

**Foundation Investigation Report  
Left Turning Lane, Lake Huron Drive  
Desbarats River Culvert Replacement  
and Proposed Retaining Walls  
Desbarats, ON  
G.W.P. 6013-03-00  
Geocres No. 41J-70**

**Prepared for:**

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Project No S09737G  
July 20, 2005

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## Part 1 Foundation Investigation

### 1.1 Introduction

This submission presents the results of a geotechnical investigation completed by Trow Associates Inc. (Trow) for the proposed eastbound left turn lane and runout lane along Highway 17 at Lake Huron Drive along with culvert replacements and proposed retaining walls at the Desbarats River on Highway 17 and Lake Huron Drive south, located within Johnson Township. Photographs are included in Appendix D.

The purpose of this geotechnical investigation was to determine the existing soil conditions within the proposed construction limits by field investigation and laboratory testing.

### 1.2 Site Description and Geological Setting

#### 1.2.1 Site Description

The proposed left hand turn lane, runout lane and culvert replacements are located in the town of Desbarats between approximately Stations 13+000 and 13+410 along Highway 17. The left hand turn lane and runout lane is proposed for Lake Huron Drive and the culvert replacements along with the proposed retaining walls located at the Desbarats River on Highway 17 and Lake Huron Drive south.

The overall terrain in the area is moderately undulating consisting of rock outcrops of Cobalt bedrock separated by intervening marshy zones and wooded areas.

#### 1.2.2 Geological Setting

According to the Ontario Geological Survey (OGS) Maps 2544 and 2556, the site is located in what is known as the Huronian Supergroup, specifically the Cobalt subgroup. As previously noted, the topography in the area is undulating consisting of bedrock outcrops. As such, the surface soils in the area consist of intervening shallow organic deposits (peat), with glaciolacustrine and till deposits consisting of gravel, sand, silt and clay.

### 1.3 Investigative Procedures

#### 1.3.1 General

The fieldwork for this project was carried out from June 18<sup>th</sup> to June 28<sup>th</sup>, 2004, April 12<sup>th</sup> to April 18<sup>th</sup> and May 5<sup>th</sup> 2005. A total of 21 boreholes were advanced.

The June 18<sup>th</sup> to June 28<sup>th</sup>, 2004 investigation consisted of 15 boreholes (BH-4 to BH-18), boreholes BH-1, BH-2 and BH-3 were conducted for the Anderson Creek Culvert Rehabilitation, and are included in a separate report. Eleven boreholes (BH-5 to BH-15) were advanced on the south side of Highway 17. These boreholes were advanced to profile the existing soil conditions for the:

- Proposed Highway widening to the south
- Proposed Gabion Basket retaining wall
- Existing Twin Corrugated Steel Pipes (CSP) outlet in Desbarats River through Highway 17 (BH-8)

The remaining 4 boreholes were advanced for the culvert investigation, one of which, was located at the inlet of the existing twin CSP culverts in Desbarats River through Highway 17 (BH-4) and 3 of which were advanced at the inlet, outlet and centre line for the existing single and twin CSP culverts through Lake Huron Drive south (BH-16 to BH-18). The boreholes were advanced to power auger refusal and/or terminated between 0.0 m (bedrock was observed at ground surface at the BH-5 location) and 6.7 m.

The April 12<sup>th</sup> to April 18<sup>th</sup>, 2005 and the May 5<sup>th</sup>, 2005 investigation consisted of 6 boreholes (BH-1B to BH-6B). Boreholes BH-1B and BH-2B were advanced on the north shoulder along Highway 17 at Stations 13+325 and Station 13+375, to determine the existing embankment construction. Borehole BH-3B was advanced at the proposed inlet location of the new culvert. Boreholes BH-4B, BH-5B and BH-6B were advanced 1 m north of the centreline of Highway 17 for the proposed roadway protection between Stations 13+308 to 13+323. The boreholes were advanced to refusal between 5.2 m and 10.4 m below existing grade.

All boreholes were advanced using a Mobile B-57 track mounted drill rig equipped with continuous flight hollow stem augers and standard soil sampling equipment.

From the drilling program, soil samples were obtained using a 51 mm (2 inch) outside diameter split spoon sampler in conjunction with Standard Penetration Tests (ASTM D 1586), at 0.75 m intervals for the upper 3.0 m and at 1.5 m intervals thereafter. The Standard Penetration Test “N” values were recorded and used to provide an assessment of the in-situ relative density of the overburden soils. Laboratory shear vanes were performed on the clay and silty clay samples to estimate the undrained shear strength.

All fieldwork was supervised by a member of Trow’s engineering staff who directed the drilling and sampling operations, logged the factual borehole data, and retrieved soil samples for subsequent laboratory testing and identification. All borehole elevations were determined in the field by Trow. The borehole elevations were established from a temporary geodetic benchmark, located approximately 23 m north of the centre line of Highway 17 at Station 13+148 (southwest bolt of light standard with elevation 178.651 m).

The locations of the boreholes and the elevations are shown on Drawing 1 in Appendix A. Conventional rock coring was not required by the Ministry.

In addition to the boreholes drilled by Trow, a total of four (4) boreholes (BH-2, BH-3, BH-7 and BH-9) performed by Geocon in February 1965 (W.P. No. 904-64) were utilized along with test pits performed in August 1995 (W.P. No. 264-90-00). The boreholes and test pit locations are shown on Drawing 1 in Appendix A, with the summary logs included in Appendix B.

## **1.4 Laboratory**

The soil samples obtained in the field were examined in the laboratory for further verification and classification. A laboratory testing program for the selected soil samples consisted of Natural Moisture Content Determination (LS 701), Particle Size Analyses (LS 702), Atterberg Limits (LS 703 and LS 704).

The laboratory test results are summarized on the attached borehole logs in Appendix B, as well as in Appendix C.

## **1.5 Subsurface Conditions**

### **1.5.1 General**

The subsurface conditions encountered during the field investigation at the sites are summarized on the borehole logs in Appendix B. The following is a description of the subsurface conditions encountered during the field investigation.

### **1.5.2 Stratigraphy South Side Highway 17**

The stratigraphy for the south side of Highway 17 is interpreted from all boreholes located on the south side of Highway 17 (BH-5 to BH-15) including the drilling for the proposed Gabion Basket retaining wall and the south end of the twin CSP culvert through Highway 17.

In general, the stratigraphy within the boreholes consisted of sand fill, sand and gravel fill, and sand and boulder fill, overlying interlayered sand, silty sand, silty clay and clayey silt.

The fill material (i.e. sand, sand and gravel and sand and boulders) was approximately 0.6 to 1.5 m thick, brown in colour, dry to damp, loose to very dense, poor to well graded fine to coarse grained and contained trace to some silt with cobbles. Uncorrected “N” values from SPT tests within the fill material ranged from 8 to 56 blows per 300 mm. The sand and silty sand was brown to grey in colour, damp to wet, very loose to compact, poor to well graded, fine to medium grained and contained trace to some clay and gravel. Uncorrected “N” values from SPT tests within the sand range from 4 to 18 blows per 300 mm. The silty clay was grey in colour, moist to wet, very soft to firm, low to medium

plasticity and contained trace to some sand and trace organics and gravel. Undrained shear strengths within the silty clay ranged from 12 to 60 kPa. A 0.7 m thick layer of clayey silt was encountered in borehole BH-13 from Elevation 176.1 m to 175.4 m. The clayey silt was grey in colour, damp, loose and was of low plasticity. Uncorrected “N” values from one SPT test performed on the clayey silt were 8 blows per 300 mm. The boreholes were advanced to power auger refusal and/or terminated between 0.0 and 6.7 m below existing grade or Elevations 178.3 and 171.6.

### **1.5.3 Stratigraphy Twin CSP Culverts Through Highway 17**

In general, the stratigraphy as determined from boreholes BH-4 and BH-8 consisted of a thin layer of topsoil overlying sand and boulder fill and sand and silty sand.

A 125 mm thick layer of topsoil was encountered in borehole BH-4. Underlying the topsoil in borehole BH-4 and from the ground surface in borehole BH-8 was a 0.8 to 1.4 m thick layer of sand and boulder fill. The sand and boulder fill was brown in colour, damp, loose, poorly graded, with gravel and cobbles. Underlying the sand and boulder fill in borehole BH-4 was a 0.6 m thick layer of silty sand overlying suspected bedrock. The silty sand was brown to grey in colour, damp, very loose, poorly graded and contained some gravel and clay with trace organics. Uncorrected “N” values from Standard Penetration Tests (SPT tests) within the silty sand were 3 blows per 300 mm. Underlying the sand and boulder fill in borehole BH-8 was a 1.5 m thick layer of sand fill. The sand fill was brown in colour, damp, compact, well graded, fine to medium grained and contained some gravel and trace silt. Uncorrected “N” values from SPT tests within the sand fill were 10 blows per 300 mm. Underlying the sand fill was a 2.0 m thick layer of sand overlying suspected bedrock. The sand was brown in colour, wet, very loose to compact, well graded, fine to medium grained and contained trace to some gravel. Uncorrected “N” values from SPT tests within the sand ranged from 4 to 12 blows per 300 mm. Auger refusal on suspected bedrock was encountered between approximately 2.1 and 4.3 m below existing grade or Elevations 176.0 to 174.1 m.

### **1.5.4 Stratigraphy Single and Twin CSP Culverts Through Lake Huron Drive South**

In general the stratigraphy as determined from boreholes BH-16 to BH-18 consisted of sand and gravel fill overlying boulders and/or suspected bedrock. Borehole BH-18 had an initial 75 mm thick layer of asphalt.

The sand and gravel fill was brown in colour, damp, loose to dense, well graded, fine to medium grained, and contained some silt and trace cobbles. Uncorrected “N” values from SPT tests within the sand and gravel were 20 to 50 blows per 300 mm. Auger refusal on suspected bedrock was encountered between approximately 0.8 and 2.1 m below existing grade or Elevations 177.7 to 176.2 m.

### 1.5.5 Stratigraphy Proposed Gabion Basket Retaining Walls

In general, the stratigraphy as determined from boreholes BH-7 to BH-11 consisted of fill material overlying sand, silty sand and silty clay. Borehole BH-11 encountered an initial 150 mm thick layer of topsoil.

The fill in boreholes BH-7, BH-9 and BH-11 consisted of a 0.6 to 1.5 m thick layer of sand fill. The sand fill was brown in colour, dry to damp, loose to dense, poor to well graded, fine to medium grained, with gravel and some to with boulders. Uncorrected “N” values from SPT tests within the sand fill were 39 blows per 300 mm. Underlying the sand fill in borehole BH-7 was interlayered silty sand and silty clay, silty clay in borehole BH-9 and refusal on boulders and/or suspected bedrock in borehole BH-11. The silty sand was brown to grey in colour, damp, loose to compact, poorly graded, fine grained, and contained some clay, with trace gravel. Uncorrected “N” values from SPT tests within the silty sand were 6 to 10 blows per 300 mm. The silty clay was brown to grey, moist to wet firm to stiff, of low to medium plasticity, and contained trace to some sand, organics and trace gravel. The undrained shear strength of the silty clay was estimated to be 25 to 60 kPa based upon laboratory torvane and SPT results. The fill in borehole BH-8 consisted of a 0.8 m thick layer of sand and boulder fill. The sand and boulder fill was brown, damp, loose, poorly graded, with gravel and cobbles. Underlying the sand and boulder fill was a 1.5 m thick layer of sand fill overlying approximately 2.0 m of sand. The sand fill and sand was brown in colour, damp to wet, very loose to compact, well graded, fine to medium grained and contained trace to some gravel and trace silt. Uncorrected “N” values from SPT tests within the sand and sand fill were 4 to 12 blows per 300 mm. Auger refusal was encountered in all boreholes between 0.6 and 6.0 m below existing grade or elevations 176.7 to 172.2 m.

### 1.5.6 Stratigraphy North Shoulder along Highway 17

In general, the stratigraphy as determined from Boreholes BH-1B and BH-2B consisted of 60 to 100 mm of asphalt overlying 1.1 to 1.7 m of Granular “B”, rock fill, and gravel and till material overlying suspected bedrock.

The Granular “B” was brown in colour, damp, compact to very dense and contained a trace to some cobbles. Uncorrected “N” values from SPT tests ranged from 31 to 65 blows per 300 mm. Underlying the Granular “B” was a 2.5 to 3.8 m thick layer of rock fill. The rock fill was dense and was approximately 300 mm in diameter. A 800 mm thick layer of wood (probably old timer cribbing) was encountered in Borehole BH-2B within the rock fill from 2.7 to 3.5 m below grade or Elevation 176.70 m to 176.00 m.

A 3.0 m thick layer of gravel was encountered in Borehole BH-1A from Elevation 174.90 m to 171.80 m underlying the rock fill. The gravel was red to grey in colour, wet, compact and contained some sand, and some silt. Uncorrected “N” values from SPT tests within the gravel ranged from 14 to 15 blows per 300 mm. Underlying the gravel in boreholes BH-1A and the rock fill in Borehole BH-2A was a till material, which ranged from predominately sand to cobbles. The till material was red to grey in colour, wet, loose to very dense, poorly graded, and fine to coarse grained. Uncorrected “N” values

from SPT tests ranged from 8 to 100 blows per 300 mm. Refusal was encountered between 6.7 and 8.5 m below existing grade or Elevations 172.80 m and 170.60 m.

#### **1.5.7 Stratigraphy Proposed Inlet New Culvert Location**

In general, the stratigraphy as determined from Borehole BH-3B consisted of a 2.0 m thick layer of sand fill, overlying cobble fill, and native sand overlying bedrock.

The sand fill was brown in colour, damp to wet, compact, well graded, fine to coarse grained and contained some cobbles and trace to some silt. Uncorrected “N” values from SPT tests within the sand ranged from 16 to 25 blows per 300 mm. underlying the sand fill was a 700 mm thick layer of cobble fill. The cobble fill was brown in colour, wet, dense and contained some sand, and some gravel. Underlying the cobble fill was native sand. The native sand was brown in colour, wet, very loose to compact, well graded, fine to medium grained and contained a trace of silt. Uncorrected “N” values from SPT tests ranged from 1 to 19 blows per 300 mm. Refusal was encountered 7.3 m below grade, or Elevation 171.50.

#### **1.5.8 Stratigraphy Proposed Roadway Protection Centerline Highway 17 Station 13+325 to Station 13+375.**

In general, the stratigraphy as determined from Boreholes BH-4B to BH-6B consisted of 280 mm of asphalt overlying a 0.9 to 3.5 m thick layer of Granular “B”, interlayered sand, and clayey silt, rock fill and a till material.

The Granular “B” was brown in colour, damp to wet, compact to very dense, and contained some cobbles. Uncorrected “N” values from SPT tests ranged from 23 to 69 blows per 300 mm. Underlying the Granular “B” in Boreholes BH-4B and BH-6B was interlayered sand material and clayey silt. The sand was 2.2 to 2.8 m thick, brown to grey in colour, wet, loose to compact, poorly graded, fine to coarse grained, and contained a trace to some silt, trace to some gravel and trace cobbles. Uncorrected “N” values from SPT tests ranged from 4 to 17 blows per 300 mm. The clayey silt was grey in colour, wet, very loose, of low plasticity, and contained a trace to some sand, and trace gravel. Underlying the clayey silt in borehole BH-6B was a till material, which ranged from predominately sand to silt. The till material was 2.1 m thick, grey in colour, wet and compact to dense and overlaid suspected bedrock. A 5.8 m thick layer of rock fill was encountered underlying the Granular “B” in Borehole BH-5B. The rock fill was approximately 450 mm in diameter, dense and overlaid a 600 mm thick layer of dense, cobble till. The cobble till overlaid suspected bedrock 7.6 m below existing grade or Elevation 171.20 m. Refusal was encountered between 5.2 m and 10.4 m below grade or Elevation 173.70 and 168.50 m.

## 1.6 Groundwater Conditions

Groundwater was encountered between elevations 177.6 m (BH-6) and 175.5 m (BH-13) (1.2 and 2.9 m below grade respectively). Where rock fill was present groundwater levels were difficult to establish since the boreholes were cased.

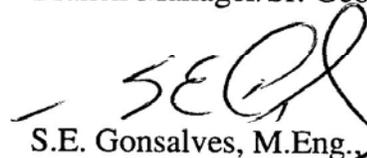
Seasonal variations in the water table should be anticipated, with higher levels occurring during wetter periods of the year (such as spring thaw and late fall) and lower levels during drier periods.

## 2.0 CLOSURE

This report has been prepared by M. Corriveau, B.Eng., and reviewed by T. Crilly M.Sc., P.Eng. and S. Gonsalves, M.Eng., P.Eng. Designated MTO Foundation Contact. The field investigation was conducted by Liz Cooke.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

### Trow Associates Inc.

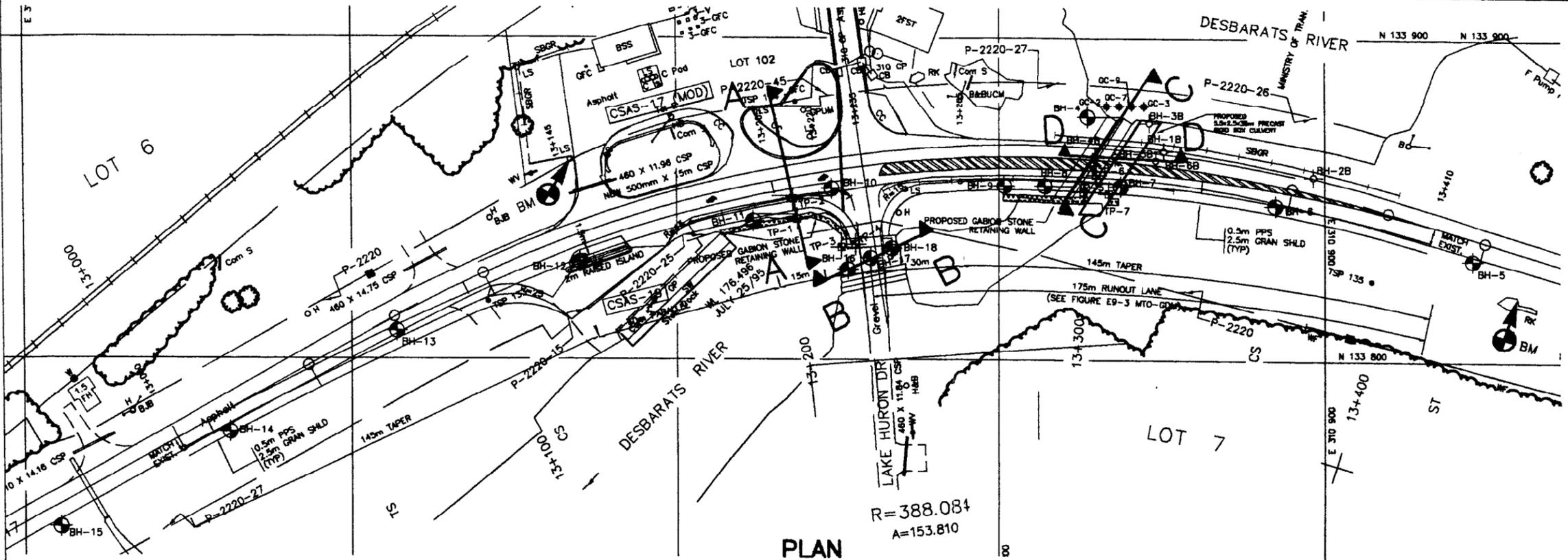
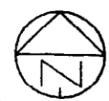
  
 Maurice Corriveau, B.Eng.  
Geotechnical Department  
Tom Crilly, M. Sc., P.Eng.  
Branch Manager/Sr. Geotechnical Engineer  
S.E. Gonsalves, M.Eng., P.Eng.  
Principal Engineer  
Designated MTO Foundation Contact

Encl.  
Dist: The Greer Galloway Group Inc.

## **APPENDIX A**

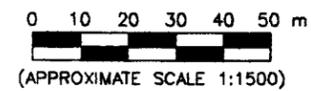
### **Drawings**

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 A=153.810

**PLAN**

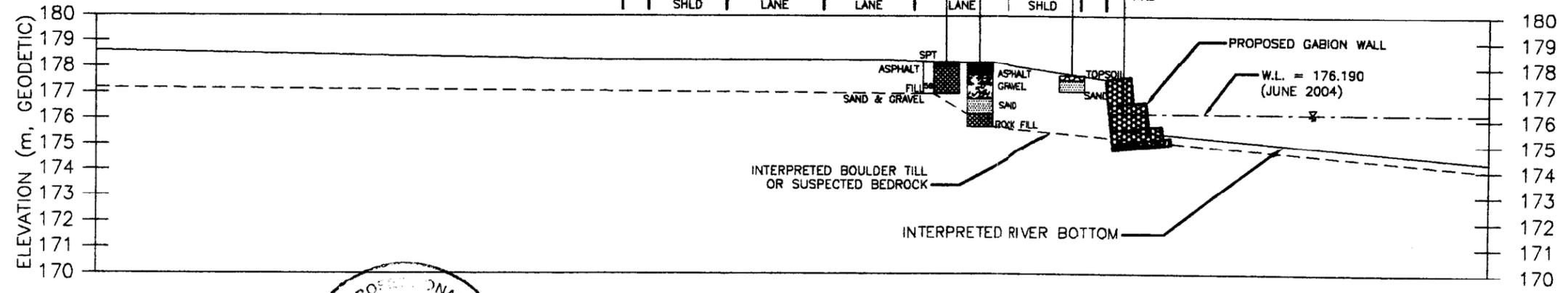
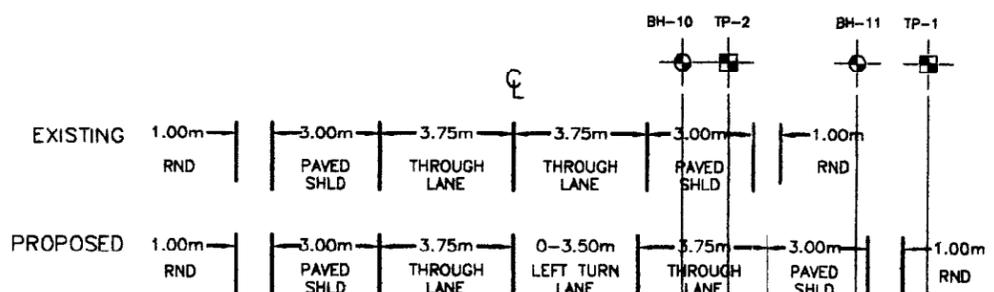


\* See Dwg. No. 3 for larger plan and profile of D-D.



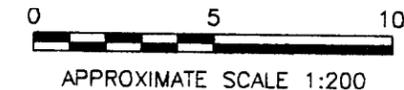
NORTH SIDE

SOUTH SIDE

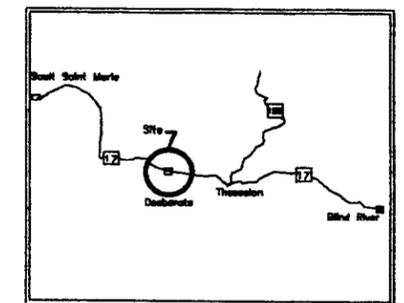


**PROFILE A-A**  
 AT STATION 13+210

**PROFILE**



**KEY PLAN**  
 NOT TO SCALE



- LEGEND**
- TROW BOREHOLE (JUNE 2004)
  - TROW BOREHOLE (APRIL 2005)
  - M.T.O. TEST PITS W.P. 264-90-00 (AUG 1995)
  - GEOCON BOREHOLE W.P. 904-64 (FEB 1965)
  - HIGHWAY CENTERLINE
  - STANDARD PENETRATION TEST
  - ROUNDING
  - GEODETIC BENCHMARK

No.	ELEVATION	No.	ELEVATION
BH-4	178.100	TP-1	178.190
BH-5	178.300	TP-2	178.083
BH-6	178.600	TP-3	178.200
BH-7	178.200	TP-5	177.900
BH-8	178.300	TP-6	178.200
BH-9	178.500		
BH-10	178.200	BH-1B	179.161
BH-11	178.300	BH-2B	179.471
BH-12	178.400	BH-3B	178.791
BH-13	178.400	BH-4B	178.811
BH-14	178.600	BH-5B	178.841
BH-15	179.200	BH-6B	178.921
BH-16	178.200		
BH-17	178.300		
BH-18	178.500		

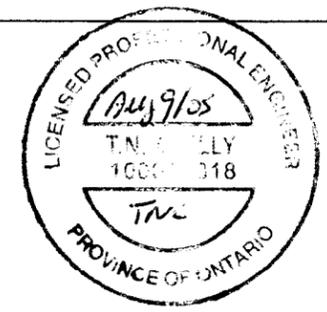
**NOTE**  
 The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

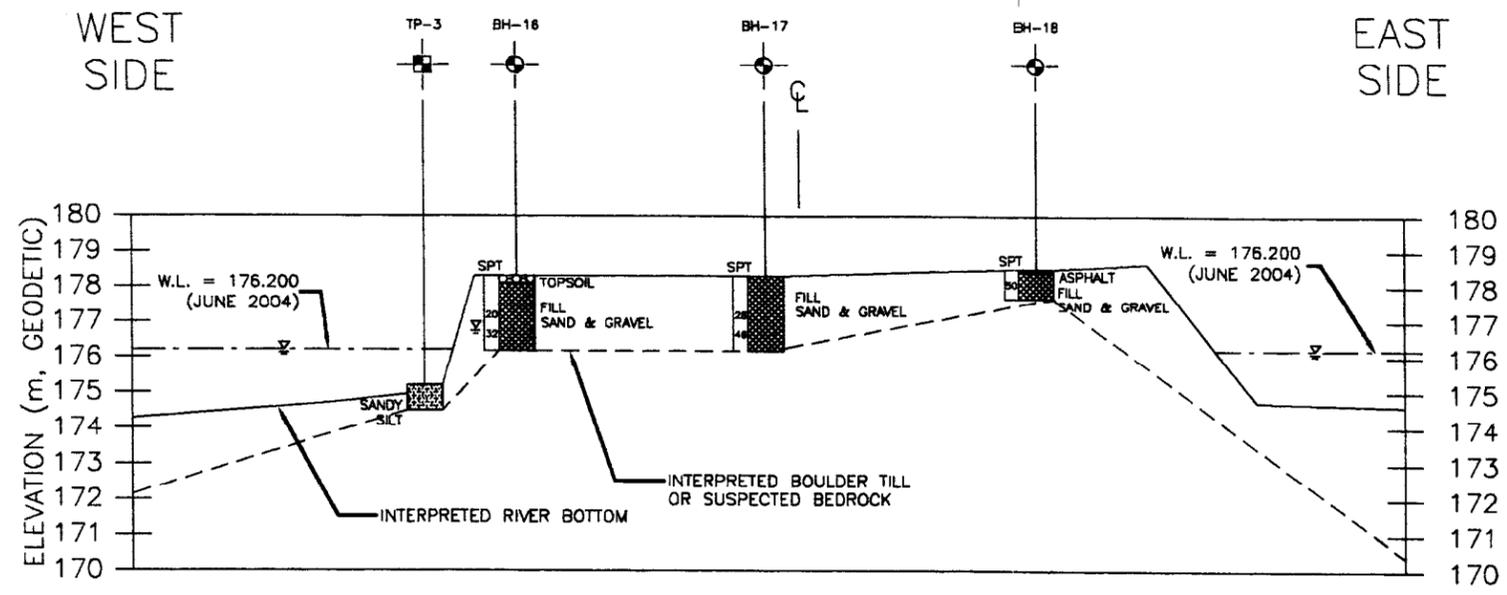
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2-01 of OPS Gen. Cond.

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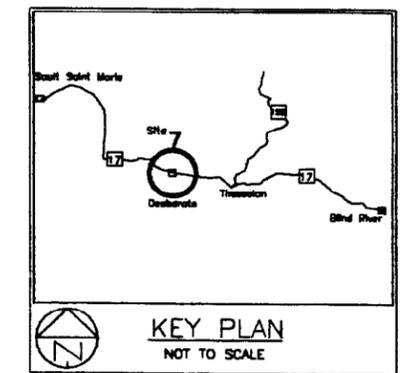
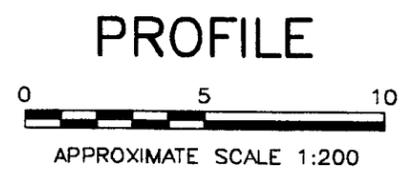
LOAD DATE JUNE 2005  
 STRUCT. SCHEME DWG 1

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 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN



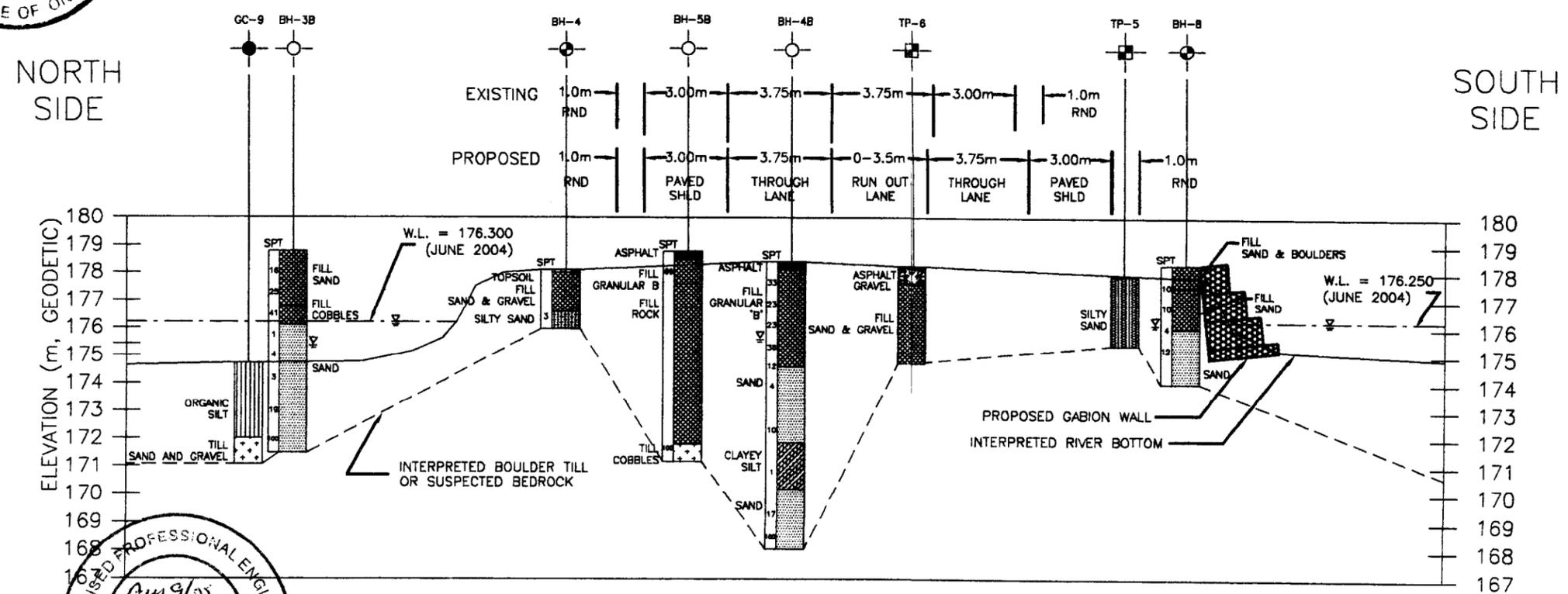


PROFILE B-B  
 AT LAKE HURON DRIVE SOUTH

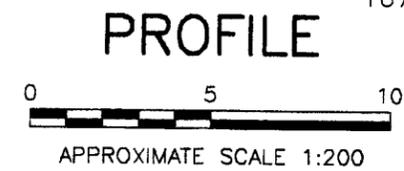


LEGEND

- TROW BOREHOLE (JUNE 2004)
- TROW BORHOLE (APRIL 2005)
- M.T.O. TEST PITS W.P. 264-90-00 (AUG 1995)
- GEOCON BOREHOLE W.P. 904-64 (FEB 1965)
- HIGHWAY CENTERLINE
- STANDARD PENETRATION TEST
- ROUNDING



PROFILE C-C  
 HIGHWAY 17 AT STATION 13+300



No.	ELEVATION	No.	ELEVATION
BH-4	178.100	TP-1	178.190
BH-5	178.300	TP-2	178.083
BH-6	178.800	TP-3	178.200
BH-7	178.200	TP-5	177.900
BH-8	178.300	TP-6	178.200
BH-9	178.500		
BH-10	178.200	BH-1B	179.161
BH-11	178.300	BH-2B	179.471
BH-12	178.400	BH-3B	178.791
BH-13	178.400	BH-4B	178.811
BH-14	178.800	BH-5B	178.841
BH-15	179.200	BH-6B	178.921
BH-16	178.200		
BH-17	178.300		
BH-18	178.500		

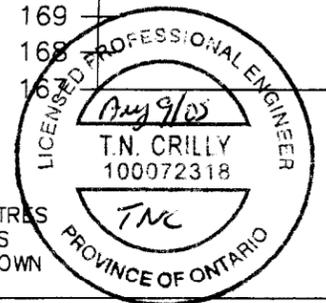
NOTE: The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

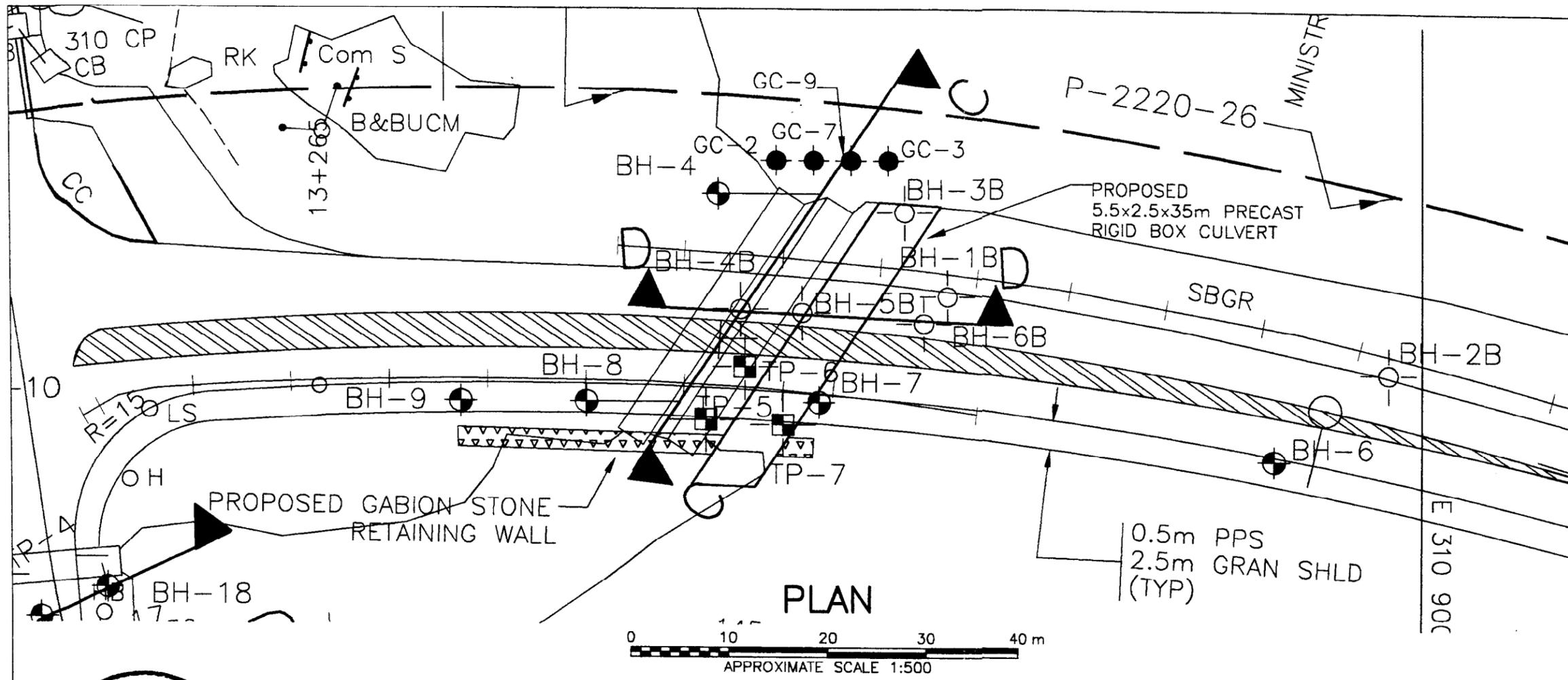
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview, information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2-01 of OPS Gen. Cond.

REVISIONS	DATE	BY	DESCRIPTION

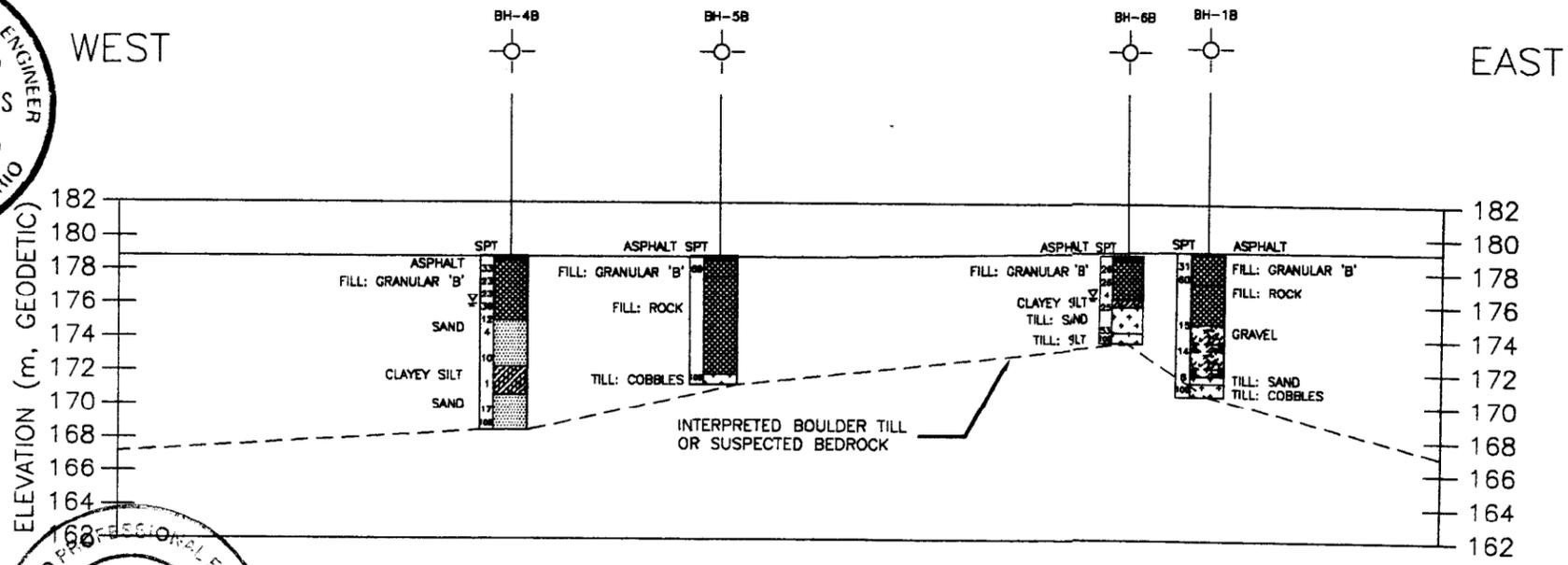
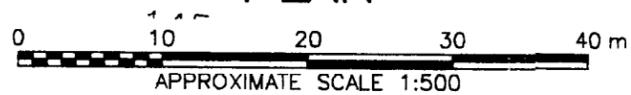
DESIGN	T.C.	CHK	T.C.	CODE	LOAD	DATE	JUNE 2005
DRAWN	D.S.	CHK	M.C.	SITE	STRUCT	SCHEME	DWG 2

METRIC  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN



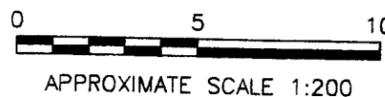


PLAN



PROFILE D-D

PROFILE

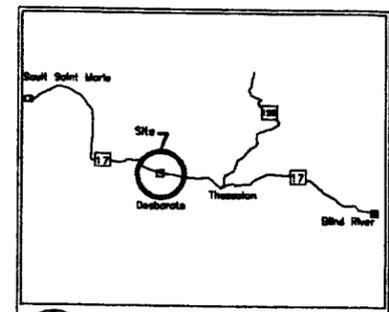


DIST ALGOMA HWY 17  
 GEOCRES NO.41J-23  
 WP No 6013-03-00

HWY 17  
 TOWNSHIP OF JOHNSON  
 BORE HOLE LOCATIONS  
 AND SOIL STRATA

SHEET  
 1 OF 1

TROW ASSOCIATES INC.  
 SUDBURY, ONTARIO  
 Trow PROJ. No. S09737G/B DWG. No. 3



KEY PLAN  
 NOT TO SCALE

- LEGEND
- TROW BOREHOLE (JUNE 2004)
  - TROW BORHOLE (APRIL 2005)
  - M.T.O. TEST PITS W.P. 264-90-00 (AUG 1995)
  - GEOCON BOREHOLE W.P. 904-64 (FEB 1965)
  - HIGHWAY CENTERLINE
  - STANDARD PENETRATION TEST
  - ROUNDING
  - GEODETIC BENCHMARK

No.	ELEVATION	No.	ELEVATION
BH-4	178.100	TP-1	178.180
BH-5	178.300	TP-2	178.083
BH-6	178.800	TP-3	178.200
BH-7	178.200	TP-5	177.900
BH-8	178.300	TP-6	178.200
BH-9	178.500		
BH-10	178.200	BH-1B	179.161
BH-11	178.300	BH-2B	179.471
BH-12	178.400	BH-3B	178.791
BH-13	178.400	BH-4B	178.811
BH-14	178.600	BH-5B	178.841
BH-15	179.200	BH-6B	178.921
BH-16	178.200		
BH-17	178.300		
BH-18	178.500		

NOTE: The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2-01 of OPS Gen. Cond.



METRIC  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

HIGHWAY 17 FROM STATION 13+300 TO 13+321

REVISIONS	DATE	BY	DESCRIPTION

DESIGN T.C. CHK T.C. CODE . . . . . LOAD . . . . . DATE JUNE 2005  
 DRAWN D.S. CHK M.C. SITE . . . . . STRUCT . . . . . SCHEME . . . . . DWG 3

**APPENDIX B**

**Borehole Logs**

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**APPENDIX B-1**

**Trow Borehole Logs, June 2004**

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## 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 475 J 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 (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING 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

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

#### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	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
$C_\alpha$	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
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_r$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

#### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	$kg/m^3$	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$kN/m^3$	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	$kg/m^3$	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$kN/m^3$	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	$kg/m^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	$kN/m^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	$kg/m^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$m^3/s$	RATE OF DISCHARGE
$\gamma_d$	$kN/m^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $\frac{w - w_p}{w_L - w_p}$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	$kg/m^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	$kN/m^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	$kg/m^3$	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	$kN/m^2$	SEEPAGE FORCE
$\gamma'$	$kN/m^3$	UNIT WEIGHT OF SUBMERGED SOIL						

# RECORD OF BOREHOLE BH-4

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algora HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 21, 2004 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl		
178.1	GROUND SURFACE															
178.0	<b>TOPSOIL</b> , 125mm thick															
0.1	<b>FILL: SAND AND BOULDERS</b> , brown, damp, loose, poorly graded, fine to medium grained															
176.6																
1.5	<b>SILTY SAND</b> , brown to grey, damp, very loose, poorly graded, some gravel, some clay, trace organics		1	SS	3									12	43 28 17	
176.0																
2.1	AUGER REFUSAL ON SUSPECTED BEDROCK AT 2.13m DEPTH <b>NOTES:</b> - Borehole located at north inlet of twin CSP culverts in Desbarats river through Hwy. 17 - Station 13+310 - No free water observed at completion of drilling															



# RECORD OF BOREHOLE BH-5

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 24, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION								
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT				wp	w	wl	10	20	30	40	kN/m <sup>3</sup>
178.3	GROUND SURFACE																								
0.0	No drilling attempted surface bedrock <b>NOTES:</b> - Borehole located south side of Hwy. 17, proposed widening Station 13+425						178																		



# RECORD OF BOREHOLE BH-6

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 24, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	CONE PENETRATION TEST				WATER CONTENT (%)			
GROUND SURFACE						SHEAR STRENGTH: Cu, KPa								GR SA SI CL	
						UNCONFINED QUICK TRIAXIAL	FIELD VANE	POCKET PENETROMETER							
						20 40 60 80	20 40 60 80			10 20 30 40					
178.8	GROUND SURFACE														
0.0	FILL: SAND AND GRAVEL, brown, damp, loose to compact, well to poorly graded, fine to coarse grained, trace to some silt		1	SS	20										
177.3															
1.5	GRAVEL, brown, wet, compact, poorly graded, fine to coarse grained, some sand		2	SS	13										
176.4															
2.4	AUGER REFUSAL ON SUSPECTED BEDROCK AT 2.44m IN DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, proposed widening Station 13+370														



# RECORD OF BOREHOLE BH-7

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 24, 2004 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION				
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80				wp	w	wl	GR
178.2	GROUND SURFACE																	
0.0	FILL: SAND, brown, damp, loose to dense, well graded, fine to medium grained, some boulders		1	SS	39													
176.7																		
1.5	SILTY SAND, brown to grey, damp, loose to compact, poorly graded, fine grained, some clay, trace gravel		2	SS	10													
			3	SS	6													
175.2																		
3.1	SILTY CLAY, grey, wet, soft to firm, low to intermediate plasticity, some sand, trace organics and gravel		4	SS	4										5	18	32	45
174.2																		
4.0	SAND, grey, wet, loose to compact, poorly graded, fine to medium grained, trace silt, some clay		1	SH														
173.1																		
5.1	SILTY SAND																	
172.2																		
6.0	AUGER REFUSAL ON SUSPECTED BEDROCK AT 6.01m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed retaining wall and widening Station 13+315																	



# RECORD OF BOREHOLE BH-8

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 24, 2004 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION		
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT			GR	SA
178.3	GROUND SURFACE																	
0.0	FILL: SAND AND BOULDERS, brown, damp, loose, poorly graded, with gravel and cobbles																	
177.6																		
0.8	FILL: SAND, brown, damp, compact, well graded, fine to medium grained, some gravel, trace silt		1	SS	10											15	82	3
			2	SS	10													
176.0						▼												
2.3	SAND, brown, wet, very loose to compact, well graded, fine to medium grained, trace to some gravel		3	SS	4													
			4	SS	12													
174.1																		
4.3	AUGER REFUSAL ON SUSPECTED BEDROCK AT 4.27m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, at outlet of twin CSP culverts in Desbarats river through Hwy. 17 - Borehole also used for proposed retaining wall and Hwy. widening - Station 13+295																	



# RECORD OF BOREHOLE BH-9

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 24, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	CONE PENETRATION TEST				WATER CONTENT (%)			
178.5	GROUND SURFACE					SHEAR STRENGTH: Cu, KPa								GR SA SI CL	
0.0	FILL: SAND, brown, damp, loose to compact, well graded, fine to medium grained, with gravel														
177.8															
0.8	SILTY CLAY, brown, moist, stiff, low plasticity, some organics, trace sand and gravel - boulders at ~ 1.22m in depth		1	SS	24			X							
177.0															
1.5	AUGER REFUSAL ON SUSPECTED BOULDERS AT 2.29m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed retaining wall and Hwy. widening - Station 13+280 - No free water observed at completion of drilling														



# RECORD OF BOREHOLE BH-10

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION							
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60	80	wp	w						wl	20	40	60	80	10	20
178.2	GROUND SURFACE																								
178.1	<b>ASPHALT</b> ~ 150mm thick																								
0.2	<b>FILL: SAND AND GRAVEL</b> , brown, dry to damp, dense to very dense, well graded, fine to medium grained																								
177.0			1	SS	56																				31 69
1.2	AUGER REFUSAL ON SUSPECTED BOULDERS AT 1.22m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed retaining wall and Hwy. widening - Station 13+220 - No free water observed at completion of drilling																								



# RECORD OF BOREHOLE BH-11

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION		
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60	80	wp	w			wl	GR
177.3	GROUND SURFACE																
177.2	TOPSOIL, 150mm thick																
0.2	SAND, brown, dry to damp, loose, poorly graded, fine to medium grained, with gravel and boulders					177											
176.7	AUGER REFUSAL ON SUSPECTED BOULDERS AT 0.61m IN DEPTH																
0.6	<p><b>NOTES:</b></p> <ul style="list-style-type: none"> <li>- 4 Attempts</li> <li>- Borehole located south side of Hwy. 17, for proposed retaining wall and Hwy. widening</li> <li>- Station 13+200</li> <li>- No free water observed at completion of drilling</li> </ul>																



# RECORD OF BOREHOLE BH-12

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION		
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl			kN/m <sup>3</sup>	GR
178.4	GROUND SURFACE																
178.4 0.1	ASPHALT ~ 100mm thick FILL: SAND AND GRAVEL, brown, damp, loose to compact, well graded, fine to coarse grained																
177.6 0.8	SILTY CLAY, grey, moist, soft to firm, low to intermediate plasticity, with organics, trace sand	1	SS	9													
		2	SS	2									109.8				
		3	SS	1									79.2				
		1	SH														
173.8 4.6	CLAY, brown, moist, firm, high plasticity	4	SS	4													
		2	SH														
171.6 6.7	END OF BOREHOLE AT 6.71m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed Hwy. widening - Station 13+140																



# RECORD OF BOREHOLE BH-13

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60	80	wp	w		
178.4	GROUND SURFACE														
178.4 0.1	ASPHALT ~ 100mm thick FILL: SAND AND GRAVEL, brown, damp, loose, well graded, fine to coarse grained														
177.7 0.8	SILT, dark grey, damp, dense, some boulders		1	SS	50			X							
176.9 1.5	SILTY CLAY, dark grey, moist, firm, low to intermediate plasticity, some sand		2	SS	5	X						O			
176.1 2.3	CLAYEY SILT, grey, damp, loose, low plasticity		3	SS	8	X				⊗		O			
175.4 3.1	SILTY CLAY AND SAND, grey, wet, compact to dense, low to intermediate plasticity, fine to medium grained, trace gravel		4	SS	45			X							
174.8 3.6	AUGER REFUSAL ON SUSPECTED BOULDERS AT 3.63m DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed Hwy. widening - Station 13+080														



# RECORD OF BOREHOLE BH-14

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80			
178.6	GROUND SURFACE												
0.1	ASPHALT, 100mm thick FILL: SAND AND GRAVEL, brown, damp, loose, well graded, fine to medium grained	1	SS	8									
177.0													
1.5	SILTY CLAY, grey, moist to wet, firm, intermediate plasticity, with sand	2	SS	5	▼								
		3	SS	6									
175.5													
3.1	SILTY CLAY AND SAND, brown, wet, loose to compact, low plasticity, fine to medium grained	4	SS	7									
174.0													
4.6													
173.5	SILTY SAND, brown, wet, very loose, poorly graded, fine to medium grained, trace clay	5	SS	4									
5.0	END OF BOREHOLE AT ~ 5.03m IN DEPTH <b>NOTES:</b> - Borehole located south side of Hwy. 17, for proposed Hwy. widening - Station 13+020												



# RECORD OF BOREHOLE BH-15

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION									
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl			20	40	60	80	10	20	30	40	GR
179.2	GROUND SURFACE																								
178.7	ASPHALT ~ 100mm thick FILL: SAND AND GRAVEL, brown, damp, compact, well graded, fine to coarse grained																								
178.4	SAND, brown, damp to wet, loose to compact, poorly graded, medium grained, some gravel		1	SS	18			X														18	82		
177.7	SANDY GRAVEL, brown, wet, dense, poorly graded, fine to coarse grained		2	SS	32				X																
176.9	SILTY CLAY, grey, wet, firm, low to intermediate plasticity, trace sand		3	SS	4			X																	
176.1	SANDY SILT, grey, wet, very loose, poorly graded, fine grained		4	SS	4			X																	
174.6	SILTY CLAY, grey, wet, firm, intermediate to high plasticity		5	SS	6			X																	
174.1	END OF BOREHOLE AT ~ 5.03m DEPTH																								
5.0	<p><b>NOTES:</b></p> <ul style="list-style-type: none"> <li>- Borehole located south side of Hwy. 17, for proposed Hwy. widening</li> <li>- Station 12+960</li> </ul>																								



# RECORD OF BOREHOLE BH-16

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT			
178.3	GROUND SURFACE															
178.1	<b>TOPSOIL</b> , ~ 200mm thick															
0.2	<b>FILL: SAND AND GRAVEL</b> , brown, damp, loose to compact, well graded, fine to medium grained, some silt, trace cobbles	1	SS	20											37	51 12
	- compact to dense, poorly graded, some to with boulders below ~ 1.52m in depth	2	SS	32	▼											
176.2	<b>AUGER REFUSAL ON SUSPECTED BOULDER AT ~ 2.13m DEPTH</b>															
2.1	<b>NOTES:</b> - Borehole located at west outlet, for the single and twin CSP culverts through Lake Huron Drive South. - Station 13+225															



# RECORD OF BOREHOLE BH-17

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION			
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl	10						20	30	40
178.3	GROUND SURFACE																						
0.0	<b>FILL: SAND AND GRAVEL</b> , brown, damp, compact, well graded, fine to medium grained, some silt, trace cobbles  - dense with some boulders below ~ 1.2m in depth		1	SS	28			X															
			2	SS	46				X														
176.2			2.1																				
<b>AUGER REFUSAL ON SUSPECTED BOULDER AT ~ 2.13m DEPTH</b> <b>NOTES:</b> - Borehole located at CL of single and twin CSP culverts through Lake Huron Drive South - Station 13+235 - No free water observed at completion of drilling																							



# RECORD OF BOREHOLE BH-18

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY M. Corriveau  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B - 57 Drill Rig COMPILED BY D. Smith  
 DATUM Geodetic DATE June 28, 2004 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION		
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl			kN/m <sup>3</sup>	GR
178.5	GROUND SURFACE																
177.7	ASPHALT ~ 75mm thick FILL: SAND AND GRAVEL, brown, damp, loose to dense, well graded, fine to medium grained, with cobbles, trace boulders	1	SS	50		178		X									
177.0	AUGER REFUSAL ON SUSPECTED BOULDER AT ~ 0.835m DEPTH <b>NOTES:</b> - Borehole located at east inlet of single and twin CSP culverts through Lake Huron Drive South - Station 13+245 - No free water observed at completion of drilling																



**APPENDIX B-1**

**Trow Borehole Logs, April and May 2005**

---

# RECORD OF BOREHOLE BH-1B

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY S. McAuliffe  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B-57 Drill Rig COMPILED BY C. Green  
 DATUM Geodetic DATE April 19, 2005 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			WATER CONTENT (%)	UNIT WEIGHT kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80	wp	w	wl			
179.2	GROUND SURFACE															
0.1	ASPHALT ~100 mm thick FILL: GRANULAR B, brown, damp, compact to very dense, trace to some cobbles.	1	SS	31												
177.3	FILL: ROCK, dense, 600 mm minus.	2	SS	60												
174.9	GRAVEL, red to grey, wet, compact, some sand, some silt.	3	SS	15												
171.8	TILL: SAND, red to brown, wet, loose to compact, some cobbles.	5	SS	8												
171.4	TILL: COBBLES, dense.	6	SS	100												
170.6	SPT REFUSAL ON SUSPECTED BEDROCK AT 8.53 m DEPTH															





# RECORD OF BOREHOLE BH-3B

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY S. McAuliffe  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B-57 Drill Rig COMPILED BY C. Green  
 DATUM Geodetic DATE May 05, 2005 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION								
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60	80	wp	w	wl			10	20	30	40	kN/m <sup>3</sup>	GR	SA	SI
178.8	GROUND SURFACE																							
0.0	FILL: SAND, brown, damp, compact, well graded, fine to coarse grained, some cobbles, trace to some silt. - wet below ~ 0.28 m.		1	SS	16																			
176.8			2	SS	25																			
2.0			FILL: COBBLES, brown, wet, dense, some sand, some gravel.		3	SS	41																	
176.1	4	SS			1																			
2.7	SAND, brown, wet, very loose, well graded, fine to medium grained, trace silt.  - compact below ~ 5.60 m. - trace to some cobbles.					▼																		
171.5			5	SS	4																			
7.3			6	SS	3																			
171.5			7	SS	19																			
171.5	8	SS	100																					
7.3	SPT REFUSAL ON SUSPECTED BEDROCK AT 7.32 m DEPTH																							



# RECORD OF BOREHOLE BH-4B

1 OF 1

# METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY S. McAuliffe  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B-57 Drill Rig COMPILED BY C. Green  
 DATUM Geodetic DATE April 12, 2005 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	WATER CONTENT (%)	UNIT WEIGHT kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION						
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60				80	wp	w	wl	GR	SA	SI
178.8	GROUND SURFACE																			
0.0 178.5	ASPHALT, ~ 280 mm thick.																			
0.3	FILL: GRANULAR B, brown, damp, compact to dense.  - some cobbles below ~ 1.20 m.		1	BAG													39% 58% 3% 0%			
			2	BAG														37% 52% 11% 0%		
			1	SS	33				X										16% 76% 8% 0%	
			2	SS	23					X									18% 75% 7% 0%	
	- wet below ~ 2.74 m.		3	SS	23													18% 76% 6% 0%		
			4	SS	36					X									12% 79% 9% 0%	
175.0			SAND, brown to grey, wet, loose to compact, poorly graded, fine to coarse grained, trace silt, trace gravel, trace cobbles.  - some to with silt below ~ 6.10 m.		5	SS	12			X										10% 86% 4% 0%
3.8					6	SS	4			X										
	7	SS			10					X										5% 72% 23% 0%
172.3	CLAYEY SILT, grey, wet, very loose, low plasticity, some sand, trace gravel, organic stained.																			
6.6			8	SS	1														2% 20% 58% 20%	
170.6	SAND, grey, wet, compact, poorly graded, fine to coarse grained, some silt, some gravel, trace cobbles.																			
8.2			9	SS	17				X										24% 60% 16% 0%	
			10	SS	100															
168.5 10.4	SPT REFUSAL ON SUSPECTED BEDROCK AT 10.36 m DEPTH																			



# RECORD OF BOREHOLE BH-5B

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY S. McAuliffe  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B-57 Drill Rig COMPILED BY C. Green  
 DATUM Geodetic DATE April 19, 2005 CHECKED BY T. Crilly

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) <span style="float: right;">X</span>				CONE PENETRATION TEST			UNIT WEIGHT kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			BLOWS/0.3m	20	40	60	80	PLASTIC LIMIT	NATURAL MOISTURE CONTENT		
178.8	GROUND SURFACE														
0.0 178.6	ASPHALT, ~280 mm thick.														
0.3 177.6	FILL: GRANULAR B, brown, damp, compact to very dense, some cobbles.		1	SS	69				X						
1.2 171.8	FILL: ROCK, dense, 450 mm minus.														
7.0 171.2	TILL: COBBLES, dense.		2	SS	100										*
7.6	SPT REFUSAL ON SUSPECTED BEDROCK AT 7.62 m DEPTH														



# RECORD OF BOREHOLE BH-6B

1 OF 1

## METRIC

G.W.P. 6013-03-00 LOCATION Desbarats River, Johnson Township ORIGINATED BY S. McAuliffe  
 DIST Algoma HWY 17 BOREHOLE TYPE Hollow Stem Augers B-57 Drill Rig COMPILED BY C. Green  
 DATUM Geodetic DATE April 12, 2005 CHECKED BY T. Crilly

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE (metres)	SPT TEST (N-Value) CONE PENETRATION TEST				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION			
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS/0.3m			20	40	60	80				wp	w	wl
178.9	GROUND SURFACE																
0.0 178.6	ASPHALT, ~ 280 m thick.																
0.3	FILL: GRANULAR B, brown, damp, compact, some cobbles.		1	SS	26			X									
			2	SS	26			X									
176.3	- wet below ~ 2.40 m.		3	SS	4			X			O			19%	53%	28%	0%
2.6 175.9	CLAYEY SILT, grey, wet, very loose, trace sand.																
3.1	TILL: SAND, grey, wet, compact to dense, some clay, trace silts, some cobbles.		4	SS	25			X									
174.4																	
4.6 173.7	TILL: SILT, grey, wet, dense, some cobbles, trace sand.		5	SS	53				X								
5.2	SPT REFUSAL ON SUSPECTED BEDROCK AT 5.18 m DEPTH		6	SS	100						X						



**APPENDIX B-2**  
**Borehole Logs From Others**

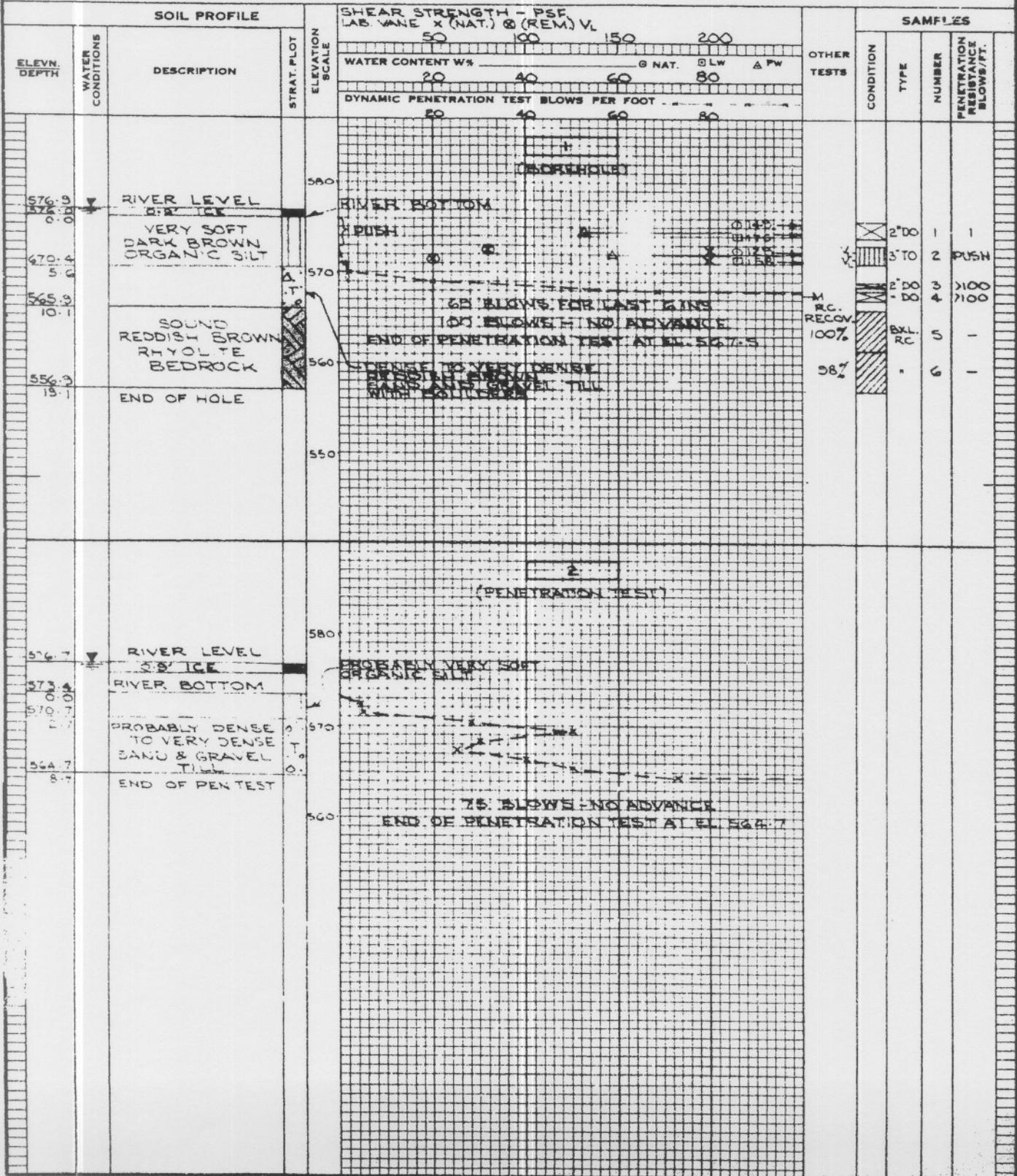
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GEOCON

OFFICE REPORT ON SOIL EXPLORATION

CONTRACT T7723 BORING # 1 AND PT. 2 DATUM GEODETIC CASING BX.  
 BORING DATE FEB 12/65 REPORT DATE FEB 22, 1966 COMPILED BY AEL CHECKED BY B.T.D.  
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN - LBS. ENERGY)

SAMPLE CONDITION		SAMPLE TYPES			ABBREVIATIONS		
DISTURBED	A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE	V	- IN-SITU VANE TEST	γ	- WET UNIT WEIGHT	
FAIR	S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN	M	- MECHANICAL ANALYSIS	K	- PERMEABILITY	
GOOD	W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE	U	- UNCONFINED COMPRESSION	C	- CONSOLIDATION	
LOST	D.O. - DRIVE-OPEN	T.O. - THIN WALLED OPEN	QC	- TRIAXIAL CONSOLIDATED UNDRAINED	WL	- WATER LEVEL 'N CASING	
	DF - DRIVE-FOOT VALVE	R.C. - ROCK CORE	Q	- TRIAXIAL UNDRAINED	WT	- WATER TABLE IN SOIL	
	C.S. - CHUNK SAMPLE		S	- TRIAXIAL DRAINED			









M.T.O. Test Pits

W.P. 264-90-00

August 1995

TP-1 STATION 13+210 – 13.0m RT (D-2.0)

0 - 1.2 Water  
1.2 NFP RF

TP-2 STATION 13+210 – 6.8m RT

0 - 240 Asph  
240 - 490 Cr Gr (Cl Sm @ 600)  
490 - 1.4 Br F-M Sa with Gr Occ  
Cob (Moist & Clean)  
(Wet @ 1.2)  
1.4 - 2.0 Gry Si(y) Cl (Wet & Stiff)  
(Fr Wat @ 1.7)  
2.0 - 2.5 RF (Wet)  
2.5 NFP RF

TP-3 STATION 13+220 – 23.0 RT (D-1.6) (Culv)

0 - 1.0 Water  
1.0 - 1.7 Gry Sa(y) Si with Cl  
(Wet & Stiff)  
1.7 NFP Blds

TP-4 STATION 13+226 – 23.0 RT (D-2.0) (Culv)

0 - 1.3 Water  
1.3 NFP

TP-5 STATION 13+300 – 14.0 RT (D-2.4) (Culv)

0 - 300 Water  
300 - 2.5 Gry Si(y) Sa with Cl  
(Wet & Soft)  
2.5 NFP Blds

TP-6 STATION 13+305 – 5.4 RT (Culv)

0 - 90 Asph  
90 - 610 Cr Gr  
610 - 3.5 Br F Sa(y) with Gr Occ  
Cob (Moist & Clean)  
(Wet @ 2.0+)  
3.5 NFP Hole Sloughing

TP-7 STATION 13+308 – 14.0 LT (D-2.3) (Culv)

0 - 1.2 Water  
1.2 NFP Blds

**APPENDIX C**  
**Laboratory Testing Results**

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## **APPENDIX C**

### **Laboratory Testing Results – June 2004**

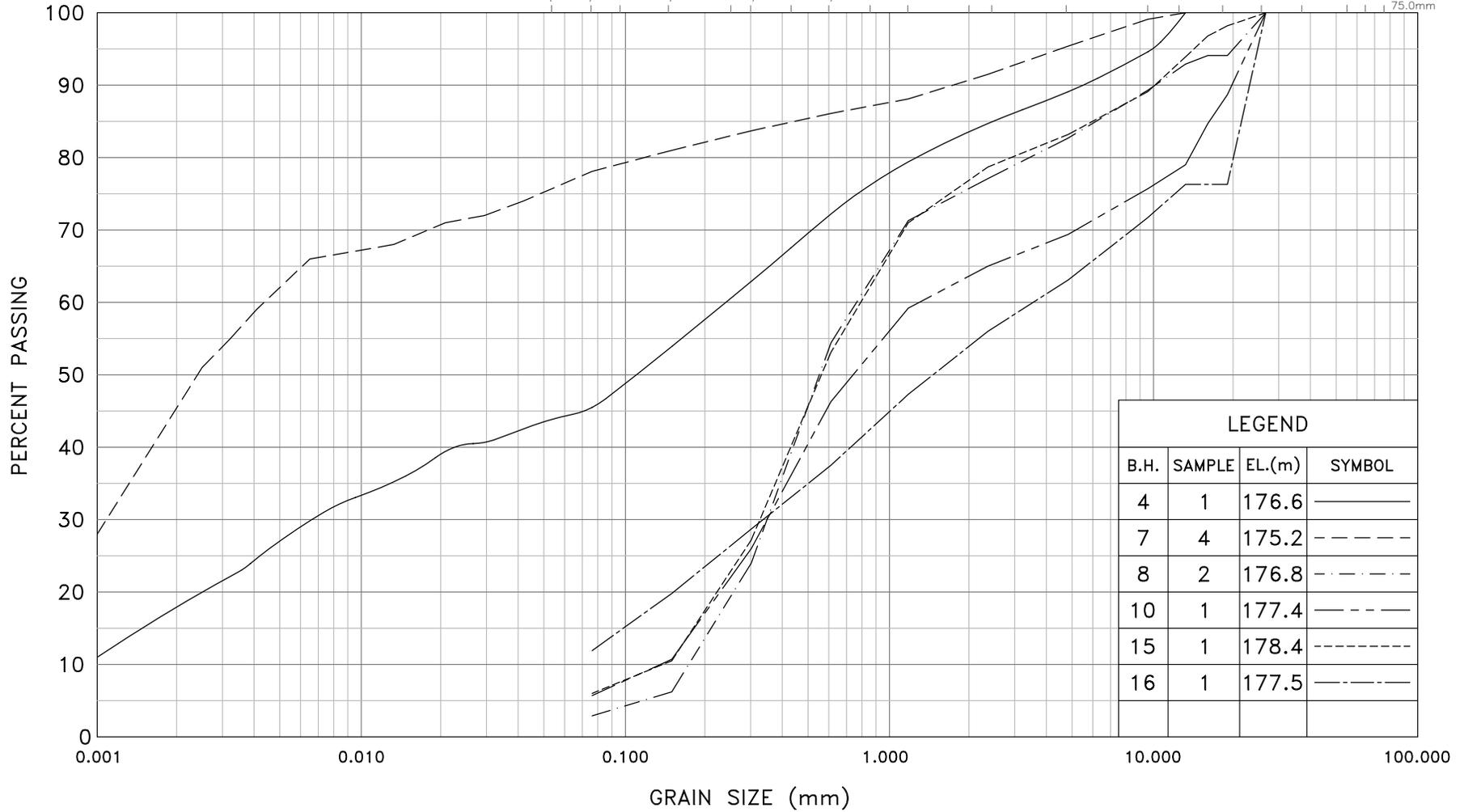
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UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

53µm 75µm 106µm 150µm 250µm 300µm 425µm 600µm 850µm 1.18mm 2.0mm 2.36mm 4.75mm 9.5mm 13.2mm 19.0mm 26.5mm 37.5mm 53.0mm 63.0mm 75.0mm



Ministry of  
Transportation

Ontario

METRIC

GRAIN SIZE DISTRIBUTION

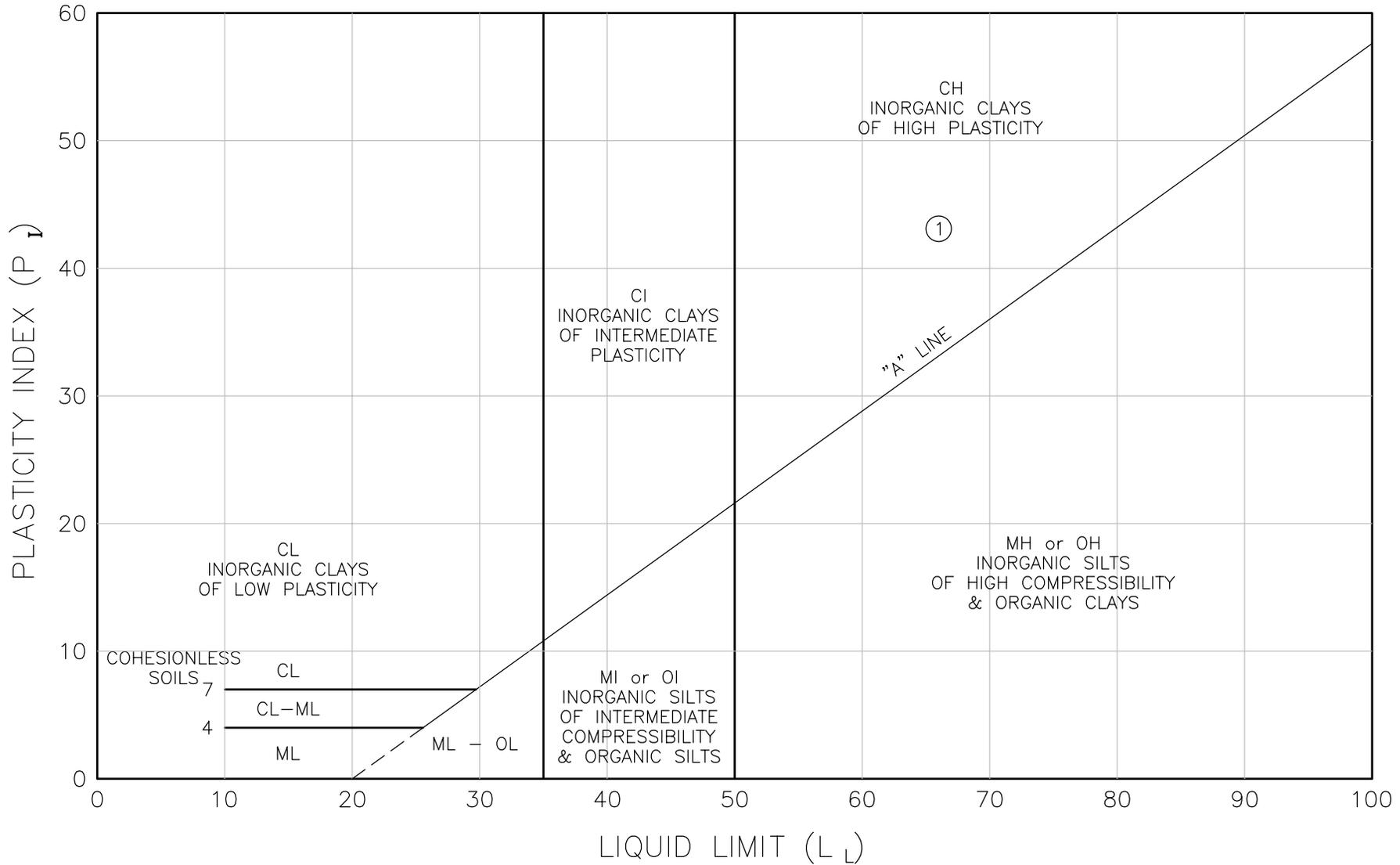
FIGURE No. 1

W.P. 6013-03-00

REF. S09737G

# ATTERBERG LIMITS – PLASTICITY CHART

① BH-12 SS-4 (4.57m – 5.03m)



## **APPENDIX C**

### **Laboratory Testing Results – April 2005**

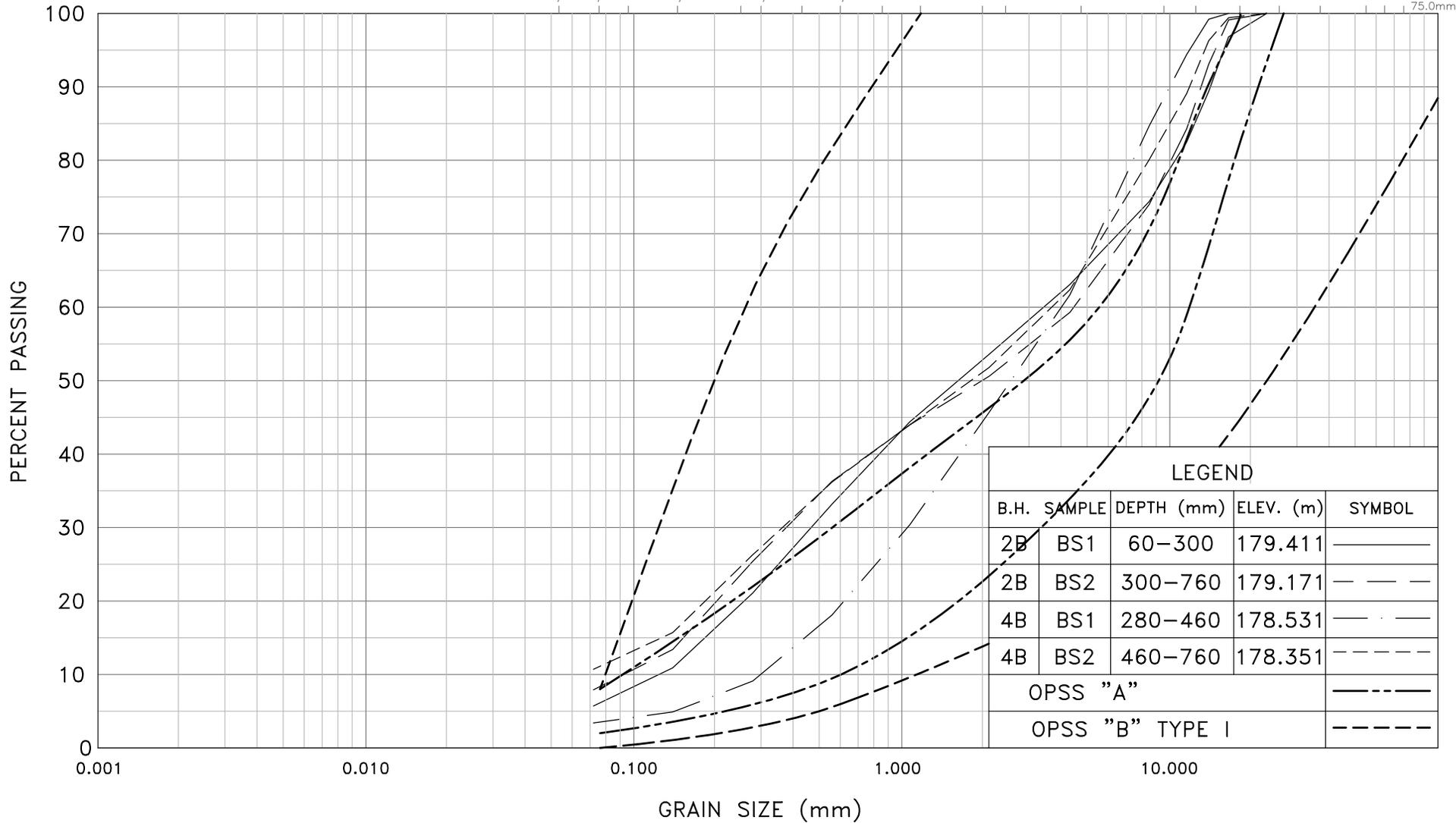
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UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

53µm 75µm 106µm 150µm 250µm 300µm 425µm 600µm 850µm 1.18mm 2.0mm 2.36mm 4.75mm 9.5mm 13.2mm 19.0mm 26.5mm 37.5mm 53.0mm 63.0mm 75.0mm



Ministry of Transportation

Ontario

METRIC

GRAIN SIZE DISTRIBUTION  
GRANULAR 'B' TYPE I

FIGURE No. 1

W.P. 6013-03-00

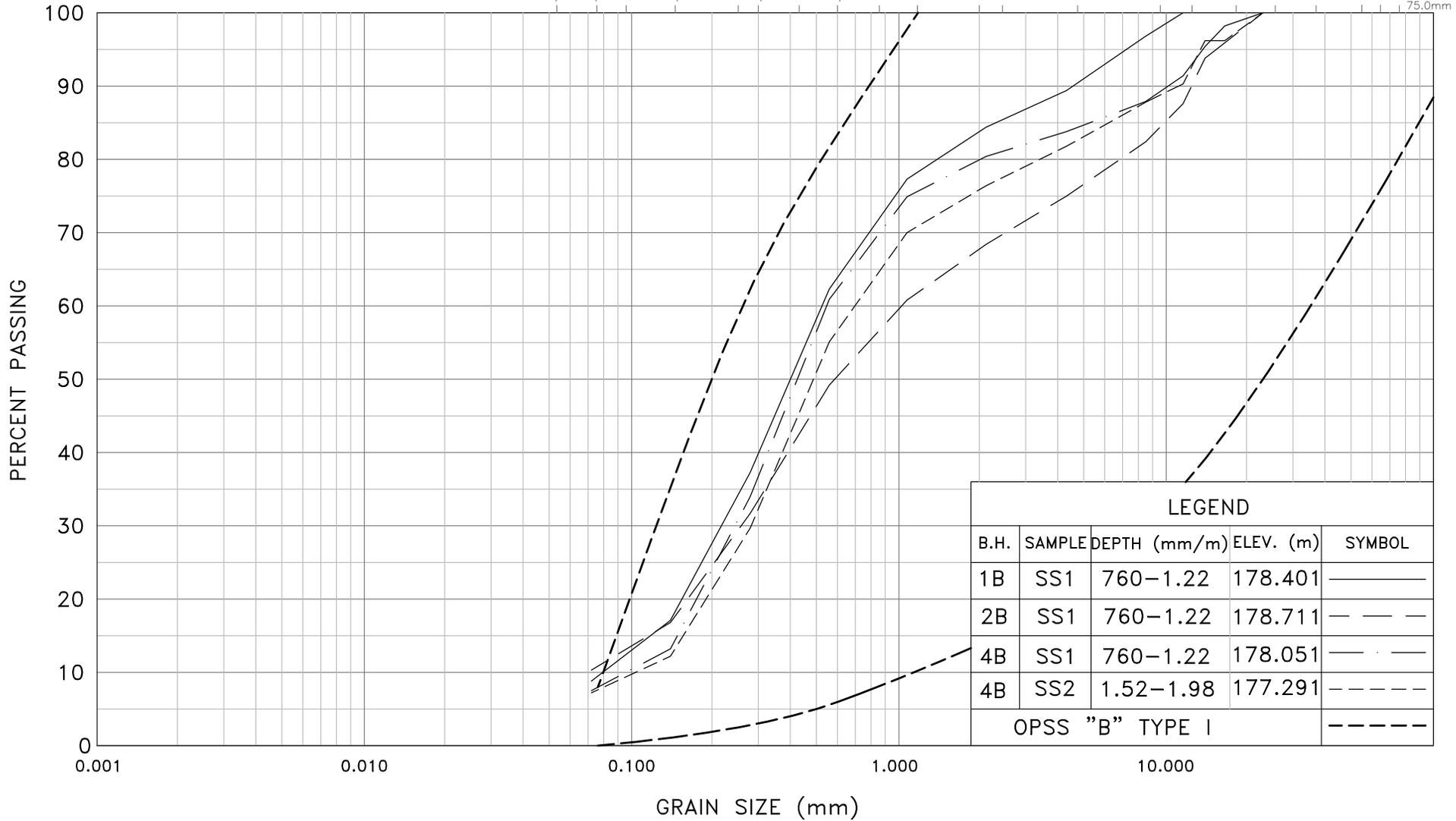
REF. S09737G/B

UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

53µm 75µm 106µm 150µm 250µm 300µm 425µm 600µm 850µm 1.18mm 2.0mm 2.36mm 4.75mm 9.5mm 13.2mm 19.0mm 26.5mm 37.5mm 53.0mm 63.0mm 75.0mm



PERCENT PASSING

0.001

0.010

0.100

1.000

10.000

GRAIN SIZE (mm)



Ministry of Transportation

Ontario

METRIC

GRAIN SIZE DISTRIBUTION

GRANULAR 'B' TYPE I

FIGURE No. 2

W.P. 6013-03-00

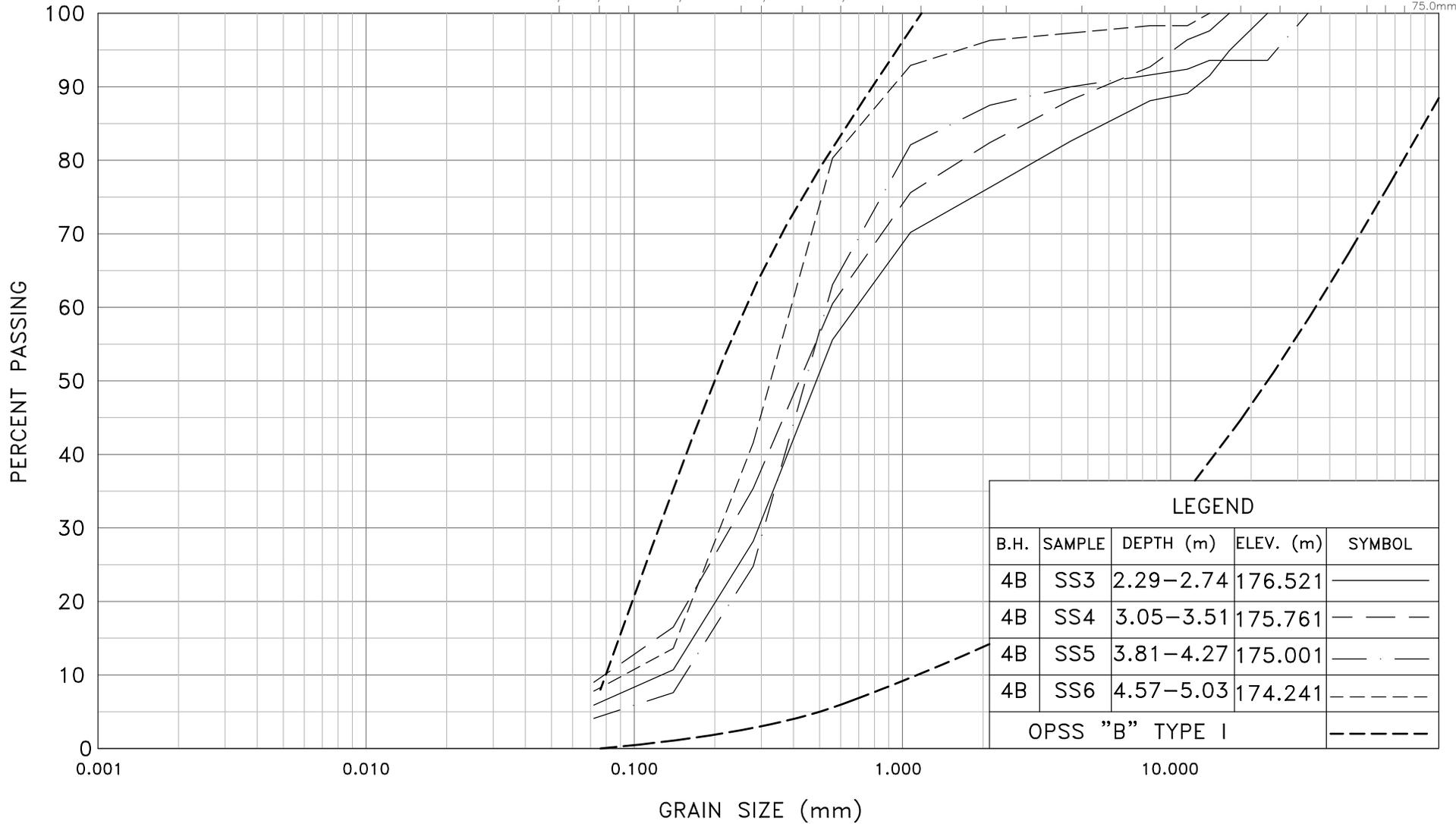
REF. S09737G/B

UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

106µm 250µm 425µm 850µm 1.18mm 2.0mm 4.75mm 9.5mm 13.2mm 26.5mm 53.0mm  
 53µm 75µm 150µm 300µm 600µm 1.18mm 2.0mm 4.75mm 9.5mm 19.0mm 37.5mm 63.0mm 75.0mm



GRAIN SIZE DISTRIBUTION  
 GRANULAR 'B' TYPE I

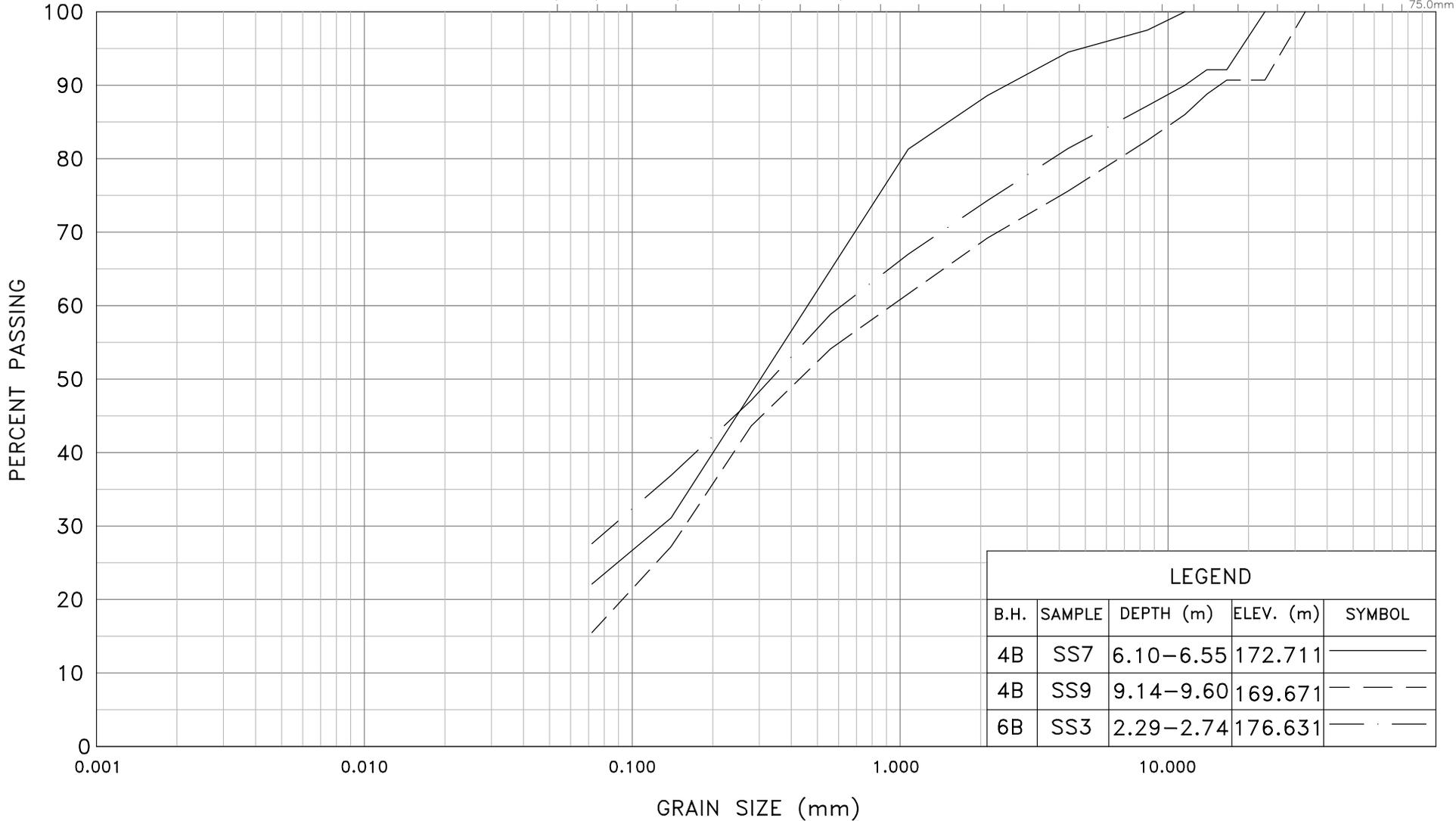
FIGURE No. 3  
 W.P. 6013-03-00  
 REF. S09737G/B

UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

53µm 75µm 106µm 150µm 250µm 300µm 425µm 600µm 850µm 1.18mm 2.0mm 2.36mm 4.75mm 9.5mm 13.2mm 19.0mm 26.5mm 37.5mm 53.0mm 63.0mm 75.0mm



GRAIN SIZE DISTRIBUTION  
SILTY SAND

FIGURE No. 4  
W.P. 6013-03-00  
REF. S09737G/B

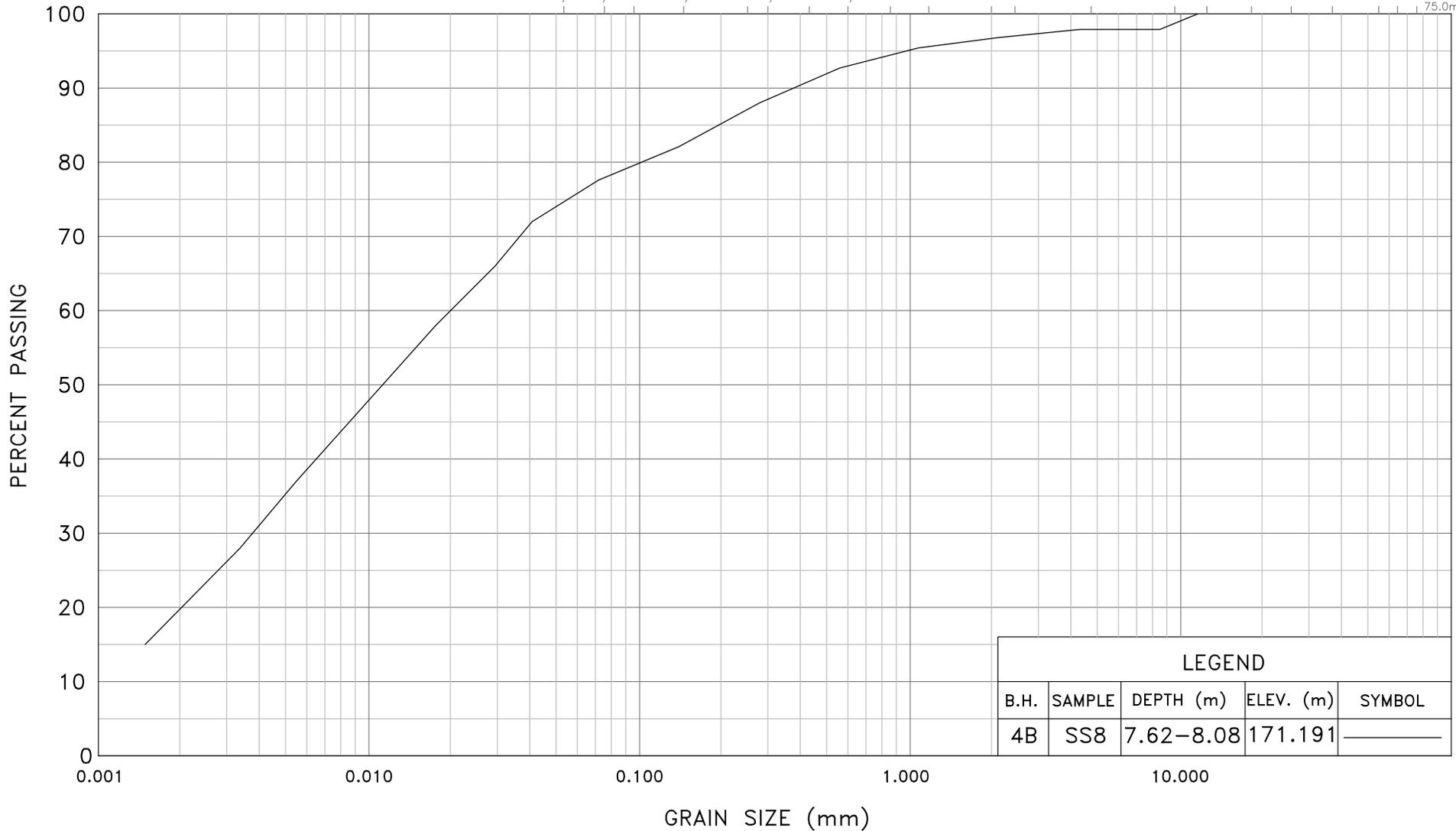


UNIFIED SOIL CLASSIFICATION

CLAY AND SILT	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

MINISTRY SIEVE DESIGNATION (Metric)

53µm 75µm 106µm 150µm 250µm 300µm 425µm 600µm 850µm 1.18mm 2.0mm 2.36mm 4.75mm 9.5mm 13.2mm 19.0mm 26.5mm 37.5mm 53.0mm 63.0mm 75.0mm



LEGEND				
B.H.	SAMPLE	DEPTH (m)	ELEV. (m)	SYMBOL
4B	SS8	7.62-8.08	171.191	—————



Ministry of Transportation

Ontario

METRIC

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT

FIGURE No. 5

W.P. 6013-03-00

REF. S09737G/B

## **APPENDIX D**

### **Photographs**

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**Photo 1**

Highway 17 from intersection of Highway 17 & Lake Huron Dr., facing east.



**Photo 2**

Highway 17 from intersection of Highway 17 & Lake Huron Dr., facing west.



**Photo 3**

Proposed gabion basket retaining wall.  
Location: West of Lake Huron Dr., facing northwest.



**Photo 4**  
**Proposed gabion basket retaining wall**  
**Location: West of Lake Huron Dr., facing north.**



**Photo 5**  
**Proposed gabion basket retaining wall**  
**Location: West of Lake Huron Dr., facing east.**



**Photo 6**  
**Proposed gabion basket retaining wall**  
**Location: East of Lake Huron Dr., facing North.**  
**Twin CSP culverts through Highway 17.**  
**South end facing north.**



**Photo 7**  
**Twin CSP culverts through Highway 17.**  
**North end facing south.**



**Photo 8**  
**Twin CSP culverts through Highway 17.**  
**North end facing southeast.**



**Photo 9**  
**Single & Twin CSP culverts through Lake Huron Dr. South**  
**East end facing west**



**Photo 10**

**Single & Twin CSP culverts through Lake Huron Dr. South  
East end facing northwest**



**Photo 11**

**Single & Twin CSP culverts through Lake Huron Dr. South  
West end facing east**



**Photo 12**

**Single & Twin CSP culverts through Lake Huron Dr. South  
West end facing east**



**Photo 13**

**Proposed location, for roadway protection, 1.0m North of centre line.**