CONQUEST ENGINEERING LTD.

Geotechnical and Materials Engineers
Concrete Technology, Blasting Consultants
Construction Quality Assurance / Quality Control

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September 18, 2013

Mr. MacDara Woodman, P.Eng.
CBCL Limited
PO Box 606
Halifax, NS B3J 2R7

Dear Mr. Woodman,

Re: Geotechnical Investigation (FINAL) – Elevator Addition
Canadian Coast Guard College, Sydney, Nova Scotia

This is our report for the Geotechnical Investigation for the proposed elevator addition at the Canadian Coast Guard College in Sydney, NS.

The field portion of the investigation included a borehole completed September 5, 2013. Based on the findings of the borehole we returned and conducted a test pit on September 17, 2013 to verify subsurface conditions.

The subsurface conditions encountered consist of rootmat over fill, organic silt, and then bedrock. The fill was encountered to a depth from 2.1 to 3.0 m and consisted of sandy silt with trace organics and frequent boulders (nominal size of 1.2 m). Organic silt was encountered at a depth from 2.1 m to 4.3 m. Bedrock was encountered at a depth from 3.0 m to 4.3 m. Bedrock consists of sandstone.

The main findings and recommendations from our investigation are as follows:

- Excavation of the test pit infers that the footing is founded at a typical frost depth of 1.2 m below exterior finish grade. The boulders encountered in the fill suggest that the existing building area was prepared by placing coarse fill, displacing the organic silt.

- The fill and organic silt beyond the building perimeter are unsuitable for support of the elevator addition.

- A foundation system consisting of spread footings bearing on the structural fill would be practical for the site, following the excavation of unsuitable material and reinstatement with structural fill. Excavations and placement of structural fill for a spread footing should be completed in sections.

- Alternately a foundation system consisting of drilled micro-piles and structural slab could be considered for this site. This pile system could be drilled through existing boulders on site and into the bedrock.

- It is anticipated that site soils will not be suitable as structural fill, and should be planned to be wasted off-site.

If you have any questions, please contact us.

Thank you,

Glenn Graham, P.Eng.
Geotechnical Engineer
ggraham@conquest-eng.com
Project # 034-085

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TABLES

APPENDICES

1.0 INTRODUCTION

We have conducted a Geotechnical Investigation for the proposed elevator addition at the Canadian Coast Guard College in Sydney, NS at the request of CBCL Ltd. The purpose of this investigation was to evaluate the subsurface conditions on the site, and to provide our recommendations.

2.0 SITE DESCRIPTION AND GEOLOGY

The site is located off Alert Road, and on the west side of the McKenzie Building at the Canadian Coast Guard College.

There are currently air conditioning units on the ground for the McKenzie Building at the site. Three mature trees also occupy the site. A steel culvert runs through the site, and is understood to be abandoned. Photograph A shows an aerial view of the Canadian Coast Guard campus.

The principal soil type is Glacial Till. Bedrock (sandstone) in the area is part of the Windsor Group.

Photograph A: Aerial View of the Canadian Coast Guard College

3.0 SUMMARIZED SUBSURFACE CONDITIONS

The field program consisted of one borehole (BH1) completed on September 4, 2013, and one test pit (TP1) completed on September 17, 2013. The borehole and test pit location is shown in Figure A. (Drawing 1 in the appendix is a complete location plan)

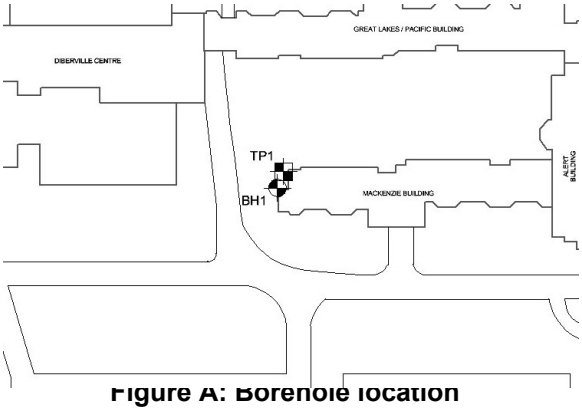


Figure A: Borehole location

The borehole was drilled using a truck mounted drill rig. Representative samples were taken during the field work and the conditions at the borehole were logged in detail. The test pit was excavated using a backhoe. The soil and groundwater conditions encountered at the site are described in detail on the appended Borehole Record and summarized in the following paragraphs and Table A.

The test pit excavation of the test pit was conducted 0.9 m from the building edge. The building drain tile was encounter at a depth of 1.2 m from the ground surface, and we infer that the footing is also at this depth.

The subsurface conditions encountered consist of rootmat over fill, organic silt, and then bedrock. The fill was encountered to a depth from 2.1 to 3.0 m and consisted of sandy silt with trace organics and frequent boulders (nominal size of 1.2 m). Organic silt was encountered at a depth from 2.1 m to 4.3 m. Bedrock was encountered at a depth from 3.0 m to 4.3 m. Bedrock consists of sandstone.

Moisture contents of samples taken from the borehole ranged from 14.8% to 26.3% in the fill layer, and 39.8% to 42.2% in the organic silt layer.

Table A: Summary of Findings

Borehole	Thickness of Rootmat/Topsoil and Fill, m	Thickness of Organic silt (Depth), m	Bedrock Depth, m	Groundwater Depth, m
BH 1	3.0	1.3	4.3	-
TP 1	2.1	0.9	3.0	-

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Main Findings

It is understood that an elevator addition is proposed. The footing elevation for the existing MacKenzie Building is not known to us at this time.

The main findings and recommendations from our investigation are as follows:

- Excavation of the test pit infers that the footing is founded at a typical frost depth of 1.2 m below exterior finish grade. The boulders encountered in the fill suggest that the existing building area was prepared by placing coarse fill, displacing the organic silt.

- The fill and organic silt beyond the building perimeter are unsuitable for support of the elevator addition.

- A foundation system consisting of spread footings bearing on the structural fill would be practical for the site, following the excavation of unsuitable material and reinstatement with structural fill. Excavations and placement of structural fill for a spread footing should be completed in sections.

- Alternately a foundation system consisting of drilled micro-piles and structural slab could be considered for this site. This pile system could be drilled through existing boulders on site and into the bedrock.

- It is anticipated that site soils will not be suitable as structural fill, and should be planned to be wasted off-site.

The following sections provide our geotechnical recommendations for site preparation and design.

4.2 Earthworks

Earthworks for this project will involve either spread footings to bedrock, or to structural fill over bedrock; or installation of piles to bedrock (e.g. micropile system). Dewatering of excavations through the installation of sumps should be anticipated by the contractor.

4.2.1 Surface Water Control and Erosion Control

Prior to excavations, surface water drainage controls should be provided on the up-gradient side of the site to minimize run-off onto exposed soil. Suitable erosion and sedimentation control measures should be provided. These may include silt fences, and granular working pads.

4.2.2 Excavation

Excavation into the site soils will be practical with conventional earth-moving equipment, although the contractor will need to remove large boulders.

Within the proposed elevator addition, the fill, and organic silt layers should be excavated as noted on the Borehole and Test Pit Records, or as determined by field inspection. The extend of excavation should take into account structural fill side slopes (1.5H:1V) and splay (0.3 m).

Temporary excavated side slopes in soil will have to be sloped for safety at 1H:1V or flatter.

It is anticipated that site material will be unsuitable as structural fill and should be used in landscaped areas or wasted off-site.

4.2.3 Dewatering of Excavations

Construction dewatering of the excavation through the use of sumps should be planned for by the contractor, and installed prior to mass excavation.

4.2.4 Fill Placement and Compaction

Mass fill required for the elevator addition should consist of imported quarried rockfill with the following gradation specification:

Table B: Rockfill Gradation Specification

Sieve Size, (mm)	Minimum Percent Passing, (%)	Maximum Percent Passing, (%)
150	100	100
100	50	70
56	20	40
20	10	20
5	0	10

Backfill against foundations should consist of well graded granular fill, with a nominal size of 100 mm.

Fills on which footings shall be founded shall have a splay of 1.5H:1V with a 0.3 m bench from the outer edge of the footings.

The lift thickness used during placement of fills must be compatible with the compaction equipment and the material type to ensure the specified density throughout. The lift thickness should not exceed approximately 450 mm for mass filling and 200 mm for

backfilling of foundations and services. The maximum particle size should be no larger than ⅔ of the lift thickness.
Fill materials should be compacted to the following percentage of maximum Standard Proctor dry density:

- Fill in building areas 100%
- Landscaped areas 93%

4.2.5 Inspection and Testing

It is recommended that inspection of the footing bearing surfaces be conducted by experienced geotechnical personnel prior to placement of concrete. Inspection and testing is also recommended during site grading and backfilling operations.

4.3 Foundations

For analysis using Limit States Design for foundations bearing on structural fill over bedrock, we calculated bearing capacities for square and strip footings on soil ranging up to 3 m with a settlement tolerance of 25 mm. Other bearing capacities for other footing sizes (or settlement tolerances) can be provided at your request. Bearing resistance values for square and strip footings are plotted on Figure 1 and Figure 2 in the appendix.

Alternatively, for analysis and design using Working Stress Design, an allowable bearing capacity of 750 kPa is recommended for foundations bearing on bedrock. An allowable bearing capacity of 200 kPa is recommended for foundations bearing on structural fill over bedrock.

Exterior footings should be founded a minimum of 1.2 m below grade for frost protection.

4.4 Concrete Floor, Exterior Slabs, and Sidewalk

Ground slabs should be founded on approved structural fill. A 150 mm thick layer of DTIR Type 2 Gravel is recommended below the floor slab for levelling and support purposes. The gravel should be compacted to 100 % Standard Proctor.

4.5 Additional Geotechnical Services

Additional geotechnical input at the final design and tendering stage is recommended to ensure that the project fully considered all of the information from the geotechnical investigation.

5.0 CLOSURE

If there are changes to the proposed work, such as adjustments in founding elevation or building loads, we require that we be notified to allow for review of our recommendations.

A field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. If the conditions encountered are significantly different than described in this report, we request that we be notified immediately.

This report was completed for the sole benefit of CBCL Limited. Any other person or entity may not rely on this report without the express written consent of Conquest Engineering Ltd.

Glenn Graham, P.Eng.
Geotechnical Engineer
ggraham@conquest-eng.com

R. Bruce MacNeil, P.Eng
Senior Geotechnical Engineer
bmacneil@conquest-eng.com

APPENDIX A

Conquest Engineering Ltd.

BOREHOLE RECORD

Project Name: Canadian Coast Guard College Elevator Addition
Project No.: 034-085
Client: CBCL
Location: Sydney, Nova Scotia
Water Level Date: Sept. 4, 2013

Borehole No.: 1
Page: 1 of 1
Date Drilled: Sept. 4, 2013
Datum: Geodetic

Depth (m)	Water Level (m)	Sample Type	Sample Number	Recovery (mm)	N Value or RQD %	Symbols	SOIL AND/OR ROCK DESCRIPTION	Depth (m)
								7.3
0		SS	1	350	13		ROOTMAT / TOPSOIL FILL: Compact to loose brown sandy silt	
1		SS	2	275	19			
							- trace organics	
2		SS	3	25	1			
		SS	4	225	4			4.3
3		SS	5	100	0		ORGANIC SILT	
4		SS	6	400	2			3.0
5							BEDROCK: Grey sandstone	
6								
7								-0.3
8							END OF BOREHOLE	
9								
10								

Moisture Content (%)
Wp |---O---| WL
5 15 25 35 45

SPT (N)
Blows/300mm
5 15 25 35 45

Conquest Engineering Ltd.

TEST PIT RECORD

Project Name: Canadian Coast Guard College Elevator Addition

Location: Sydney, Nova Scotia | **Test Pit:** 1

Project No.: 034-085 | **Sheet:** 1 of 1

Client: CBCL Limited | **Date:** September 17,2013

Water Level Date: September 17, 2013 | **Datum:** Geodetic

SUBSURFACE PROFILE				SAMPLE			
Depth (m)	Symbol	Soil and/or Rock Description	Elevation (m)	Water Level (m)	Type	Number	Comments
0		Ground Surface	7.3				
		ROOTMAT/TOPSOIL	7.2				
		FILL: Loose to compact reddish brown sandy silt iwth gravel - frequent boulders (nominal size 0.6 m) - trace organics					
1							
2			5.2				
		ORGANIC SILT - boulder (nominal size 1.2 m)					
3			4.3				
		Excavator refusal on inferred bedrock at 3.0 m. No groundwater seepage was observed.					
4							
5							

FACTORED ULS BEARING RESISTANCE

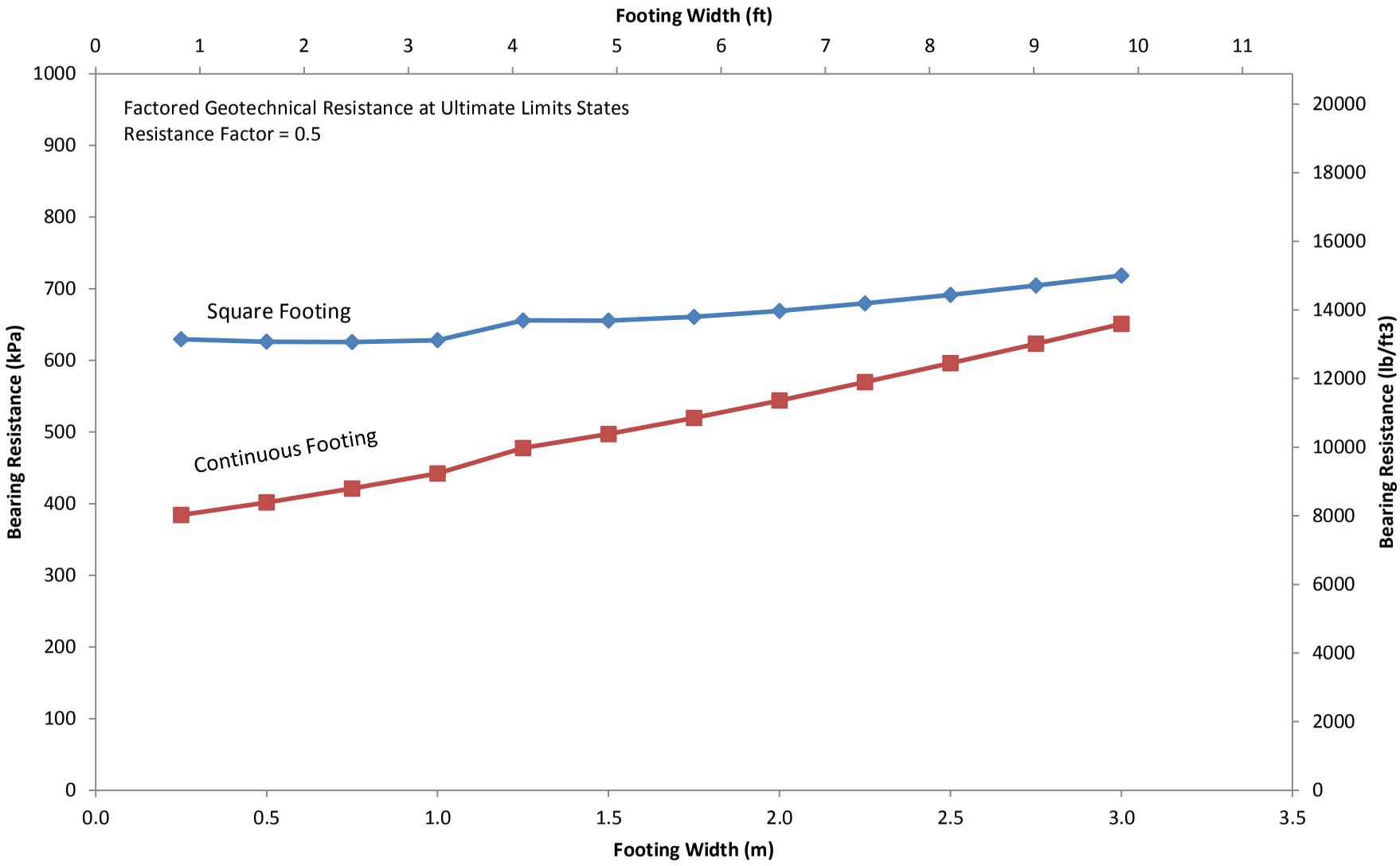


Figure 1

Project # 034-085

SLS BEARING RESISTANCE

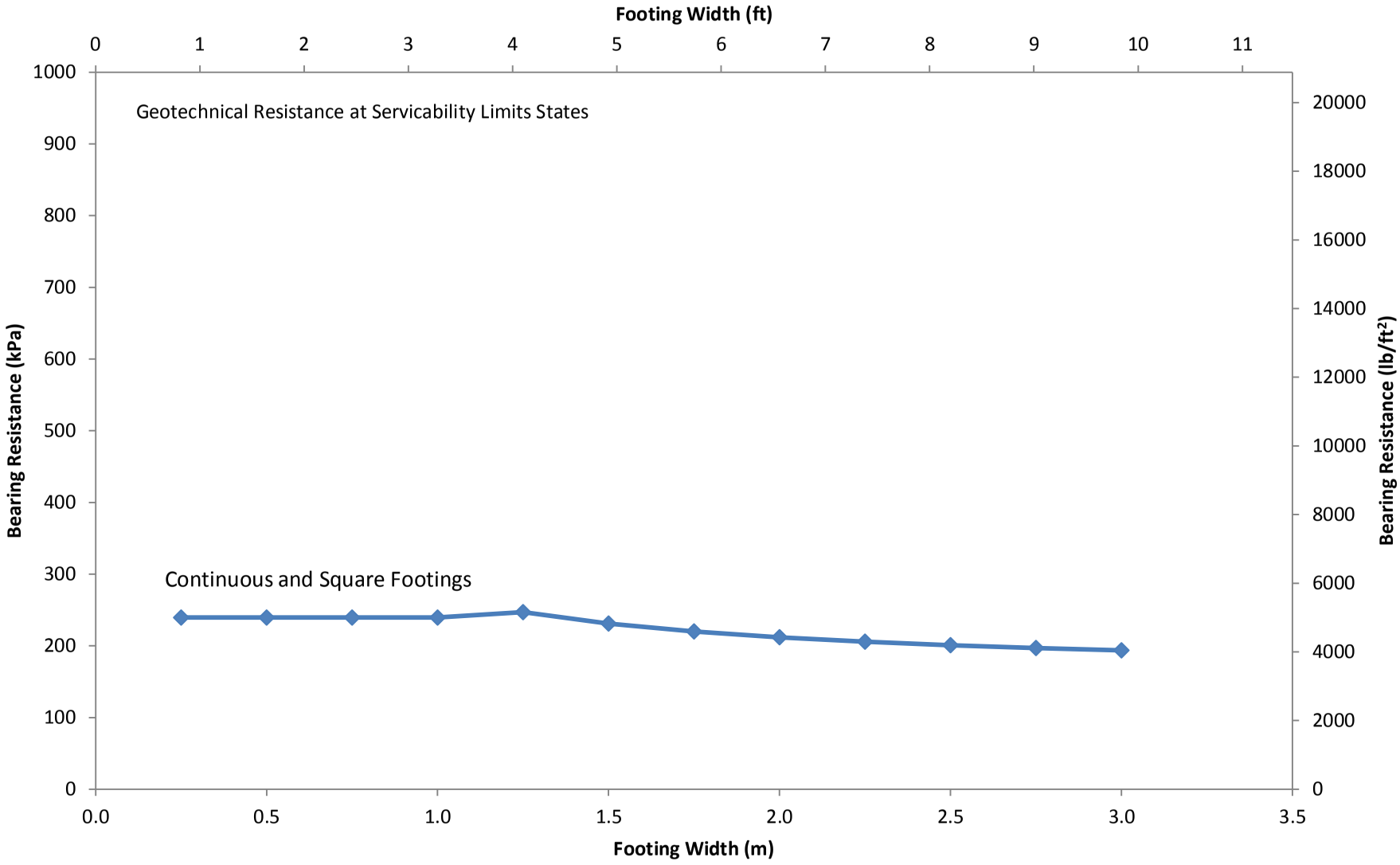
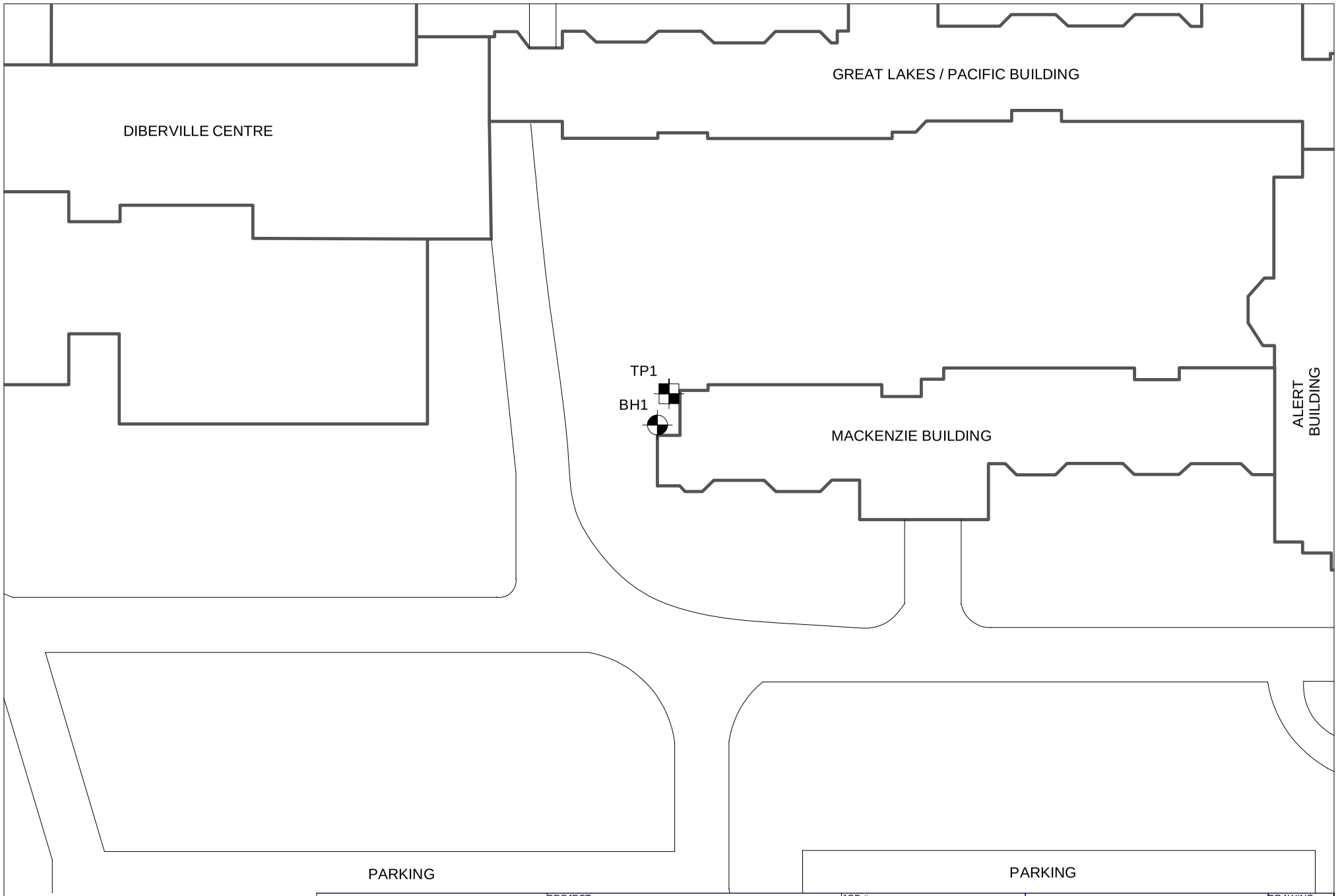


Figure 2

Project # 034-085



BOREHOLE LOCATION

TEST PIT LOCATION

CONQUEST ENGINEERING LTD.
348 Bluewater Road
Bedford, Nova Scotia
B4B 1J6

PROJECT

BOREHOLE LOCATION PLAN

CCGC ELEVATOR ADDITION
SYDNEY, NOVA SCOTIA

JOB #:	034-085
SCALE:	NTS
DATE:	18-SEP-2013
DRAWN BY:	AGG
CHECKED BY:	RBM

DRAWING: 1

REV: 0