



Soil and Materials Engineering  
Environmental Engineering  
Building Science  
Supply Chain Quality

## **National Capital Commission**

# **Leamy Stream Pedestrian Bridge Complementary Geotechnical Study**

## **Final Report**

July 2015

O/Ref.: 033-B-0012112-1-GE-R-0001-00

**LVM, a division of EnGlobe Corp.**



## National Capital Commission

### Leamy Stream Pedestrian Bridge Complementary Geotechnical Study

Final Report | 033-B-0012112-1-GE-R-0001-00

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REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification and/or Publication Details
00	2015-07-08	Final Report

## INTRODUCTION

**LVM, a division of Englobe Corp. (LVM)** services were selected by the National Capital Commission to carry out an additional geotechnical study for the replacement of the Leamy Creek pedestrian bridge in Gatineau, Quebec. This mandate also included a *Phase II Environnemental Site Assessment* (ESA) presented in a different report (N/Ref.: 033-B-0012112-2-HG-R-0001-00).

A geotechnical study was done in 2013 by LVM Inc. (N/Ref. 237-B-0001957-2-GE-R-0001-00, March 2013) as part of a feasibility study for the replacement of the structure.

The information collected during the field investigation work as part of this study allowed us to determine the properties of subsoils materials and groundwater conditions to develop suitable recommendations for geotechnical project design, in regards to:

- ▶ Bearing capacity for prefabricated retaining walls;
- ▶ Overall stability of the site with and without retaining walls;
- ▶ Maximum slopes of the earth banks, with or without walls;
- ▶ Recommendations for the paving the temporary trail that is used as a pathway detour and as a final trail.

The terms governing this mandate are based on the statement contained in our proposal, identified 12-0045-033 and accepted by the client. This report contains a site description and investigation methods, as well as a detailed description of the nature and properties of subsoils materials encountered in the sounding and the conditions of groundwater. Finally, a section is devoted to the discussion of the results and geotechnical recommendations for the design of the project.

The recommendations in this report have been formulated in accordance to the Canadian Highway Bridge Design Code (CAN/CSA-S6-06).

The terms defining the impact of the study are described in Appendix 1 of the report.

## 1 SITE AND PROJECT DESCRIPTION

This project concerns the replacement of the Lake Lemay pedestrian bridge, located approximately 130 meters east of Fournier Blvd, on the Voyageurs Pathway in Leamy Lake Park. The bridge is about 56 meters long. According to information provided by the client, the bridge was built over 80 years ago. The deck sits on three (3) concrete pillars supported by wooden piles.

The following work is part of the project:

- ▶ Possible decontamination of the east abutment;
- ▶ Demolition of the concrete deck, pillars and abutments;
- ▶ Construction of a single span bridge;
- ▶ Construction or rehabilitation of retaining walls;
- ▶ Installation of riprap.

Figure 1 shows an aerial view of the site under study.

Figure 1 Aerial view of the pedestrian bridge (source: Carte interactive de la Ville de Gatineau)



## 2 INVESTIGATION PROCEDURES (FIELDWORKS)

### 2.1 LOCATION OF THE CORING

A site survey to determine the boreholes locations was carried out by LVM representatives. The establishment sounding was performed by LVM personnel before work begins. The boreholes for environmental testing were located by the designer.

### 2.2 FIELDWORKS

The field investigation was performed from May 4<sup>th</sup> to 12<sup>th</sup>, 2015. It consisted of drilling thirty-three (33) boreholes, numbered F-01-15 to F-33-15. These boreholes were done using a "Geoprobe" drill on the abutments on each side of the pedestrian bridge. Table 1 presents a summary of the boreholes.

Table 1 Boreholes Summary

BOREHOLES	ABUTMENT	TESTS	DEPTH (m)
F-01-15	East	Environmental samplings with thin-walled tubes	5.36*
F-01A-15	East	Destructive borehole	5.36*
F-02-15	West	Environmental Standard penetration test (SPT)	6.10
F-03-15	West	Environmental samplings with thin-walled tubes	6.10
F-04-15	West	Environmental Standard penetration test (SPT)	6.10
F-05-15	West	Environmental Standard penetration test (SPT)	6.10
F-06-15	East	Geotechnical samples, Standard penetration test (SPT), Field vane testing, Dynamic cone penetration test (DCPT), install an observation well	30.48
F-07-15	West	Dynamic cone penetration test (DCPT)	5.49*
F-08-15	West	Geotechnical samples, Standard penetration test (SPT), Field vane testing, Dynamic cone penetration test (DCPT), install an observation well	30.48
F-09-15	West	Dynamic cone penetration test (DCPT)	29.95*
F-10-15	West	Dynamic cone penetration test (DCPT)	10.97
F-11-15	West	Dynamic cone penetration test (DCPT)	9.75
F-12-15	West	Dynamic cone penetration test (DCPT)	9.75
F-13-15	West	Dynamic cone penetration test (DCPT)	9.75
F-14-15	West	Dynamic cone penetration test (DCPT)	9.75

BOREHOLES	ABUTMENT	TESTS	DEPTH (m)
F-15-15	East	Dynamic cone penetration test (DCPT)	4.37*
F-16-15	East	Dynamic cone penetration test (DCPT)	2.84*
F-17-15	East	Dynamic cone penetration test (DCPT)	4.52*
F-18-15	East	Dynamic cone penetration test (DCPT)	5.23*
F-19-15	East	Dynamic cone penetration test (DCPT)	5.41*
F-20-15	East	Dynamic cone penetration test (DCPT)	5.23*
F-21-15	East	Dynamic cone penetration test (DCPT)	5.28*
F-22-15	East	Dynamic cone penetration test (DCPT)	5.28*
F-23-15	East	Dynamic cone penetration test (DCPT)	5.28*
F-24-15	East	Dynamic cone penetration test (DCPT)	8.53
F-25-15	East	Dynamic cone penetration test (DCPT)	28.07
F-26-15	East	Dynamic cone penetration test (DCPT)	0.90*
F-27-15	East	Dynamic cone penetration test (DCPT)	8.23
F-28-15	East	Dynamic cone penetration test (DCPT)	8.23
F-29-15	East	Dynamic cone penetration test (DCPT)	4.32*
F-30-15	East	Dynamic cone penetration test (DCPT)	8.23
F-31-15	East	Dynamic cone penetration test (DCPT)	4.93*
F-32-15	East	Dynamic cone penetration test (DCPT)	5.46*
F-33-15	East	Dynamic cone penetration test (DCPT)	5.44*

\*: End drilling after obtaining a refusal on a block, very dense soil or probable rock.

Soil sampling was performed with a standard split spoon sampler of 51 mm outer diameter, for boreholes F-02-15, F-04-15 F-06-15 and F-08-15. The average penetration value N was also measured in accordance with the ASTM D-1586 requirements. Drilling F-06-15 and F-08-15 were continued by Field vane testing.

The dynamic cone penetration test was done for the boreholes F-07-15 and F-09-15 to F-33-15 to determine the presence of the footing of the abutment or the rock.

Two (2) field vane profiles were performed for the boreholes F-06-15 and F-08-15 using a "Nilcon Vane". Tests were performed on undisturbed soils at intervals of 1 m and 2 m. These tests were done to depths of 15.35 m and 13.55 m respectively. These tests allow the measurements the undrained shear strength of the intact clay (Cu) and disturbed (Cur).

All field work was done in under the supervision of a full time experienced geotechnical technician from LVM. The description of materials met in the boreholes can be found on the individual boreholes reports in the Appendix 2.

## 2.3 DYNAMIC CONE PENETRATION TEST (DCPT)

Eleven (11) DCPT (Dynamic Cone Penetrometer Test) were carried out at the existing bike path to depths of 0.20 m to 2.45 m. The DCPT determines the relative density of soils by measuring the penetration of the rods of the instrument after each hit from the hammer.

The location of the tests is shown on the plan 033-B-0012112-1-GE-D-0003-00 in the Appendix 4.

## 2.4 GEOPHYSICS TESTS

Geophysical tests with a geo-radar were carried out at the two abutments, which was presented in a separate report.

## 2.5 LABORATORY WORK

All samples collected in the sounding were taken to our laboratory for analysis, identification and classification purposes. They have all been subject to a careful visual examination by a geotechnical engineer.

Soil samples collected from different depths have been submitted to laboratory testing in order to complete information of the geotechnical characteristics gathered during field work. These tests were performed according to the requirements of the BNQ standards and the results are presented in the Appendix 3.

The following Table 2 presents the laboratory program.

Table 2 Laboratory testing program

TESTS	NUMBER
Sieve analysis	2
Atterberg Limits	3

All samples collected in the sounding, including those who were not subjected to laboratory tests, will be preserved for a period of six (6) months and this from the date of completion of field work. They will be destroyed unless a written notice as to their destination is transmitted to us.

### 3 NATURE AND PROPERTIES OF SUBSOIL

This section discusses the stratigraphic units identified at the borehole locations of the studied site. Table 3 shows the distribution of stratigraphic units.

Table 3 Summary of stratigraphic units encountered in the borehole

ABUTMENT	BOREHOLE #	ASPHALT/ TOPSOIL (m)	HETERO-GENEOUS FILL (m)	SANDY SILT TO SILT DEPOSIT (m)	CLAY DEPOSIT (m)	END OF BOREHOLE (m)
East	F-01-15	0.00-0.05	0.05-5.36*	N/E	N/E	5.36*
	F-06-15	0.00-0.05	0.05-2.44	N/E	2.44-13.41	14.02
West	F-02-15	0.00-0.05	0.05-3.66	3.66-6.10	N/E	6.10
	F-03-15	0.00-0.10	0.10-4.88	4.88-6.10	N/E	6.10
	F-04-15	0.00-0.10	0.10-4.26	4.26-6.10	N/E	6.10
	F-05-15	N/E	0.00-3.05	3.05-6.10	N/E	6.10
	F-08-15	N/E	0.00-2.44	2.44-5.61	5.61-13.71	13.71

\*: End drilling after obtaining a refusal on a block, very dense soil or probable rock

N/E : Not encountered.

#### 3.1 EAST ABUTMENT

##### 3.1.1 Heterogeneous Fill

Directly under the asphalt, a heterogeneous fill was intercepted at a depth of 5.36 m in the location of the borehole F-01-15, where a refusal on a block or concrete structure was obtained. This fill was encountered till depth of 2.44 m at borehole F-06-15, followed by a clay deposit.

Low recoveries were obtained in this unit. Indeed, large gaps were observed within the fill. Difficulties during the tubing penetration were also encountered.

The samples obtained consisted mainly of sand with varying proportions of silt and gravel.

In the absence of representative samples and in sufficient quantities, no laboratory analysis was performed in that unit.



### 3.1.2 Clay deposit

At the location of borehole F-06-15, a clay deposit was encountered immediately below the heterogeneous fill. Sampling was done to a depth of 14 m within this deposit.

DCPT were performed at the location of the boreholes F-01-15 and F-25-15 in order to determine the thickness of the deposit. Testing in borehole F-01-15 ended at a depth 30.48 m without refusal, while a refusal was obtained at a depth of 28.07 m of borehole F-25-15.

The deposit was composed of gray silty clay. Sand traces were observed at a depth of 6.10 m at the location of the borehole F-06-15.

The shear strength of the intact and remodeled clay was measured at the location of borehole F-06-15, in accordance with NQ-2501-200 standard, using a controlled deformation Nilcon field vane. The testing was performed down from depths of 3.35 m to 15.35 m. Generally, the consistency of the deposit varied from stiff to very stiff.

Measurements of the clay consistency limits were performed in the laboratory on two (2) representative samples of this deposit. The results are presented in Table 4 below and in the Appendix 3.

Table 4 Consistency limits results – East abutment

BOREHOLE #	SAMPLES NBR	DEPTH (m)	W <sub>N</sub> (%)	W <sub>L</sub> (%)	W <sub>P</sub> (%)	I <sub>P</sub> (%)	I <sub>L</sub>	USCS
F-06-15	CF-6	3.05 – 3.66	42	73	33	40	0.2	CH
F-06-15	CF-15	7.31 – 7.92	64	76	29	47	0.7	CH

According to the results and the Unified Soil Classification System (USCS), this is a high plasticity clay deposit "CH".

## 3.2 WEST ABUTMENT

### 3.2.1 Heterogeneous Fill

Similar to the east abutment, poor recoveries and difficulties during the tubing penetration were encountered at the west abutment.

### 3.2.2 Sandy Silt to Silt Deposit

At the location of boreholes F-02-15 to F-05-15 and F-08-15, under the granular fill, a deposit of silty sand to silt was encountered. Boreholes F-02-15 to F-05-15 finished at a depth of 6.10 m in this deposit. Clay deposit was intercepted starting from 5.61 m at the location of the borehole F-08-15.

Furthermore, at the location of borehole F-08-15, the penetration index "N" was measured 17 times during the sampling with the standard split corer in this silt deposit. Values of "N" varying between 1 and 14 were obtained with an average of 5. The density of this deposit can be described as "very loose" to "medium".

Two (2) particle size analysis and one (1) determinations of the natural moisture test were performed on samples taken from this deposit. The results are summarized in Table 5.

Table 5 Results of the sieves analyze on target samples - West Abutment

BOREHOLES #	DEPTH (m)	GRAVEL > 5 mm (%)	SAND < 5mm and > 80µm (%)	SILT AND CLAY < 80µm (%)	UCSC
F-08-15	3.05 - 3.66	0.0	12.4	87.5	ML
F-08-15	4.88 - 5.49	0.0	52.7	47.3	SM-ML

The results from the analysis and visual examinations of samples indicate that this deposit consists of materials ranging from "silt with some sand" to "sand and silt."

### 3.2.3 Clay deposit

A clay deposit similar to the one found in the east abutment was encountered at the location of the borehole F-08-15 starting at a depth of 5.88 m.

Dynamic cone penetration tests were performed at the location of the boreholes F-08-15 and F-09-15 in order to determine the thickness of the deposit. The test on the borehole F-08-15 ended at a depth of 30.48 m without refusal, while a refusal was obtained at a depth of 29.95 m at the location of borehole F-09-15.

The deposit was presented in the form of gray silty clay. Traces of sand were observed to a depth of 6.10 m at the location of the borehole F-06-15.

The shear strength of intact and remodeled clay was measured at the location of borehole F-08-15, in accordance with NQ-2501-200 standard, using a controlled deformation Nilcon field vane. The tests were performed at depths between 6.55 m to 13.55 m. Generally, the consistency of the deposit ranges from "stiff" to "very stiff".

Measurement of clay consistency limits was completed on one (1) representative sample in laboratory. The results are presented in Table 6 below and at the Appendix 3.

Table 6 Consistency limits results – West abutment

BOREHOLE NBR	SAMPLES NBR	DEPTH (m)	W <sub>N</sub> (%)	W <sub>L</sub> (%)	W <sub>P</sub> (%)	I <sub>P</sub> (%)	I <sub>L</sub>	USCS
F-08-15	CF-11	6.10 – 6.71	68	71	28	43	0.9	CH

According to the results of the tests performed and according to The Unified Soil Classification System (USCS), there is a high plasticity clay deposit "CH".

### 3.3 DYNAMIC CONE PENETROMETER TEST RESULTS (DCPT)

Eleven (11) tests DCP (Dynamic Cone Penetrometer) tests were performed along the two sections of the existing pathway to a depth between 0.20 m to 2.45 m. The DCP test allows the relative density of the soil to be determined by measuring the penetration of the rods after each hammer impact. The CBR values (California Bearing Ratio) (ASTM D 1883) can be correlated from the penetration index (DPI).

Table 7 DCPT results and CBR correlation

SOUNDING #	DEPTH (m)	BLOW COUNT/ 100 mm	DPI (mm/hit)	CORRELATED CBR (%)
<b>Pathway on the west side of the bridge</b>				
DCP-01A-15	0.00 – 0.038	Asphalt		
	0.038 – 0.138	24	4.2	69.0
	0.138 – 0.238	19	5.3	51.3
	0.238 – 0.338	15	6.7	37.9
	0.338 – 0.438	5	20.0	9.4
	0.438 – 0.538	4	25.0	7.1
	0.538 – 0.638	3	33.3	4.9
	0.638 – 0.738	3	33.3	4.9
	0.738 – 0.838	5	20.0	9.4
	0.838 – 0.938	5	20.0	9.4
	0.938 – 1.038	5	20.0	9.4
DCP-01-15	0.00 – 0.040	Asphalt		
	0.040 – 0.140	20	5.0	54.7
	0.140 – 0.240	13	7.7	31.6
	0.240 – 0.340	11	9.1	25.6
	0.340 – 0.440	3	33.3	4.9
	0.440 – 0.540	4	25.0	7.1
	0.540 – 0.640	4	25.0	7.1
	0.640 – 0.740	4	25.0	7.1
	0.740 – 0.840	5	20.0	9.4
	0.840 – 0.940	7	14.3	14.4

SOUNDING #	DEPTH (m)	BLOW COUNT/ 100 mm	DPI (mm/hit)	CORRELATED CBR (%)
	0.940 – 1.040	7	14.3	14.4
DCP-02-15	0.00 – 0.038	Asphalt		
	0.038 – 0.138	13	7.7	31.6
	0.138 – 0.238	13	7.7	31.6
	0.238 – 0.338	9	11.1	19.8
	0.338 – 0.438	3	33.3	4.9
	0.438 – 0.538	3	33.3	4.9
	0.538 – 0.638	2	50.0	2.9
	0.638 – 0.738	3	33.3	4.9
	0.738 – 0.838	4	25.0	7.1
	0.838 – 0.938	3	33.3	4.9
	0.938 – 1.038	4	25.0	7.1
DCP-03-15	0.00 – 0.038	Asphalt		
	0.038 – 0.138	30	3.3	91.7
	0.138 – 0.238	17	5.9	44.5
	0.238 – 0.338	5	20.0	9.4
	0.338 – 0.438	6	16.7	11.8
	0.438 – 0.538	4	25.0	7.1
	0.538 – 0.638	5	20.0	9.4
	0.638 – 0.738	5	20.0	9.4
	0.738 – 0.838	6	16.7	11.8
	0.838 – 0.938	5	20.0	9.4
	0.938 – 1.038	6	16.7	11.8
DCP-04-15	0.00 – 0.038	Asphalt		
	0.038 – 0.138	17	5.9	44.5
	0.138 – 0.238	34	2.9	107.5
	0.238 – 0.338	16	6.3	41.2
	0.338 – 0.438	8	12.5	17.0
	0.438 – 0.538	5	20.0	9.4
	0.538 – 0.638	4	25.0	7.1
	0.638 – 0.738	10	10.0	22.6
	0.738 – 0.838	9	11.1	19.8
	0.838 – 0.938	10	10.0	22.6
	0.938 – 1.038	8	12.5	17.0
<b>Pathway on the east side of the bridge</b>				
DCP-05-15	0.00 – 0.005	Asphalt		
	0.005 – 0.150	81 / 145 mm	1.8	> 100
	0.150 – 0.250	25	4.0	72,7
	0.250 – 0.320	100 / 70 mm	0.7	> 100
	0.320 – 0.321	20 / 1 mm	0.1	> 100
DCP-06-15	0.00 – 0.040	Asphalt		
	0.040 – 0.140	85	1.2	> 100
	0.140 – 0.200	100 / 60 mm	0.6	> 100
	0.200	20 / 0 mm	0	> 100
DCP-07-15	0.00 – 0.050	Asphalt		
	0.050 – 0.150	103	1.0	> 100

SOUNDING #	DEPTH (m)	BLOW COUNT/ 100 mm	DPI (mm/hit)	CORRELATED CBR (%)
	0.150 – 0.250	100	1.0	> 100
	0.250 – 0.350	53	1.9	> 100
	0.350 – 0.358	100 / 8 mm	0.1	> 100
	0.358	20 / 0 mm	0.0	> 100
DCP-08-15	0.00 – 0.050	Asphalt		
	0.050 – 0.150	36	2.8	> 100
	0.150 – 0.250	60	1.7	> 100
	0.250 – 0.350	91	1.1	> 100
	0.350 – 0.450	25	4.0	72.7
	0.450 – 0.550	8	12.5	17.0
	0.550 – 0.650	10	10.0	22.6
	0.650 – 0.750	14	7.1	34.8
	0.750 – 0.850	17	5.9	44.5
	0.850 – 0.950	16	6.3	41.2
	0.950 – 1.050	13	7.7	31.6
	1.050 – 1.150	17	5.9	44.5
	1.150 – 1.250	15	6.7	37.9
	1.250 – 1.350	16	6.3	41.2
	1.350 – 1.450	16	6.3	41.2
	1.450 – 1.550	10	10.0	22.6
	1.550 – 1.650	10	10.0	22.6
	1.650 – 1.750	9	11.1	19.8
	1.750 – 1.850	11	9.1	25.6
	1.850 – 1.950	13	7.7	31.6
	1.950 – 2.050	14	7.1	34.8
	2.050 – 2.150	15	6.7	37.9
	2.150 – 2.250	14	7.1	34.8
	2.250 – 2.350	14	7.1	34.8
	2.350 – 2.450	14	7.1	34.8
DCP-09-15	0.00 – 0.050	Asphalt		
	0.050 – 0.150	50	2.0	> 100
	0.150 – 0.250	120	0.8	> 100
	0.250 – 0.270	100 / 2 mm	0.0	> 100
	0.270	20 / 0 mm	0.0	> 100
DCP-10-15	0.00 – 0.025	Asphalt		
	0.025 – 0.125	71	1.4	> 100
	0.125 – 0.255	50	2.0	> 100
	0.255 – 0.258	100 / 3 mm	0.0	> 100
	0.258	20 / 0 mm	0.0	> 100

## 4 GROUNDWATER

As mentioned previously, two (2) "Casagrande" piezometers were left in place at boreholes F-06-15 and F-08-15, to measure and monitor, if necessary, the level of groundwater in the subsoil. Table 8 shows the result obtained during the measurement of water level in the piezometers installed in 2012 at boreholes TF-01-12 and TF-03-12, as well as those installed during this investigation.

Table 8 Water level measured in the piezometer

BOREHOLE #	TYPE	READING DATE	DEPTH (m)	
			WATER LEVEL	BOTTOM OF PIEZOMETERS
TF-01-12	Casagrande	2012-12-18	3.87	6.41
		2015-05-20	Destroyed installation (see note)	
TF-03-12	Casagrande	2012-12-18	3.90	9.41
		2015-05-20	3.11	10.01
		2015-06-05	1.41	10.01
F-06-15	Casagrande	2015-05-20	3.82	5.83
		2015-06-05	3.97	5.83
F-08-15	Casagrande	2015-05-20	3.20	4.93
		2015-06-05	3.34	4.93

\* Note: The piezometer at the location of the borehole TF-01-12 was destroyed between the two sets of readings.

It is important to note that the level of groundwater can be influenced by several factors including, precipitation, melting of snow and changes to the physical environment. It also should be mentioned that the stabilization of the water level in the piezometer installed in the clay deposit requires several weeks.

## 5 DISCUSSION AND RECOMMENDATIONS

### 5.1 GENERAL REMARKS

As mentioned in the introduction, the project involves the replacement of the pedestrian bridge Leamy Stream. A geotechnical study was carried out in 2013 by LVM inc. (Ref. 237 B-0001957-2 GE-R-0001-00, March 2013). The study was performed as part of a feasibility study for the replacement of the structure. This study presented the relevant recommendations for shallow and deep foundations of the new bridge.

At the request of the designer, further investigations were required issue recommendations for slope stability, structural capacity of the existing roadway pavement and location of existing wooden pilings.

In general, in the location of the two abutments, one heterogeneous fill has been encountered on the surface on thickness of 3 to 5 meters. At the abutment, the fill is followed by a clay deposit. At the west abutment, a deposit of silty sand has been encountered, to a depth of 3 m as well as a deposit similar to the clay encountered on the other side of the bridge.

Groundwater was intercepted at about 3 m below ground level.

### 5.2 STRUCTURE OF CONCRETE OR BLOCK HORIZONS

Several dynamic cone penetration tests (DCPT) were carried out in order to locate the footing of the existing head wall. In total, nineteen (19) tests on the east side and five (5) on the west side were done. The results are shown in Table 9.

Table 9 Dynamic cone penetration tests results

ABUTMENT	BOREHOLE #	DISTANCE FROM THE BACK OF THE HEAD WALL (m)	LOCATION	DEPTH OF THE BOREHOLE (m)	END TO OBTAINING A REFUSAL
East	F-15-15	0.15	Eastbound Lane	4.37	Yes
	F-16-15	0.45	Eastbound Lane	2.84	Yes
	F-17-15	0.75	Eastbound Lane	4.52	Yes
	F-18-15	1.04	Eastbound Lane	5.23	Yes
	F-19-15	1.35	Eastbound Lane	5.41	Yes
	F-20-15	1.65	Eastbound Lane	5.23	Yes
	F-21-15	2.25	Eastbound Lane	5.28	Yes
	F-22-15	2.84	Eastbound Lane	5.28	Yes
	F-23-15	3.31	Eastbound Lane	5.28	Yes

ABUTMENT	BOREHOLE #	DISTANCE FROM THE BACK OF THE HEAD WALL (m)	LOCATION	DEPTH OF THE BOREHOLE (m)	END TO OBTAINING A REFUSAL
	F-24-15	4.83	Eastbound Lane	8.53	No
	F-25-15	5.28	Center lane	28.07	Yes
	F-26-15	0.15	Center lane	0.89	Yes
	F-27-15	0.76	Center lane	8.23	No
	F-28-15	0.47	Center lane	8.23	No
	F-29-15	0.15	Westbound Lane	4.31	Yes
	F-30-15	0.76	Westbound Lane	8.23	No
	F-31-15	0.46	Westbound Lane	4.93	Yes
	F-32-15	1.07	Westbound Lane	5.46	Yes
	F-33-15	1.97	Westbound Lane	5.44	Yes
West	F-10-15	0.30	Eastbound Lane	10.97	No
	F-11-15	0.15	Center lane	9.75	No
	F-12-15	0.45	Center lane	9.75	No
	F-13-15	0.17	Westbound Lane	9.75	No
	F-14-15	0.47	Westbound Lane	9.75	No

On the west side, no refusal was attained at the location of the five (5) boreholes interrupted at a depth no less than 9.75 m without refusal.

On the east site, a refusal was obtained at depths from 2.84 m to 5.46 m. The refusals were obtained at a depth of approximately 5 m until a horizontal distance of 3.31 m from the headwall on the eastbound lane. At the location of the center lane and westbound lane, refusals were met until 0.15 m and 0.76 m horizontal distance from the wall. Although we believe that the refusals were obtained on the existing footing, it is important to note that these refusals can be obtained on either concrete structures like blocks or dense soils. Dynamic cone penetration testing does not allow the identification of the nature of materials.

Comments relating to the excavation of the heterogeneous fill are presented in Section 5.3.3.

## 5.3 RETAINING WALL

### 5.3.1 Frost protection

According to Environment Canada database, the average frost index is about 1014 °C day in Gatineau. To ensure protection against the effects of frost in the soil, unheated structures foundations must be placed at a depth of at least 1.8 m above the final level of the ground.



### 5.3.2 Excavation

In order to achieve the projected foundation elevation, it will be required to excavate within the heterogeneous fill containing blocks, and part of clay deposit or silt to sand and silt deposit.

It must be noted that in no case should the foundation of the wall be located on heterogeneous materials of the embankment. In this particular case, it will be necessary to completely excavate these materials down to the adjacent natural soil and backfill the excavation. Therefore, the filling must be done using compactable materials. These materials, once accepted by the laboratory engineer, must be put in place in 300 mm layers and densified to least 90% of the maximum dry density of the material as determined by a modified Proctor (NQ 2501 -255).

It is our opinion that the excavations required to reach the projected level of the foundation can be done in open trenches. Considering the working methods of the contractor is unknown to us, and it is a temporary excavation slope, the stability and security of the workers as well as the structures to be built are the responsibility of the contractor when the safety depends on the temporary slopes.

It is important to consider that the use of trench boxes is not an effective soil support system. They should be considered only as a system for the protection of workers.

It is recommended not to park heavy vehicles at the crest of the slope to a distance less than the depth of the excavations. It is also recommended to avoid vehicle traffic at the crest of the excavations and that, within a distance less than the depth of the excavations to minimize vibrations. These conditions must be respected at all times unless specific studies are carried out for each specific case. It is the same when structures are located near the excavations.

In all cases, the *Code de Construction du Québec* and the CSST requirements must be respected any times during the execution of the excavations.

### 5.3.3 Excavation in the heterogeneous backfill

The construction works may require the excavation of a portion or the entire heterogeneous fill identified in all boreholes with sampling. Refusals were obtained during the realization of dynamic cone penetration tests to fourteen (14) times on a total of nineteen (19) tests before a depth of six (6) meters. Thus, it is probable that the excavation of the blocks may be required. Difficulties are to anticipate for the removal of the large blocks. **In this case, the contractor must provide adequate equipment and submit an appropriate excavation method for this operation.**

#### 5.3.4 Temporary drainage

The June 5th, 2015, the level of groundwater was at a depth of about 3 to 4 meters below the current ground surface. Depending on the time of year when the work would be performed, groundwater may be intercepted.

For this purpose, a surface water drainage system must be planned prior to excavation to avoid coming surface water in excavations. In addition, during the work, it is required to install an adequate and efficient pumping system to evacuate runoff and infiltration water as it accumulate at the bottom of excavations, to perform work in a dry environment. Given the purpose of the site, it will probably be required to undertake the construction of cofferdams. The directives listed in CCDG can be used.

#### 5.3.5 Temporary and permanent retaining

In the event that stable and safe unsupported slopes cannot be obtained, a temporary shoring system is recommended.

The temporary support system must be designed by taking into account the soil stratigraphy in place (as discussed above), the position of the groundwater as well as the geometry of the existing structures. The temporary support system must support all the soil in place.

Table 10 presents the geotechnical parameters to be considered for the design of temporary of the excavations support system.

Table 10 Design parameters for temporary and permanent retaining

PARAMETERS	HETERO-GENEIOUS FILL	CLAY DEPOSIT	SILT/SAND AND SILT DEPOSIT	CONTROLLED FILL
<b>Temporary</b>				
Effective angle of internal friction ( $\phi'$ )	---	0°	---	---
Undrained shear strength (kPa)	---	See borehole logs	---	---
Unit weight of wet soil (kN/m <sup>3</sup> )	---	16.5	---	---
<b>Permanent</b>				
Effective angle of internal friction ( $\phi'$ )	32°	28°	30°	36°
Cohesion (kPa)	0	5	0	0
Unit weight of wet soil (kN/m <sup>3</sup> )	20.0	16.5	16.5	21.0
Submerged unit weight (kN/m <sup>3</sup> )	10.2	6.7	6.7	11.2
Coefficient of active earth pressure $K_a$ *	0.31	0.36	0.33	0.26
Coefficient of earth pressure at rest $K_0$ *	0.47	0.53	0.50	0.41
Coefficient of passive earth pressure $K_p$ *	3.25	2.77	3.00	3.85
*: Vertical walls and horizontal slope surface ( $\beta = 0^\circ$ )				

Surcharge created by the presence of adjacent structures to the project must be considered in the calculation of lateral forces.

### 5.3.6 Lateral Earth Pressures

Retaining walls will be subject to earth pressure caused by the backfill behind them and by compacting operations. For this purpose, it is necessary to refer to Section 6.9 of the "Canadian Highway Bridge Design Code" and supplier specifications.

The geotechnical parameters given in Table No. 10 may be considered for this deposit as part of a design.

### 5.3.7 Soil Bearing Capacity

#### 5.3.7.1 Ultimate Limit States (ULS)

To determine the resistance at the ultimate limit state (ULS) for foundations bearing in the clay deposit or silt/sand and silt deposit, the designer must consider the tilt of the resulting, the geometry of the foundation and the eccentricity of the load. The following parameters are supplied to the designers and can be used to calculate the ultimate bearing capacity.

The formula to be used is:

$$ULS = c' N_c S_c I_c + q' N_q S_q I_q + 0,5 \gamma B N_\gamma S_\gamma I_\gamma$$

ULS = Ultimate limit state (ULS) resistance

$q'$  = Effective vertical earth pressure at foundation level

$c'$  = Effective cohesion

If the load is eccentric, the width of the footing must be modified to take account of the eccentricity and make a concentric load footing with an effective width  $B'$  and a length  $L'$  where:

$$B' = B - 2e_B, \text{ but lower than } L'$$

$$L' = L - 2e_L$$

$e$  : Eccentricity of load

$S_c, S_q, S_\gamma$  are shape coefficients allows to take in account the geometry of the footing:

$$S_c = S_q = 1 + (B'/L') (N_q/N_c)$$

$$S_\gamma = 1 - 0,4 (B'/L')$$

$I_c, I_q, I_\gamma$  are inclination coefficients for taking in account of the inclination of the load:

$$I_c = I_q = (1 - \delta/90^\circ)^2$$

$$I_\gamma = (1 - \delta/\phi')^2$$

$\delta_i$  : Vertical inclination angle

The geotechnical parameters recommended for ULS calculations are those presented in Table 11.

Table 11 Geotechnical parameters for the calculation of resistance ULS

PARAMETERS	CLAY DEPOSIT OF STIFF CONSISTENCY		SILT/SAND AND SILT DEPOSIT
	WATER LEVEL	BOTTOM OF PIEZOMETERS	
Effective cohesion intercept ( $c'$ ) (kPa)	Cu, see borehole logs	5	0
Unit Weight (kN/m <sup>3</sup> )	16.5	16.5	17
Submerged unit weight (kN/m <sup>3</sup> )	6.7	6.7	7.2
Effective angle of internal friction ( $\phi'$ )	0°	28°	30°
Bearing capacity factor for cohesion ( $N_c$ )	5.1	26	30
Bearing capacity factor for the earth pressure ( $N_q$ )	1	15	18
Bearing capacity factor for the soil weight ( $N_\gamma$ )	0	6.2	16
Foundation width (B)	To be defined by the designer		
Foundation depth (D)	To be defined by the designer		

For the calculation of allowable ultimate limit state, the "Canadian Highway Bridge Design Code" demands to apply a safety factor of 0.5 to the value ultimate limit state value.

#### 5.3.7.2 *Serviceability Limit States (SLS)*

The serviceability limits states (SLS) correspond to the mechanisms that limit or prevent the intended use of the structure. These mechanisms are usually associated with movements that prevent or limit a structure to fulfill its role. For foundations, serviceability limits states can result, for example, by excessive movement and settlement.

The table 12 present the resistance of SLS engenders settlement of 25 mm and 50 mm for retaining walls with a maximum width of 2 m implanted at a depth of 5 m.

Table 12 Resistance of the serviceability limit states SLS

SHORES	SETTLEMENT (MM)	SLS RESISTANCE (kPa)
EAST	25	40
	50	80
WEST	25	45
	50	100

## 5.4 SITE STABILITY

In order to evaluate the current conditions of stability of the site, the following methodology was used:

- ▶ Historical research using aerial photographs;
- ▶ Detailed site visit.

The results and interpretation of the results are presented in the following paragraphs. Aerial photographs and photographs on the site are presented in Appendix 5 of this report.

### 5.4.1 References

- ▶ Aerial Photographs (see section 5.4.2);
- ▶ Statement of work for design services and technical assistance during construction “Sentier des Voyageurs - Ruisseau Leamy - Reconstruction of the pedestrian bridge, Gatineau, Quebec”;
- ▶ Topographic Sketch Showing Leamy Creek Bridge prepared by the NCC, Ref.: No. 09011 dated June 22, 2009.

### 5.4.2 Historical research

Aerial photographs covering the period 1945 to 2014 were studied. These are presented in the Appendix 5 (numbered photographs 1 to 6). An examination of the photographs allowed to describe human intervention and to identify, if any, impact on the stability of the soil.

#### ▶ 1945 (A9546-38)

In 1945, the bridge and the current boul. Fournier were built. The cemetery in the west of the boulevard is in place. On the north shore site, with the exception of the current boul. Fournier and the road connecting the bridge to the study and the boulevard, no manmade structure can be observed. To the south, the land is mostly wooded. At the time the picture was taken, the stream was nearly dry. Also, no water is present inside the meander.

#### ▶ 1965 (GéoOttawa)

Most of the woodland on the south side is now removed. Only a strip along the stream is left intact. Still on the south side, the road connecting the bridge to Fournier Blvd seems to have been removed. On the north side, the bike pathway along the stream and passing under the bridge of Fournier Blvd. is built. A building was also built to the east of the studied bridge. Generally, water is present inside the meanders. The stream also has the width observed today.

► **1976 (GéoOttawa)**

Fournier Blvd was broadened. Highway 50 is also constructed. A dock was built on the north bank of the creek, east of the bridge. Some meanders have been drained or filled in.

► **1994 (A28143-116)**

A significant deforestation was done upstream of edge of the cemetery.

► **2005 (GéoOttawa)**

No significant change.

► **2014 (GéoOttawa)**

The quay below the bridge is demolished. A pathway below the bridge, on the north shore, was paved. Part of the land on the north side is submerged. The water level seems very high when taking the shot. Water is present in most meanders.

### 5.4.3 Detailed site visit

A detailed site visit was conducted April 13th, 2015 by Mr. Tommy Lampron, Eng. This visit showed the presence or absence of instability. The visit is limited to visual observations and taking photographs in areas where access was considered safe. No sampling or testing has been made.

The site was divided into two (2) sectors, the east and west shores.

#### 5.4.3.1 General

The pedestrian bridge allows crossing the Leamy Stream flowing south. The bridge is located approximately 130 m southeast of the Fournier Blvd Bridge crossing the same stream.

The bridge, built in 1930, is located at the site of a narrowing of the stream. According to the data obtained by drilling, this narrowing is due to the deposit of a heterogeneous fill.

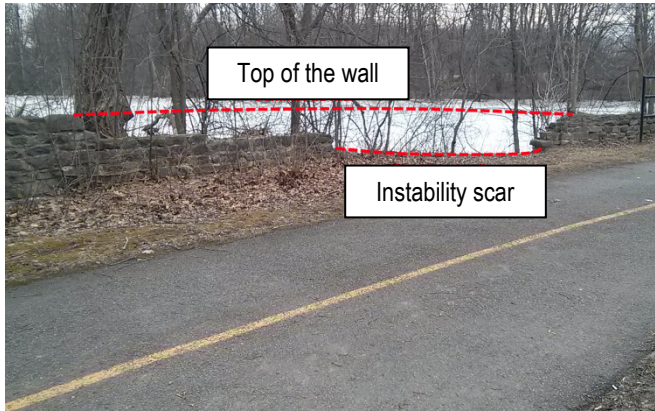
#### 5.4.3.2 East Shore

A difference of 4.50 m elevation separates the waterfront (elev. 41.50 m) from the surface of the trail (elev. 46.00 m). On the north side, a retaining wall made up of a stack of cut blocks and mortar has a slope of about 60 ° from the crest of the slope and the edge of the water. The top of the wall is located at a distance of 2.2 m to 4.0 m from the edge of the pathway. A part of the wall takes seated under the water level.

On the south shore (downstream), a slope of 35 ° separates the top slope to the water's edge. The slope is partly covered with trees and large blocks embedded in soil. The slope is composed entirely of blocks close to the head wall. The top of the slope is bounded by a wall

into two sections less than 0.5 m high made of cut stone. It is probable that instability has been happened there, as shown in Figure 2.

Figure 2 : Probable instability at the location of the wall on the east abutment



#### 5.4.3.3 *West Shore*

At the location of the west abutment on the north (upstream), a slope of about 30° separates the top of the track and the waterfront. A wooded area (probable wetland) is also located down slope at a slightly higher elevation.

On the south shore, a retaining wall of a length of about 5 m and up to 3 m high connects to the head wall. This wall is of similar composition to the wall found on the east shore. This wall has a slope of about 50 °.

#### 5.4.3.4 *Comments about the stability of the site*

On the basis of observations made at the site, the following comments were made:

- ▶ The review of historical aerial photos found no evidence natural instability along the Leamy Stream, between Leamy Lake and Gatineau River. **A probable anthropogenic instability has been identified only in a structure.**
- ▶ The entire area can be impacted by water level. Rapid variations of the water level can act as landslides triggering factor.
- ▶ The stone walls do not appear to act as effective soil retaining wall. The wall configuration does not optimize the retention of soil behind the retaining wall. The absence of a foundation makes it susceptible to a sliding.

#### 5.4.3.5 *Recommendations for maintenance of stability*

To maintain the current conditions of site stability, adequate protection against the erosion of the slopes surface must be done. Thus, the designer can refer to the "Guide des bonnes pratiques, chapitre 7, Protection des rives, du littoral et des plaines inondables" 2005 edition.



## 5.5 PAVEMENT STRUCTURES RECOMMENDATION

### 5.5.1 Ultimate Capacity of the Pathway

During the reconstruction work of the bridge, the pathway leading to the bridge on both sides will be used to access the site.

Given the high compactness of the pavement structure of the pathway to the east, the calculation of the ultimate capacity of the road is only possible at the site of the DCP-08-15 test.

The minimum thickness of the granular base can be expressed in terms of the acceptable maximum strain, the heavy traffic load and the CBR value of the infrastructure.

The following equation is proposed:

$$h = \frac{0,19[\log N_s - 2,34(r - 0,075)]}{CBR^{0,63}}$$

Where:

$h$  = Minimum thickness of the road structure, in meters

$N_s$  = Number of passes for an axial load  $P_s = 80$  kN

$r$  = Rut depth, in meters

In the case where the axial load is different from 80 kN, the value of  $N_s$  is calculated as follows:

$$N_s/N_i = \left(P_s/P_i\right)^{3,94}$$

Where:

$N_i$  = Number of passes for different axial load of 80 kN

$P_i$  = Axial load (kN)

For a fixed number of passes of 10,000, an axial load of 80 kN and allowable rut depth of 10 mm, the minimum thickness should be around 450 mm, which is higher than what is currently observed.

Concerning paved surface, the AASHTO\* guidelines recommends a thickness of asphalt of at least 90 mm for such solicitation.

**In short, the passage of heavy vehicles on the trail during construction will damage the trail.**

### 5.5.2 Rehabilitation of the pathway following the work

In the event that vehicles circulation would have made the necessary restoration work, the following recommendations are proposed:

- ▶ Complete removal of the bituminous mix;
- ▶ Removing a thickness of 150 mm of the existing embankment;
- ▶ Backfilling in a thickness of 300 mm by means of a material MG- 20 caliber, compacted to at least 98% of the Proctor (existing embankment can be reused approval of laboratory);
- ▶ Establishment of a bituminous mix of EC-10 Type (PG 58-34) to a thickness of 30 mm.

### 5.5.3 Pavement Structures recommendation for the Paving of Temporary Pathway

#### 5.5.3.1 Preparation of the subgrade

More specifically and in order to minimize the deformations and the premature cracking of the paved surface it is recommended to profile the subgrade to obtain the required gradients to promote flow toward a permanent and effective drainage system (ex. trenches or drains).

The subgrade must be free of any reworked material, frozen material or deformation of the surface. In this context, particular attention should be given not to remold the subgrade that will remain in place (and below) before the establishment of the pavement structure. The degree of compaction must be at least 90% of the maximum value of Modified Proctor according to standard NQ 2501-255. The advice of geotechnical engineer is required in the case where the percentage of compaction cannot be reached.

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\* AASHTO (1986-93) *Guide for Design of Pavement Structures*. Washington DC., 1986, 1993.

### 5.5.3.2 Pavement structure for the temporary pathway

Following the preparation of subgrade, the surface should be covered with a layer of 400 mm of a material MG-112 caliber (the granular material excavated could be reused in the present structure, but shall be environmentally approved and have a particle size consistent with MG - 112, in any case approval of engineer is required), followed by a layer of 200 mm of a material MG-20 caliber. A new layer of 35 mm of asphalt can then be installed after granular reloading.

Table 13 Road structure out of the influence of existing street

PAVEMENT ELEMENT	MATERIALS	THICKNESS (mm)	COMPACTION (%)
<b>Pavement structure <sup>(1)</sup></b>			
<b>Asphalt</b>	EC-10, bitumen PG 58-34	30	93-98 % (LC 26-040/045)
<b>Granular backfill</b>	Crushed stone or crushed gravel MG-20 caliber	300	98 % min. (NQ 2501-255)
<b>Subgrade</b>	Clay deposit / sand and silt to silt deposit	s/o	Prepared according to section 5.5.3.1
<small>(1) The advice of a road geotechnical engineer is required in the case where the percentage of compaction cannot be reached</small>			

## 5.6 GENERAL RECOMMENDATIONS

### 5.6.1 Recycled materials from the existing pavement structures

A portion of granular material from the backfill can be reused for backfill excavations in the subgrade until level of the frost line, as long as its water content is adequate at the time of compaction. They must be approved in all cases by an engineer before reuse.

If it becomes impossible to reuse the excavated material, backfilling can then be done with granular material such as MG-112 caliber until the level of infrastructure.

### 5.6.2 Sensitivity of soil to remolding

Considering its high portion of fine particles, the natural deposit in place will be sensitive to remolding caused by bad weather (rain, frost and snow melt) or movement of workers and construction machinery. Excessive remolding of sitting surfaces can cause soil strength loss and subsequently excessive settlements.

### 5.6.3 Quality control during construction

We recommend that a quality control program be established. This must be supervised by a specialist engineer in this field and/or in consultation with a geotechnical engineer familiar with this project to assure the quality of work is adequate. The quality control program must be fulfilled the recommendations in this report, in any case.



## **Appendix 1**

## **Scope of the geotechnical study**

## **SCOPE OF THE GEOTECHNICAL STUDY**

### **1.0     *Characteristics of soil and rock***

The soil and rock characteristics described in this report originate from geotechnical investigations conducted within a given period and correspond to the nature of the terrain only at the specific locations where these investigations were carried out.

Soil and rock formations have natural variations. The limits between the different formations presented in the sounding logs must therefore be considered as transitions between the formations rather than set boundaries. The precision of these limits depends on the type and number of soundings, the sounding methods used, as well as sampling frequency and methods.

The descriptions of the samples taken are based on recognized identification and classification methods used in geotechnics. They can call into play the judgement and interpretation of the personnel who carried out the examination of materials and can be presumed to be accurate and correct in keeping with current best practices in the field of geotechnics. Finally, if tests were carried out, the results of these tests apply solely to the samples tested, as described in this report.

The properties of the soil and rock can undergo significant modifications in the wake of construction activities such as excavation, blasting, pile driving or drainage activities, carried out on the site under study or an adjacent site. They can also be indirectly modified by the exposure of the soil or rock to freezing or weather stresses.

### **2.0     *Groundwater***

The groundwater conditions presented in this report apply only to the site under study. The accuracy and representation of these conditions must be interpreted based on the type of instrumentation used, as well as the period, duration, and number of observations carried out. These conditions can vary depending on precipitation, the seasons and, ultimately, the tides. They can also vary as a result of construction activities or the modification of physical elements on the site under study or in its vicinity. The problematic of ferrous ochre and its effects is not covered in this report.

### **3.0     *Use of the report***

The comments and recommendations contained in this report are intended primarily for the project's design team. The number of soundings required to identify all of the underground conditions that could impact construction costs, techniques, the choice of equipment and planning of operations could be greater than the number required for design purposes. All contractors bidding on or carrying out the work on the site under study must undertake their own interpretation of the results of the soundings and, if need be, carry out their own investigations to determine how site conditions could influence their operations or work methods.

Any modifications to the design, position and elevation of the works must be quickly communicated to Englobe, allowing the validity of the recommendations presented to be verified. Complementary site or laboratory work could ultimately be required.

This report cannot be reproduced, in whole or in part, without the authorization of Englobe.

### **4.0     *Project tracking***

The interpretation of the on-site and laboratory results obtained, as well as the recommendations presented in this report, apply solely to the site under study and to the information available about the project at the time this report was drafted.

Information available concerning the site and groundwater conditions increases as construction work progresses. As site conditions were interpreted and correlated between sounding points, Englobe should be allowed to verify these conditions, during site visits conducted as work progresses, in order to confirm the information provided by the drillings soundings. If it is not possible for us to conduct these verifications, Englobe shall assume no responsibility for geotechnical interpretations by third parties concerning recommendations contained in this report, particularly if the design has been modified or if site conditions different from those described in this report are encountered. The identification of such changes requires experience and must be carried out by an experienced geotechnical engineer.

### **5.0     *Environment***

The information contained in this report does not cover the environmental aspects of the site conditions, as these aspects were not included in the study mandate.



## Appendix 2

## Explanative notes, borehole logs



## Appendix 3

## Laboratory testing results










The following sounding logs summarize soils and rock geotechnical properties as well as ground water conditions, as collected during field work and/or obtained from laboratory tests. This note explains the different symbols and abbreviations used in these logs.

## STRATIGRAPHIC UNITS

**Elevation/Depth:** Reference to the geodesic elevation of the soil or to a bench mark of arbitrary elevation, at the location of the sounding. Depth of the different geological boundaries as measured from ground surface. On the left, the scale is in meters while on the right, it is in feet.

**Description of the stratigraphic units:** Every geological formation is detailed. The proportion of the different elements of the soil, defined according to the size of the particles, is given following the classification hereafter. The relative compactness of cohesionless soils is defined by the "N" index of the Standard Penetration Test. The consistency of cohesive soils is defined by their shear resistance.

## SYMBOLS

TOP SOIL		SAND		COBBLE	
BACKFILL		SILT		BOULDER	
GRAVEL		CLAY		ROCK	

## WATER LEVEL

This column shows the ground water level, as measured at a given time during the geotechnical investigation. The details of the installation (type and depth) are also illustrated in this column.

## SAMPLES

**Type and number:** Each sample is labelled in accordance with the number of this column and the given notation refers to samples types.

**Sub-sample:** When a sample contains two or more different stratigraphic units, it is sometimes necessary to separate it and create sub-samples. This column allows for the identification of the latter and the association to *in situ* or laboratory measurements to these sub-samples.

**Condition:** The position, length and condition of each sample are shown in this column. The symbol shows the condition of the sample, following the legend given on the sounding log.

**Size:** This column indicates the split spoon sampler size.

**"N" index** The standard penetration index shown in this column is expressed with the letter "N". This index is obtained with the Standard Penetration Test. It corresponds to the number of blows required to drive the last 300mm of the split spoon, using a 622 Newton hammer falling freely from a height of 762mm (ASTM D-1586). For a 610mm long split spoon, the "N" index is obtained by adding the number of blows required for the driving of the 2<sup>nd</sup> and 3<sup>rd</sup> 150mm of the split spoon. Refusal (R) indicates a number of blows greater than 100. A set of numbers such as 28-30-50/60mm indicates that the number of blows required to drive the 1<sup>st</sup> and 2<sup>nd</sup> 150mm of the split spoon are respectively 28 and 30. Moreover, it indicates that 50 blows were necessary to get a penetration of 60mm, whereupon the test was suspended.

**RQD index:** Rock Quality Designation index: This index is defined as the ratio between the total length of all rock cores of 100mm and more in length over the total length of the core run. The RQD index is an indirect measurement of the number of "natural" fractures and of the amount of the alteration in a rock mass.

## TESTS

**Results:** This column shows, for the corresponding depth, the results of tests carried out in the field or in the laboratory (shear strength, dynamic penetration, Atterberg limits with the cone, etc.). For more information, please refer to the legend in the upper part of the sounding log. However, an abbreviation indicating the type of analysis performed is shown next to the sample tested.

**Graph:** This graph shows the undrained shear strength resistance of cohesive soils, as measured *in situ* or in the laboratory (NQ 2501-200). It is also used to present the Dynamic Cone Penetration Test (NQ 2501-145) results. Moreover, this graph is used for the representation of the water content and Atterberg limits test results.

### Classification

### Particle size (mm)

Clay	< 0.002
Clay and silt (undifferentiated)	< 0.08
Sand	0.08 to 5
Gravel	5 to 80
Cobble	80 to 300
Boulder	> 300

### Descriptive terminology

### Proportion (%)

"Traces" (tr.)	1 to 10
"Some" (s.)	10 to 20
Adjective (ex.: sandy, silty)	20 to 35
"And" (ex.: sand and gravel)	35 to 50

### Compactness of cohesionless soils

### Standard Penetration Test index ("N" value), ASTM D-1586 (blows for a 300mm penetration)

Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

### Consistency of cohesive soils

### Undrained shear strength (kPa)

Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200

### Plasticity of cohesive soils

### Liquid limit (%)

Low	< 30
Medium	30 to 50
High	> 50

### Sensitivity of cohesive soils

### $S_t = (C_u/C_{ur})$

Low	$S_t < 2$
Medium	$2 < S_t < 4$
High	$4 < S_t < 8$
Extra-sensitive	$8 < S_t < 16$
Quick (sensitive) clay	$S_t > 16$

### Classification of rock

### RQD (%)

Very poor quality	< 25
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100



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B-0012112-2 [EN]  
R.F.  
Vertical Scale = 1 : 75  
EQ-09-Ge-66A R.1 04.03.2009



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-2 [EN]

Borehole n°: F-01-15

Date: From 2015-05-04 to 2015-05-04

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034744.0 (Y)

East 366814.0 (X)

Elevation 45.90 (Z)

Bedrock: m End depth: 5.36 m

### Sample condition

Intact Remoulded Lost Core

### Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

### Sample type

SS Split Spoon  
TM Thin wall Tube  
PS Piston Tube  
RC Rock core  
AS Auger  
MA Bulk sample  
TU Transparent tube  
PW LVM Mega-Sampler  
FG Frozen ground

### Tests

L Consistency Limits  
W<sub>L</sub> Liquid Limit (%)  
W<sub>P</sub> Plastic Limit (%)  
I<sub>P</sub> Plasticity Index (%)  
I<sub>L</sub> Liquidity Index  
W Natural Water Content (%)  
GS Grain Size Analysis  
S Hydrometer analysis  
R Refusal  
VBS Methylene Blue Value  
WR Weight of Rods  
O.M. Organic Matter (%)  
K Permeability (cm/s)  
UW Unit Weight (kN/m³)  
A Absorption (l/min. m)  
U Uniaxial Compressive strength (MPa)  
RQD Rock Quality Designation (%)  
CA Chemical Analysis  
P<sub>L</sub> Limit Pressure (kPa)  
E<sub>m</sub> Pressuremeter Modulus (MPa)  
E<sub>r</sub> Modulus of subgrade reaction (MPa)  
SP<sub>0</sub> Segregation Potential (mm²/H °C)

▼ Water Level  
N Std Penetration test (blows/300mm)  
N<sub>C</sub> Dyn. Penetration test (blows/300mm) ●  
σ'<sub>p</sub> Preconsolidation Pressure (kPa)  
SCI Soil Corrosivity Index

### Undrained shear strength

C<sub>U</sub> Undisturbed (kPa)

C<sub>UR</sub> Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

STRATIGRAPHY				SAMPLES								FIELD AND LABORATORY TESTS			
DEPTH - ft	DEPTH - m	ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) W <sub>p</sub> W WL
															20 40 60 80 100 120
															UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION
															20 40 60 80 100 120
		45.90	Asphalt												
1		0.00	Heterogeneous Fill: Sand and			TM-1				50			I	I	
2		45.85	gravel gray-black, some silt										I	I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC,
3		0.05	Brown gravelly sandy, traces of silt			TM-2				50			I	I	SULFUR, PAH
4		45.29											I	I	
5		0.61	Brown gravelly sand, some silt,			TM-3				25			I	I	
6		44.68	very wet, traces of organic										I	I	
7		1.22	materials			TM-3-1				25			I	I	
8						TM-4				33			I	I	
9		43.46	Grey sand gravel, some silt										I	I	
10		2.44				TM-4-1				33			I	I	
11						TM-5				31			I	I	
12		42.24	Sand and gravel, traces of soil,										I	I	
13		3.66	very wet			TM-5-1				31			I	I	
14						TM-6				77			I	D	C <sub>10</sub> -C <sub>50</sub> , METALS, PHENOLS, SULFUR, PAH
15		41.02	Grey gravelly sand, some silt,												
16		4.88	saturated												
17		40.54	End of the borehole at 5.36 m after												
18		5.36	obtaining a refusal during the												
19			casing insertion												
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															

Remarks:

Borehole type: HW/HQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: J.-L. Ngoundzi, Eng., DESS

2015-12-18

Page: 1 of 1



Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034727.0 (Y)

East 366750.0 (X)

Elevation 45.55 (Z)

Bedrock: m End depth: 6.10 m

## Sample condition

Intact Remoulded Lost Core

## Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

## Sample type

SS Split Spoon  
TM Thin wall Tube  
PS Piston Tube  
RC Rock core  
AS Auger  
MA Bulk sample  
TU Transparent tube  
PW LVM Mega-Sampler  
FG Frozen ground

## Tests

L Consistency Limits  
W<sub>L</sub> Liquid Limit (%)  
W<sub>P</sub> Plastic Limit (%)  
I<sub>P</sub> Plasticity Index (%)  
I<sub>L</sub> Liquidity Index  
W Natural Water Content (%)  
GS Grain Size Analysis  
S Hydrometer analysis  
R Refusal  
VBS Methylene Blue Value  
WR Weight of Rods  
O.M. Organic Matter (%)  
K Permeability (cm/s)  
UW Unit Weight (kN/m³)  
A Absorption (l/min. m)  
U Uniaxial Compressive strength (MPa)  
RQD Rock Quality Designation (%)  
CA Chemical Analysis  
P<sub>L</sub> Limit Pressure (kPa)  
E<sub>M</sub> Pressuremeter Modulus (MPa)  
E<sub>r</sub> Modulus of subgrade reaction (MPa)  
SP<sub>0</sub> Segregation Potential (mm²/H °C)

Water Level  
N Std Penetration test (blows/300mm)  
N<sub>C</sub> Dyn. Penetration test (blows/300mm) ●  
σ'<sub>p</sub> Preconsolidation Pressure (kPa)  
SCI Soil Corrosivity Index

## Undrained shear strength

C<sub>U</sub> Undisturbed (kPa)

C<sub>UR</sub> Remoulded (kPa)

Field Laboratory  
▲ ▴  
■ □

## STRATIGRAPHY

## SAMPLES

## FIELD AND LABORATORY TESTS

DEPTH - ft	DEPTH - m	ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%) W <sub>p</sub> W <sub>L</sub>		UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION
													Odor	Visual		20 40 60 80 100 120	20 40 60 80 100 120	
		45.55	Topsoil and organic matter															
		0.00																
		45.50	Heterogeneous Fill : Grey sand			SS-1				42	3-4	13	I	I	C <sub>10</sub> -C <sub>50</sub> , METALS, SULFUR, PAH			
		0.05	gravel, traces of silt							9-11								
		44.94	Grey sand, some silt, traces of			SS-2				25	3-20	25	I	I				
		0.61	gravel							5-2								
		44.33	Grey silty clay, some sand, some			SS-3				25	6-6	17	I	I				
		1.22	gravel							11-3					C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, PHENOLS, SULFUR, PAH			
		43.72	Sand grey gritty, some silt, traces			SS-4				17	5-11	25	I	I				
		1.83	of clay							14-7								
		41.89				SS-5				29	3-12	35	I	I				
										23-6								
		41.89	Natural ground: Grey silty sand,			SS-6				46	4-5	14	I	I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, PHENOLS, SULFUR, PAH			
		3.66	traces of clay, traces of gravel,							9-4								
		41.28	traces of organic matter, very wet			SS-7 DUP-1				87	2-1	3	I	I				
		4.27	Grey silty sand, very wet							2-2								
						SS-8				92	1-1	4	I	I				
										3-2								
						SS-9				87	2-3	4	I	I				
										2-3								
						SS-10				75	2-1	2	I	I				
										1-2								
		39.45	End of borehole to 6.10 m															
		6.10																

Remarks:

Borehole type: HW/HQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: J.-L. Ngoundzi, Eng., DESS

2015-12-18

Page: 1 of 1



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-2 [EN]

Borehole n°: F-03-15

Date: From 2015-05-05 to 2015-05-05

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034726.0 (Y)

East 366755.0 (X)

Elevation 45.93 (Z)

Bedrock: m End depth: 6.10 m

## Sample condition



Intact



Remoulded



Lost



Core

## Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

## Sample type

SS Split Spoon  
TM Thin wall Tube  
PS Piston Tube  
RC Rock core  
AS Auger  
MA Bulk sample  
TU Transparent tube  
PW LVM Mega-Sampler  
FG Frozen ground

## Tests






L Consistency Limits  
W<sub>L</sub> Liquid Limit (%)  
W<sub>P</sub> Plastic Limit (%)  
I<sub>P</sub> Plasticity Index (%)  
I<sub>L</sub> Liquidity Index  
W Natural Water Content (%)  
GS Grain Size Analysis  
S Hydrometer analysis  
R Refusal  
VBS Methylene Blue Value  
WR Weight of Rods  
O.M. Organic Matter (%)  
K Permeability (cm/s)  
UW Unit Weight (kN/m³)  
A Absorption (l/min. m)  
U Uniaxial Compressive strength (MPa)  
RQD Rock Quality Designation (%)  
CA Chemical Analysis  
P<sub>L</sub> Limit Pressure (kPa)  
E<sub>m</sub> Pressurometer Modulus (MPa)  
E<sub>r</sub> Modulus of subgrade reaction (MPa)  
SP<sub>0</sub> Segregation Potential (mm²/H °C)

▼ Water Level  
N Std Penetration test (blows/300mm)  
N<sub>C</sub> Dyn. Penetration test (blows/300mm) ●  
σ'<sub>p</sub> Preconsolidation Pressure (kPa)  
SCI Soil Corrosivity Index

## Undrained shear strength

C<sub>u</sub> Undisturbed (kPa)C<sub>ur</sub> Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

DEPTH - ft DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS								
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)					
													Odor	Visual		W <sub>p</sub>	W <sub>L</sub>				
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION					
																20	40	60	80	100	120
1		0.00 45.83	<b>Asphalt</b> <b>Heterogeneous Fill</b> : Grey silty clay, traces of sand ----- Grey-brown gravelly sandy, traces of silt ----- Brown gravelly sand, some silt, wet			TM-1 DUP-2				50				I	I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, SULFUR, PAH					
2		0.10 45.32				TM-2				50				I	I						
3	1	0.61 44.71				TM-3				19				I	I						
4		1.22				TM-3-1				63				I	I						
5			Gravel, some sand, traces of silt, wet			TM-4				31				I	I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, SULFUR, PAH					
6		43.49 2.44				TM-4-1				31				I	I						
7	2					TM-5				21				I	I						
8		42.27 3.66				TM-5-1				21				I	I						
9			Grey sand gravelly, traces of silt, traces of clay, traces of organic matter, very wet			TM-6				4				I	I						
10	3					TM-6-1				4				I	I						
11			<b>Natural grownd</b> : Grey silty sand, very wet																		
12		41.05 4.88																			
13			End of borehole																		
14		39.83																			
15	5	6.10																			
16																					
17																					
18																					
19																					
20	6																				
21																					
22																					
23	7																				
24																					
25																					
26	8																				
27																					
28																					
29																					

Remarks:

Borehole type: HW/HQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: J.-L. Ngoundzi, Eng., DESS

2015-12-18

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-2 [EN]

Borehole n°: F-04-15

Date: From 2015-05-06 to 2015-05-06

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m): North 5034724.0 (Y)

East 366756.0 (X)

Elevation **45.94 (Z)**

Bedrock: m End depth: 6.10 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

		STRATIGRAPHY				SAMPLES							FIELD AND LABORATORY TESTS					
DEPTH - ft	DEPTH - m	ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)		
													Odor	Visual		Wp      W      WL		
																20   40   60   80   100   120		
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION		
																20   40   60   80   100   120		
1		0.00	<b>Asphalt</b> <b>Heterogeneous Fill</b> : Grey silty clay, traces of gravel, traces of sand Grey sand gravelly, traces of silt			SS-1				40	2-4 3-5	7			C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, SULFURE, PAH			
2		45.84									21	6-5 5-6	10					
3	1	0.10									17	5-3 7-7	10					
4		45.33																
5		0.61																
6		44.11																
7	2	1.83	Grey gravelly sand, some silt, wet							33	2-3 19-9	22						
8																		
9																		
10	3																	
11																		
12		42.28																
13	4	3.66	Pebbles, gravel, some sand, traces of silt, traces of organic matter, wet							33	8-12 16-15	28						
14		41.67																
15		4.27	<b>Natural ground</b> : Grey silty sand, traces of gravel, very wet							75	4-3 3-2	6			C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, PHENOLS, SULFUR, PAH			
16	5	41.06	Grey silty sand, very wet															
17		4.88								92	2-2 1-2	3			VOC			
18																		
19																		
20	6	39.84								79	3-2 2-4	4						
21		6.10	End of borehole															
22																		
23	7																	
24																		
25																		
26	8																	
27																		
28																		
29																		

Remarks:

Borehole type: **HW/HQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **J.-L. Ngoundzi, Eng., DESS**

2015-12-18

Page: 1 of 1

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B-0012112-2 [EN]  
Vertical Scale = 1 : 75  
EQ-09-Ge-66A R.1 04.03.2009



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-2 [EN]

Borehole n°: F-05-15

Date: From 2015-05-06 to 2015-05-06

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034721.0 (Y)

East 366752.0 (X)

Elevation 45.55 (Z)

Bedrock: m End depth: 6.10 m

### Sample condition

Intact Remoulded Lost Core

### Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

### Sample type

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

### Tests

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>P</sub>** Plastic Limit (%)  
**I<sub>P</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressurometer Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>C</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

### Undrained shear strength

**C<sub>U</sub>** Undisturbed (kPa)

**C<sub>UR</sub>** Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS		
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) W <sub>p</sub> W WL
															20 40 60 80 100 120
															UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION
															20 40 60 80 100 120
1	0.00	45.55	Heterogeneous Fill: grey silty clay, some sand, traces of gravel			SS-1				21	2-4 4-5	8	I I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, BPC, SULFUR, PAH	
2	0.61	44.94	No collection			SS-2				0	2-8 6-3	14	I I		
3						SS-3				0	3-6 4-2	10	I I		
4						SS-4				8	1-4 5-11	9	I I		
5						SS-5				17	3-4 4-21	8	I I		
6	1.83	43.72	Grey sand, some silt, traces of gravel			SS-6				67	17-6 4-4	10	I I	VOC	
7	2.44	43.11	Grey gravelly sand, traces of silt			SS-7				79	2-1 1-1	2	I I	C <sub>10</sub> -C <sub>50</sub> , METALS, VOC, PHENOLS, SULFUR, PAH	
8						SS-8				79	2-2 1-1	3	I I		
9						SS-9				83	2-3 3-3	6	I I		
10						SS-10				75	1-1 2-2	3	I I		
11															
12															
13															
14															
15															
16															
17															
18															
19															
20	6.10	39.45	End of borehole												
21															
22															
23															
24															
25															
26															
27															
28															
29															

Remarks:

Borehole type: HW/HQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: J.-L. Ngoundzi, Eng., DESS

2015-12-18

Page: 1 of 1

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B-0012112-1 [EN]  
R.F.  
Vertical Scale = 1 : 75  
EQ-09-Ge-66A R.1 04.03.2009



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-06-15

Date: From 2015-05-04 to 2015-05-04

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034748.0 (Y)

East 366817.0 (X)

Elevation 45.78 (Z)

Bedrock: m End depth: 30.48 m

### Sample condition

Intact Remoulded Lost Core

### Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

### Sample type

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

### Tests

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

### Undrained shear strength

**C<sub>u</sub>** Undisturbed (kPa)

**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory

DEPTH - ft DEPTH - m		STRATIGRAPHY				SAMPLES							FIELD AND LABORATORY TESTS											
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)								
													Odor	Visual		W <sub>p</sub>	W <sub>L</sub>							
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION								
																20	40	60	80	100	120	140	160	180
1		0.00	Topsoil and organic matter		el. 41.81 m 2015-06-05	SS-1				42	10-7 5-4	12												
2		45.28	<b>Heterogeneous Fill</b> : Grey Sand, some silt, traces of gravel			SS-2				17	4-4 3-3	7												
3	1	0.50				SS-3				33	4-6 6-17	12												
4										17	16-4 4-4	8												
5		43.96	Sand and gravel, traces of silt			SS-4				17	16-4 4-4	8												
6	2	1.82				SS-5				75	2-2 1-3	3												
7		43.34	<b>Clay deposit</b> : Grey silty clay, traces of sand			SS-6				79	2-4 3-6	7												
8		42.12				SS-7				100	2-3 5-5	8												
9	3	2.44	Grey silty clay, traces of sand and gravel																					
10		42.43																						
11		3.35	Beginning of Vane Shear Tests at 3.35 m																					
12		42.12	Grey silty clay, traces of sand and gravel																					
13	4	3.66																						
14																								
15																								
16	5	4.88	Grey silty clay, traces of sand, very stiff, wet			SS-8				100	3-3 6-8	9												
17																								
18																								
19																								
20	6	39.68	Grey silty clay, wet			SS-9				83	1-1 1-2	2												
21		6.10																						
22																								
23	7																							
24																								
25																								
26	8	37.86	Silty clay grey-green, wet			SS-10				100	1-1 2-2	3												
27		7.92																						
28																								
29						SS-11				87	2-2 2-3	4												

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 1 of 3





Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-06-15

Date: From 2015-05-04 to 2015-05-04

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034748.0 (Y)

East 366817.0 (X)

Elevation 45.78 (Z)

Bedrock: m End depth: 30.48 m

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES							FIELD AND LABORATORY TESTS															
		ELEVATION - m	DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)												
														Wp	W		WL												
																	20 40 60 80 100 120												
																	UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION												
																	20 40 60 80 100120140160180												
30																C <sub>u</sub> > 100 kPa													
31																													
32																													
33	10															SS-12			100	1-0 3-2	3							C <sub>u</sub> > 70 kPa	
34																													
35																													
36	11																												
37				SS-13			92	1-2 3-2	5								C <sub>u</sub> > 188 kPa												
38																													
39	12																												
40				SS-14			92	1-1 2-3	3								C <sub>u</sub> > 136 kPa												
41																													
42	13																												
43																													
44																													
45				SS-15			96	1-1 2-2	3								C <sub>u</sub> > 138 kPa I <sub>L</sub> = 0,7 I <sub>p</sub> = 47,0												
46	14	31.76																											
47		14.02		End of sampling at 14.02 m and the beginning of the dynamic penetration test													C <sub>u</sub> > 182 kPa												
48																													
49	15																												
50		30.43																											
51		15.35		End of Vane Shear Tests at 15.35 m													C <sub>u</sub> > 124 kPa												
52	16																												
53																													
54																													
55																													
56	17																												
57																													
58																													
59	18																												
60																													
61																													
62	19																												
63																													
64																													
65	20																												
66																													
67																													
68																													
69	21																												
70																													
71																													
72	22																												

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 3



## BOREHOLE REPORT

File n°: **B-0012112-1 [EN]**

Borehole n°: TF-06-15

Date: From **2015-05-04** to **2015-05-04**Project: **Pedestrian bridges Ruisseau Leamy**

Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m):	North	5034748.0 (Y)
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East 366817.0 (X)

Elevation **45.78 (Z)**

Bedrock:	m	End depth:	30.48 m
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[illegible]

Remarks:

Borehole type: **NW/NQ casing by rotation**

Boring equipment: **Geoprobe**

Prepared by: **S. Séguin, tech.**

Approved by: **T. Lampron, ing.**

2015-12-17

Page: 3 of 3



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-07-15

Date: From 2015-05-05 to 2015-05-06

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m): North 5034725.1 (Y)

East 366755.8 (X)

Elevation **0.00 (Z)**

Bedrock: m End depth: 5.51 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS												
		ELEVATION - m DEPTH - m		SOIL OR BEDROCK DESCRIPTION		SYMBOLS		WATER LEVEL (m) / DATE		TYPE AND NUMBER		SUB-SAMPLE CONDITION		SIZE RECOVERY %		Blows/150mm		"N" or RQD		Organo. Exam		RESULTS		NATURAL WATER CONTENT AND LIMITS (%) W <sub>p</sub> W WL			
		0.00																						20 40 60 80 100 120			
		0.00		Beginning of dynamic penetration test																				UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION 20 40 60 80 100120140160180			
1																						N <sub>c</sub> = 87					
2																						N <sub>c</sub> = 11					
3	1																					N <sub>c</sub> = 5					
4																						N <sub>c</sub> = 6					
5																						N <sub>c</sub> = 8					
6	2																					N <sub>c</sub> = 6					
7																						N <sub>c</sub> = 1					
8																						N <sub>c</sub> = 5					
9																						N <sub>c</sub> = 17					
10	3																					N <sub>c</sub> = 21					
11																						N <sub>c</sub> = 10					
12																						N <sub>c</sub> = 9					
13	4																					N <sub>c</sub> = 9					
14																						N <sub>c</sub> = 6					
15																						N <sub>c</sub> = 4					
16	5																					N <sub>c</sub> = 0					
17																						N <sub>c</sub> = 0					
18		-5.51																				N <sub>c</sub> = 0					
19		5.51		End of dynamic penetration test at 5.51 m after obtaining a refusal on dense soils, block or probable rock																		N <sub>c</sub> = Refusal					
20	6																										
21																											
22																											
23	7																										
24																											
25																											
26	8																										
27																											
28																											
29																											

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1

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B-0012112-1 [EN]  
Vertical Scale = 1 : 75  
EQ-09-Ge-66A R.1 04.03.2009



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-08-15

Date: From 2015-05-07 to 2015-05-07

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034720.0 (Y)

East 366745.0 (X)

Elevation 45.45 (Z)

Bedrock: m End depth: 30.48 m

### Sample condition

Intact Remoulded Lost Core

### Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

### Sample type

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

### Tests

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

### Undrained shear strength

**C<sub>u</sub>** Undisturbed (kPa)

**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory

DEPTH - ft	DEPTH - m	STRATIGRAPHY				SAMPLES							FIELD AND LABORATORY TESTS								
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)					
													Odor	Visual		W <sub>p</sub>	W <sub>L</sub>				
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION					
																20	40	60	80	100	120
1		45.45	0.00	Fill heterogeneous: Silty Sand beige-gray with traces gravel		SS-1				33	3-4 6-7	10									
2		44.84	0.61															Sand and gravel, traces of silt	SS-2		
3	1	44.23	1.22	Sand and gravel, some silt	SS-3				17	4-11 16-8	27										
4		43.62		no collection		SS-4				0	3-14 3-4	17									
5		43.01	1.83															SS-5			
6	2	42.40	2.44	Filing of silty sand: Grey silty sand, small roots, wet		SS-6				75	2-2 1-1	3									
7		41.79	3.05	Silty sand brown, wet		SS-7				100	1-0 1-2	1									
8			3.66	Grey silty sand, saturated		SS-8				75	2-3 2-3	5									
9						SS-9				92	4-5 4-3	9									
10	3	39.84		Clay deposit: Grey silty clay, stiff to very stiff consistency		SS-10		A		100	1-2 1-2	3									
11			5.61			SS-11		B			83	1-0 1-0	1								
12		38.90	6.55	Beginning of Vane Shear Tests at 6.55 m						100	1-0 1-2	1									
13						SS-12															
14						SS-13				100	1-1 1-2	2									
15																					
16	5																				
17																					
18																					
19	6																				
20																					
21																					
22																					
23	7																				
24																					
25																					
26	8																				
27																					
28																					
29																					

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

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Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: **B-0012112-1 [EN]**

Borehole n°: TF-08-15

Date: From **2015-05-07** to **2015-05-07**Project: **Pedestrian bridges Ruisseau Leamy**

Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m):	North	5034720.0 (Y)
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East 366745.0 (X)

Elevation 45.45 (Z)

Bedrock:	m	End depth:	30.48 m
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[illegible]

Remarks:

Borehole type: **NW/NQ casing by rotation**

Boring equipment: **Geoprobe**

Prepared by: **S. Séguin, tech.**

Approved by: **T. Lampron, ing.**

2015-12-17

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## BOREHOLE REPORT

File n°: **B-0012112-1 [EN]**

Borehole n°: TF-08-15

Date: From **2015-05-07** to **2015-05-07**

Project: **Pedestrian bridges Ruisseau Leamy**

Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m):	North	5034720.0 (Y)
------------------	-------	---------------

East 366745.0 (X)

Elevation 45.45 (Z)

Bedrock:	m	End depth:	30.48 m
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[illegible]

Remarks:

Borehole type: **NW/NQ casing by rotation**

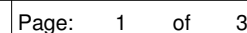
Boring equipment: **Geoprobe**

Prepared by: **S. Séguin, tech.**

Approved by: **T. Lampron, ing.**

2015-12-17

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Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-09-15

Date: From 2015-05-08 to 2015-05-08

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034721.0 (Y)

East 366751.0 (X)

Elevation 45.65 (Z)

Bedrock: m End depth: 29.95 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS						
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)				
													Odor	Visual		W <sub>p</sub>	W <sub>L</sub>			
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION				
															20	40	60	80	100	120
															20	40	60	80	100	120
30														N <sub>c</sub> = 8						
31														N <sub>c</sub> = 9						
32														N <sub>c</sub> = 10						
33	10													N <sub>c</sub> = 10						
34														N <sub>c</sub> = 10						
35														N <sub>c</sub> = 11						
36	11													N <sub>c</sub> = 12						
37														N <sub>c</sub> = 11						
38														N <sub>c</sub> = 13						
39														N <sub>c</sub> = 12						
40	12													N <sub>c</sub> = 13						
41														N <sub>c</sub> = 14						
42														N <sub>c</sub> = 14						
43	13													N <sub>c</sub> = 13						
44														N <sub>c</sub> = 14						
45														N <sub>c</sub> = 16						
46	14													N <sub>c</sub> = 15						
47														N <sub>c</sub> = 16						
48														N <sub>c</sub> = 16						
49	15													N <sub>c</sub> = 20						
50														N <sub>c</sub> = 18						
51														N <sub>c</sub> = 17						
52	16													N <sub>c</sub> = 18						
53														N <sub>c</sub> = 20						
54														N <sub>c</sub> = 19						
55														N <sub>c</sub> = 19						
56	17													N <sub>c</sub> = 21						
57														N <sub>c</sub> = 22						
58														N <sub>c</sub> = 22						
59	18													N <sub>c</sub> = 21						
60														N <sub>c</sub> = 20						
61														N <sub>c</sub> = 23						
62	19													N <sub>c</sub> = 24						
63														N <sub>c</sub> = 23						
64														N <sub>c</sub> = 24						
65														N <sub>c</sub> = 24						
66	20													N <sub>c</sub> = 24						
67														N <sub>c</sub> = 26						
68														N <sub>c</sub> = 27						
69	21													N <sub>c</sub> = 28						
70														N <sub>c</sub> = 27						
71														N <sub>c</sub> = 28						
72	22													N <sub>c</sub> = 31						

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 3



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-09-15

Date: From 2015-05-08 to 2015-05-08

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034721.0 (Y)

East 366751.0 (X)

Elevation 45.65 (Z)

Bedrock: m End depth: 29.95 m

DEPTH - ft		DEPTH - m		STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	TYPE AND NUMBER	SUB-SAMPLE		CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Page: 2 of 2



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-11-15

Date: From 2015-05-08 to 2015-05-08

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m): North 5034726.0 (Y)

East 366757.0 (X)

Elevation **46.05 (Z)**

Bedrock: m End depth: 9.75 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

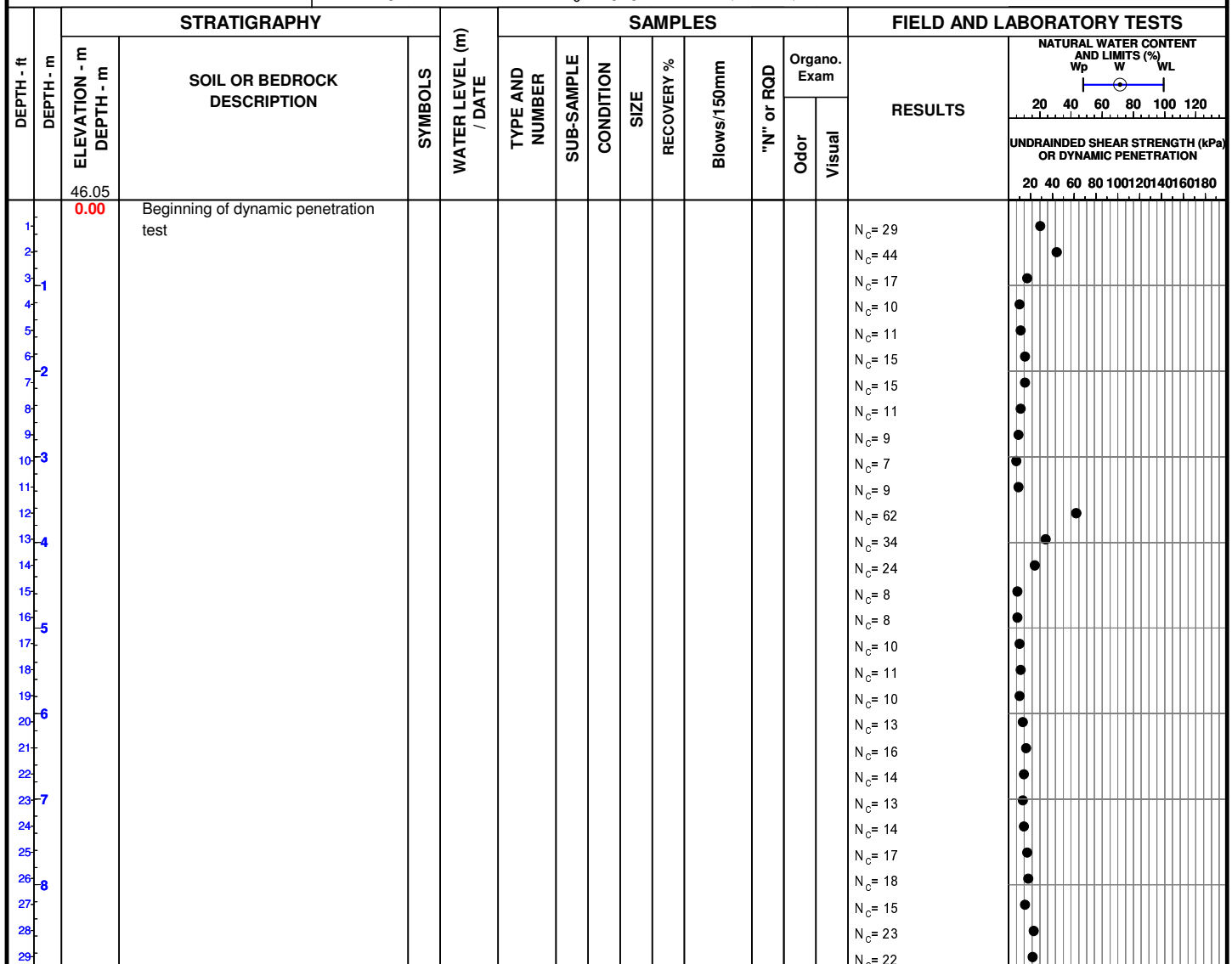
**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>M</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □



Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 2



Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-11-15

Date: From 2015-05-08 to 2015-05-08

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034726.0 (Y)

East 366757.0 (X)

Elevation 46.05 (Z)

Bedrock: m End depth: 9.75 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY		SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS	
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION			TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL 20 40 60 80 100 120
30															
31															
32		36.30	End of dynamic penetration test to 9.75 m without refusal											N <sub>c</sub> = 20	
33	10	9.75												N <sub>c</sub> = 20	
34														N <sub>c</sub> = 20	
35															
36	11														
37															
38															
39															
40	12														
41															
42															
43	13														
44															
45															
46	14														
47															
48															
49	15														
50															
51															
52	16														
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56	17														
57															
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59	18														
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61															
62	19														
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64															
65															
66	20														
67															
68															
69	21														
70															
71															
72	22														

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 2



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-12-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, West shore**

Coordinates (m): North 5034725.0 (Y)

East 366757.0 (X)

Elevation **46.05 (Z)**

Bedrock: m End depth: 9.75 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>M</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS		
		ELEVATION - m	DEPTH - m	SOIL OR BEDROCK DESCRIPTION	TYPE AND NUMBER	SUB-SAMPLE			CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)	
														Odor	Visual		W <sub>p</sub>	W <sub>L</sub>
		46.05	0.00	Beginning of dynamic penetration test										UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION				
														20 40 60 80 100120140160180				
1														N <sub>C</sub> = 37				
2														N <sub>C</sub> = 42				
3	1													N <sub>C</sub> = 32				
4														N <sub>C</sub> = 11				
5														N <sub>C</sub> = 24				
6	2													N <sub>C</sub> = 16				
7														N <sub>C</sub> = 11				
8														N <sub>C</sub> = 15				
9														N <sub>C</sub> = 22				
10	3													N <sub>C</sub> = 22				
11														N <sub>C</sub> = 23				
12														N <sub>C</sub> = 16				
13	4													N <sub>C</sub> = 34				
14														N <sub>C</sub> = 16				
15														N <sub>C</sub> = 14				
16	5													N <sub>C</sub> = 14				
17														N <sub>C</sub> = 8				
18														N <sub>C</sub> = 11				
19														N <sub>C</sub> = 10				
20	6													N <sub>C</sub> = 12				
21														N <sub>C</sub> = 15				
22														N <sub>C</sub> = 20				
23	7													N <sub>C</sub> = 16				
24														N <sub>C</sub> = 17				
25														N <sub>C</sub> = 19				
26	8													N <sub>C</sub> = 23				
27														N <sub>C</sub> = 24				
28														N <sub>C</sub> = 23				
29														N <sub>C</sub> = 21				

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 2



Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-12-15

Date: From 2015-05-11 to 2015-05-11

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034725.0 (Y)

East 366757.0 (X)

Elevation 46.05 (Z)

Bedrock: m End depth: 9.75 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS			
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)	
													Odor	Visual		W <sub>p</sub>	W
30		36.30	End of dynamic penetration test to 9.75 m without refusal											N <sub>c</sub> = 24	<div><div></div><div></div><div></div></div>	<div><div></div><div></div><div></div></div>	
31		9.75												N <sub>c</sub> = 29			
32														N <sub>c</sub> = 30			
33	10																
34																	
35																	
36	11																
37																	
38																	
39																	
40	12																
41																	
42																	
43	13																
44																	
45																	
46	14																
47																	
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49	15																
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52	16																
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62	19																
63																	
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65																	
66	20																
67																	
68																	
69	21																
70																	
71																	
72	22																

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 2





Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-13-15

Date: From 2015-05-11 to 2015-05-11

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034727.0 (Y)

East 366757.0 (X)

Elevation 46.04 (Z)

Bedrock: m End depth: 9.75 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS		
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS	NATURAL WATER CONTENT AND LIMITS (%)	
															Wp	WL
															20	120
															UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION	
															20	180
30														N <sub>c</sub> = 19	•	
31														N <sub>c</sub> = 21	•	
32		36.29	End of dynamic penetration test to 9.75 m without refusal											N <sub>c</sub> = 20	•	
33	-10	9.75														
34																
35																
36	-11															
37																
38																
39																
40	-12															
41																
42																
43	-13															
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72	-22															

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

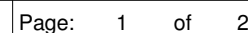
Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

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Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-14-15

Date: From 2015-05-11 to 2015-05-11

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, West shore

Coordinates (m): North 5034727.0 (Y)

East 366757.0 (X)

Elevation 46.04 (Z)

Bedrock: m End depth: 9.75 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
													Odor	Visual		W <sub>p</sub>	W	W <sub>L</sub>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 2



Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-15-15

Date: From 2015-05-11 to 2015-05-11

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034742.0 (Y)

East 366812.0 (X)

Elevation 46.02 (Z)

Bedrock: m End depth: 4.37 m

## Sample condition



Intact



Remoulded



Lost



Core

## Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

## Sample type

SS Split Spoon  
TM Thin wall Tube  
PS Piston Tube  
RC Rock core  
AS Auger  
MA Bulk sample  
TU Transparent tube  
PW LVM Mega-Sampler  
FG Frozen ground

## Tests

L Consistency Limits  
W<sub>L</sub> Liquid Limit (%)  
W<sub>p</sub> Plastic Limit (%)  
I<sub>p</sub> Plasticity Index (%)  
I<sub>L</sub> Liquidity Index  
W Natural Water Content (%)  
GS Grain Size Analysis  
S Hydrometer analysis  
R Refusal  
VBS Methylene Blue Value  
WR Weight of Rods  
O.M. Organic Matter (%)  
K Permeability (cm/s)  
UW Unit Weight (kN/m³)  
A Absorption (l/min. m)  
U Uniaxial Compressive strength (MPa)  
RQD Rock Quality Designation (%)  
CA Chemical Analysis  
P<sub>L</sub> Limit Pressure (kPa)  
E<sub>M</sub> Pressuremeter Modulus (MPa)  
E<sub>r</sub> Modulus of subgrade reaction (MPa)  
SP<sub>o</sub> Segregation Potential (mm²/H °C)

▼ Water Level  
N Std Penetration test (blows/300mm)  
N<sub>C</sub> Dyn. Penetration test (blows/300mm) ●  
σ'<sub>p</sub> Preconsolidation Pressure (kPa)  
SCI Soil Corrosivity Index

## Undrained shear strength

C<sub>U</sub> Undisturbed (kPa)C<sub>UR</sub> Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

DEPTH - ft DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS						
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp      W      WL			
													Odor	Visual		20   40   60   80   100   120			
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION		20   40   60   80   100   120   140   160   180	
1		46.02 0.00	Beginning of dynamic penetration test												N <sub>c</sub> = 147 N <sub>c</sub> = 7 N <sub>c</sub> = 2 N <sub>c</sub> = 4 N <sub>c</sub> = 10 N <sub>c</sub> = 15 N <sub>c</sub> = 12 N <sub>c</sub> = 8 N <sub>c</sub> = 23 N <sub>c</sub> = 52 N <sub>c</sub> = 19 N <sub>c</sub> = 16 N <sub>c</sub> = 19				
2																			
3	1																		
4																			
5																			
6	2																		
7																			
8																			
9																			
10	3																		
11																			
12																			
13	4																		
14																			
15	41.65 4.37	End of dynamic penetration test to 4.37 m without refusal													N <sub>c</sub> = 36 N <sub>c</sub> = Refusal				
16																			
17	5																		
18																			
19																			
20	6																		
21																			
22																			
23	7																		
24																			
25																			
26	8																		
27																			
28																			
29																			

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-16-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034742.0 (Y)

East 366812.0 (X)

Elevation **46.02 (Z)**

Bedrock: m End depth: 2.84 m

**Sample condition**

Intact
 Remoulded
 Lost
 Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory   
 ▲ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS		
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	TYPE AND NUMBER	SUB-SAMPLE		CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam.		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)	
													Wp			W	WL
																UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION	
1		46.02	Beginning of dynamic penetration test											N <sub>c</sub> = 208			
2		0.00															
3	1																
4																	
5																	
6																	
7	2																
8			End of dynamic penetration test to 2.84 m without refusal											N <sub>c</sub> = 16			
9		43.18															
10	3	2.84															
11																	
12																	
13	4																
14																	
15																	
16	5																
17																	
18																	
19																	
20	6																
21																	
22																	
23	7																
24																	
25																	
26	8																
27																	
28																	
29																	

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-17-15

Date: From 2015-05-11 to 2015-05-11

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034742.0 (Y)

East 366812.0 (X)

Elevation 46.01 (Z)

Bedrock: m End depth: 4.52 m

## Sample condition



Intact



Remoulded



Lost



Core

## Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

## Sample type

SS Split Spoon  
TM Thin wall Tube  
PS Piston Tube  
RC Rock core  
AS Auger  
MA Bulk sample  
TU Transparent tube  
PW LVM Mega-Sampler  
FG Frozen ground

## Tests

L Consistency Limits  
W<sub>L</sub> Liquid Limit (%)  
W<sub>P</sub> Plastic Limit (%)  
I<sub>P</sub> Plasticity Index (%)  
I<sub>L</sub> Liquidity Index  
W Natural Water Content (%)  
GS Grain Size Analysis  
S Hydrometer analysis  
R Refusal  
VBS Methylene Blue Value  
WR Weight of Rods  
O.M. Organic Matter (%)  
K Permeability (cm/s)  
UW Unit Weight (kN/m³)  
A Absorption (l/min. m)  
U Uniaxial Compressive strength (MPa)  
RQD Rock Quality Designation (%)  
CA Chemical Analysis  
P<sub>L</sub> Limit Pressure (kPa)  
E<sub>M</sub> Pressuremeter Modulus (MPa)  
E<sub>r</sub> Modulus of subgrade reaction (MPa)  
SP<sub>o</sub> Segregation Potential (mm²/H °C)

▼ Water Level  
N Std Penetration test (blows/300mm)  
N<sub>C</sub> Dyn. Penetration test (blows/300mm) ●  
σ'<sub>p</sub> Preconsolidation Pressure (kPa)  
SCI Soil Corrosivity Index

## Undrained shear strength

C<sub>U</sub> Undisturbed (kPa)C<sub>UR</sub> Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

DEPTH - ft	DEPTH - m	STRATIGRAPHY		SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS	
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION			TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS
		46.01 0.00	Beginning of dynamic penetration test											
1														N <sub>C</sub> = 278
2														N <sub>C</sub> = 25
3														N <sub>C</sub> = 8
4														N <sub>C</sub> = 7
5														N <sub>C</sub> = 3
6														N <sub>C</sub> = 6
7														N <sub>C</sub> = 4
8														N <sub>C</sub> = 5
9														N <sub>C</sub> = 4
10														N <sub>C</sub> = 40
11														N <sub>C</sub> = 11
12														N <sub>C</sub> = 18
13														N <sub>C</sub> = 53
14														N <sub>C</sub> = 49
15		41.49 4.52	End of dynamic penetration test to 4.52 m without refusal											N <sub>C</sub> = Refusal
16														
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

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Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-18-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034742.0 (Y)

East 366813.0 (X)

Elevation **46.00 (Z)**

Bedrock: m End depth: 5.23 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft	DEPTH - m	STRATIGRAPHY		SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS	
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION			TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS
		46.00 <b>0.00</b>	Beginning of dynamic penetration test											
1														N <sub>c</sub> = 320
2														N <sub>c</sub> = 75
3														N <sub>c</sub> = 16
4														N <sub>c</sub> = 10
5														N <sub>c</sub> = 6
6														N <sub>c</sub> = 7
7														N <sub>c</sub> = 12
8														N <sub>c</sub> = 7
9														N <sub>c</sub> = 5
10														N <sub>c</sub> = 2
11														N <sub>c</sub> = 59
12														N <sub>c</sub> = 17
13														N <sub>c</sub> = 18
14														N <sub>c</sub> = 8
15														N <sub>c</sub> = 10
16														N <sub>c</sub> = 15
17		40.77 <b>5.23</b>	End of dynamic penetration test to 5.23 m without refusal											N <sub>c</sub> = 22
18														N <sub>c</sub> = Refusal
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

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Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-19-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034742.0 (Y)

East 366813.0 (X)

Elevation **46.00 (Z)**

Bedrock: m End depth: 5.41 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

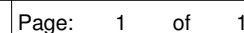
DEPTH - ft	DEPTH - m	STRATIGRAPHY				SAMPLES							FIELD AND LABORATORY TESTS				
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL	
													Odor	Visual		20 40 60 80 100 120	
		46.00														UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION 20 40 60 80 100120140160180	
1		0.00	Beginning of dynamic penetration test												N <sub>c</sub> = 289		
2																	
3	1																
4																	
5																	
6	2																
7																	
8																	
9																	
10	3																
11																	
12																	
13	4																
14																	
15																	
16	5																
17																	
18		40.59	End of dynamic penetration test to 5.41 m without refusal												N <sub>c</sub> = 16		
19																	
20	6																
21																	
22																	
23	7																
24																	
25																	
26	8																
27																	
28																	
29																	

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1







Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-21-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034743.0 (Y)

East 366814.0 (X)

Elevation **45.98 (Z)**

Bedrock: m End depth: 5.28 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS					
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	TYPE AND NUMBER	SUB-SAMPLE		CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)				
													W <sub>p</sub>	W <sub>L</sub>		UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION				
															20	40	60	80	100	120
		45.98	Beginning of dynamic penetration test											N <sub>c</sub> = 42 N <sub>c</sub> = 9 N <sub>c</sub> = 10 N <sub>c</sub> = 12 N <sub>c</sub> = 9 N <sub>c</sub> = 7 N <sub>c</sub> = 7 N <sub>c</sub> = 4 N <sub>c</sub> = 2 N <sub>c</sub> = 2 N <sub>c</sub> = 8 N <sub>c</sub> = 6 N <sub>c</sub> = 2 N <sub>c</sub> = 6 N <sub>c</sub> = 10 N <sub>c</sub> = 11						
		0.00																		
1																				
2																				
3	1																			
4																				
5																				
6																				
7	2																			
8																				
9																				
10	3																			
11																				
12																				
13	4																			
14																				
15																				
16	5																			
17		40.70	End of dynamic penetration test to 5.28 m without refusal											N <sub>c</sub> = 8 N <sub>c</sub> = Refusal						
		5.28																		
18																				
19																				
20	6																			
21																				
22																				
23	7																			
24																				
25																				
26	8																			
27																				
28																				
29																				

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-22-15

Date: From 2015-05-11 to 2015-05-11

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034743.0 (Y)

East 366814.0 (X)

Elevation **45.88 (Z)**

Bedrock: m End depth: 5.28 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS				
		ELEVATION - m DEPTH - m		SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam.		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)		
														Wp			W		WL
																		UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION	
																		20 40 60 80 100 120	
																		20 40 60 80 100 120 140 160 180	
1		0.00	Beginning of dynamic penetration test													N <sub>c</sub> = 70			
2																			
3	1																		
4																			
5																			
6																			
7	2																		
8																			
9																			
10	3																		
11																			
12																			
13	4																		
14																			
15																			
16	5																		
17		40.60	End of dynamic penetration test to 5.28 m without refusal																
18		5.28																	
19																			
20	6																		
21																			
22																			
23	7																		
24																			
25																			
26	8																		
27																			
28																			
29																			

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-23-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034743.0 (Y)

East 366815.0 (X)

Elevation **45.85 (Z)**

Bedrock: m End depth: 5.28 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

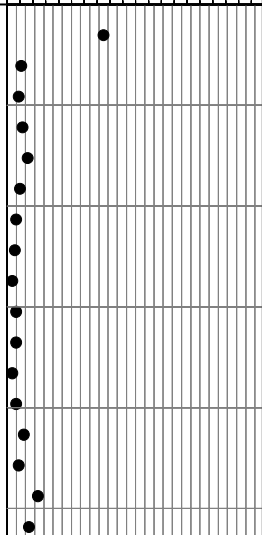
**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS					
DEPTH - ft	DEPTH - m	ELEVATION - m	DEPTH - m	SOIL OR BEDROCK DESCRIPTION	TYPE AND NUMBER	SUB-SAMPLE			CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam.		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)				
														Odor	Visual		W <sub>p</sub>	W	W <sub>L</sub>		
		45.85														UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION					
		0.00		Beginning of dynamic penetration test												20	40	60	80	100	120
1		0.00		Beginning of dynamic penetration test											N <sub>c</sub> = 75						
2																					
3	1																				
4																					
5																					
6	2																				
7																					
8																					
9																					
10	3																				
11																					
12																					
13	4																				
14																					
15																					
16	5																				
17		40.57		End of dynamic penetration test to 5.28 m without refusal											N <sub>c</sub> = 17 N <sub>c</sub> = Refusal						
18	5.28																				
19																					
20	6																				
21																					
22																					
23	7																				
24																					
25																					
26	8																				
27																					
28																					
29																					

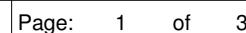
Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1







Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-25-15

Date: From 2015-05-12 to 2015-05-12

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034745.0 (Y)

East 366817.0 (X)

Elevation 45.85 (Z)

Bedrock: m End depth: 28.07 m

DEPTH - ft	DEPTH - m	STRATIGRAPHY		SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES								FIELD AND LABORATORY TESTS	
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION			TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL
															20 40 60 80 100 120
															UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION
															20 40 60 80 100 120 140 160 180
30														N <sub>c</sub> = 7	
31														N <sub>c</sub> = 8	
32														N <sub>c</sub> = 8	
33	-10													N <sub>c</sub> = 8	
34														N <sub>c</sub> = 8	
35														N <sub>c</sub> = 10	
36	-11													N <sub>c</sub> = 12	
37														N <sub>c</sub> = 11	
38														N <sub>c</sub> = 13	
39														N <sub>c</sub> = 13	
40	-12													N <sub>c</sub> = 14	
41														N <sub>c</sub> = 13	
42														N <sub>c</sub> = 14	
43	-13													N <sub>c</sub> = 16	
44														N <sub>c</sub> = 17	
45														N <sub>c</sub> = 16	
46	-14													N <sub>c</sub> = 18	
47														N <sub>c</sub> = 18	
48														N <sub>c</sub> = 20	
49	-15													N <sub>c</sub> = 18	
50														N <sub>c</sub> = 20	
51														N <sub>c</sub> = 21	
52	-16													N <sub>c</sub> = 21	
53														N <sub>c</sub> = 20	
54														N <sub>c</sub> = 21	
55														N <sub>c</sub> = 19	
56	-17													N <sub>c</sub> = 21	
57														N <sub>c</sub> = 22	
58														N <sub>c</sub> = 22	
59	-18													N <sub>c</sub> = 23	
60														N <sub>c</sub> = 25	
61														N <sub>c</sub> = 24	
62	-19													N <sub>c</sub> = 27	
63														N <sub>c</sub> = 26	
64														N <sub>c</sub> = 28	
65														N <sub>c</sub> = 26	
66	-20													N <sub>c</sub> = 27	
67														N <sub>c</sub> = 27	
68														N <sub>c</sub> = 28	
69	-21													N <sub>c</sub> = 28	
70														N <sub>c</sub> = 29	
71														N <sub>c</sub> = 28	
72	-22													N <sub>c</sub> = 30	

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 2 of 3

Client :

## National Capital Commission

## BOREHOLE REPORT

File n°: **B-0012112-1 [EN]**

Borehole n°: TF-25-15

Date: From **2015-05-12** to **2015-05-12**

Project: **Pedestrian bridges Ruisseau Leamy**

Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m):	North	5034745.0 (Y)
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East 366817.0 (X)

Elevation 45.85 (Z)

Bedrock:	m	End depth:	28.07 m
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[illegible]

Remarks:

Borehole type: **NW/NQ casing by rotation**

Boring equipment: **Geoprobe**

Prepared by: **S. Séguin, tech.**

Approved by: **T. Lampron, ing.**

2015-12-17

Page: 3 of 3







Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-27-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034743.0 (Y)

East 366812.0 (X)

Elevation **46.01 (Z)**

Bedrock: m End depth: 8.23 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressurometer Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY				SAMPLES								FIELD AND LABORATORY TESTS									
		ELEVATION - m DEPTH - m		SOIL OR BEDROCK DESCRIPTION		SYMBOLS		WATER LEVEL (m) / DATE		TYPE AND NUMBER		SUB-SAMPLE CONDITION		SIZE RECOVERY %		Blows/150mm		"N" or RQD		Organo. Exam		RESULTS		NATURAL WATER CONTENT AND LIMITS (%)	
																								W <sub>p</sub> W      W <sub>L</sub>	
																						UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION			
																						20 40 60 80 100120140160180			
1		46.01 0.00		Beginning of dynamic penetration test																		N <sub>c</sub> = 105 N <sub>c</sub> = 9 N <sub>c</sub> = 15 N <sub>c</sub> = 10 N <sub>c</sub> = 13 N <sub>c</sub> = 9 N <sub>c</sub> = 16 N <sub>c</sub> = 17 N <sub>c</sub> = 25 N <sub>c</sub> = 18 N <sub>c</sub> = 22 N <sub>c</sub> = 23 N <sub>c</sub> = 23 N <sub>c</sub> = 25 N <sub>c</sub> = 30 N <sub>c</sub> = 30 N <sub>c</sub> = 17 N <sub>c</sub> = 22 N <sub>c</sub> = 23 N <sub>c</sub> = 19 N <sub>c</sub> = 17 N <sub>c</sub> = 15 N <sub>c</sub> = 15 N <sub>c</sub> = 16 N <sub>c</sub> = 15 N <sub>c</sub> = 13			
2																									
3	1																								
4																									
5																									
6	2																								
7																									
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9																									
10	3																								
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13	4																								
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16	5																								
17																									
18																									
19																									
20	6																								
21																									
22																									
23	7																								
24																									
25																									
26	8																								
27																									
28																									
29	9																								
30																									
		37.78 8.23		End of dynamic penetration test to 8.23 m without refusal																					

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1

Z:\Style\_LVM\Log\Log\_Geotec\_80Log\_Forage\_LVM\_AN.sty-Printed : 2015-12-17 11h  
B-0012112-1 [EN]  
Vertical Scale = 1 : 75  
EQ-09-Ge-66A R.1 04.03.2009



Client :

National Capital Commission

## BOREHOLE REPORT

File n°: B-0012112-1 [EN]

Borehole n°: TF-28-15

Date: From 2015-05-12 to 2015-05-12

Project: Pedestrian bridges Ruisseau Leamy

Location: Sentier des Voyageurs, Gatineau, Quebec, East shore

Coordinates (m): North 5034743.0 (Y)

East 366812.0 (X)

Elevation 46.02 (Z)

Bedrock: m End depth: 8.23 m

### Sample condition

Intact Remoulded Lost Core

### Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)  
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

### Sample type

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

### Tests

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

### Undrained shear strength

**C<sub>u</sub>** Undisturbed (kPa)  
**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
▲ ■  
△ □

DEPTH - ft	DEPTH - m	STRATIGRAPHY		SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS	
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION			TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam	RESULTS
		46.02 0.00	Beginning of dynamic penetration test											
1														N <sub>c</sub> = 78
2														N <sub>c</sub> = 28
3														N <sub>c</sub> = 20
4														N <sub>c</sub> = 19
5														N <sub>c</sub> = 18
6														N <sub>c</sub> = 10
7														N <sub>c</sub> = 16
8														N <sub>c</sub> = 14
9														N <sub>c</sub> = 6
10														N <sub>c</sub> = 6
11														N <sub>c</sub> = 8
12														N <sub>c</sub> = 11
13														N <sub>c</sub> = 4
14														N <sub>c</sub> = 6
15														N <sub>c</sub> = 6
16														N <sub>c</sub> = 13
17														N <sub>c</sub> = 10
18														N <sub>c</sub> = 9
19														N <sub>c</sub> = 16
20														N <sub>c</sub> = 16
21														N <sub>c</sub> = 12
22														N <sub>c</sub> = 10
23														N <sub>c</sub> = 12
24														N <sub>c</sub> = 15
25														N <sub>c</sub> = 12
26														N <sub>c</sub> = 10
27		37.79 8.23	End of dynamic penetration test to 8.23 m without refusal											
28														
29														

Remarks:

Borehole type: NW/NQ casing by rotation

Boring equipment: Geoprobe

Prepared by: S. Séguin, tech.

Approved by: T. Lampron, ing.

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-29-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034744.0 (Y)

East 366811.0 (X)

Elevation **46.02 (Z)**

Bedrock: m End depth: 4.32 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

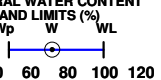

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft	DEPTH - m	STRATIGRAPHY			WATER LEVEL (m) / DATE	SAMPLES							FIELD AND LABORATORY TESTS																										
		ELEVATION - m DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS		TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)																							
													Odor	Visual		W <sub>p</sub>	W	WL																					
		46.02 <b>0.00</b>	Beginning of dynamic penetration test											N <sub>c</sub> = 117 N <sub>c</sub> = 55 N <sub>c</sub> = 43 N <sub>c</sub> = 19 N <sub>c</sub> = 16 N <sub>c</sub> = 35 N <sub>c</sub> = 14 N <sub>c</sub> = 27 N <sub>c</sub> = 43 N <sub>c</sub> = 13 N <sub>c</sub> = 13 N <sub>c</sub> = 14																									
		41.70 <b>4.32</b>													End of dynamic penetration test to 4.32 m without refusal										N <sub>c</sub> = 23 N <sub>c</sub> = Refusal														
1																																							
2																																							
3	<b>1</b>																																						
4																																							
5																																							
6	<b>2</b>																																						
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10	<b>3</b>																																						
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13	<b>4</b>																																						
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16	<b>5</b>																																						
17																																							
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26	<b>8</b>																																						
27																																							
28																																							
29																																							

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1





Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-31-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034745.0 (Y)

East 366811.0 (X)

Elevation **46.02 (Z)**

Bedrock: m End depth: 4.93 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ Water Level  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS					
		ELEVATION - m DEPTH - m		SOIL OR BEDROCK DESCRIPTION		SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)		
														Odor	Visual	W <sub>p</sub> W      WL				
																		UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION		
																		20 40 60 80 100120140160180		
1		46.02	0.00	Beginning of dynamic penetration test													N <sub>c</sub> = 126			
2																		N <sub>c</sub> = 40		
3	1																	N <sub>c</sub> = 23		
4																		N <sub>c</sub> = 8		
5																		N <sub>c</sub> = 12		
6	2																	N <sub>c</sub> = 2		
7																		N <sub>c</sub> = 4		
8																		N <sub>c</sub> = 8		
9																		N <sub>c</sub> = 20		
10	3																	N <sub>c</sub> = 23		
11																		N <sub>c</sub> = 19		
12																		N <sub>c</sub> = 37		
13	4																	N <sub>c</sub> = 32		
14																		N <sub>c</sub> = 19		
15																	N <sub>c</sub> = 19			
16	5	41.09	4.93	End of dynamic penetration test to 4.93 m without refusal													N <sub>c</sub> = 19			
17																		N <sub>c</sub> = Refusal		
18																				
19																				
20	6																			
21																				
22																				
23	7																			
24																				
25																				
26	8																			
27																				
28																				
29																				

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-32-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034745.0 (Y)

East 366812.0 (X)

Elevation **46.04 (Z)**

Bedrock: m End depth: 5.46 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

**Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS			
		ELEVATION - m DEPTH - m		SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)	
														Wp	W		WL	
														20 40 60 80 100 120				
																	UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION	
																	20 40 60 80 100120140160180	
1		0.00		Beginning of dynamic penetration test												N <sub>c</sub> = 189		
2																		
3																		
4																		
5																		
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7																		
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9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18		40.58 5.46		End of dynamic penetration test to 5.46 m without refusal											N <sub>c</sub> = 10			
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27																		
28																		
29																		

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



Client :

National Capital Commission

**BOREHOLE REPORT**

File n°: B-0012112-1 [EN]

Borehole n°: TF-33-15

Date: From 2015-05-12 to 2015-05-12

Project: **Pedestrian bridges Ruisseau Leamy**Location: **Sentier des Voyageurs, Gatineau, Quebec, East shore**

Coordinates (m): North 5034745.0 (Y)

East 366813.0 (X)

Elevation **45.95 (Z)**

Bedrock: m End depth: 5.43 m

**Sample condition**

Intact



Remoulded



Lost



Core

**Organoleptic soil examination:**

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)

Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

**Sample type**

**SS** Split Spoon  
**TM** Thin wall Tube  
**PS** Piston Tube  
**RC** Rock core  
**AS** Auger  
**MA** Bulk sample  
**TU** Transparent tube  
**PW** LVM Mega-Sampler  
**FG** Frozen ground

**Tests**

**L** Consistency Limits  
**W<sub>L</sub>** Liquid Limit (%)  
**W<sub>p</sub>** Plastic Limit (%)  
**I<sub>p</sub>** Plasticity Index (%)  
**I<sub>L</sub>** Liquidity Index  
**W** Natural Water Content (%)  
**GS** Grain Size Analysis  
**S** Hydrometer analysis  
**R** Refusal  
**VBS** Methylene Blue Value  
**WR** Weight of Rods  
**O.M.** Organic Matter (%)  
**K** Permeability (cm/s)  
**UW** Unit Weight (kN/m³)  
**A** Absorption (l/min. m)  
**U** Uniaxial Compressive strength (MPa)  
**RQD** Rock Quality Designation (%)  
**CA** Chemical Analysis  
**P<sub>L</sub>** Limit Pressure (kPa)  
**E<sub>m</sub>** Pressuremeter Modulus (MPa)  
**E<sub>r</sub>** Modulus of subgrade reaction (MPa)  
**SP<sub>o</sub>** Segregation Potential (mm²/H °C)

▼ **Water Level**  
**N** Std Penetration test (blows/300mm)  
**N<sub>c</sub>** Dyn. Penetration test (blows/300mm) ●  
**σ'<sub>p</sub>** Preconsolidation Pressure (kPa)  
**SCI** Soil Corrosivity Index

**Undrained shear strength****C<sub>u</sub>** Undisturbed (kPa)**C<sub>ur</sub>** Remoulded (kPa)

Field Laboratory  
 ▲ ■  
 △ □

DEPTH - ft		DEPTH - m		STRATIGRAPHY			SAMPLES								FIELD AND LABORATORY TESTS															
		ELEVATION - m	DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam		RESULTS	NATURAL WATER CONTENT AND LIMITS (%)													
														Wp	W		WL													
		45.95																20 40 60 80 100 120												
																	UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION													
																	20 40 60 80 100120140160180													
1		0.00		Beginning of dynamic penetration test																										
2																														
3	1																													
4																														
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12																														
13	4																													
14																														
15																														
16																														
17	5																													
18		40.52		End of dynamic penetration test to 5.44 m without refusal																										
19		5.43																												
20	6																													
21																														
22																														
23	7																													
24																														
25																														
26	8																													
27																														
28																														
29																														

Remarks:

Borehole type: **NW/NQ casing by rotation**Boring equipment: **Geoprobe**Prepared by: **S. Séguin, tech.**Approved by: **T. Lampron, ing.**

2015-12-17

Page: 1 of 1



## Appendix 4

## Borehole location plan





10 cm  
5  
4  
3  
2  
1  
0

LEGEND :

TF-NN-AA

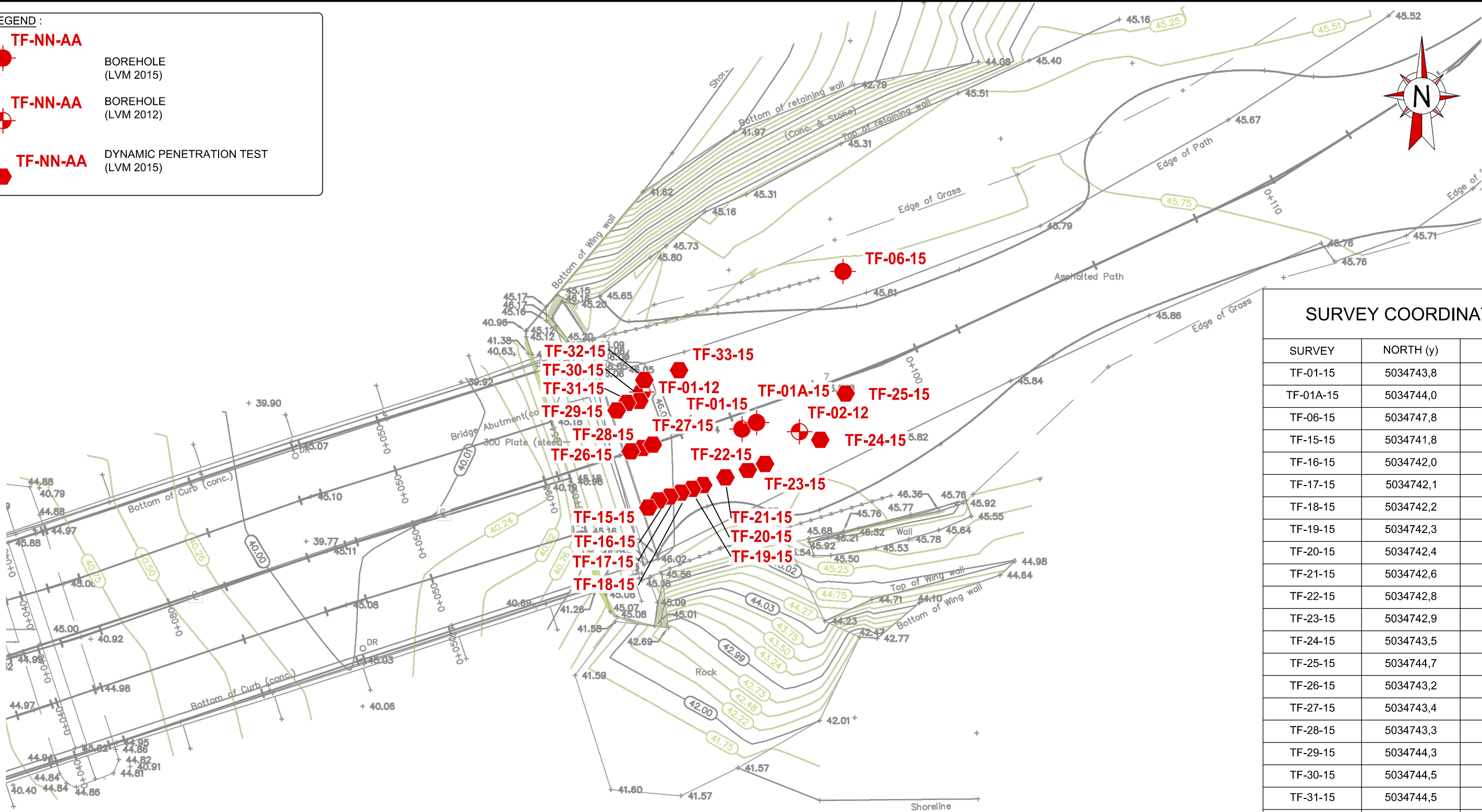
BOREHOLE  
(LVM 2015)

TF-NN-AA

BOREHOLE  
(LVM 2012)

TF-NN-AA

DYNAMIC PENETRATION TEST  
(LVM 2015)



SURVEY COORDINATED		
SURVEY	NORTH (y)	EAST (X)
TF-01-15	5034743,8	366814,3
TF-01A-15	5034744,0	366814,6
TF-06-15	5034747,8	366816,8
TF-15-15	5034741,8	366811,9
TF-16-15	5034742,0	366812,1
TF-17-15	5034742,1	366812,4
TF-18-15	5034742,2	366812,7
TF-19-15	5034742,3	366813,0
TF-20-15	5034742,4	366813,3
TF-21-15	5034742,6	366813,9
TF-22-15	5034742,8	366814,4
TF-23-15	5034742,9	366814,9
TF-24-15	5034743,5	366816,3
TF-25-15	5034744,7	366816,9
TF-26-15	5034743,2	366811,4
TF-27-15	5034743,4	366812,0
TF-28-15	5034743,3	366811,7
TF-29-15	5034744,3	366811,1
TF-30-15	5034744,5	366811,7
TF-31-15	5034744,5	366811,4
TF-32-15	5034745,1	366811,8
TF-33-15	5034745,3	366812,7



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Projet

## National Capital Commission Pedestrian bridges Ruisseau Leamy

Sentier des Voyageurs , Gatineau, Québec

Titre

West shore borehole location



Englobe Corp.

900, de la Carrière Blvd, suite 100  
Gatineau (Québec) J8Y 6T5  
Phone : 819.778.3143  
Fax : 819.770.1373

Prepared **S. Séguin**

Drawn **R. Frenette**

Checked **T. Lampron**

Discipline **Geotechnical**

Scale **1:100**

Date **2015-12-04**

Project Manager

**Y. Coulibaly**

Extract from: Rev.:

Serv. resp.

**033**

Projet

**B-0012112**

Otp

**1**

Disc.

**GE**

Type

**D**

N° Dessin

**0001**

Rév.




10 cm  
5  
4  
3  
2  
1  
0

G:\033B-0012112\_CON-PONT-LEAMY\Z4\_CAD\INF1\_OTP\_15\_LIVRABLES\A033B-0012112-1-GE\_DCP.DWG



**LÉGENDE :**

 **DCP-NN** PORTABLE DYNAMIC PENETROMETER TESTS (DPC)

**NOTES :**

1. REFERENCES : Geo Ottawa, date 2014

This document must be used jointly with the recommendations formulated in the geotechnical study report



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Projet

**National Capital Commission  
Pedestrian bridges Ruisseau Leamy**

Sentier des Voyageurs , Gatineau, Québec

Titre

**Location of the portable dynamic penetrometer tests**



Englobe Corp.

900, de la Carrière Blvd, suite 100  
Gatineau (Québec) J8Y 6T5  
Phone : 819.778.3143  
Fax : 819.770.1373

Prepared **S. Séguin**  
Drawn **R. Frenette**  
Checked **T. Lampron**

Discipline **Geotechnical**  
Scale **1:2500**  
Date **2015-12-04**

Project Manager  
**Y. Coulibaly**  
Extract from: Rev.:

Serv. resp.	Projet	Otp	Disc.	Type	Nº Dessin	Rév.
<b>033</b>	<b>B-0012112</b>	<b>1</b>	<b>GE</b>	<b>D</b>	<b>0003</b>	



## Appendix 5

## Photographic report



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 1 of 8



**Photo 1 :**  
Aerial photography from 1945 (A9546-38)



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 2 of 8



**Photo 2 :**  
Aerial photography from 1965 (Source : geoOttawa)

**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 3 of 8



**Photo 3 :**  
Aerial photography from 1976 (Source : geoOttawa)



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 4 of 8



**Photo 4 :**  
Aerial photography from 1994 (A28143-116)



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 5 of 8



**Photo 5 :**  
Aerial photography from 2005 (Source : geoOttawa)

**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 6 of 8



**Photo 5 :**  
Aerial photography from 2014 (Source : geoOttawa)



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 7 of 8



**Photo 6 :**  
 Northern access road (2015-04-13)



**Photo 7 :**  
 Pathway near east abutment (2015-04-13)



**Photo 8 :**  
 Northern retaining wall on the east abutment (2015-04-13)



**Photo 9 :**  
 Southern slope on the east abutment (2015-04-13)



**Project :** Leamy Creek Pedestrian Bridge – Complementary Geotechnical Study  
**Location :** Sentier des Voyageurs, Gatineau, Québec

**Project # :** 033-B-0012112-1  
**Date :** N/A

## PHOTOGRAPHIC REPORT

Page 8 of 8



**Photo 10 :**  
 Pathway near west abutment (2015-04-13)



**Photo 11 :**  
 Probable wetland north to west abutment (2015-04-13)



**Photo 12 :**  
 Southern retaining wall on the west abutment (2015-04-13)



**Photo 13 :**  
 Voyageurs pathway south to the bridge (2015-05-12)