APPENDIX A

Geotechnical Investigation
Val Comeau Wharf Replacement

SHM Canada Consulting Limited

Type of Document:
Final

Project Name:
Val Comeau Wharf Replacement Geotechnical Investigation, Val Comeau, New Brunswick

Project Number:
HFX-00248944-A0

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Date Submitted:
2018-12-03

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Table of Contents

List of Tables

EXP Quality System Checks	
Project No.: HFX-00248944-A0	Date: 2018.12.03
Type of Document: Final	Revision No.: 0
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1 Introduction

EXP Services Inc. (EXP) was retained by SHM Canada Consulting Limited (SHM) to carry out a geotechnical investigation for the proposed replacement of the Val Comeau Wharf in Val Comeau, New Brunswick. This investigation was carried out to determine the sub-surface conditions at the site and to provide geotechnical information and design parameters for the new structure.

We understand that the existing wharf structures 401, 402, and 405 will be replaced with a new wharf structure, 408. The new structure 408 would consist of a new stem (approximately 37.7 m long), composed of Northeast Extreme Tee Beams (NEXT) supported on piles, and tee wharf (approximately 117 m by 14.5 m); including two extensions to the east and west of the existing tee wharf composed of Berlin Wall structures. New piles would be installed to surround the existing tee wharves (Structure 401 and 405) as part of the Berlin Wall structures. The timber cribwork that comprises the stem (structure 402) would be removed as part of the replacement.

2 Site Description

The Val Comeau Wharf site is located at the end of Rue du Quai, approximately 400 m from Chemin du Parc Val Comeau within the community of Val Comeau, New Brunswick. The site is approximately 3 km east of Highway 11.

The existing wharf structures 401, 402, and 405 consist of a mixture of timber cribwork and timber pile construction with concrete decks. It is understood that the existing wharf structures have reached the end of their service lives.

3 Fieldwork

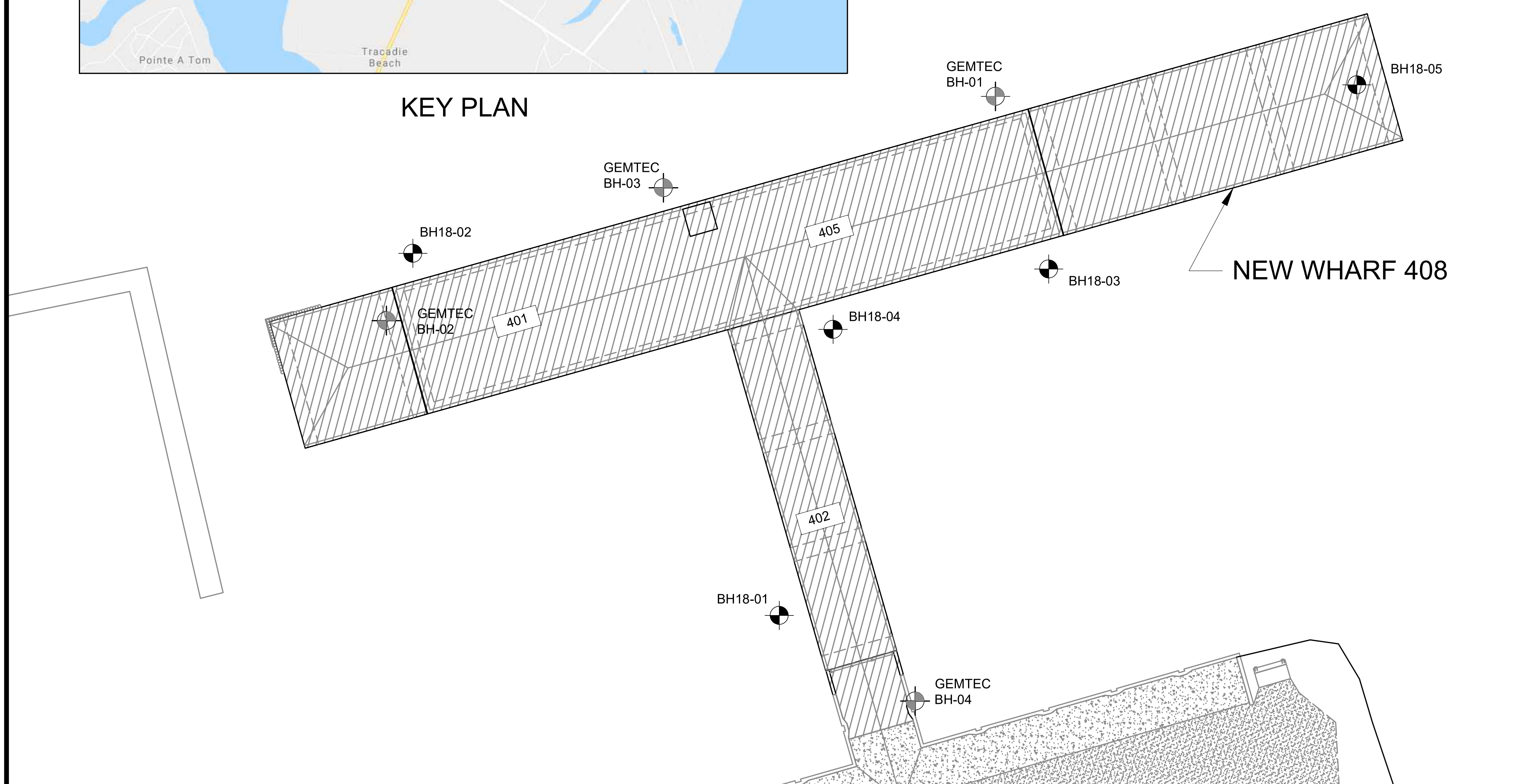
The fieldwork for the geotechnical investigation consisted of advancing five boreholes (BH18-01 to BH18-05), with depths extending from 9.0 to 14.0 m below harbour bottom. The investigation was carried out using a skid-mounted marine drill rig and were drilled within the harbour from a barge. The drill and barge were supplied and operated by Lantech Drilling Services out of their operation located in Dieppe, New Brunswick. The investigation took place between September 25 and 27, 2018.

The borehole investigation was conducted in the presence of EXP geotechnical staff, who logged the sub-surface stratigraphy and collected representative soil and bedrock samples.

Drilling was previously completed by GEMTEC at this site for Public Works and Government Services Canada in February 2013. Four boreholes (BH-01 to BH-04) were drilled for structures 401, 402, and 405. Subsurface conditions from these boreholes were used to supplement the current investigation.

The general site arrangement and location of the boreholes are shown on Figure 1, attached.

KEY PLAN



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No.	Issue	Date

LEGEND:

- PREVIOUS 2013 GEMTEC BOREHOLE LOCATIONS
- APPROXIMATE BOREHOLE LOCATIONS
- STRUCTURE NUMBER 401

No.	Revision	Date

Drawn By:	BM
Dwg Standards Ckd By:	
Designed By:	CM
Design Checked By:	
Scale:	1:500

Project Title

VAL COMEAU WHARF REPLACEMENT

Dwg. Title

BOREHOLE LOCATION PLAN

Project No.
HFX-00248944-A0

Dwg. No.
FIG. 1

Rev. No.
0

 17

\\TROW.COM\PROJECTS\HFX\HFX-00248944-A0\60 PROJECT EXECUTION\60.1 CADD\FIG. 1\FIG. 1

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3.1 Investigation Methodology

The proposed borehole locations were selected by EXP and SHM, based on preliminary plans for the wharf replacement.

EXP surveyors provided control points (locations and elevation of the ground surface) along the existing wharf deck, referencing NB Survey Monument 26581 with a published elevation of 2.018 m (Geodetic). Approximate borehole locations and elevations were measured from the control points. The survey was conducted in Geodetic Datum and Converted to Chart Datum. Chart Datum is 0.084 m above Geodetic Datum.

The boreholes were advanced using casing/coring equipment. Representative soil samples were obtained from the 50 mm diameter split spoon sampler during Standard Penetration Tests (SPT), conducted ahead of the casing. Coring was conducted using HQ sized equipment, which uses HW sized casing. A preliminary assessment of particle size, density, moisture and colour was visually assessed and recorded for each soil sample in the field. The bedrock cores were reviewed for colour, quality (RQD), and natural discontinuities.

3.2 Sample Storage and Lab Testing

Soil samples were reviewed in the laboratory by an EXP engineer to confirm soil boundaries and descriptions. One Unconfined Compressive Strength test was conducted on a representative bedrock sample.

4 Surface and Sub-Surface Conditions

4.1 Summary of Conditions

The general stratigraphy encountered on the site included the following:

- Marine Sediments
- Bedrock (Sandstone)

A general summary of the thickness of the marine sediment and depth to bedrock encountered during the investigation is provided below in Table 1. Detailed summaries of the various strata are provided on the borehole records presented in Appendix 1, with descriptions of the strata given below in subsequent paragraphs. Select site and bedrock core photos are provided in Appendix 2.

It should be noted that the soil and bedrock stratigraphy detailed on the borehole records and in the descriptions of subsurface conditions is only valid at the location where the boreholes were conducted. Soil and bedrock stratigraphy should be expected to vary between borehole locations.

Table 1: Summary of Sub-Surface Stratigraphy

Borehole ID	Thickness of Marine Sediment (m)	Depth to Bedrock Surface (m)	Bedrock Elevation[1] (m)
BH18-01	0.4	0.4	-2.1
BH18-02	0.3	0.3	-2.2
BH18-03	0.6	0.6	-2.0
BH18-04	0.4	0.4	-2.0
BH18-05	1.9	1.9	-3.0

Notes: [1]Elevations are based on the local chart datum; corrected from Geodetic.

4.2 Detailed Descriptions of Surficial and Sub-Surface Strata

4.2.1 Marine Sediment

Marine sediment was encountered at the harbour bottom in all five boreholes. The marine sediment was generally described as sandy silt, with some organics. The marine sediment was generally very soft in terms of consistency and black to grey in colour. The marine sediments were generally 0.3 to 1.9 m thick.

The marine sediment in the GEMTEC boreholes was described as black to brown silty sand and ranged in thickness from 0.3 to 0.4 m.

4.2.2 Bedrock

Sandstone Bedrock was encountered in all five boreholes under the surficial marine sediment. The bedrock was generally described as weathered and transitioning in colour from green-grey to blue-grey with depth. The quality of the bedrock was generally very poor to poor, based on RQD values ranging from 0 to 44%; averaging 7%. Fracture spacing varied from very close to close, with fractures predominantly horizontally orientated.

One compressive strength test of 58.3 MPa was completed on a sample of bedrock, which would classify the rock as ‘strong’. The majority of the retrieved bedrock core did not have sufficient length for compressive strength testing.

The bedrock elevation ranged from -2.0 to -3.0 m (Chart Datum). Bedrock elevations from the GEMTEC boreholes ranged from -2.1 to -2.6 m (Chart Datum).

5 Discussion and Recommendations

Geotechnical recommendations for the design of the proposed wharf structure are given below, based on our current understanding of the proposed development plans.

We understand that wharf structure 402 is to be removed and replaced and the existing timber cribwork for wharf structures 401 and 405 is to remain in place. It is understood that a pile supported structure with concrete pile caps and deck are preferred for the replacement of 402 and the two wharf extensions. A Berlin wall is the preferred method of construction for the replacement section over structures 401 and 405; using new piles with the existing timber crib work.

The major site-specific geotechnical considerations for the new wharf structure are summarized in the following points. Additional commentary and recommendations are provided in subsequent report sections.

- Due to the presence of shallow bedrock, socketed piles (caissons) are the preferred foundation type. The piles would be socketed into bedrock and designed to resist loads through skin friction in the bedrock socket. We note that socketed piles have been a common foundation for similar developments within northern New Brunswick.
- Driven piles are not ideally suited for this site due to the presence of shallow bedrock and thin overburden soils. Problems with shallow refusal and achieving 'fixity' in bedrock would be of concern. It is understood that steel H Piles would need to be driven a minimum 3 m into competent bedrock, which could be difficult due to the bedrock quality.
- Concrete cribs could be considered as an alternative. However, it is understood that this option is not preferred and would require dredging of the marine sediment.

5.1 Socketed Piles – Drilled Caissons

Socketed piles are typically installed by advancing a steel pipe pile to bedrock by a number of potential drilling methods and extending a socket into rock. After thorough cleaning of the rock socket by air and water jetting, a reinforcement cage is typically lowered to the bottom of the socket and concrete is tremied to fill the socket and the pipe pile.

This type of pile relies on the bond between the grout/concrete and the rock for its capacity. The contribution of end bearing is not typically considered due to the large deformations required to mobilize the end bearing and the practical difficulty of removing all loose debris from the base of the socket.

An ultimate bond strength (unit socket shear) of 750 kPa is recommended for the design of sockets for caissons. The bond strength is applicable for both tensile and compressive loading. For preliminary design a geotechnical resistance factor of 0.4 and 0.3 should be applied for compressive and tensile loading, respectively. Minimum bond lengths of 3 m and maximum bond lengths of 10 m are recommended.

For uplift loading, the unit shear bond between the grout/concrete and rock socket should be reduced by 50%. The total uplift should also include the weight of the pile, the weight of rock contained in a cone extending from the base of the socket at an angle of 35 degrees from vertical to the bedrock surface and the weight of soil between the pile and a vertical line extending upward from the intercept with the bedrock. The maximum uplift, including the contribution of the weight of soil and rock, should be limited to a value equal to the design compressive socket shear.

The upper 1 m of the socket should not be included in compressive or uplift bond resistance calculations and the socket should extend a minimum of 3 m into bedrock.

Steel casing should be extended to the top of the bond zone, which should begin no less than 1 m below the bedrock surface. These types of piles rely on the bond between grout/concrete and the rock for their capacity so cleaning of the socket by air, water jetting or other means is critical for acceptable performance. Another important aspect is to achieve a positive seal in bedrock, to prevent the inflow of soil and ensure a clean socket can be obtained. Piling contractors are responsible for measures such as extending the steel casing, consolidation grouting or similar measures needed to achieve a positive seal.

To avoid the potential for group effects, we recommend a minimum centre to centre spacing of at least three pile diameters between the bond zones of adjacent caissons.

5.2 Geotechnical Design Parameters

5.2.1 Parameters for Retaining Structures

The recommended geotechnical parameters to determine lateral earth pressures for design of the retaining structures are summarized below in Table 2. These parameters are given assuming that level, compacted structural fill will be used to backfill retaining structures. If a different type of backfill such as the local harbour sediments, or inclined slopes behind structures are planned, the geotechnical engineer should be consulted for the appropriate earth pressure coefficients for design.

Table 2: Recommended Geotechnical Parameters for Retaining Structures

Parameter	Compacted Structural (Granular) Fill
Total Unit Weight, kN/m^3	21.5
Buoyant Unit Weight, kN/m^3	11.5
Effective Friction Angle, degrees	36
Coefficient of Active Earth Pressure, K_a	0.26
Coefficient of Passive Earth Pressure, K_p	3.90
Coefficient of Earth Pressure at Rest, K_o	0.40

Care should be taken not to damage walls when performing backfilling and compaction operations. Compaction within 1.5 m of retaining structures should be carried out with a walk-behind vibratory plate roller or plate tamper rather than a large vibratory drum roller.

5.2.2 Soil Profile Type for Seismic Response

We recommend that designers use a site class of B (rock) or C (very dense soil and soft rock) for seismic considerations, in accordance with Table 4.1.8.4.A (Site Classification for Seismic Site Response) in the 2015 National Building Code of Canada. Note that the site class is based on the investigation methods and assumed average conditions of the ground profile in the upper 30 m of the site. Based on our current understanding of the proposed development, the use of Site Class B would be appropriate.

5.3 General Recommendations

5.3.1 Structural Fill

Where required for development, structural fill should consist of well graded, sand and gravel with less than 10% fines (% passing the 0.080 mm sieve size). The particles comprising the fill should be durable and it should be free of organics, flat or elongated particles and all other deleterious materials. Examples of suitable structural fill would be a ‘Type 1' or ‘Type 2' Gravel, ‘Gravel Borrow’, or ‘Fill Against Structure’ as specified in the Nova Scotia Transportation and Infrastructure Renewal’s Standard Specifications.

6 Closure

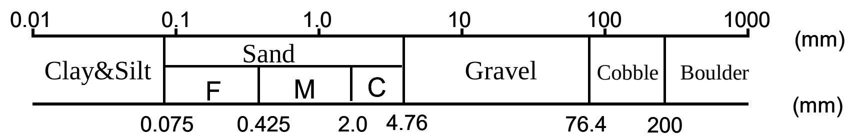
This report has been prepared to assist in the design and construction of the proposed Val Comeau Wharf replacement in Val Comeau, New Brunswick. If any details are included in the final design of the structure that differ from the assumptions outlined in this report, the geotechnical engineer should be consulted. Similarly, if conditions different from those detailed on the borehole records are noted during construction, the engineer should be notified to allow reassessment of any design assumptions, if necessary.

Appendix 1 –
Descriptive Terms Used on Borehole Logs
Borehole Records

Descriptive Terms - Borehole and Test Pit Logs

Soils

Grain Size



Compactness
(gravel, sand, tills)

N, Range	0 - 4	4 - 10	10 - 30	30 - 50	>50
Density	V. Loose	Loose	Compact	Dense	V. Dense

Consistency
(silt, clay)

S, KPa	< 12.5	12.5 - 25	25 - 50	50 - 100	100 - 200
Consistency	V. Soft	Soft	Firm	Stiff	V. Stiff

Rock

RQD	**Overall Quality**	**Fracture Spacing**
0 - 25	Very Poor	< 50 mm Very Close
25 - 50	Poor	50 - 300 mm Close
50 - 75	Fair	0.3 - 1 m Moderate
75 - 90	Good	1 - 3 m Wide
90 - 100	Excellent	> 3 m Very Wide

Comp. Str., MPa	0.25 - 1	1 - 5	5 - 25	25 - 50	50 - 100	100 - 250	> 250
Description	Extremely Weak	Very Weak	Weak	Medium Strong	Strong	Very Strong	Extremely Strong

Sample Types (location to scale on log)

SS	Split Spoon	**B**	Shovel (bulk)
T	Shelby Tube	**H**	Carved Block
P	Piston	**V**	In Situ Vane
F	Auger	**NR**	No Recovery
W	Wash		

Rock Cores: BQ (36.5mm), NQ (47.6mm), HQ (63.5mm)

Notation and Symbols

N - N-value from standard penetration test; blows by 475 J drop hammer to advance std. 50mm O.D. split spoon sampler 0.3m

RQD - percent of core consisting of hard, sound pieces in excess of 100mm long (excluding machine breaks)

Recovery - sample recovery expressed as percent or length

S	- shear strength, kPa	**PL**	- plastic limit, percent
Sr	- shear strength, remoulded	**LL**	- liquid limit, percent
Dd	- dry density, t/m^3	▼	- groundwater level
W	- natural moisture content, percent	▽	- seepage

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

Soil Description

Behavioral properties (i.e., plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology Describing Soil Structure

Desiccated	Having visible signs of weathering by oxidation of clay minerals,
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 type, e.g., silt and sand
Well Graded	Having wide range in grain size and substantial amounts of all
Uniformly Graded	Predominantly of one grain size

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace or occasional	Less than 10%
Some	10–20%
Adjective (e.g., silty or sandy)	20–35%
And (e.g., silt and sand)	35–50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test “N”-value: the number of blows of 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2-inch (50.8 mm) O.D. splitspoon sampler one foot (305 mm) into the soil.

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 cohesive soils includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Undrained Shear Strength

Consistency	**kips/sq. ft.**	**kPa**	**'N' Value**
Very Soft	<0.25	<12.5	<2
Soft	0.25–.50	12.5–25	2–4
Firm	0.5–1.0	25–50	4–8
Stiff	1.0–2.0	50–100	8–15
Very Stiff	2.0–4.0	100–200	15–30
Hard	>4.0	>200	>30

BOREHOLE RECORD

CLIENT: SHM Canada Consulting Limited
LOCATION: Val Comeau Wharf, Val Comeau, New Brunswick
DATES of BORING: Sep 25, 2018
WATER LEVEL:
PROJECT No. HFX-00248944-A0
BOREHOLE No. BH18-01
DATUM: Chart

DEPTH (m)	ELEV. (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	OTHER TESTS
0	-1.7	**MARINE SEDIMENT** Sandy SILT, some organics, soft, black.			SS	SS1	360	50/600	
	-2.1	**SANDSTONE BEDROCK** SANDSTONE, weathered at harbour bottom, strong, very poor quality, very close to close horizontal fractures, green grey to blue grey.			RC	RC2	26%	0	
					RC	RC3	80%	0	
					RC	RC4	50%	0	
					RC	RC5	90%	7	
		Bedrock colour changes from green grey to blue grey.			RC	RC6	95%	7	
					RC	RC7	71%	0	
9	-10.7	End of Borehole at 9.0 m Depth.							

Undrained Shear Strength, kPa: 20 40 60 80

Water Content & Atterberg Limits W_p W W_l

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

Depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

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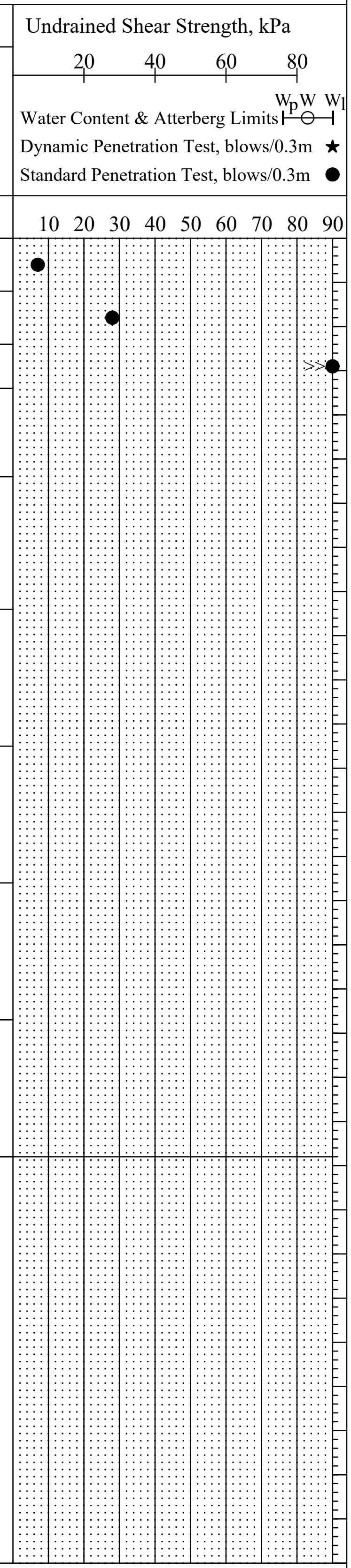
BOREHOLE RECORD

CLIENT: SHM Canada Consulting Limited
PROJECT No. HFX-00248944-A0
LOCATION: Val Comeau Wharf, Val Comeau, New Brunswick
BOREHOLE No. BH18-02
DATES of BORING: Sep 26, 2018
WATER LEVEL:
DATUM: Chart

DEPTH (m)	ELEV. (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD	SAMPLES OTHER TESTS
0	-1.9								
0.3	-2.2	**MARINE SEDIMENT** Sandy SILT, some organics, firm, black.			SS	SS1	380	7	
		SANDSTONE BEDROCK SANDSTONE, weathered at harbour bottom, strong, very poor quality, very close to close horizontal fractures, green grey to blue grey.			SS	SS2	600	28	
					SS	SS3	360	50/500	
					RC	RC4	76%	0	
					RC	RC5	30%	0	
					RC	RC6	100%	0	
					RC	RC7	100%	7	
					RC	RC8	100%	13	
		Bedrock colour changes from green grey to blue grey.			RC	RC9	100%	32	
10.4	-12.3	End of Borehole at 10.4 m Depth.							



△ Unconfined Compression Test
□ Field Vane Test ■ Remoulded

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BOREHOLE RECORD

CLIENT: SHM Canada Consulting Limited
PROJECT No. HFX-00248944-A0

LOCATION: Val Comeau Wharf, Val Comeau, New Brunswick
BOREHOLE No. BH18-03

DATES of BORING: Sep 26, 2018
WATER LEVEL:
DATUM: Chart

DEPTH (m)	ELEV. (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	OTHER TESTS
0	-1.4	**MARINE SEDIMENT** Sandy SILT, some organics, very soft, black.			SS	SS1	240	0	
0.6	-2.0	**SANDSTONE BEDROCK** SANDSTONE, weathered at harbour bottom, strong, very poor to poor quality, very close to close horizontal fractures, green grey to blue grey.			SS	SS2	600	50/ 575	
					RC	RC3	50%	0	
2					RC	RC4	80%	0	
4					RC	RC5	31%	0	
5					RC	RC6	73%	0	
7		Bedrock colour changes from green grey to blue grey.			RC	RC7	95%	0	
8.5					RC	RC8	93%	15	
10					RC	RC9	95%	0	
11.5					RC	RC10	97%	30	
13					RC	RC11	95%	44	
14	-15.4	End of Borehole at 14.0 m Depth.							
15									

Undrained Shear Strength, kPa: 20 40 60 80

Water Content & Atterberg Limits W_p W W_l

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

☐ Field Vane Test ■ Remoulded

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BOREHOLE RECORD

CLIENT: SHM Canada Consulting Limited
PROJECT No. HFX-00248944-A0
LOCATION: Val Comeau Wharf, Val Comeau, New Brunswick
BOREHOLE No. BH18-04
DATES of BORING: Sep 27, 2018
WATER LEVEL:
DATUM: Chart

DEPTH (m)	ELEV. (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	OTHER TESTS
0	-1.6	**MARINE SEDIMENT** Sandy SILT, some organics, very soft, black.			SS	SS1	100	0	
	-2.0	**SANDSTONE BEDROCK** SANDSTONE, weathered at harbour bottom, strong, very poor quality, very close to close horizontal fractures, green grey to blue grey.			SS	SS2	350	50/575	
1					RC	RC3	56%	0	
2					RC	RC4	80%	0	
3–4					RC	RC5	63%	10	UCS
5		UCS = 58.3 MPa at 4.6 m Depth.			RC	RC6	90%	0	
6					RC	RC7	78%	0	
7		Bedrock colour changes from green grey to blue grey.			RC	RC8	93%	0	
8–9					RC	RC9	95%	0	
10					RC	RC10	95%	15	
11–12	-13.8				RC	RC11	90%	15	
12.2		End of Borehole at 12.2 m Depth.							

Undrained Shear Strength, kPa: 20 40 60 80

Water Content & Atterberg Limits W_p W W_l

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

☐ Field Vane Test ■ Remoulded

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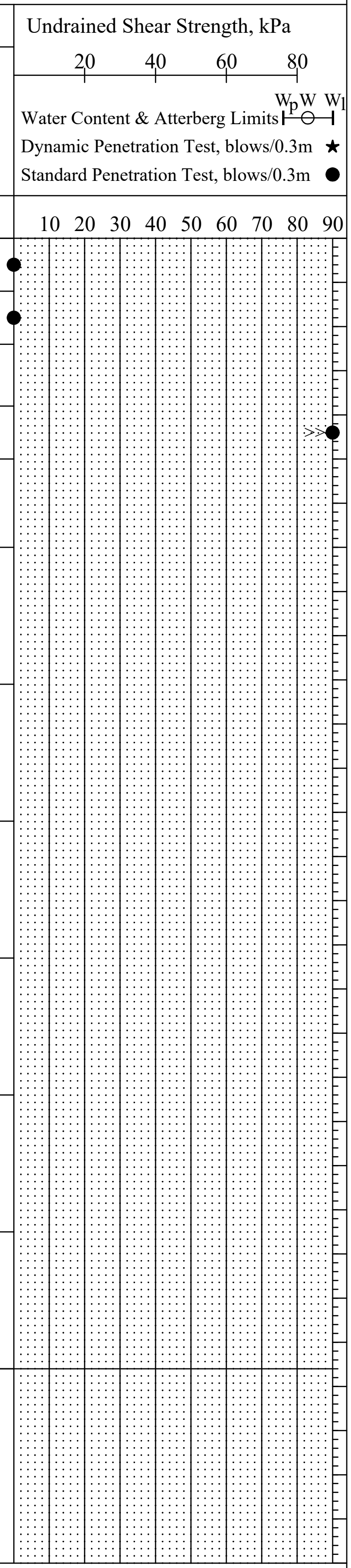
BOREHOLE RECORD

CLIENT SHM Canada Consulting Limited — PROJECT No. HFX-00248944-A0
LOCATION Val Comeau Wharf, Val Comeau, New Brunswick — BOREHOLE No. BH18-05
DATES of BORING Sep 26, 2018 — WATER LEVEL — DATUM Chart

DEPTH (m)	ELEV. (m)	DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES: TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	OTHER TESTS
0	-1.1	**MARINE SEDIMENT** Sandy SILT, some organics, very soft, black to grey.			SS	SS1	370	0	
					SS	SS2	230	0	
1.9	-3.0	**SANDSTONE BEDROCK** SANDSTONE, weathered at harbour bottom, strong, very poor to poor quality, very close to close horizontal fractures, green grey to blue grey.			SS	SS3	480	50/600	
					RC	RC4	74%	0	
					RC	RC5	85%	0	
					RC	RC6	88%	0	
					RC	RC7	82%	0	
					RC	RC8	95%	0	
		Bedrock colour changes from green grey to blue grey.			RC	RC9	95%	29	
					RC	RC10	98%	30	
12.8	-13.9	End of Borehole at 12.8 m Depth.							



△ Unconfined Compression Test
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Appendix 2 –
Select Site and Bedrock Core Photos

Photo 1: **BH-18-01**
Seabed Elevation :-1.7 meters
Bedrock Elevation : -2.1 meters
Amount cored : 8.6 meters

Photo 2: **BH-18-02**
Seabed Elevation :-2.0 meters
Bedrock Elevation : -2.3 meters
Amount cored : 10.1 meters

EXP Services Inc. 90 Lovett Lake Court, Suite 401 Halifax, NS B3S 0H6 T: 902.453.5555 F: 902.429.5457	PROJECT TITLE AND LOCATION Val Comeau Wharf Geotechnical Investigation, New Brunswick	PROJECT NO.: HFX-00248944-A0 DATE: September 2018

Photo 3: **BH-18-03**
Seabed Elevation :-1.5 meters
Bedrock Elevation : -2.1 meters
Amount cored : 13.4 meters

Photo 4: **BH-18-04**
Seabed Elevation :-1.7 meters
Bedrock Elevation : -2.1 meters
Amount cored : 11.8 meters

Photo 5: **BH-18-05**
Seabed Elevation :-1.2 meters
Bedrock Elevation : -3.1 meters
Amount cored : 10.9 meters

Photo 6: **View of the site looking northeast across the wharf.**