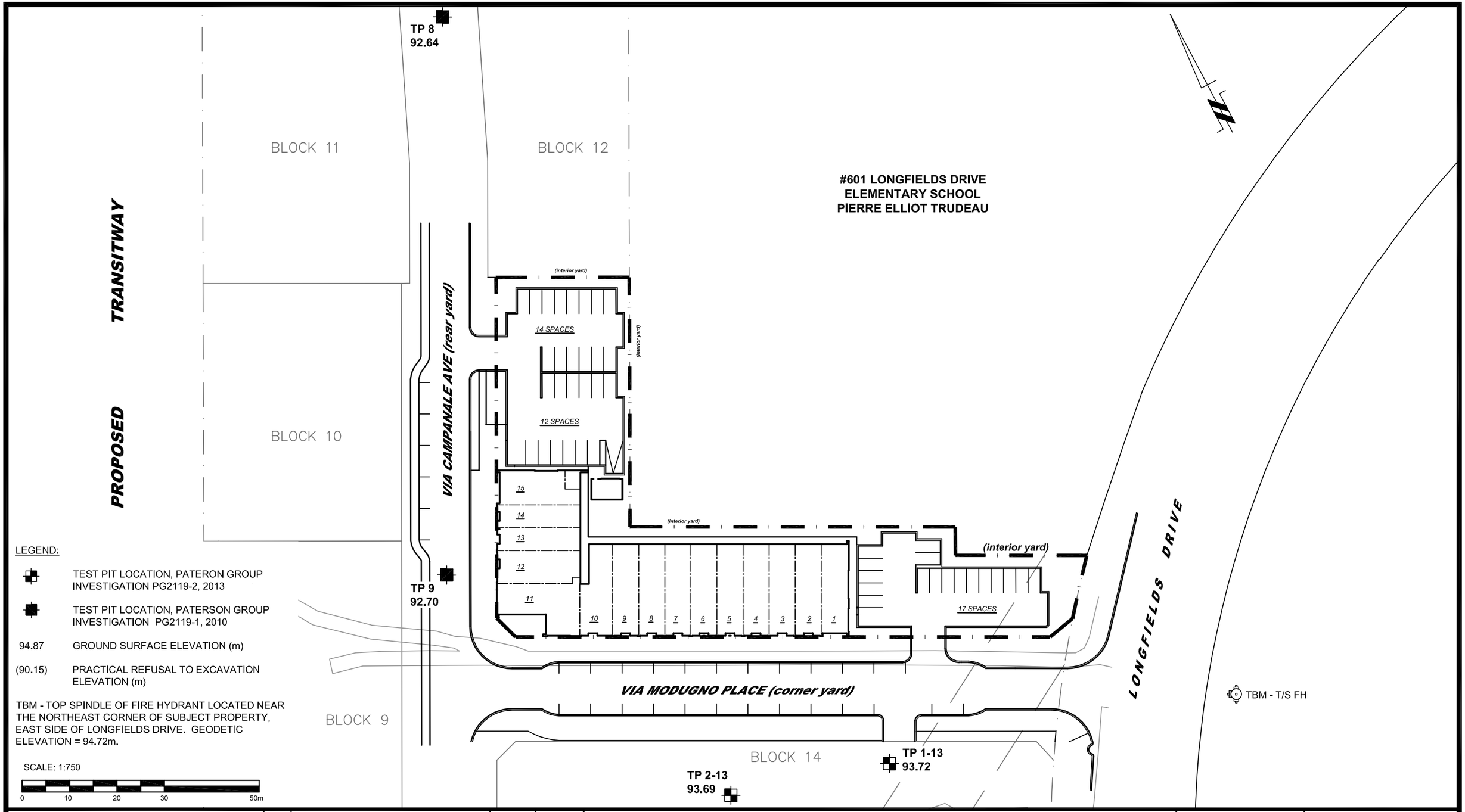


FIGURE 1

KEY PLAN



LEGEND:

- TEST PIT LOCATION, PATERON GROUP INVESTIGATION PG2119-2, 2013
- TEST PIT LOCATION, PATERSON GROUP INVESTIGATION PG2119-1, 2010
- 94.87 GROUND SURFACE ELEVATION (m)
- (90.15) PRACTICAL REFUSAL TO EXCAVATION ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT LOCATED NEAR THE NORTHEAST CORNER OF SUBJECT PROPERTY, EAST SIDE OF LONGFIELDS DRIVE. GEODETIC ELEVATION = 94.72m.

SCALE: 1:750

0 10 20 30 50m

patersongroup
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL
0			

CAMPANALE HOMES

GEOTECHNICAL INVESTIGATION
PROP. COMMERCIAL BUILDING - BLOCK 13 - 605 LONGFIELDS DRIVE
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:750	Date: 10/2017
Drawn by: RCG	Report No.: PG2119-LET.02
Checked by: NZ	Dwg. No.: PG2119-5
Approved by: DJG	Revision No.: 0

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