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March 12, 2018
PG4451-LET.01

Bridge Capital Investments
83 Hinton Avenue North
Ottawa, ON
K1Y 0Z7

Attention: **Mr. Chady Eldali**

Subject: **Geotechnical Investigation**
Proposed Residential Building
83 Hinton Avenue North - Ottawa

Dear Sir,

Paterson Group (Paterson) was commissioned by Bridge Capital Investments to conduct a geotechnical investigation for a proposed residential building to be located at 83 Hinton Avenue North in the City of Ottawa, Ontario.

The proposed development is anticipated to consist of a low-rise residential building with one basement level, an access lane and landscaped areas. Specific details regarding the proposed development were not known at the time of writing the present report.

1.0 Field Investigation

The field program for the current investigation was conducted on August 4, 2017, and consisted of excavating two (2) test pits to a maximum depth of 1.8 m. The test pits were excavated using a mini-excavator. 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 pits were placed in a manner to provide general coverage of the site taking into consideration existing site features and underground services. The approximate location of the test holes are shown on Figure-1 - Test Hole Location Plan attached to the present report.

2.0 Field Observations

The subject site is currently occupied by a two 2-storey residential dwelling with associated landscaped areas, mature trees and a driveway leading to parking areas at the rear of the dwelling. The ground surface at the subject site is relatively flat and generally at grade with Hinton Avenue. The site is bounded by residential properties to the east, north, and south, and by Hinton Avenue to the west.

Generally, the subsurface profile encountered at the test pit locations consisted of a layer of asphalt at ground surface overlying a layer of fill consisting of ash with organics at TP 1 and silty sand with gravel at TP2. The fill layer was underlain by a layer of stiff brown silty clay followed by dense glacial till consisting of silty sand with gravel cobbles and boulders. Practical refusal to excavation was encountered on the glacial till layer at depths of 1.78 and 1.63 m at TP 1 and TP 2, respectively. 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, the bedrock within the area consists of interbedded limestone and dolomite of the Gull River formation with an overburden thickness that ranges between 2 and 3 m.

Groundwater was not observed in the test pits at the completion of excavation. However, it should be noted that groundwater levels are subject to seasonal fluctuations and that groundwater conditions could vary at the time of construction.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed residential development. The proposed residential building is expected to be founded on conventional shallow foundations placed on undisturbed, stiff silty clay or glacial till bearing surface.

Site Grading and Preparation

Topsoil, asphalt, and fill, containing deleterious or organic materials or construction debris, should be stripped from under any building, paved areas, pipe bedding and other settlement sensitive structures. Care should be taken to not disturb adequate bearing surfaces during site preparation activities.

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

Fill Placement

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 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 respective SPMDD.

Foundation Design

Bearing Resistance Values

Footings placed on an undisturbed, stiff silty clay 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 **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

An undisturbed, stiff silty clay or glacial till bearing surface consists of one from which all topsoil, fill, loose soil and any other deleterious materials have been removed prior to the placement of concrete for footings.

The bearing resistance values at SLS 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 stiff silty clay or glacial till 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.

Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for foundations constructed at the subject site. A higher site classification such as Class A or B can be provided if site specific shear wave velocity testing is completed. Refer to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements. The soils underlying the subject site are not susceptible to liquefaction.

Basement Slab

It is anticipated that all existing fill material will be removed during the proposed building excavation and the basement floor slab will be placed over a stiff silty clay or glacial till subgrade. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. The upper 150 to 200 mm of the sub-slab fill should consist of 19 mm clear crushed stone.

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 base of 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 are not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a drainage geocomposite such as Miradrain G100N, Delta Drain 6000 or an approved equivalent. 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 side slopes of excavations in the overburden soils should be sloped back at acceptable slopes from the start of the excavation until the structure is backfilled. 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 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 Paterson in order to detect if the slopes are exhibiting signs of distress.

If sufficient room for slopes is unavailable due to existing structures or property boundaries, a temporary shoring system may be required. Underpinning may also be required for the existing neighbouring structures, dependent on their existing foundation elevations relative to the foundation elevations of the proposed building.

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.

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 structures due to the freezing conditions should be provided.

5.0 Recommendations

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

- ❏ 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.

A report confirming that the construction has 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 requests permission to review the recommendations when the drawings and specifications are completed.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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 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 Bridge Capital Investments, or their agents is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Best Regards,

Paterson Group Inc.

Colin Belcourt, M.Eng.

David J. Gilbert, P.Eng.

Attachments

- ❑ Soil Profile and Test Data sheets
- ❑ Symbols and Terms
- ❑ Figure 1 - Test Hole Location Plan

Report Distribution

- ❑ Bridge Capital Investments (3 copies)
- ❑ Paterson Group (1 copy)

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Site Memorandum

TO: Bridge Capital Investments
DATE: Aug 04.2017 1:40 PM
FILE: PM10359
PROJECT: New Construction test pits
ADDRESS: 83 Hinton Avenue North, Ottawa
LOCATION: **Test pits next to existing building**
AUTHOR: Randy Elliott

Note: If any recommendations provided by the Paterson Group result in an additional cost, the contractor shall obtain authorization from the owner directly, prior to undertaking the work.

COMMENTS:

As requested a site visit was made to observe the excavation of two test pits in the driveway next to the existing building that will be demolished in order to construct the new building. The following was observed at each test pit:

Test pit 1 (in rear area of driveway 4.0 m in from rear fence and 5.5 m in from North fence)

- 50 mm of asphalt
- 150 mm of a crushed stone base
- from 0.15 to 0.5 m was Ash fill with organics mixed in
- from 0.5 m to 1.65 m very stiff silty clay
- 1.65 m to 1.78 m loose glacial till
- 1.78 refusal on a dense glacial till (silty sand gravel)

Test pit 2 (in centre of driveway at front 4.6 m from sidewalk)

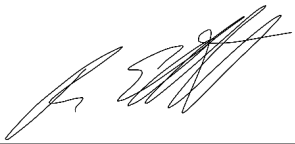
- 60 mm of asphalt
- 100 mm of crushed stone base
- 0.16 to 0.5 m was a brown sand gravel
- 0.5 m to 1.63m very stiff silty clay, undisturbed
- 1.63 m refusal on a dense glacial till (silty sand gravel)

Recommendations:

Footings placed on the dense glacial till can be designed to a maximum allowable bearing pressure of 150 Kpa SLS and 225Kpa ULS.

Call for a visit to see the bearing medium once excavated for the new building.

There is a thin layer of loose glacial till just below the very stiff silty clay that would require removal should the new footings be at that grade



RANDY ELLIOTT

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Site Memorandum

PHOTO1

Test pit 1

PHOTO2

Test pit 2

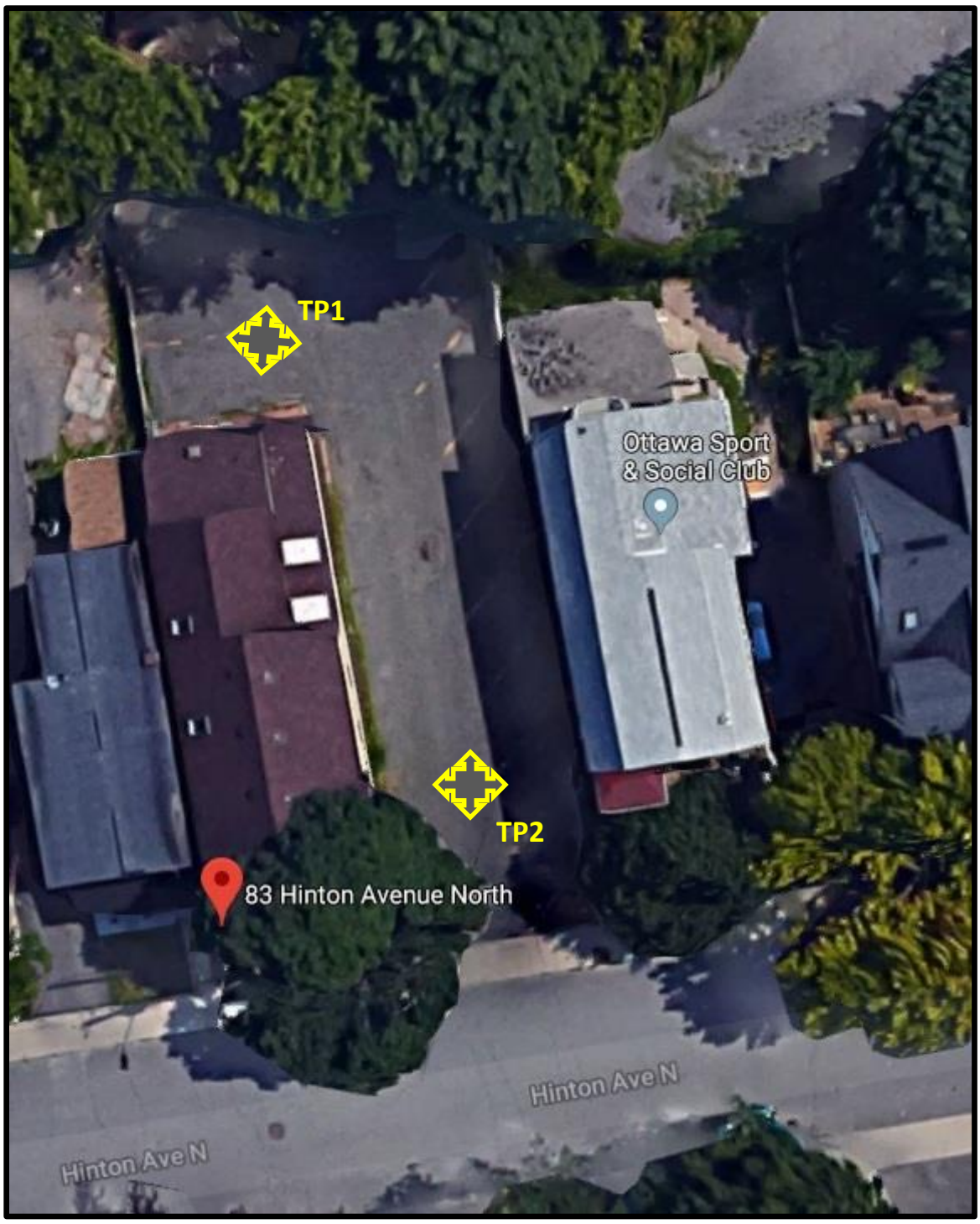

FIGURE 1

TEST HOLE LOCATION PLAN