

FINAL REPORT

**Foundation Investigation Report
Gabion Wall Construction near Laronde Creek
Hwy 17, District 54
G.W.P. 5274-08-00
MTO GEOCRES No. 31L-137**

Prepared for:
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Trow Associates Inc.

October 15, 2009

SD000360624d

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1. Part I: FOUNDATION INVESTIGATION

1.1 Introduction

This report presents the results of a geotechnical investigation completed by Trow Associates Inc. (Trow) for the Gabion wall construction near Laronde Creek. The Gabion walls will be located on the east and west side of a cantilevered pedestrian walkway at Laronde Creek Bridge on Hwy 17 about 20 km west of North Bay.

The work was undertaken under Agreement # 5006-E-0094, Assignment No. 3. The terms of reference were as presented in MTO letter dated July 30, 2009.

The purpose of the investigation is to examine the existing soil conditions within the proposed construction limits. The site specific geotechnical investigation consisted of test borings, borehole logging, and field and laboratory testing. This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing.

1.2 Site Description and Geological Setting

1.2.1 Site Description

The site is located near Laronde Creek Bridge on Hwy 17, approximately 20 km west of North Bay, where Hwy 17 crosses Laronde Creek. Hwy 17 runs approximately east-west and the Laronde Creek flows north to south towards Lake Nipissing. The site plan and cross-section profiles are as shown on the drawings in Appendix B.

The existing Laronde Creek Bridge is a one span structure approximately 28.7 m long and 9.4 m wide. The bridge conveys one westbound lane and one eastbound lane of Hwy 17 over the Laronde Creek, as shown in Photograph No. 1 in Appendix A. The side slope at the south side of Hwy 17 embankment is approximately 2H:1V to 1.5H:1V. The surface at the existing bridge is at Elevation about 201.7 m and the water level in the creek is at Elevation about 195.9 m at the time of geotechnical investigation (Sept./11/2009).

The bank on the east side of the creek is relatively steep. On the west side, the bank is much flatter, as shown in Photographs 2 and 3 Appendix A. The vegetation in the area consists of shrubs and grass. However, there is a dense clump of trees and brush on the south side of Hwy 17, east of the Laronde Creek, as shown in Photograph 2, Appendix A.

The drainage in the area generally consists of road side open ditches which drain into Laronde Creek. The ditches are lined with gravel/cobble and sand at the east side of Laronde Creek, and with sand and silt at the west side, as shown in Photographs 2 and 3, Appendix A.

1.2.2 Geological Setting

The site lies within the Canadian Shield in an area where the bedrock is overlain by deep overburden. According to Bedrock Geology of Ontario Map 2544 (Ministry of Northern Development and Mines, Ontario), the bedrock underlying the site consists of Mesoproterozoic Precambrian rocks (approximately 900 to 1600 million years old), primarily felsic igneous tonalite, granodiorite, monzonite, granite, syenite, and derived gneisses. According to Ontario Department of Mines and Northern Affairs Map 2216 (North Bay Area), the overburden consists of boulder clay, clay, varved clay, minor gravel, sand, and silt.

In general, the overburden consists of surficial sands and silts overlying thick deposit of clay.

1.3 Investigation Procedures

1.3.1 General

The field work for this investigation was performed between September 03, 2009 and September 11, 2009. The field work consisted of drilling seven (7) sampled boreholes (BH-1, BH-2, BH-3, BH-4, BH-5, BH-6, and BH-7) and installing three (3) monitoring wells in (BH-1, BH-2, and BH-5). Drawing No. 1 in Appendix B shows the locations of the seven boreholes. Boreholes BH-1, BH-6 and BH-7 were drilled on the east side of the creek, whereas boreholes BH-2, BH-3, BH-4, and BH-5 were drilled on the west side. Boreholes BH-1, BH-2, BH-4, and BH-6 were advanced near the edge of pavement in the east bound lane, approximately at Stations 13+660, 13+565, 13+585, and 13+626, respectively. Boreholes BH-3, BH-5, and BH-7 were drilled near the ditch bottom at Stations 13+578, 13+590, and 13+626. The boreholes were advanced to depths ranging from about 15.4 m to 22.3 m.

Boreholes BH-1, BH-2, BH-4, and BH-6 were advanced using a bombardier mounted CME 55 drill rig, equipped with continuous flight hollow stem augers (4-1/4" HAS). The other boreholes including BH-3, BH-5, and BH-7 were advanced using a tri-pod wash-type boring hollow stem auger (2.5" inside diameter). All borehole drilling/sampling were operated by a specialist drilling contractor, LandCore Drilling Co. Ltd.

During the drilling, soil samples were obtained using thin wall tubes (Shelby), and a 51 outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Tests (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The SPT "N" values were recorded and used to provide an assessment of in-situ consistency or relative density of non-cohesive soils. In-situ field vane testing (ASTM D 2573) was performed in the cohesive deposits to measure the in-situ undrained shear strength. The torque was measured using two calibrated scales on a lever arm threaded to the drill rod.

Following completion of the boreholes, water level measurements were obtained from the boreholes in accordance with Ministry of Transportation guidelines. Monitoring wells were installed in Borehole BH-1, BH-2, and BH-5 to permit monitoring of groundwater levels at the site. After completion, boreholes were sealed with bentonite pellets.

The fieldwork was supervised by a member of Trow's engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO Soils Classification System for foundation report, and retrieved soil samples for subsequent laboratory testing and identification. All of the recovered soil samples were placed in moisture-proof bags and returned to Trow's Sudbury and Brampton laboratories for additional visual, textual and olfactory examination.

Details of the soil strata encountered in the boreholes are included in attached borehole log sheets in Appendix C, and plotted on the profiles in Appendix B.

The borehole locations and the ground surface elevations along the cross sections were surveyed by Trow personnel, with reference to the benchmark at the south-west end corner of the concrete bridge slab at the south concrete guard rail. The final geodetic locations and elevations were established based on the site survey map provided by MTO.

1.3.2 Laboratory Testing

All samples returned to the laboratory were subjected to detailed visual examination and classification. The laboratory testing program included natural water content of all samples (LS-701), and routine classification testing of approximately 25% of the selected soil samples. The routine tests included Atterberg Limits (LS-702), grain size distribution (LS703/704), and specific gravity tests.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the Atterberg Limits tests and grain size analyses are presented in Appendix D.

1.4 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix C, and the laboratory test results are provided in Appendix D. The "Explanation of Terms Used in Report" preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and cross section soil profiles are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole log and cross section soil profiles are inferred from non-continuous sampling, observations of drilling progress, results of Standard Penetration Tests, and in-situ vane shear tests. These boundaries

typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

In general, the stratigraphic sequence at the site typically consists of surficial sand fill, followed by silty sand, sandy silt, clayey silt, and a thick layer of silty clay overlying tills. The silty clay is the dominant deposit in this location.

A summary of the soil and groundwater conditions encountered in the boreholes is provided below.

1.4.1 Asphalt

At BH-1, BH-2, BH-4, and BH-6, asphalt was encountered at ground surface. The thickness of the asphalt layer ranges from 50 mm to 300 mm, and the elevation of this layer are between 201.5 m and 202.2 m.

1.4.2 Sand Fill

In all boreholes, sand fill was encountered. At BH-1, BH-2, BH-4, and BH-6, the sand fill was found directly below the asphalt. At BH-7, the sand fill was encountered at ground surface. At BH-3 and BH-5, the sand fill was overlaid by a 15 mm to 76 mm thick topsoil layer at ground surface. The thickness of the sand fill ranges from 0.6 m to 2.8 m.

The composition of this layer is sand, trace to some gravel, and trace to some silt. The fill is brown in color, and damp to wet. Uncorrected STP “N” value ranges from 2 to 25 blows per 300 mm, classifying the material as very loose to compact in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 2% to 22%

Grain Size Distribution:

- 24% to 64% gravel;
- 71% to 30% sand; and
- 5% to 6% fines

The result of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The results of the grain size distribution tests on the sand fill are also provided on Figure 3 in Appendix D.

1.4.3 Sandy Silt

Beneath the sand fill, sandy silt was encountered BH-6. This sandy silt layer has a thickness of 4.4 m and extends to a depth of about 5.3 m below the existing grade (approximately Elevation 196.5 m). The deposit consists of silt, sand, trace to some gravel, and trace clay. The sandy silt is brown in color, and wet. Uncorrected SPT “N” values range from 2 to 11 blows per 300 mm, classifying the sandy silt as very loose to compact in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 16 % to 28%

Grain Size Distribution:

- 10% gravel;
- 33% sand;
- 50% silt; and
- 7% clay

The result of the moisture content and grain size distribution tests are provided on the record of borehole sheet (BH-6) in Appendix C. The result of the grain size distribution test on the sandy silt is also provided on Figure 4 in Appendix D.

1.4.4 Silty Sand

Silty sandy was encountered in BH-4 underneath the sand fill layer. This silty sand has a thickness of 3 m, and extends to a depth of 6.1 m (approximately at Elevation of 195.7 m). The deposit consists of silt, sand, and trace clay. The sandy silt is brown in color, and damp to wet. Uncorrected SPT “N” values range from 2 to 7 blows per 300 mm, classifying the silty sand as very loose to loose in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 16% to 24%

Grain Size Distribution:

- 0% gravel;
- 56% sand;

- 31% silt; and
- 13% clay

The result of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The result of the grain size distribution test on the sandy silt is also provided on Figure 5 in Appendix D.

1.4.5 Clayey Silt

A layer of clayey silt was encountered underlying the fill in BH-1 and BH-2. The thickness of the clayey silt at these locations is between 1.1 m to 1.6 m. The deposit extends to depths between 2.3 m and 3.1 m, corresponding to Elevations of approximately between 199.9 m and 198.8 m, respectively. The clayey silt contains trace to some sand, and trace to some clay. The deposit is grey in color, and damp to wet. Uncorrected SPT “N” values range from 2 to 10 blows per 300 mm, classifying the clayey silt as very loose to loose in compactness condition.

Laboratory testing performed on selected samples consisted of moisture content and grain size distribution tests. The test results are as follows:

Moisture Content:

- 21.4 % to 31%

Grain Size Distribution:

- 0% gravel;
- 1% sand;
- 52 % silt; and
- 47% clay

Atterberg Limits:

- Liquid Limit: 32%;
- Plastic Limit: 24%; and
- Plasticity Index: 8%

The result of the moisture content and grain size distribution tests are provided on the record of borehole sheet in Appendix C. The results of the Atterberg Limits and grain size distribution tests on the clayey silt are also provided on Figure 2 and Figure 6, respectively, in Appendix D.

1.4.6 Silty Clay

A deposit of silty clay was encountered in all boreholes. The top of this deposit ranged from Elevation 195.7 m to 199.9 m. The silty clay has thickness between about 18.2 m to 20 m, and extends to Elevation ranging from about 180.8 m to 180.5 m at BH-1 and BH-2, respectively. The other boreholes, BH-3, BH-4, BH-5, BH-6, and BH-7, were terminated in the silty clay deposit at Elevations in the range of about 179.6 m to 185.7 m.

The silty clay is grey in color and saturated. It is varved with clayey silt. The thickness of individual layers or laminations varies from a few millimeters to a few centimeters, but in general is about one centimeter. The portion of silty clay and clayey silt varies from about 2:1 to 5:1, and the clay portion in general dominates.

Uncorrected SPT “N” values range from 0 (weight of hammer) to 18 blows per 300 mm of penetration. *In-situ* field vane tests were performed to measure undrained shear strengths of the silty clay. The results of the *in-situ* field vane tests measured in the boreholes are shown on the record of borehole sheets in Appendix C and Figure 1.1. The in-situ vane shear strength ranges from 15 kPa to 90.1 kPa, indicating a soft to stiff consistency. Sensitivity ranges from 2 to 5 (the average sensitivity is about 3), classifying the silty clay as low sensitivity according to Canadian Foundation Engineering Manual 2006 (CFEM, Chapter 3, page 18).

Figure 1.1 summarizes the measured field vane shear tests that were carried out as part of the current investigation. The results show that the silty clay has a crust extending to about 5 m depth below the ground surface. The typical vane strength is about 35 kPa for the crust layer. Beneath the crust, the typical vane strength reduces to 30 kPa at a depth of 10 m and then increases with depth at a rate of about 4 kPa/meter.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, and Atterberg Limits. The test results are as follows:

Moisture Content:

- 22% to 68%

Grain Size Distribution:

- 0% gravel;
- 0% to 2% sand;
- 25% to 70% silt; and
- 28% to 73% clay

Atterberg Limits:

- Liquid Limits: 31% to 38%

- Plastic Limits: 19% to 25%
- Plasticity Index: 8% to 16%

The results of the moisture content, grain size distribution, and Atterberg Limits are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests on the silty clay are provided on Figures 7 and 8 in Appendix D. The results of the Atterberg Limits tests are provided on Figure 1 in Appendix D.

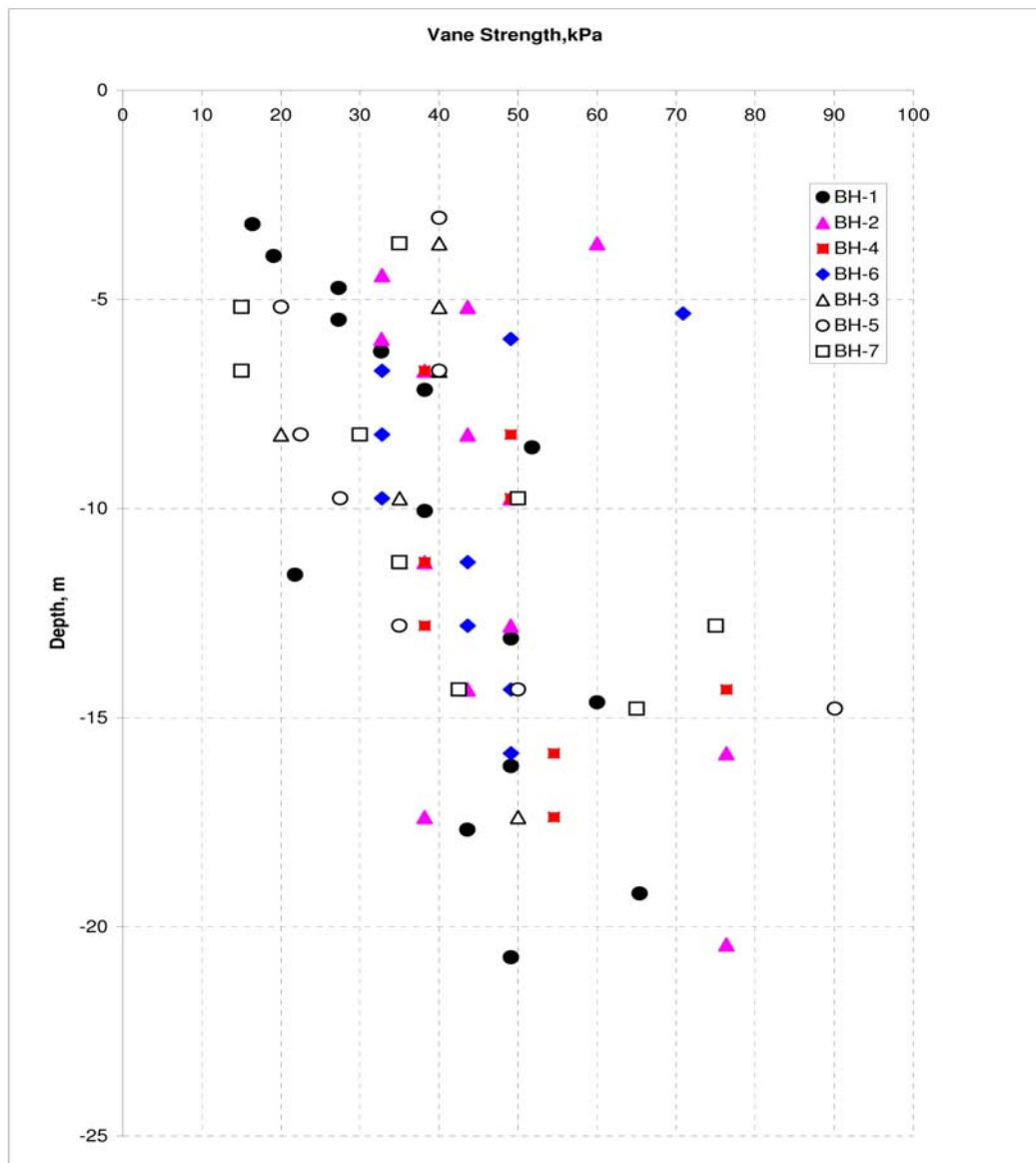


Figure 1.1 Vane strength of the silty clay measured on the site

1.4.7 Till

Beneath the silty clay, silty sandy till and suspected sand and gravel till were encountered at BH-1 and BH-2, respectively. The top elevation of the till ranges from Elevation 180.5 m to 180.8 m, corresponding to a depth of 21.3 m below ground surface. The till extends to about 22.3 m depth at the borehole termination due to auger refusal. The till is grey in color and wet.

1.5 Groundwater Conditions

Information regarding to the groundwater levels at the site was obtained by measuring the water levels in the open boreholes after completion of drilling and in monitoring wells installed in Boreholes BH-1, BH-2, and BH-5. The ground water levels encountered in the boreholes are also shown in Table 1.1.

The monitoring wells consists of a 6 m long slotted screen embedded in a sand pack and bentonite seals above and below the sand pack.

The difference in groundwater level between boreholes could be due to disturbance in the holes a time of drilling and that the boreholes had not stabilized prior to backfilling. It should be noted that the groundwater level is subject to seasonal fluctuations.

Table 1.1 Groundwater levels recorded at the site

| Borehole No. | Date of drilling | Well tip depth, (m) | Water level | |
|--------------|------------------|---------------------|-------------|----------------|
| | | | Depth, (m) | Elevation, (m) |
| BH-1* | 09/03/2009 | 12.2 | 0.9 | 201.3 |
| BH-2* | 09/04/2009 | 12.2 | 1.52 | 200.4 |
| BH-3 | 09/08/2009 | Open hole | 0.84 | 197.4 |
| BH-4 | 09/09/2009 | Open hole | 3.05 | 198.7 |
| BH-5* | 09/09/2009 | 11.2 | 0.2 | 196.6 |
| BH-6 | 09/10/2009 | Open hole | 0.91 | 200.9 |
| BH-7 | 09/10/2009 | Open hole | 1.5 | 196.9 |

*Monitoring well GWL reading was taken on 09/11/2009

1.6 Closure

A soil investigation is a limited sampling of a site. The information is collected at specific borehole locations and can be extrapolated to an approximate limited area around the borehole. The extent of the limited area depends on the variability of the soil and groundwater conditions as influenced by geological processes and the construction activities. Should any conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to allow reassessment of our recommendations. It may then be necessary to carry out additional field work and analyses.

This report has been prepared by S. Micic, Ph.D., P.Eng and G. Qu, Ph.D. and reviewed by S. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact.

Yours truly,

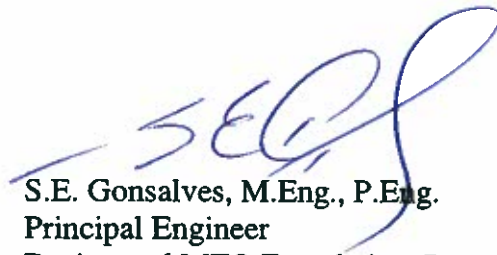
Trow Associates Inc.



Silvana Micic, Ph.D, P.Eng.
Geotechnical Engineer



Encl.



S.E. Gonsalves, M.Eng., P.Eng.
Principal Engineer
Designated MTO Foundation Contact



APPENDIX A : PHOTOGRAPHS



Photograph 1 Laronde Creek Bridge on Highway 17, south side



Photograph 2 The east side of Laronde Creek, south side of Highway 17



Photograph 3 The west side of Laronde Creek, south side of Highway 17

APPENDIX B : DRAWING

DIMENSIONS ARE IN METERS
AND/OR MILLIMETERS
UNLESS OTHERWISE SHOWN

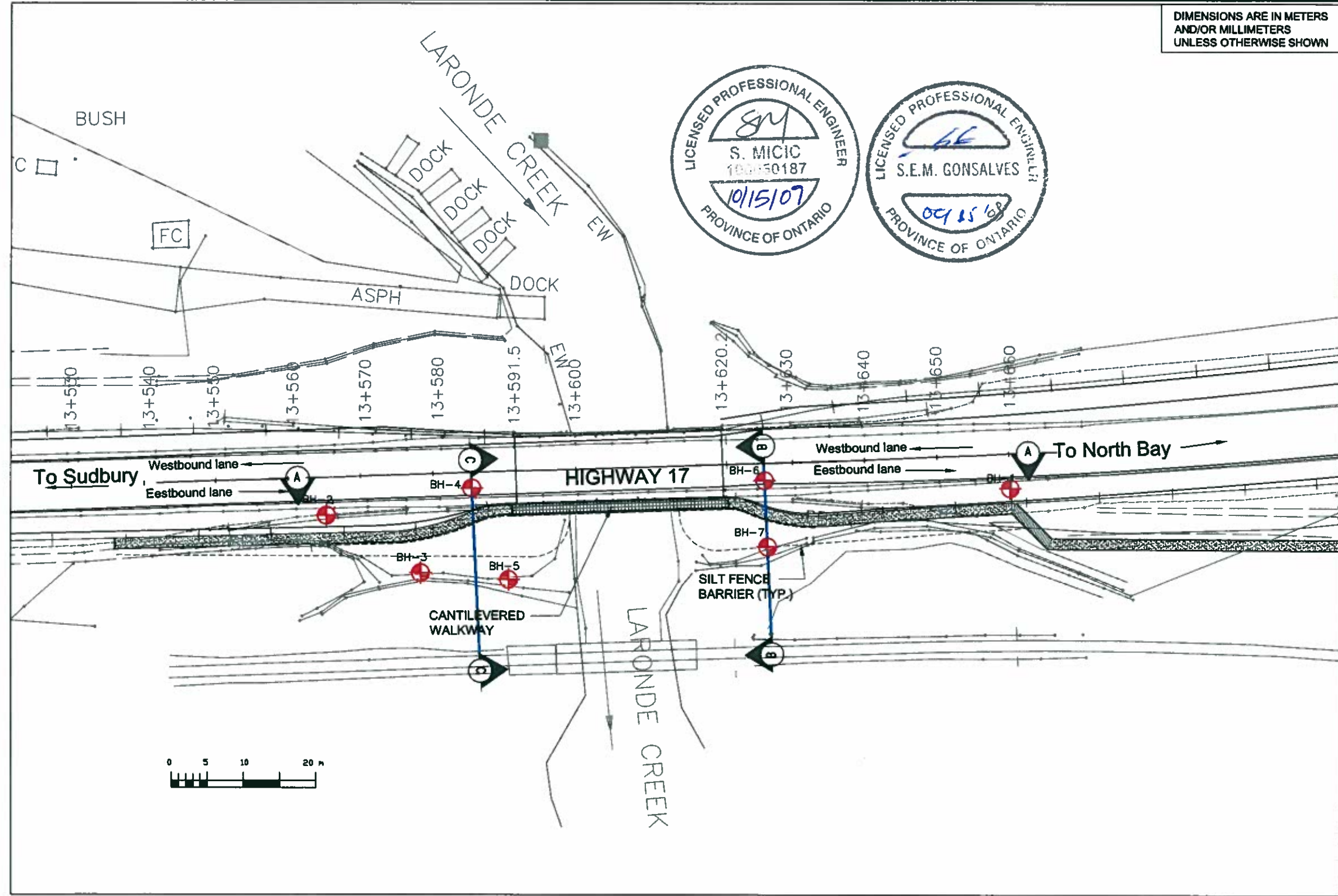
GWP

No. 5274-08-00

SITE PLAN AND
BOREHOLE LOCATIONS

N

SHEET
1



KEY MAP
Not to Scale

LEGEND

BOREHOLE

Water Level (Piezometer)

Water Level (Open hole)

| No. | ELEVATION | STATION | OFFSET |
|------|-----------|----------|--------|
| BH-1 | 202.183 | 13+659.9 | 4.9 |
| BH-2 | 201.872 | 13+565.0 | 5.3 |
| BH-3 | 198.224 | 13+577.7 | 13.8 |
| BH-4 | 201.799 | 13+585.3 | 2.2 |
| BH-5 | 196.842 | 13+590.0 | 15.2 |
| BH-6 | 201.824 | 13+625.9 | 2.2 |
| BH-7 | 199.429 | 13+625.9 | 11.7 |

| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
| | | | |
| | | | |
| | | | |

Trow Associates Inc.

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BRAMPTON, ONTARIO, L6V 4M8
(905) 796-3200

PROJECT TITLE AND LOCATION:

Gabion Wall Construction
near Laronde Creek
Hwy 17, Sudbury

DRAWING TITLE:

SITE PLAN AND
BOREHOLE LOCATIONS

PROJECT NO.

5274-08-00

DWN.: GQ

SCALE:

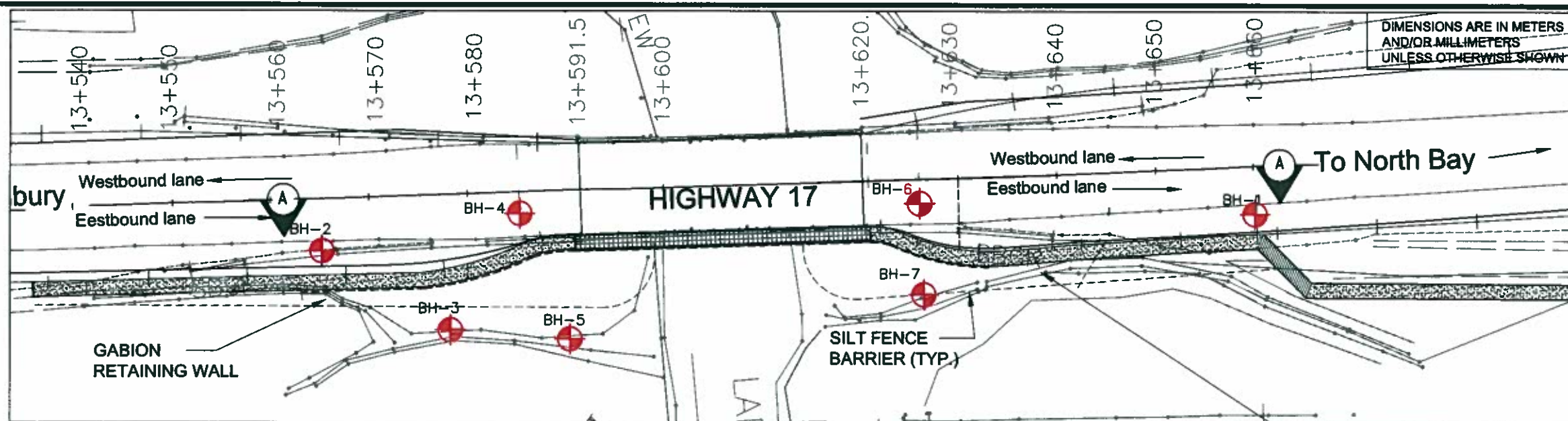
AS NOTED

CHKD.: SM

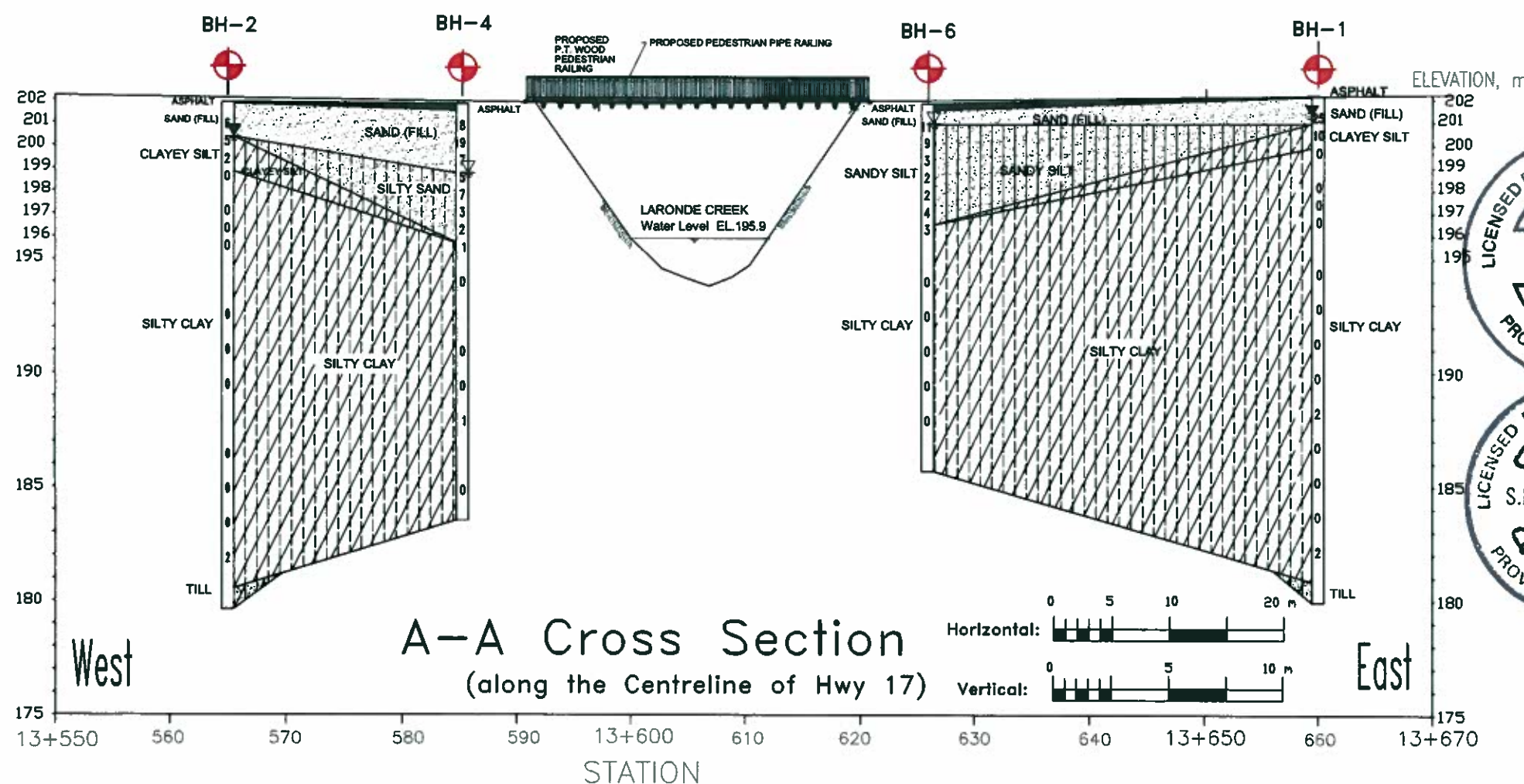
DATE:

Sept. 2009

DWG. No.: 1



KEY MAP
Not to Scale



LEGEND

- BOREHOLE
- Water Level (Piezometer)
- Water Level (Open hole)

| No. | ELEVATION | STATION | OFFSET |
|------|-----------|----------|--------|
| BH-1 | 202.183 | 13+659.9 | 4.9 |
| BH-2 | 201.872 | 13+565.0 | 5.3 |
| BH-3 | 198.224 | 13+577.7 | 13.8 |
| BH-4 | 201.799 | 13+585.3 | 2.2 |
| BH-5 | 196.842 | 13+590.0 | 15.2 |
| BH-6 | 201.824 | 13+625.9 | 2.2 |
| BH-7 | 199.429 | 13+625.9 | 11.7 |

NOTES

1. The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
2. This drawing to be read with subject report.
3. This drawing is for subsurface information only. Surface details and features are for conceptual illustration only.
4. Borehole locations are approximate.
5. Borehole elevations should not be used to design building(s), or floor slab(s), or parking lot(s) grades.
6. The elevation of the water level in the creek was measured by TROW on 11/Sept./2009



| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
| | | | |
| | | | |

SOIL STRATA SYMBOLS:

| | | |
|------------|-------------|------------|
| ASPHALT | SAND | SILTY CLAY |
| SILTY SAND | CLAYEY SILT | TILL |

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PROJECT TITLE AND LOCATION:
**Gabion Wall Construction
near Laronde Creek
Hwy 17, Sudbury**

DRAWING TITLE:
A-A CROSS-SECTION

| | |
|----------------------------------|----------------|
| PROJECT NO. 5274-08-00 | DWN.: GQ |
| SCALE: AS NOTED | CHKD.: SM |
| DATE: Sept. 2009 | DWG. No.: 2 |



DIMENSIONS ARE IN METERS
AND/OR MILLIMETERS
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GWP No. 5274-08-00

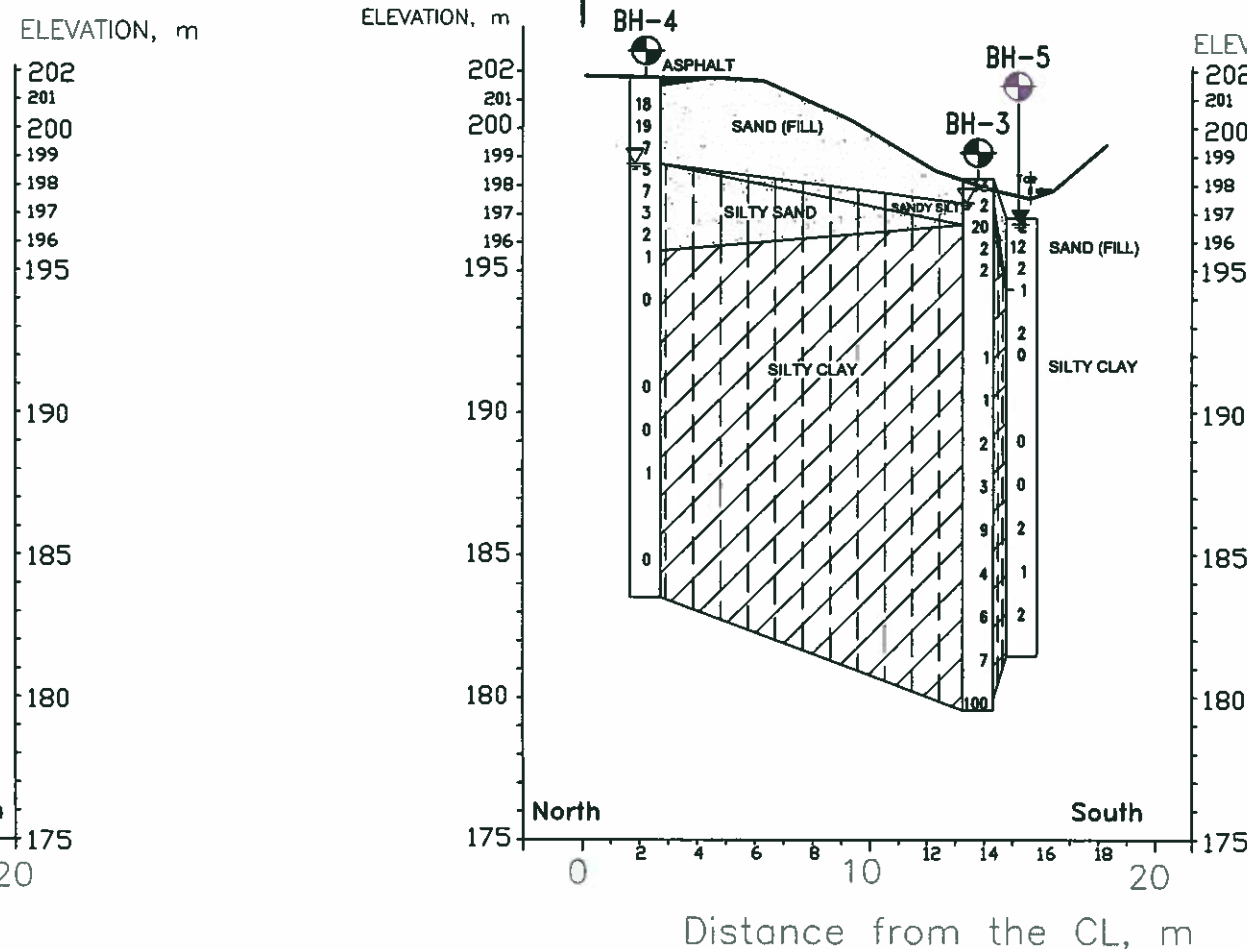
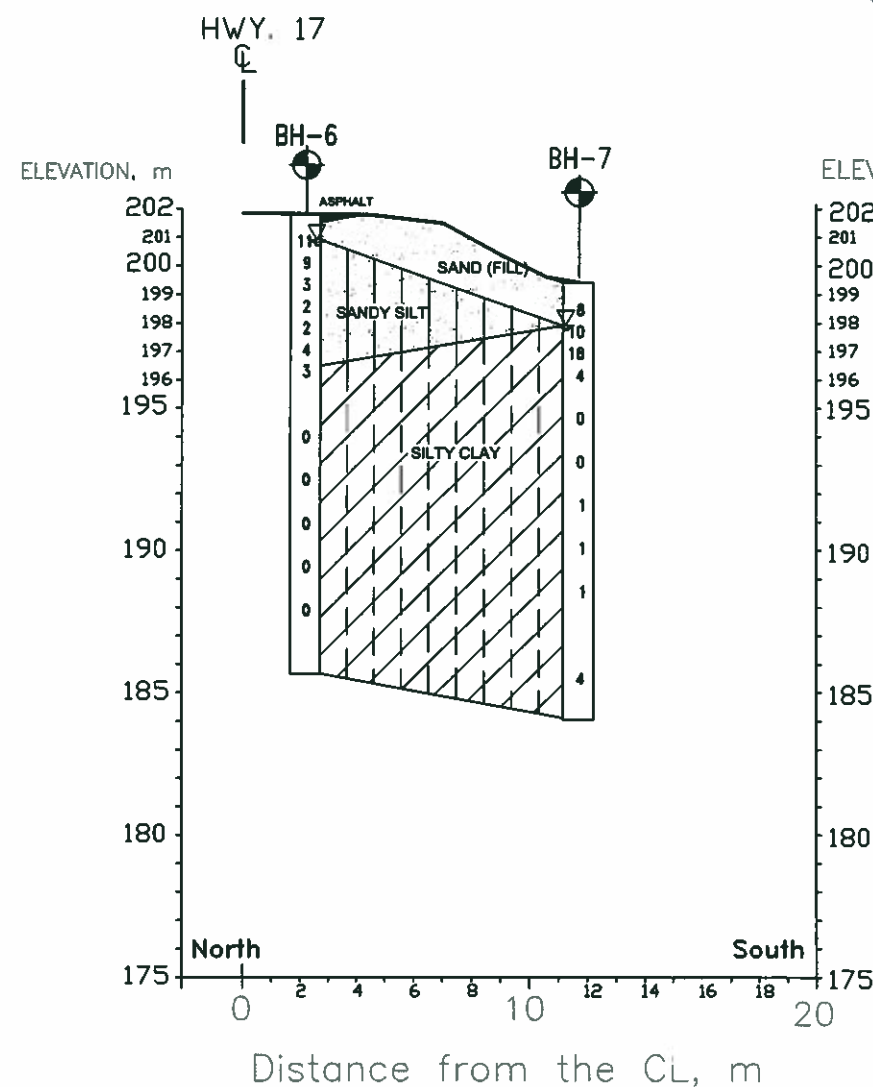


SHEET
3

Cross Section B-B
(at Station ~13+626)



Cross Section C-C
(at Station ~13+585)



KEY MAP
Not to Scale

LEGEND

- BOREHOLE
- Water Level (Piezometer)
- Water Level (Open hole)

| No. | ELEVATION | STATION | OFFSET |
|------|-----------|----------|--------|
| BH-1 | 202.183 | 13+659.9 | 4.9 |
| BH-2 | 201.872 | 13+565.0 | 5.3 |
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| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
| | | | |
| | | | |
| | | | |

SOIL STRATA SYMBOLS:

| | | |
|------------|-------------|------------|
| ASPHALT | SAND | SILTY CLAY |
| SILTY SAND | CLAYEY SILT | TILL |

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PROJECT TITLE AND LOCATION:
**Gabion Wall Construction
near Laronde Creek
Hwy 17, Sudbury**

DRAWING TITLE:
**CROSS-SECTIONS
B-B and C-C**

| | |
|----------------------------------|----------------|
| PROJECT NO. 5274-08-00 | DWN.: GQ |
| SCALE: AS NOTED | CHKD.: SM |
| DATE: Sept. 2009 | DWG. No.: 3 |

APPENDIX C : BOREHOLE LOGS

EXPLANATION OF TERMS USED IN REPORT

N-VALUE: THE STANDARD PENETRATION TEST (SPT) N-VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N-VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N-VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

| C_u (kPa) | 0 – 12 | 12 – 25 | 25 – 50 | 50 – 100 | 100 – 200 | >200 |
|-------------|-----------|---------|---------|----------|------------|------|
| | VERY SOFT | SOFT | FIRM | STIFF | VERY STIFF | HARD |

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 – 5 | 5 – 10 | 10 – 30 | 30 – 50 | >50 |
|----------------|------------|--------|---------|---------|------------|
| | VERY LOOSE | LOOSE | COMPACT | DENSE | VERY DENSE |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY IS:

| RQD (%) | 0 – 25 | 25 – 50 | 50 – 75 | 75 – 90 | 90 – 100 |
|---------|-----------|---------|---------|---------|-----------|
| | VERY POOR | POOR | FAIR | GOOD | EXCELLENT |

JOINT AND BEDDING:

| SPACING | 50mm | 50 – 300mm | 0.3m – 1m | 1m – 3m | >3m |
|----------|------------|------------|------------|---------|------------|
| JOINTING | VERY CLOSE | CLOSE | MOD. CLOSE | WIDE | VERY WIDE |
| BEDDING | VERY THIN | THIN | MEDIUM | THICK | VERY THICK |

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

| | | | |
|----|---------------------|----|---------------------------|
| SS | SPLIT SPOON | TP | THINWALL PISTON |
| WS | WASH SAMPLE | OS | OSTERBERG SAMPLE |
| ST | SLOTTED TUBE SAMPLE | RC | ROCK CORE |
| BS | BLOCK SAMPLE | PH | TW ADVANCED HYDRAULICALLY |
| CS | CHUNK SAMPLE | PM | TW ADVANCED MANUALLY |
| TW | THINWALL OPEN | FS | FOIL SAMPLE |

STRESS AND STRAIN

| | | |
|--------------------------------------|-----|-------------------------------|
| u_w | kPa | PORE WATER PRESSURE |
| r_u | 1 | PORE PRESSURE RATIO |
| σ | kPa | TOTAL NORMAL STRESS |
| σ' | kPa | EFFECTIVE NORMAL STRESS |
| τ | kPa | SHEAR STRESS |
| $\sigma_1, \sigma_2, \sigma_3$ | kPa | PRINCIPAL STRESSES |
| ϵ | % | LINEAR STRAIN |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | % | PRINCIPAL STRAINS |
| E | kPa | MODULUS OF LINEAR DEFORMATION |
| G | kPa | MODULUS OF SHEAR DEFORMATION |
| μ | 1 | COEFFICIENT OF FRICTION |

MECHANICAL PROPERTIES OF SOIL

| | | |
|----------------|-----------------------|--------------------------------------|
| m_v | kPa^{-1} | COEFFICIENT OF VOLUME CHANGE |
| C_c | 1 | COMPRESSION INDEX |
| C_s | 1 | SWELLING INDEX |
| C_a | 1 | RATE OF SECONDARY CONSOLIDATION |
| C_v | m^2/s | COEFFICIENT OF CONSOLIDATION |
| H | m | DRAINAGE PATH |
| T_v | 1 | TIME FACTOR |
| U | % | DEGREE OF CONSOLIDATION |
| σ'_{vo} | kPa | EFFECTIVE OVERBURDEN PRESSURE |
| σ'_p | kPa | PRECONSOLIDATION PRESSURE |
| τ_f | kPa | SHEAR STRENGTH |
| c' | kPa | EFFECTIVE COHESION INTERCEPT |
| ϕ' | ° | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| c_u | kPa | APPARENT COHESION INTERCEPT |
| ϕ_u | ° | APPARENT ANGLE OF INTERNAL FRICTION |
| τ_R | kPa | RESIDUAL SHEAR STRENGTH |
| τ_r | kPa | REMOULDED SHEAR STRENGTH |
| S_i | 1 | SENSITIVITY = c_u / τ_r |

PHYSICAL PROPERTIES OF SOIL

| | | | | | | | | |
|-----------------------|------------------------|--------------------------------|------------------|------|---------------------------------------|------------------|------------------------|--|
| P_s | kg/m^3 | DENSITY OF SOLID PARTICLES | e | 1, % | VOID RATIO | e_{min} | 1, % | VOID RATIO IN DENSEST STATE |
| γ_s | kN/m^3 | UNIT WEIGHT OF SOLID PARTICLES | n | 1, % | POROSITY | I_D | 1 | DENSITY INDEX = $\frac{e_{\text{max}} - e}{e_{\text{max}} - e_{\text{min}}}$ |
| P_w | kg/m^3 | DENSITY OF WATER | w | 1, % | WATER CONTENT | D | mm | GRAIN DIAMETER |
| γ_w | kN/m^3 | UNIT WEIGHT OF WATER | S_r | % | DEGREE OF SATURATION | D_n | mm | N PERCENT – DIAMETER |
| P | kg/m^3 | DENSITY OF SOIL | w_L | % | LIQUID LIMIT | C_u | 1 | UNIFORMITY COEFFICIENT |
| γ' | kN/m^3 | UNIT WEIGHT OF SOIL | w_p | % | PLASTIC LIMIT | h | m | HYDRAULIC HEAD OR POTENTIAL |
| P_d | kg/m^3 | DENSITY OF DRY SOIL | w_s | % | SHRINKAGE LIMIT | q | m^3/s | RATE OF DISCHARGE |
| γ_d | kN/m^3 | UNIT WEIGHT OF DRY SOIL | I_p | % | PLASTICITY INDEX = $(w_L - w_p)$ | v | m/s | DISCHARGE VELOCITY |
| P_{sat} | kg/m^3 | DENSITY OF SATURATED SOIL | I_L | 1 | LIQUIDITY INDEX = $(w - w_p) / I_p$ | i | 1 | HYDRAULIC GRADIENT |
| γ_{sat} | kN/m^3 | UNIT WEIGHT OF SATURATED SOIL | I_C | 1 | CONSISTENCY INDEX = $(w_L - w) / I_p$ | k | m/s | HYDRAULIC CONDUCTIVITY |
| P' | kg/m^3 | DENSITY OF SUBMERGED SOIL | e_{max} | 1, % | VOID RATIO IN LOOSEST STATE | j | kN/m^2 | SEEPAGE FORCE |
| γ' | kN/m^3 | UNIT WEIGHT OF SUBMERGED SOIL | | | | | | |

RECORD OF BOREHOLE No BH-1

1 OF 2

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
DIST 54 HWY 17 BOREHOLE TYPE CME 200mm OI Hollow Stem Auger COMPILED BY KR
DATUM Geodetic DATE 09.9.3 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | |
|---------------|--|------------|---------|------|------------|----------------------------|--------------------|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---|---|-------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | WATER CONTENT (%) | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | | | | | | | | | | |
| | | | | | | | | 20 40 60 80 100 | | | | | | | | | | |
| 202.2 | | | | | | | 202 | | | | | | | | 64 30 (6) | | | |
| 202.0 | ASPHALT, (~ 50 mm) | | 1 | AS | | | | | | | | | | | | | | |
| 201.0 | SAND (FILL) (SW), brown, damp, well graded, compact, fine to coarse grained, some gravel, trace to some silt. | | 2 | SS | 25 | | | | | | | | | | | | | |
| 1.2 | Clayey SILT (ML), grey, damp to wet, compact, poorly graded, some fine grained sand. | | 3 | SS | 10 | | | | | | | | | | | | | |
| 199.9 | | | 4 | SS | 0 | | | | | | | | | | | | | |
| 2.3 | SILTY CLAY (CL), grey, saturated, low plasticity, soft to stiff. | | 5 | TW | | | | | | | | | | | | | | |
| | | | 6 | SS | 0 | | | | | | | | | | | | | |
| | | | 7 | SS | 0 | | | | | | | | | | | | | |
| | | | 8 | SS | 0 | | | | | | | | | | | | | |
| | | | 9 | TW | | | | | | | | | | | | | | |
| | | | 10 | SS | 0 | | | | | | | | | | | | | |
| | varved below ~ 7.62 m depth. | | 11 | SS | 0 | | | | | | | | | | | | | |
| | | | 12 | SS | 0 | | | | | | | | | | | | | |
| | | | 13 | SS | 0 | | | | | | | | | | | | | |
| | | | 14 | SS | 2 | | | | | | | | | | | | | |
| | brown/grey below ~ 13.72 m depth. | | 15 | SS | 0 | | | | | | | | | | | | | |
| | | | 16 | SS | 0 | | | | | | | | | | | | | |
| | with silt seems below ~ 15.24 m depth. | | 17 | SS | 0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | no silt seems below ~ 16.76 m depth. | | | | | | | | | | | | | | | | | |
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Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ON_MOT_SO11878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT_GDT 09/10/21

METRIC

| SOIL PROFILE | | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | |
|--|---|------------|--------|---------|------------|--------------------|-------------------------|-----------------|--|-------------------|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|----|----|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | SHEAR STRENGTH kPa | | | | WATER CONTENT (%) | | | | | | | | | |
| | | | | | | 20 | | | 40 | 60 | 80 | 100 | | | | | | 20 | 40 |
| 180.8 | trace to some fine grained sand below ~ 19.81 m depth. | | 18 | SS | 2 | | | | | | | | | | | | | | |
| 21.3 | SILTY SAND TILL , grey, wet, compact, poorly graded, trace to some gravel. | | 19 | BAG | | | | | | | | | | | | | | | |
| 179.9 | | | | | | | | | | | | | | | | | | | |
| 22.3 | BOREHOLE TERMINATED AT ~ 22.25 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK | | | | | | | | | | | | | | | | | | |
| NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Date of W.L.=Sept. 11, 2009. 4. Installed monitoring well to 12.2 m depth. | | | | | | | | | | | | | | | | | | | |





+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-2

1 OF 2

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
 DIST 54 HWY 17 BOREHOLE TYPE CME 200mm OI Hollow Stem Auger COMPILED BY KR
 DATUM Geodetic DATE 09.9.4 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | |
|---------------|--|--|---------|------|------------|---|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | WATER CONTENT (%) | |
| 201.9 | ASPHALT, (~ 50 mm) SAND (FILL) (SW), brown, damp, loose, well graded, fine to coarse grained, some fine to coarse gravel, trace silt. - some silt below 0.8 m |  | 1 | AS | |  | 201 | | | | | | | (Gs=2,726) 0 1 52 47 | | |
| 200.4 | | | 2 | SS | 6 | | 200 | | | | | | | | | |
| 1.5 | CLAYEY SILT (ML), grey, wet, very loose to loose, trace sand, trace to some clay. very loose below ~ 2.29 m depth. |  | 3 | SS | 5 | | 199 | | | | | | | | (Gs=2,721) 0 2 25 73 | |
| | | | 4 | SS | 2 | | 198 | | | | | | | | | |
| 198.8 | SILTY CLAY (CI), grey, saturated, medium plasticity, firm to stiff. |  | 5 | SS | 0 | | 197 | | | | | | | | | |
| 3.1 | | | 6 | TW | | | 196 | | | | | | | | | |
| | | | 7 | SS | 0 | | 195 | | | | | | | | | |
| | | | 8 | SS | 0 | | 194 | | | | | | | | | |
| | | | 9 | SS | 0 | | 193 | | | | | | | | | |
| | | | 10 | TW | | | 192 | | | | | | | | | |
| | | | 11 | SS | 0 | | 191 | | | | | | | | | |
| | | | 12 | SS | 0 | | 190 | | | | | | | | | |
| | | | 13 | SS | 0 | | 189 | | | | | | | | | |
| | | | 14 | TW | | | 188 | | | | | | | | | |
| | | | 15 | SS | 0 | | 187 | | | | | | | | | |
| | | | 16 | SS | 0 | | 186 | | | | | | | | | |
| | | | 17 | SS | 0 | | 185 | | | | | | | | | |
| | | | | | | 184 | | | | | | | | | | |
| | | | | | | 183 | | | | | | | | | | |
| | | | | 182 | | | | | | | | | | | | |

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ON_MOT_SO11878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT.GDT 09/10/21

RECORD OF BOREHOLE No BH-2

2 OF 2

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
 DIST 54 HWY 17 BOREHOLE TYPE CME 200mm OI Hollow Stem Auger COMPILED BY KR
 DATUM Geodetic DATE 09.9.4 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | | |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|---|------------|------------------|---|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | | WATER CONTENT (%) | | |
| | | | | | | | | ○ UNCONFINED | + | FIELD VANE | ● QUICK TRIAXIAL | × | | | | | | LAB VANE | | |
| | | | 18 | SS | 2 | | | | | | | | | | | | | | | |
| 180.5 | | | | | | | | | | | | | | | | | | | | |
| 21.3 | HARD AUGERING, suspected sand and gravel till. | | 19 | BAG | | | | | | | | | | | | | | | | |
| 179.6 | | | | | | | | | | | | | | | | | | | | |
| 22.3 | BOREHOLE TERMINATED AT ~ 22.25 m DEPTH DUE TO AUGER REFUSAL ON SUSPECTED BEDROCK | | | | | | | | | | | | | | | | | | | |
| | NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Date of W.L.=Sept. 11, 2009. 4. Installed monitoring well to 12.2 m depth. | | | | | | | | | | | | | | | | | | | |

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-3

1 OF 1

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
 DIST 54 HWY 17 BOREHOLE TYPE Hollow Stem Auger (Wash Boring) COMPILED BY KR
 DATUM Geodetic DATE 09.9.8 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | |
|---------------|---------------------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----------------------------|--|---|---------------------------------------|--|--|-------------------|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | WATER CONTENT (%) | |
| | | | | | | | | ○ UNCONFINED ● QUICK TRIAXIAL | + FIELD VANE × LAB VANE | | | | | | | |
| 198.2 | | | | | | | 20 40 60 80 100 | 20 40 60 80 100 | 10 20 30 | | | | | | | |
| 0.0 | TOPSOIL (~76mm) over | | 1 | SS | 13 | ▽ | 198 | | | | | | | | | |
| 197.4 | SAND (FILL) (SW), brown, damp, | | 2 | SS | 2 | | 197 | | | | | | | | | |
| 0.8 | compact, poorly graded, fine to | | | | | | | | | | | | | | | |
| 196.6 | coarse grained, some silt, trace to | | 3 | SS | 20 | | 196 | | | | | | | | | |
| 1.6 | SANDY SILT (SM), grey, wet, very | | 4 | SS | 2 | | 195 | | | | | | | | | |
| | loose, some gravel. | | 5 | SS | 2 | | 194 | 5.3 | | | | | | | | |
| | SILTY CLAY (CI-MI), brown, | | 6 | TW | | | 193 | 5.3 | | | | | | | | |
| | saturated, medium plasticity, soft to | | 7 | SS | 1 | | 192 | 5.3 | | | | | | | | |
| | stiff. | | 8 | SS | 1 | | 191 | 5.3 | | | | | | | | |
| | grey below ~ 3.05 m depth. | | 9 | SS | 2 | | 190 | 2.7 | | | | | | | | |
| | | | 10 | SS | 3 | | 189 | | | | | | | | | |
| | | | 11 | SS | 9 | | 188 | 2.8 | | | | | | | | |
| | | | 12 | SS | 4 | | 187 | 4.0 | | | | | | | | |
| | | | 13 | SS | 6 | | 186 | | | | | | | | | |
| | | | 14 | SS | 7 | | 185 | | | | | | | | | |
| | | | 15 | SS | 100 | | 184 | | | | | | | | | |
| 179.6 | BOREHOLE TERMINATED AT | | | | | | 183 | | | | | | | | | |
| 18.7 | ~ 18.67 m DEPTH DUE TO SPT | | | | | | 182 | | | | | | | | | |
| | REFUSAL ON SUSPECTED | | | | | | 181 | | | | | | | | | |
| | BEDROCK | | | | | | 180 | | | | | | | | | |

+³, X³: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ON_MOT_S011878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT_GDT 09/10/21

RECORD OF BOREHOLE No BH-4

1 OF 2

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
 DIST 54 HWY 17 BOREHOLE TYPE CME 200mm OI Hollow Stem Auger COMPILED BY KR
 DATUM Geodetic DATE 09.9.9 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|--------------|------------------------------------|-------------------------------------|-----------------------------------|--|---|-------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | WATER CONTENT (%) |
| | | | | | | | | ○ UNCONFINED | + FIELD VANE | | | | | | |
| 201.8 | | | | | | | 20 40 60 80 100 | | | | | | | | |
| 200.9 | ASPHALT, (~ 300 mm) | | | | | | 20 40 60 80 100 | | | | | | | | |
| 0.3 | SAND (FILL) (SW), brown, damp, loose to compact, poorly graded, fine grained, trace to some silt, trace gravel. with silt below ~ 0.76 m depth. HARD AUGERING | | 1 | AS | | | | | | ○ | | | | | |
| | | | 2 | SS | 18 | | | | | ○ | | | | | |
| | | | 3 | SS | 19 | | | | | ○ | | | | | |
| | No Sample Recovery | | 4 | SS | 7 | | | | | | | | | | |
| 198.7 | SILTY SAND(SM), brown, damp to wet, loose, trace clay. | | 5 | SS | 5 | | | | | | ○ | | | | |
| 3.1 | | | 6 | SS | 7 | | | | | | ○ | | | | |
| | brown to grey, very loose below ~ 4.57 m depth. | | 7 | SS | 3 | | | | | | ○ | | | | |
| | brown, wet, fine to medium grained, trace organics below ~ 5.33 m depth. | | 8 | SS | 2 | | | | | | ○ | | | | |
| 195.7 | SILTY CLAY (CL), grey, saturated, firm to stiff, low plasticity | | 9 | SS | 1 | | | | | | | | 43.8 | | |
| 6.1 | | | | | | | | | | | | | | | |
| | | | 10 | SS | 0 | | | 2.0 | | | | | 67.2 | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 4.5 | | | | | | | |
| | | | 11 | TW | | | | | | | | | 47.6 | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 3.6 | | | | | | | |
| | | | 12 | SS | 0 | | | | | | | | 48.5 | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 3.5 | | | | | | | |
| | varved below ~ 12.19 m depth. | | 13 | SS | 0 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 3.5 | | | | | | | |
| | | | 14 | SS | 1 | | | | | | | | 48.8 | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 15 | TW | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 2.9 | | | | | | | |
| | | | | | | | | | | | | | | | |
| | brown/grey, with silt seems below ~ 16.76 m depth. | | 16 | SS | 0 | | | | | | | | 57.6 | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | 2.9 | | | | | | | |
| 183.5 | | | | | | | | | | | | | | | |
| 18.3 | BOREHOLE TERMINATED AT ~ 18.28 m DEPTH | | | | | | | | | | | | | | |
| | NOTES: 1. This drawing is to be read with the subject report and project number as presented above. | | | | | | | | | | | | | | |

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ON_MOT_S011878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT_GDT 09/10/21

2 OF 2

METRIC

| ELEV. DEPTH | SOIL PROFILE | | SAMPLES | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | |
|----------------|--------------|-------------|---------|------|----------------------------|-----------------|---|--------------------|---|----------------|----|---|---|----------------|
| | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | | "N" VALUES | 20 40 60 80 100 | | W _P | W | | | W _L |
| | | | | | | | | SHEAR STRENGTH kPa | | | | | | |
| | | | | | | | ○ UNCONFINED | + FIELD VANE | | | | | | |
| | | | | | | | ● QUICK TRIAXIAL | × LAB VANE | | | | | | |
| | | | | | | | 20 40 60 80 100 | | | | | | | |
| | | | | | | | | | WATER CONTENT (%) | | | | | |
| | | | | | | | | | 10 | 20 | 30 | | | |

2. Interpretation assistance by Trow is required before use by others.
3. Date of W.L.=Sept. 11, 2009.
4. Installed PVC standpipes to 12.2 m depth.

+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-5

1 OF 1

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY GQ
 DIST 54 HWY 17 BOREHOLE TYPE Hollow Stem Auger (Wash Boring) COMPILED BY GQ
 DATUM Geodetic DATE 09.9.9 CHECKED BY VD

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | |
|---------------|-------------|--|---------|------|------------|----------------------------|-----------------|---|----|------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|----|-----|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | |
| | | | | | | | | 20 | 40 | 60 | | | | | | 80 | 100 |
| | | | | | | | | ○ UNCONFINED | + | FIELD VANE | | | | | | | |
| | | | | | | ● QUICK TRIAXIAL | × | LAB VANE | | | | WATER CONTENT (%) | | | | | |
| 196.8 | 0.0 | TOPSOIL, (~ 15 mm) over SAND (FILL) (SW) , some silt, trace rootlets and wood deris. brown, damp to wet, very loose to compact, fine grained. - a thin (0.15 m) layer of silty clay at a depth of about 0.9 m - become wet below 1.05 m | | 1 | SS | 2 | | | | | | | | | | | |
| | | | | 2 | SS | 12 | | | | | | | | | | | |
| | | | | 3 | SS | 2 | | | | | | | | | | | |
| 194.4 | 2.5 | SILTY CLAY (CL) , varved, grey, saturated, soft to stiff, low plasticity | | 4 | SS | 1 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 5 | SS | 2 | | | | | | | | | | | |
| | | | | 6 | SS | 0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 7 | TW | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 8 | SS | 0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 9 | SS | 0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 10 | SS | 2 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 11 | SS | 1 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | 12 | SS | 2 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| 181.5 | 15.4 | BOREHOLE TERMINATED AT ~ 15.4 m DEPTH | | | | | | | | | | | | | | | |
| | | NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Date of W.L.=Sept. 11, 2009. 4. Installed monitoring well to 11.2 m depth. | | | | | | | | | | | | | | | |

ON_MOT_SO11878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT.GDT 09/10/21

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-6

1 OF 1

METRIC

W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY CS
 DIST 54 HWY 17 BOREHOLE TYPE CME 200mm OI Hollow Stem Auger COMPILED BY KR
 DATUM Geodetic DATE 09.9.10 CHECKED BY IM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT w _p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | |
|---|---|------------|---------|------|------------|----------------------------|-----------------|---|-------------------|------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | |
| | | | | | | | | ○ UNCONFINED | + | FIELD VANE | | | | | | | |
| | | | | | | ● QUICK TRIAXIAL | × | LAB VANE | WATER CONTENT (%) | | | | | | | | |
| | | | | | | 20 | 40 | 60 | 80 | 100 | 10 | 20 | 30 | | | | |
| 201.8 | | | | | | | | | | | | | | | | | |
| 200.9 | ASPHALT, (~ 300 mm) | | | | | | | | | | | | | | | | |
| 0.3 | SAND (FILL) (SW), brown, damp, fine to coarse grained, trace fine grained gravel, some silt. SANDY SILT(SM), brown, wet, very loose to compact, trace fine to coarse grained gravel. very loose below ~ 2.57 m depth. trace clay below ~ 3.05 m depth. clayey below ~ 4.57 m depth. | | 1 | AS | | | | | | | | | | | | | |
| 200.9 | | | 2 | SS | 11 | | | | | | | | | | | | |
| 0.9 | | | 3 | SS | 9 | | | | | | | | | | | | |
| | | | 4 | SS | 3 | | | | | | | | | | | | |
| | | | 5 | SS | 2 | | | | | | | | | | | | |
| | | | 6 | SS | 2 | | | | | | | | | | | | |
| | | | 7 | SS | 4 | | | | | | | | | | | | |
| 196.5 | SILTY CLAY (CL), grey, saturated, low plasticity, firm to stiff | | 8 | SS | 3 | | | | | | | | | | | | |
| 5.3 | | | 9 | TW | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | 10 | SS | 0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | 11 | SS | 0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | 12 | SS | 0 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | 13 | SS | 0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | 14 | SS | 0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | 15 | TW | | | | | | | | | | | | | | |
| 185.7 | BOREHOLE TERMINATED AT ~ 16.15 m DEPTH | | | | | | | | | | | | | | | | |
| 16.2 | | | | | | | | | | | | | | | | | |
| NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Date of W.L.=Sept. 11, 2009. 4. Installed PVC standpipes to 12.2 m depth. | | | | | | | | | | | | | | | | | |

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

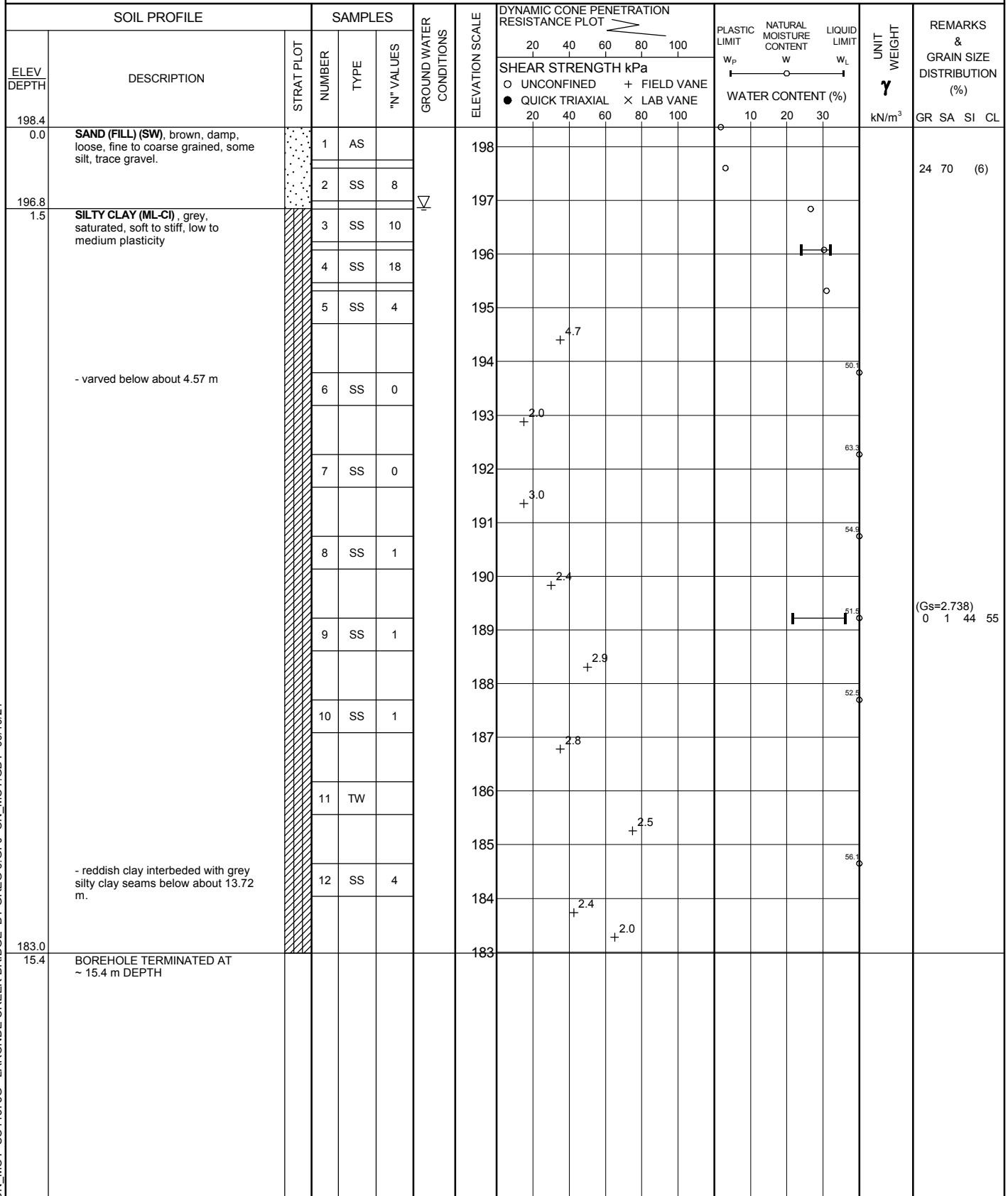
ON_MOT_SO11878G - LARONDE CREEK BRIDGE BY GREG & GPJ ON_MOT.GDT 09/10/21

RECORD OF BOREHOLE No BH-7

1 OF 1

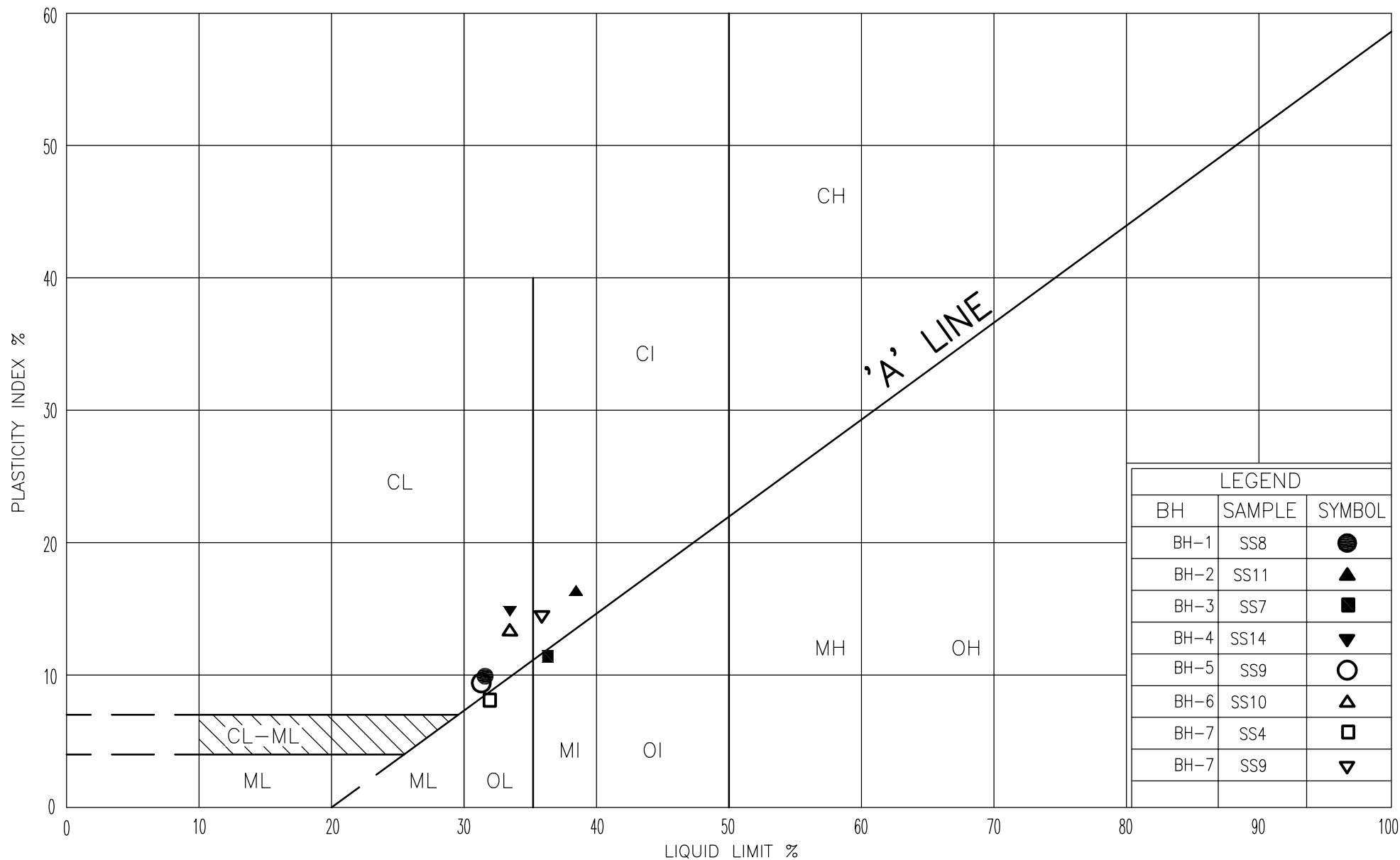
METRIC

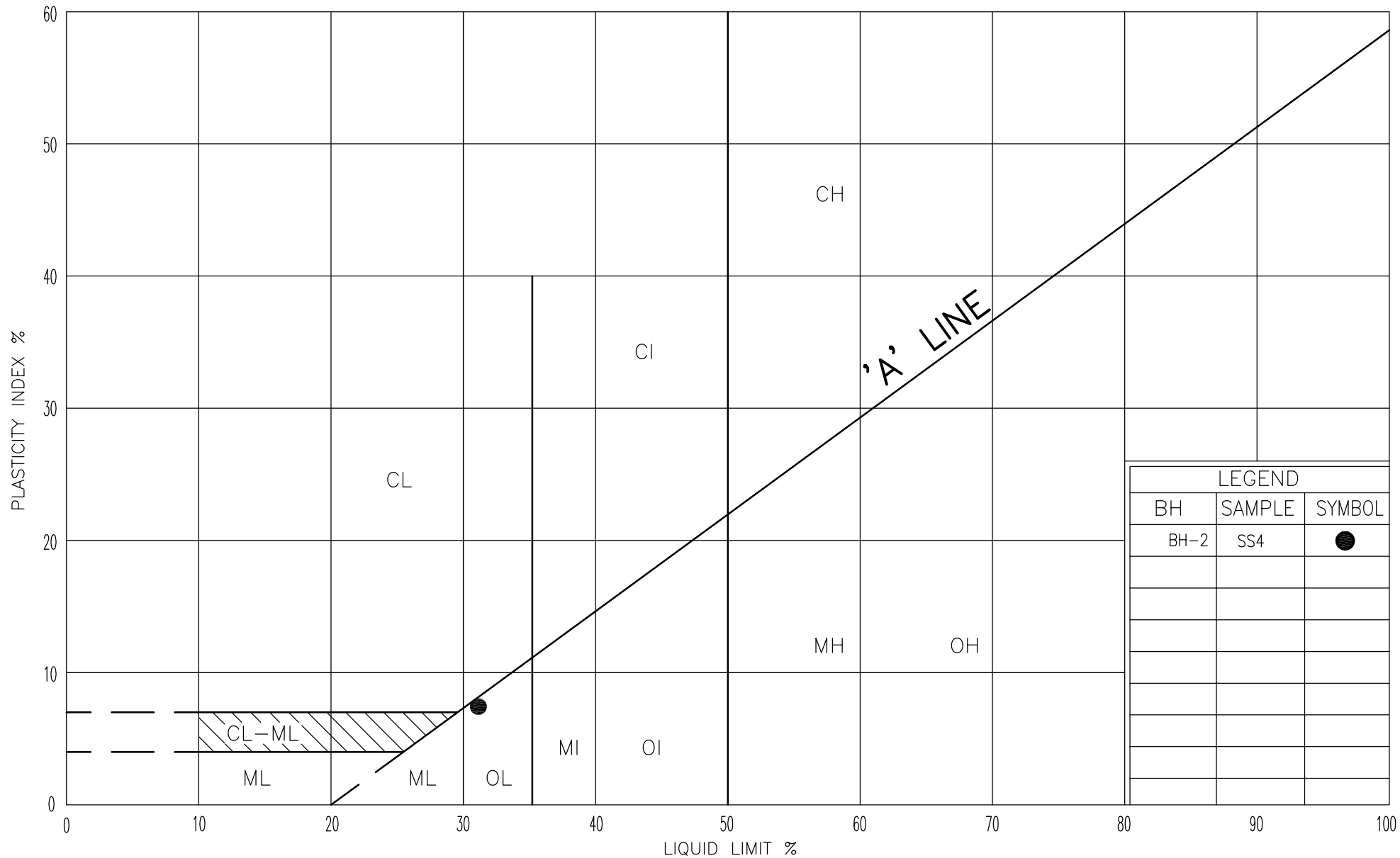
W.P. 5274-08-00 LOCATION Laronde Creek, Nipissing Indian Reserve No. 10 ORIGINATED BY GQ
 DIST 54 HWY 17 BOREHOLE TYPE Hollow Stem Auger (Wash Boring) COMPILED BY GQ
 DATUM Geodetic DATE 09.9.10 CHECKED BY VD



+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Appendix D: LABORATORY DATA





PLASTICITY CHART SILT, (ML)

FIGURE No. 2

WO: 5274-08-00

Gabion Wall Construction, Hwy 17 Sudbury

