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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED REDEVELOPMENT
19 AND 23 BACHMAN TERRACE
OTTAWA, ONTARIO

Submitted to:

Tega Developments
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February 12, 2014 Our ref: 13-042

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out at the site of the proposed twenty-five (25) row house development at 19 and 23 Bachman Terrace in Ottawa, Ontario. The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of test pits and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the proposed development, including construction considerations that could influence design decisions.

This investigation was carried out in accordance with our proposal dated January 10, 2013.

2.0 PROJECT AND SITE DESCRIPTION

2.1 Project Description

Plans are being prepared to construct twenty-five (25) row house residential dwellings at 19 and 23 Bachman Terrace in Ottawa, Ontario (see Key Plan, Figure 1). Twenty (20) units will be constructed on the property located at 23 Bachman Terrace, and the remaining five (5) to be constructed on a portion of property located at 19 Bachman Terrace. The site of the proposed units on 23 Bachman Terrace is currently occupied by a single family residential dwelling, which is serviced by a drilled well and septic system. The site of the proposed units on 19 Bachman Terrace is currently vacant. It is understood that the proposed dwellings will consist of slab on grade construction and will be serviced by municipal water and sewer. A new access roadway is also included in the scope of the project. The existing residential building on 23 Bachman Terrace is to be demolished.

2.2 Review of Geology Maps

Based on available geology maps of the Ottawa area, the subject site is underlain by shallow/exposed interbedded sandstone and dolostone bedrock of the March formation.

3.0 SUBSURFACE INVESTIGATION

The field work for this investigation was carried out on March 7, 2013. During that time, a total of four (4) test pits were excavated across the site using a 4 ton CAT 304 track mounted excavator supplied and operated by KingEx Landscaping and Excavating of Kemptville, Ontario. Details for the test pits are provided below:

- Four (4) test pits, numbered 13-1 to 13-4, inclusive, were advanced to between 0.4 and 1.2 metres below ground surface in the area of the proposed six (6) semi-detached residential dwellings for foundation design purposes.

The subsurface conditions in the test pits were identified by visual and tactile examination of the materials exposed on the sides and bottom of the test pits. The groundwater conditions in the open test pits were observed on completion of excavating. The field work was observed throughout by a member of our engineering staff, who directed the excavation and logged the test pits.

Descriptions of the subsurface conditions logged in the test pits are provided on the Record of Test Pit sheets in Appendix A. The approximate locations of the test pits are shown on the Test Pit Location Plan, Figure 2.

The test pit locations were selected by Houle Chevrier Engineering Ltd. personnel and positioned at the site using a Trimble R8 GPS survey instrument. The ground surface elevations at the test pits were also determined using a Trimble R8 GPS survey instrument. The elevations are referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

The soil and groundwater conditions logged in the test pits are given on the Record of Test Pit sheets in Appendix A. The test pit logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at other than the test pit locations may vary from the conditions encountered in the test pits. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Houle Chevrier Engineering Ltd. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The following presents an overview of the subsurface conditions encountered in the test pits advanced during this investigation.

4.2 Topsoil

A surficial layer of topsoil, having a thickness of about 0.3 metres, was encountered in test pit 13-2.

4.3 Fill Material

A surficial layer of topsoil fill, having a thickness of about 0.1 and 0.4 metres, was encountered in test pits 13-1, 13-3, and 13-4.

At test pit 13-3, the topsoil fill is underlain by about 0.7 metres of fill material composed of brown silty sand followed by reddish grey to grey brown gravel with variable amounts of sand and silt. At test pit 13-4, the topsoil fill is underlain by 0.1 metres of brown silty sand fill containing miscellaneous debris.

4.4 Former Topsoil

A 0.1 metre thick former topsoil layer, composed of dark brown sandy silt with variable amounts of organic material, was encountered in test pit 13-4 below the fill material at 0.2 metres below ground surface.

4.5 Glacial Till

At test pits 13-2 and 13-4, a deposit of glacial till was encountered below the topsoil and former topsoil at 0.3 metres below ground surface. The glacial till can generally be described as brown to grey brown silty sand with variable amounts of gravel. Cobbles and boulders should also be expected in the glacial till. At test pits 13-2 and 13-4, the glacial till has a thickness of about 0.6 and 0.3 metres, respectively.

4.6 Fractured/Inferred Bedrock

A layer of fractured/weathered bedrock was encountered below the glacial till in test pits 13-2 and 13-4 at 0.9 and 0.6 metres below ground surface, respectively (elevation 117.0 and 117.6 metres, geodetic datum). The fractured/weathered bedrock was excavated with the 4 ton CAT 304 track mounted excavator with little effort. At test pits 13-2 and 13-4, the fractured/weathered bedrock has a thickness of 0.3 metres.

Practical excavator refusal to further advancement of test pits 13-1 to 13-4, inclusive, occurred on the inferred surface of the bedrock occurred at depths ranging between 0.4 and 1.2 metres below ground surface (elevation 116.7 to 117.5 metres, geodetic datum).

It should be noted that practical excavator refusal can sometimes occur within cobbles and boulders and may not necessarily be representative of the upper surface of the bedrock.

4.7 Groundwater Conditions

No groundwater inflow was observed in the test pits during the relatively short period of time they were left open following excavation on March 7, 2013.

It should be noted that groundwater levels will fluctuate seasonally and may be higher during wet periods of the year, such as the early spring or fall, or following periods of heavy precipitation.

5.0 GEOTECHNICAL DESIGN GUIDELINES

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. While the results of the geotechnical investigation carried out at the site by Houle Chevrier Engineering Ltd. are considered adequate to provide geotechnical recommendations for the proposed development, it is noted that the subsurface conditions (e.g., thickness of fill material, bedrock depth) present within 19 Bachman Terrace could vary from the subsurface conditions encountered in test pits 13-1 to 13-4, inclusive.

Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site of materials from off site sources are outside the terms of reference for this report.

5.2 Removal of Existing Septic System

The existing septic tank, and associated fill materials, deleterious material or topsoil should be removed from below any foundations and concrete slabs to expose undisturbed native soil or bedrock. Furthermore, any distribution piping should also be removed. The grade below the proposed building could then be raised with imported granular material conforming to OPSS Granular B Type II compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II materials. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the proposed building be composed of virgin material only for environmental reasons. To provide adequate spread of load below the footings, the material should extend at least 0.5 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

If the existing septic tank is not located below foundations or hard surfaced areas (concrete slabs on grade, pavement etc.), the existing tank could be filled with 19 millimetre clear stone and the access lids placed back in place. Alternatively, the tank and distribution piping could be removed as described above.

5.3 Proposed Buildings

5.3.1 Excavation

The excavation for the proposed buildings will be carried out through topsoil, fill material, glacial till, and possibly fractured/weathered bedrock. For excavations exceeding 1.2 metres depth, the sides should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the act, soils at this site can be classified as Type 3. That is, open cut excavations within overburden deposits should be carried out with walls sloped at 1 horizontal to 1 vertical, or flatter, from the base of the excavation.

The groundwater inflow from the overburden deposits, if any, should be controlled by pumping from sumps within the excavation.

5.3.2 Spread Footing Design

Based on the results of the investigation, the proposed structures could be founded on spread footings. The fill materials, topsoil and former topsoil is considered to be highly compressible and should be removed from below the foundations and concrete slabs. Furthermore, foundation elements from the existing structure, building rubble, the existing septic tank and distribution piping, and any fill materials should also be removed from the building areas.

The following alternatives could be considered for the spread footings:

1) Spread footings bearing on or within native, undisturbed native glacial till deposits or engineered fill above native, undisturbed soil deposits; OR
2) Spread footings bearing on or within bedrock.

Alternative 1: Bearing on Native Soil or Engineered Fill above Native Soil

The native soil deposits (i.e., glacial till) could be considered for the support for the proposed structures. If required, the grade below the proposed buildings could be raised with imported granular material conforming to OPSS Granular B Type II compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II materials. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the proposed building be composed of virgin material only for environmental reasons. To provide adequate spread of load below the footings, the granular material should extend at least 0.3 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

Spread footing foundations bearing on or within native undisturbed deposits of glacial till, or on a pad of compacted granular fill above native, undisturbed glacial till deposits should be sized using an allowable bearing pressure of 150 kilopascals.

Alternative 2: Bearing on Bedrock

Based on the results of the investigation, the proposed structure could be founded on conventional spread footings placed either directly on the surface of the bedrock or on a pad of engineered fill above bedrock (i.e., at or above elevation 117.0 to 117.5 metres, geodetic datum).

In areas where the underside of footing level is above the level of the bedrock or where significant undulations exist in the bedrock, the grade below the proposed building could be raised with imported granular material conforming to OPSS Granular B Type II compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular B Type II materials. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the proposed building be composed of virgin material only for environmental reasons. To provide adequate spread of load below the footings, the material should extend at least 0.5 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

Spread footings founded on a pad of compacted granular material above competent bedrock, or spread footings bearing directly on undisturbed weathered bedrock, should be sized using an allowable bearing pressure of 500 kilopascals. This bearing pressure assumes that all loose or disturbed soil and bedrock is removed from the bearing surfaces and that the pad of compacted granular material is prepared as described in this report.

In contrast, spread footings founded on or within competent bedrock should be sized using an allowable bearing pressure of 1,000 kilopascals. This bearing pressure should be confirmed at the time of construction and assumes that all soil and any fractured or disturbed bedrock is removed from the bearing surface.

The bearing pressures provided above are summarized in the table below:

Subgrade Material	Allowable Bearing Pressure (kilopascals)[1]
Glacial till, or on a pad of compacted crushed stone above glacial till	150
Pad of compacted granular material above undisturbed, fractured or competent bedrock	500[2]
Fractured bedrock	500[3]
Bedrock	1,000[3]

Notes:
1. These bearing pressures assume the subgrade surface is prepared as described in this report
2. The engineered fill must placed compacted as described in this report.
3. The bedrock should be inspected and approved by geotechnical personnel.

To reduce the potential for cracking in the footings, foundation walls, and concrete slabs on grade where the footings transition between different subgrade materials, the foundation walls should be suitably reinforced as specified by the structural engineer.

5.3.3 Frost Protection Requirements for Foundations

All exterior footings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated (unheated) piers that are located in areas that are to be cleared of snow should also be provided with at least 1.8 metres of earth cover for frost protection purposes. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

The required frost protection could be waived for footings on relatively sound bedrock. Inspection of the bedrock by geotechnical personnel would be required to reduce or waive the frost protection.

5.3.4 Foundation Wall Backfill and Drainage

The native soils at this site are frost susceptible and should not be used as backfill against foundations. To avoid frost adhesion and possible heaving, the foundations should be backfilled with imported, free-draining, non-frost susceptible granular material such as that meeting OPSS Granular B Type I or II requirements.

Where the backfill will ultimately support areas of hard surfacing (sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment. Where future landscaped areas will exist next to the proposed structures and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the standard Proctor maximum dry density value.

Where areas of hard surfacing (concrete, sidewalk, pavement, etc.) abut the proposed building, all topsoil, and fill material (including septic system materials etc.), should be removed to the level of relatively undisturbed native soil or bedrock. In the event that the hard surfaced areas are underlain by frost susceptible material, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible native materials to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from the bedrock surface to the underside of the granular base/subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

Perimeter foundation drainage is not considered necessary for a slab on grade structure at this site, provided that the floor slab level is above the finished exterior ground surface level.

5.3.5 Slab on Grade Support

Based on the test pits advanced during this investigation, the area of the proposed building is underlain by topsoil, fill material, and former topsoil followed by glacial till and bedrock. The topsoil, fill material, former topsoil and septic system materials are not considered suitable for the support of the slab on grade and should be removed from the area of the proposed building.

The grade within the proposed building could be raised, where necessary, with granular material meeting OPSS requirements for Granular B Type I or II. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A. City of Ottawa documents allow recycled asphaltic concrete and concrete to be used in Granular A and Granular B Type II materials. Since the source of recycled material cannot be determined, it is suggested that any granular materials used beneath the floor slab be composed of virgin material (100 percent crushed rock) only, for environmental reasons.

All imported granular materials placed below the proposed floor slab should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density value.

Underfloor drainage is not considered necessary provided that the floor slab level is above the finished exterior ground surface level.

If any areas of the buildings are to remain unheated during the winter period, thermal protection of the materials beneath the slab on grade may be required. Further details on the insulation requirements could be provided, if necessary. The required frost protection could be waived if the floor slab is underlain by non frost susceptible imported granular materials over bedrock. Inspection of the bedrock by geotechnical personnel would be required to reduce or waive the frost protection.

5.4 Site Services

Probable bedrock was encountered across the site at depths ranging between 0.4 and 0.9 metres below existing surface grade (about elevation 117.0 to 117.6 metres). As such, bedrock excavation may be required in order to install the site services.

Removal of the fractured/weathered bedrock could be carried out using large hydraulic excavation equipment. In contrast, the competent bedrock will likely require rock hammering (i.e., hoe ramming equipment). It is noted that the bedrock likely contains near vertical joints and bedding planes. Therefore, some vertical and horizontal over break of the bedrock should be expected and allowance should be made for the use of additional granular bedding. In addition, the bedrock type in this area is known to be hard and abrasive, and significant equipment wear should be expected.

Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls.

Flexible service pipes should be installed in accordance with Ontario Provincial Standard Drawing (OPSD) 802.013 for Type 1 Soil. The excavation for rigid service pipes should be in accordance with OPSD 802.033 for Type 1 Soil.

5.5 Proposed Access Roadway

5.5.1 Subgrade Preparation

In preparation for the construction of the access roadway, all surficial topsoil, and any loose/soft, wet, organic or deleterious materials should be removed from the proposed subgrade surface. This need not include the removal of the existing fill provided that some minor post construction settlement of the flexible (asphaltic concrete) pavement can be accommodated. Any settlement of the asphaltic concrete paving could be corrected by padding with asphaltic concrete, if necessary.

The subgrade surface for the pavement areas should be proof rolled with a large (10 tonne minimum) steel drum roller under dry conditions. Any soft areas exposed from the proof rolling should be subexcavated and replaced with suitable earth borrow. An assessment of the subgrade conditions within the roadway should be made by the geotechnical engineer at the time of construction.

The grade within the parking lot could be raised, where necessary, using suitable earth borrow or OPSS Select Subgrade Material. The earth borrow and Select Subgrade Material should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. The fill type and placement should be uniform to reduce the potential for differential frost heaving of the pavement.

The subgrade surface should be crowned and shaped to promote drainage of the granular materials to the catch basins, as discussed in Section 5.5.6.

5.5.2 Proposed Pavement Structure

It is suggested that parking areas to be used by light vehicles (cars, etc.) be constructed using the following minimum pavement structure:

50 millimetres of Superpave 12.5 asphaltic concrete, over
150 millimetres of OPSS Granular A base, over
300 millimetres of OPSS Granular B Type II subbase

The thickness of the Granular B Type II subbase could be reduced to a minimum of 150 millimetres where bedrock is encountered at subgrade level.

For any access roadways which will be used by truck traffic or fire trucks, the asphaltic concrete surfacing thickness should be increased to 80 millimetres (40 millimetres of Superpave 12.5 (Traffic Level B) over 40 millimetres of Superpave 19.0 (Traffic Level B)) and the thickness of the subbase layer increased to 375 millimetres.

In accordance with current practice in the City of Ottawa, performance graded PG 58-34 asphaltic concrete should be specified. An assessment of the subgrade conditions within the parking areas should be made by the geotechnical engineer at the time of construction.

5.5.3 Compaction Requirements

The granular base and subbase materials should be compacted in maximum 200 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

5.5.4 Effects of Soil Disturbance and Construction Traffic

The above pavement structure assumes that the trench backfill is adequately compacted and that the roadway subgrade surface is prepared as described in this report. If the roadway subgrade surface becomes disturbed or wetted due to construction operations or precipitation, the Granular B Type II thickness given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or to incorporate a woven geotextile separator between the roadway subgrade surface and the granular subbase material. The adequacy of the design pavement thickness should be assessed by geotechnical personnel at the time of construction.

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the Granular B Type II, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material.

5.5.5 Pavement Transitions

In areas where the new pavement will abut the existing pavement along Bachman Terrace, the depths of the granular materials should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the depths of the granular material(s) exposed in the existing pavement.

5.5.6 Drainage of the Granular Materials

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. Where storm sewers are used to convey surface water runoff, catch basins should be provided with minimum 3 metre long perforated stub drains which extend in at least two directions from each catch basin at pavement subgrade level. Perimeter drainage is also suggested, where practicable.

5.6 Effects of Construction Induced Vibration

Some of the construction operations (such as granular material compaction, overburden excavation, rock hammering etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. The vibration effects of excavator ramming are usually minor and localized. Monitoring of the hoe ramming could be carried out, at least initially, to measure the vibrations to ensure that they are below the acceptable threshold value.

5.7 Winter Construction

In the event that construction is required during freezing temperatures, the frost susceptible subgrade below the footings and slabs should be protected immediately from freezing using straw, propane heaters, polystyrene insulation, insulated tarpaulins, or other suitable means. Inspection of the bedrock by geotechnical personnel would be required to determine if the bedrock is frost susceptible.

5.8 Design Review and Construction Observation

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the buildings should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Yours truly,

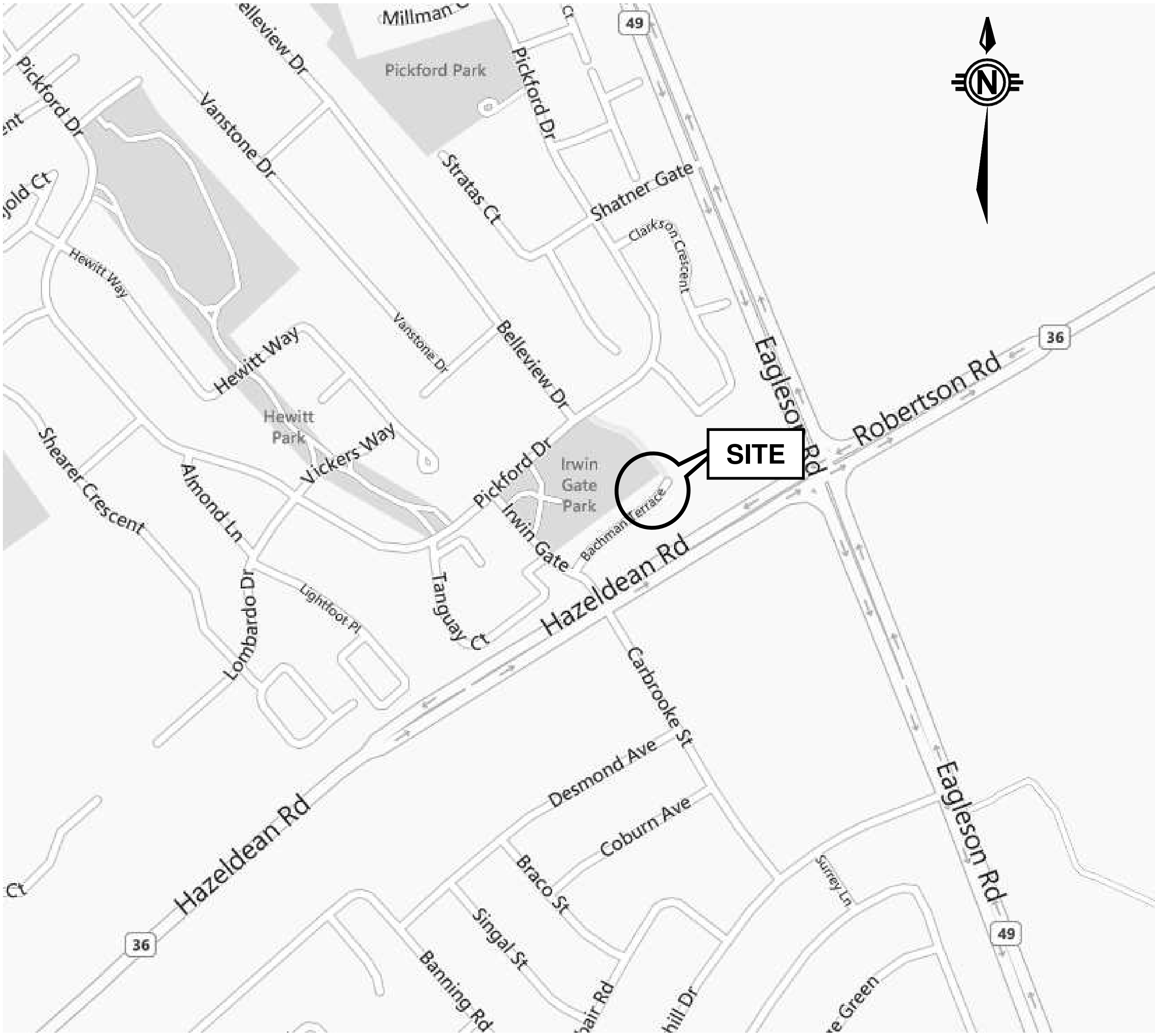
HOULE CHEVRIER ENGINEERING LTD.

Johnathan A. Cholewa, Ph.D., P.Eng.

Craig Houle, M.Eng.,P.Eng.
Principal

KEY PLAN

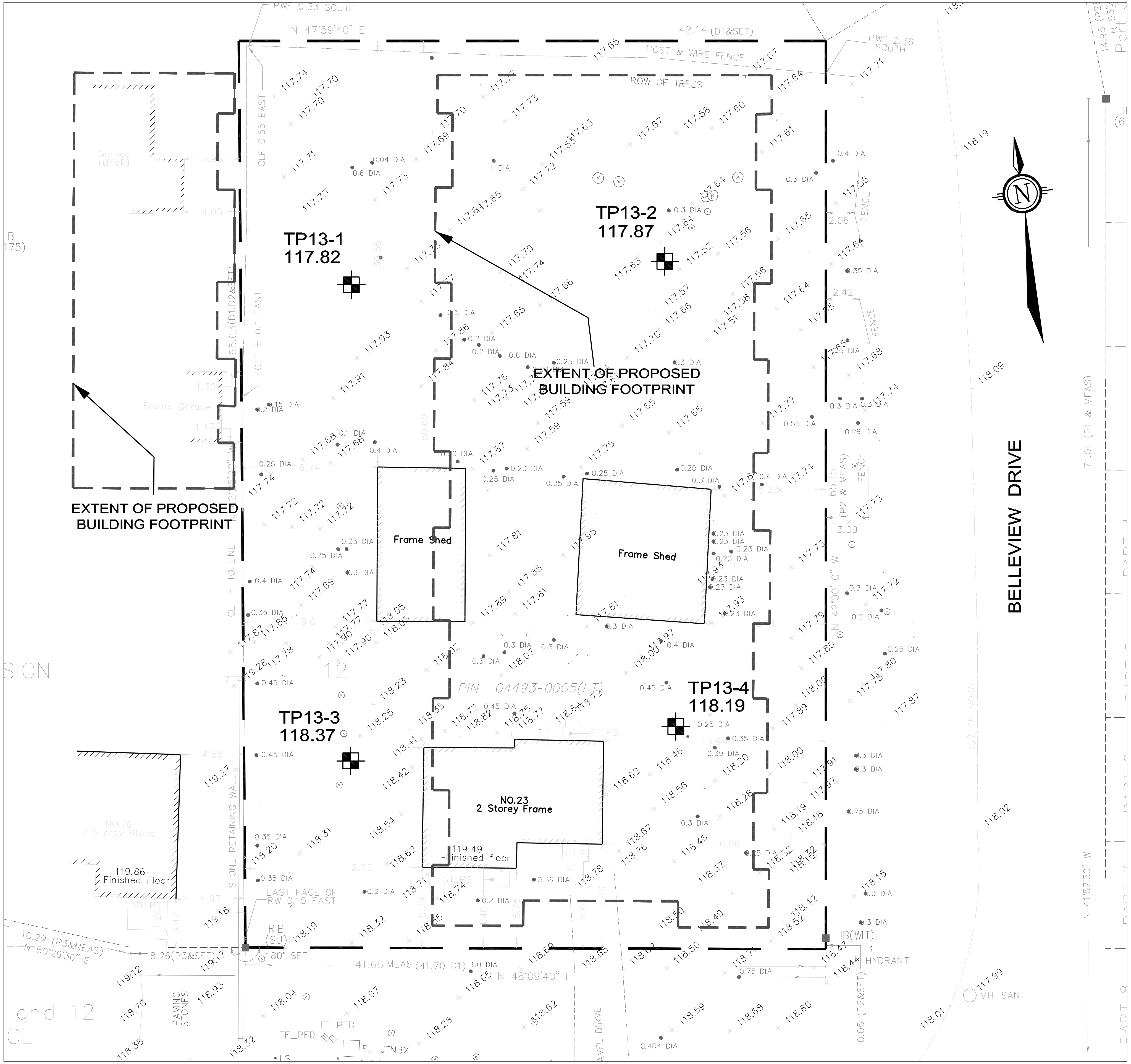
FIGURE 1



N.T.S

Date: February 2014

Project: 13-042



LEGEND

TP13-1	APPROXIMATE TEST PIT LOCATION IN PLAN, CURRENT INVESTIGATION BY HOULE CHEVRIER ENGINEERING LTD.
118.37	GEODETIC ELEVATION AT GROUND SURFACE OF TEST PIT, MEASURED IN METRES.

REFERENCE: PLAN PREPARED USING SITE PLAN PROVIDED BY J. D. BARNES SURVEYING LTD.

Client NINAVA LTD.		Location 23 BACHMAN TERRACE OTTAWA, ON	Revision 0
Drawn by M.J.L.	Approved by J.A.C	Project No. 13-042	Scale 1:300
Houle Chevrier Engineering		Title TEST PIT LOCATION PLAN	
		Date February 2014	FIGURE 2

APPENDIX A

LIST OF ABBREVIATIONS AND TERMINOLOGY
RECORD OF TEST PIT SHEETS

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance, N

The number of blows by a 63.5 kg hammer dropped 760 millimetres required to drive a 50 mm drive open sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

Dynamic Penetration Resistance

The number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

WH

Sampler advanced by static weight of hammer and drill rods.

WR

Sampler advanced by static weight of drill rods.

PH

Sampler advanced by hydraulic pressure from drill rig.

PM

Sampler advanced by manual pressure.

SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remoulded shear strength

SOIL DESCRIPTIONS

Relative Density	'N' Value
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Consistency	Undrained Shear Strength (kPa)
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very Stiff	over 100

LIST OF COMMON SYMBOLS

c_u undrained shear strength
e void ratio
C_c compression index
c_v coefficient of consolidation
k coefficient of permeability
I_p plasticity index
n porosity
u pore pressure
w moisture content
w_L liquid limit
w_P plastic limit
ϕ^1 effective angle of friction
γ unit weight of soil
γ^1 unit weight of submerged soil
σ normal stress

RECORD OF TEST PIT 13-1

PROJECT: 13-042

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: March 7, 2013

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢—⊖ W —⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.82					
	Dark brown sandy silt, some gravel with organic material and cobbles (TOPSOIL FILL)			1				Backfilled with excavated material
	End of Test Pit Excavator Refusal		117.45 0.37					Test pit dry upon completion on March 7, 2013
1								
2								
3								

DEPTH SCALE

1 to 15

Houle Chevrier Engineering Ltd.

LOGGED: M.L.

CHECKED: [signature]

RECORD OF TEST PIT 13-2

PROJECT: 13-042

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: March 7, 2013

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural, V - + Remoulded, V - ⊕ 20 40 60 80	WATER CONTENT (PERCENT) Wp ⊢ ⊖ W ⊣ Wl 20 40 60 80	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		117.87					
	Dark brown sandy silt with organic material (TOPSOIL)		117.55 0.32	1				Backfilled with excavated material
	Brown to grey brown silty sand, some gravel with probable cobbles and boulders (GLACIAL TILL)		116.97 0.90	2				
1	Grey, weathered/fractured bedrock		116.67 1.20	3				
	End of Test Pit Excavator Refusal							Test pit dry upon completion on March 7, 2013
2								
3								

DEPTH SCALE

1 to 15

Houle Chevrier Engineering Ltd.

LOGGED: M.L.

CHECKED: [signature]

RECORD OF TEST PIT 13-3

PROJECT: 13-042
LOCATION: See Test Pit Location Plan, Figure 2
DATE OF EXCAVATION: March 7, 2013

SHEET 1 OF 1
DATUM: Geodetic
TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLE NUMBER	SHEAR STRENGTH, Cu (kPa) Natural. V - + Remoulded. V - ⊕ (20 40 60 80)	WATER CONTENT (PERCENT) Wp ⊢—○W—⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface		118.37					
	Dark brown sandy silt with organic material (TOPSOIL FILL)		118.17 0.20	1				Backfilled with excavated material
	Brown silty sand, trace gravel (FILL MATERIAL)		117.67 0.70	2				
	Reddish grey to grey brown, gravel, some sand and silt (FILL MATERIAL)		117.52 0.85					
1	End of Test Pit Excavator Refusal							Test pit dry upon completion on March 7, 2013
2								
3								

DEPTH SCALE
1 to 15

Houle Chevrier Engineering Ltd.

LOGGED: M.L.
CHECKED: [signature]

RECORD OF TEST PIT 13-4

PROJECT: 13-042

LOCATION: See Test Pit Location Plan, Figure 2

DATE OF EXCAVATION: March 7, 2013

SHEET 1 OF 1

DATUM: Geodetic

TYPE OF EXCAVATOR: Hydraulic Shovel

DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	WATER LEVEL IN OPEN TEST PIT OR STANDPIPE INSTALLATION
0	Ground Surface	118.19		
	Dark brown sandy silt with organic material (TOPSOIL FILL)	118.09 0.10	1	
	Grey silty sand with pieces of plastic (FILL MATERIAL)	117.97 0.22	2	
	Dark brown sandy silt with organic material (FORMER TOPSOIL)	117.86 0.33	3	
	Brown to grey brown silty sand, some gravel with probable cobbles and boulders (GLACIAL TILL)	117.57 0.62	4	Backfilled with excavated material
	Grey, weathered/fractured bedrock	117.26 0.93	5	
1	End of Test Pit Excavator Refusal			Test pit dry upon completion on March 7, 2013
2				
3				

SHEAR STRENGTH, Cu (kPa) — Natural. V - + ; Remoulded. V - ⊕ — 20 40 60 80

WATER CONTENT (PERCENT) — Wp ⊢—⊖ W —⊣ Wl — 20 40 60 80

ADDITIONAL LAB. TESTING

DEPTH SCALE 1 to 15

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TESTPIT RECORD 2012 13-042 GINT TP.GPJ HCE DATA TEMPLATE.GDT 21/3/13