

May 4, 2021

Ian Sceles

Public Services & Procurement Canada

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Subject: Geotechnical Investigation – Interior Test Pit Investigation

Fish Lab Renovations, Bedford Institute of Oceanography, Dartmouth, NS

Our ref: 2004260.000

Mr. Ian Sceles

At your request, Englobe has investigated the subsurface conditions at the interior of the Fish Lab at the above-mentioned site. The following is a summary of the encountered conditions and recommendations for design and costing.

1 DESCRIPTION OF THE PROJECT

Currently, it is understood that renovations are being conducted to the Fish Lab at the BIO in Dartmouth, NS. The new structures will be of conventional design and supported by a shallow foundation system consisting of strip and spread footings.

Englobe completed a borehole investigation at the site in the Fall of 2020 (i.e. report dated November 13, 2020). This report should be read in conjunction with the initial report.

2 SUBSURFACE CONDITIONS

Field investigation was carried out on April 28, 2021, when four (4) test pits were excavated at the approximate locations shown on the enclosed site plan. The work was carried out using an excavator supplied by the site contractor. It should be noted that subsurface conditions may vary between and beyond the test pit locations.

In general, fill deposits have been encountered overlying site-native till. The fill generally consisted of silty gravelly sand, some silt with occasional cobbles and boulders. Observations of the in situ deposits indicated that the fill was grey-brown in colour and in a loose to compact condition. The fill was proven to a total depth of 1.1 metres test pit TP 4. Site-native till was encountered in all test pits below the fill. The till generally consisted of gravelly sand, some silt with occasional cobbles and boulders. Observations of

the site-native till indicated that the material was grey-brown in colour, moist and in a compact to dense condition. The till was proven to a total depth of 1.8 metres at test pit TP 2.

3 RECOMMENDATIONS

Building Site Preparation

To prepare the immediate building areas to receive footings/slabs, we recommend a general proof-rolling of the exposed subgrade with a vibratory drum roller (minimum 7 tonnes) or large diesel plate tamper (as conditions permit) to recompact any loose areas and following excavation to design subgrade levels for footings. Any soft or weak areas identified should be subexcavated and replaced with engineered fill.

Contingent upon final design grades, a typical cut and fill program to reach desired floor and foundation subgrade levels may be necessary. Filling may be carried out utilizing select portions of the site fill/till and approved imported structural fill. Final design grades will dictate the extent of earthworks and if importation of structural fill is required. The reuse of on-site materials will be contingent to a large extent on the condition of the materials after excavation, handling and stockpiling. Some processing of the fill/till may be required.

Imported structural fill should consist of well-graded sand and gravel or rockfill with a maximum particle size of 200 mm diameter. The fill is to be free of organics, debris, and slate and should have a fines (i.e. silt and clay sized) content not greater than 15 percent. The material should be placed in lifts not exceeding 300 mm in thickness compacted to 100 percent of the material's standard Proctor maximum dry density. Quality control inspection and testing of engineered fill is recommended.

Foundations

Footings placed on properly prepared structural fill or glacial till can be designed for an allowable soil bearing pressure of 200 kPa. At this design pressure total and differential settlements are not expected to exceed 25 and 19 millimetres, respectively.

For design of foundations by Limit States Design, the factored soil bearing resistance (using a bearing resistance factor of 0.5) for footings with a minimum width of 0.6 metres and at a minimum depth of 1.2 metres are as follows:

Table 1: Summary of Subsurface Conditions

LIMIT STATES DESIGN PARAMETER	GLACIAL TILL OR STRUCTURAL FILL
Factored Geotechnical Bearing Resistance at Ultimate Limit States (ULS)	300 kPa
Geotechnical Resistance at Serviceability Limit States (SLS)	200 kPa

The serviceability limit states are based on a maximum allowable settlement of 25 millimetres. Unfactored loads should be used with the SLS bearing pressures in accordance with the 2015 National Building Code of Canada (NBCC).

The effect of site conditions on seismic response should be considered in the design of foundations. Based on the subsurface soil conditions encountered in the test pits, the site may be considered as Class C for seismic site response (NBCC 2015 Table 4.1.8.4.A) if footings are founded on glacial till or structural fill. Site Class B may be utilized provided all footings are founded on bedrock.

Generally, foundations on engineered fill or site-native till should be placed at a minimum depth of 4 feet below finished outside grade to maintain adequate frost protection.

Re-use of On-site Materials and Backfilling

Select portions of the fill deposits, glacial till would be considered suitable for reuse at the site as common material or, in some applications, as engineered fill. The reuse of on-site materials will be contingent on the condition of the materials after excavation, handling and stockpiling. Organic soils and wet soils are not suitable for structural fill; these soils should only be used in non-settlement sensitive areas of the site.

To qualify as engineered backfill, all boulders, debris and deleterious inclusions should be removed. Backfill should be placed in lifts and compacted using appropriate compaction equipment. Lift thickness should be limited to 400 mm using large vibratory rollers, and 250 mm using hand equipment (e.g. diesel plate tampers). The maximum particle size should be limited to 2/3 of the lift thickness.

Backfill against structures should be compacted to 95% of Standard Proctor Density.

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We trust the enclosed to your satisfaction. If, however, additional information should be required, please communicate with the undersigned.

Yours truly,

Englobe Corp.

A handwritten signature in blue ink that reads "Richard W. Henry". The signature is written in a cursive, flowing style.

Richard Henry, P.Eng.
Project Manager, Geotechnical Engineering

Discipline: Geotechnical			Prepared by: RH		Verified by:	
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TEST PIT LOG

PROJECT

Interior of Fish Lab
BIO, Dartmouth, Nova Scotia

LOGGED/DWN. GG		CKD. RH		DATE OF INVEST. 21-4-28	JOB NO.	2004260.000		TEST PIT	TP 1
		DEPTH ft m	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION		SOIL SAMPLE		BACKHOE TYPE
					DATUM Existing Ground Surface		COND.	TYPE	POCKET PENE.
WC % 10 20 30 40 50				SURFACE ELEVATION					
		1			FILL: gravelly sand, some silt, occasional cobbles and boulders, loose to compact, moist, grey-brown.				
		2							
		3	1		TILL: gravelly sand, some silt, occasional cobbles and boulders, dense, moist, grey-brown.				
		4							
		5			End of Test Pit at 1.5 metres in Till.				
		6			Test Pit dry upon completion.				
		7	2						
		8							
		9							
		10	3						
		11							
		12							
		13	4						
		14							
		15							
		16	5						



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TEST PIT LOG

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Interior of Fish Lab
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LOGGED/DWN. GG		CKD. RH		DATE OF INVEST. 21-4-28	JOB NO.	2004260.000		TEST PIT	TP 2
		DEPTH ft m	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION		SOIL SAMPLE		BACKHOE TYPE
					DATUM Existing Ground Surface		COND.	TYPE	POCKET PENE.
WC % 10 20 30 40 50				SURFACE ELEVATION					
		1			FILL: gravelly sand, some silt, occasional cobbles and boulders, loose to compact, moist, grey-brown.				
		2							
		3	1		TILL: gravelly sand, some silt, occasional cobbles and boulders, dense, moist, grey-brown.				
		4							
		5							
		6							
		7	2		End of Test Pit at 1.8 metres in Till.				
		8			Test Pit dry upon completion.				
		9							
		10	3						
		11							
		12							
		13	4						
		14							
		15							
		16	5						



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LOGGED/DWN. GG		CKD. RH		DATE OF INVEST. 21-4-28	JOB NO.	2004260.000		TEST PIT	TP 3
		DEPTH ft m	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE			BACKHOE TYPE
					DATUM Existing Ground Surface	COND.	TYPE	POCKET PENE.	Excavator
				SURFACE ELEVATION					
WC % wp- — w-● wl- —					Gravel.				
10 20 30 40 50		1			FILL: gravelly sand, some silt, occasional cobbles and boulders, loose to compact, moist, grey-brown.				
		2							
		3	1		INFERRED LEVEL OF TILL: gravelly sand, some silt, occasional cobbles and boulders, compact, moist, grey-brown.				
		4							
		5			End of Test Pit at 1.5 metres in Till.				
		6			Test Pit dry upon completion.				
		7	2						
		8							
		9							
		10	3						
		11							
		12							
		13	4						
		14							
		15							
		16	5						



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Interior of Fish Lab
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LOGGED/DWN. GG	CKD. RH		DATE OF INVEST. 21-4-28	JOB NO.	2004260.000	TEST PIT	TP 4	
<div>WC % wp- w-● wl- </div> <div>10 20 30 40 50</div>	DEPTH	ELEVATION	SOIL SYMBOL	SOIL DESCRIPTION	SOIL SAMPLE		BACKHOE TYPE	
				DATUM Existing Ground Surface	COND.	TYPE	POCKET PENE.	Excavator
				SURFACE ELEVATION				
							OTHER TESTS	
				Sand				
				Gravel.				
	1			FILL: gravelly sand, some silt, occasional cobbles and boulders, loose to compact, moist, grey-brown.				
	2							
	3	1						
	4			INFERRED LEVEL OF TILL: gravelly sand, some silt, occasional cobbles and boulders, compact, moist, grey-brown.				
	5			End of Test Pit at 1.5 metres in Till.				
	6			Test Pit dry upon completion.				
	7	2						
	8							
	9							
	10	3						
	11							
	12							
	13	4						
	14							
	15							
	16	5						