

## REPORT

Foundation Investigation Report  
Pagwachuan River Bridge  
Replacement  
Site No. 39W-001  
Highway 11  
District – New Liskeard

G.W.P. 5412-04-00

LEA CONSULTING LTD.

PROJECT NO. 1015345  
GEOCRES NO. 42F-20

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## **REPORT NO. 1015345**

**REPORT TO**                    **Lea Consulting Ltd.**  
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**Suite 900**  
**Markham, Ontario**  
**L3R 9R9**

**FOR**                            **Foundation Investigation Report**

**ON**                             **Pagwachuan Bridge Replacement**  
**Site 39W-001, Highway 11**  
**District – New Liskeard**  
**G.W.P. 5412-04-00**  
**Geocres. No. 42F-20**

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**December 17, 2007**

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	Record of Borehole Sheets
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# FOUNDATION INVESTIGATION REPORT

**Pagwachuan River Bridge Replacement  
Site No. 39W-001, Highway 11  
Near Hearst, Ontario  
G.W.P. 5412-04-00  
District – New Liskeard**

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## 1.0 INTRODUCTION

Jacques Whitford Limited (Jacques Whitford) was retained by Lea Consulting Ltd., to complete a Foundation Investigation Report for the replacement of the Pagwachuan River Bridge on Highway 11, located approximately 52 km west of the intersection of Highway 11 and Highway 631, approximately half way between Hearst and Longlac, Ontario, (GWP No. 5412-04-00).

The work was carried out under Agreement No. 5005-E-0025. Authorization to proceed with the investigation was provided by Mr. Peter Ojala, P.Eng., Vice President, Head of Bridges and Structures, of Lea Consulting Ltd, the prime consultant on this design assignment.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the foundation investigation and the laboratory testing.

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## 2.0 SITE DESCRIPTION

The site is located on Highway 11 at the Pagwachuan River, approximately 52 km west of the junction of Highway 11 and Highway 631, approximately half way between Hearst and Longlac, Ontario.

Highway 11 is generally oriented in an east west direction with one east bound lane and one west bound lane. Highway 11 at the Pagwachuan River is built on shallow embankments to a rural highway section with wide gravel shoulders and is generally higher than the surrounding lands. Drainage for Highway 11 is provided by ditches located along the sides of the highway, which are sloped to drain to the Pagwachuan River.

The existing bridge structure consists of a through-truss main span and two steel girder approach spans. The main span is approximately 46 m long and the two approach spans are each approximately 15 m long. The deck is reportedly a reinforced concrete deck. The bridge was constructed about 1942 and rehabilitated in 1982.

Two drawing sheets, TWP 770-1-1-A and 770-1-2-A, dated August 1941 both indicate that the existing bridge structure is likely supported on spread footings. The drawings indicate that the tops of the footings for the piers are at elevations of approximately 193.7 m and 193.8 m, and the tops of the abutment footings are at elevations of approximately 198.3 m and 197.7 m for the east and west abutment, respectively.



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### 3.0 PHYSIOGRAPHY

Based on Map 2518, titled "Surficial Geology of Northern Ontario", dated 1987, by the Ministry of Northern Development and Mines, Highway 11 at the Pagwachuan River is situated on the boundary between exposed bedrock, bedrock with a thin veneer of glacial sediment cover and shallow drift, and glacial till.

Based on Map 2543, titled "Bedrock Geology of Ontario, East-Central Sheet", dated 1991, by the Ontario Ministry of Northern Development and Mines, the bedrock at the site is noted as Metasedimentary rock comprised of wacke, arkos, argillite, slate, marble, chert, iron formation and minor metavolcanic rocks, with intrusions of mafic and related rock.

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### 4.0 BACKGROUND

A preliminary foundation investigation and design report was carried out by Jacques Whitford Limited. The results of the preliminary investigation were provided in the following draft Preliminary Foundation Investigation and Design report:

- Draft Report  
Preliminary Foundation Investigation and Design Report  
Pagwachuan River Bridge Replacement  
Site No. 39W-001  
Highway 11  
District – New Liskeard  
GWP 5412-04-00  
Jacques Whitford Project Number: 1015345  
Draft report dated: April 27, 2007

The factual results from the draft preliminary foundation report, including the Record of Borehole Sheets and Laboratory Test data, have been incorporated in this report.

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### 5.0 INVESTIGATION PROCEDURES

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#### 5.1 Field Program

The fieldwork for the preliminary investigation was carried out from February 21 to 23, 2007, and March 16 to 26, 2007. The field work for the detailed investigation was carried out from July 11 to 20, 2007. A total of 13 boreholes were advanced for this investigation using track and barge mounted drill rigs equipped with 250 mm (outside diameter) continuous flight, hollow-stem augers, steel casings and mud rotary drilling. The drill rigs were supplied and operated by Landcore Drilling, Abraflex Drilling and Walker Drilling. The following table outlines the drilling program:



Structure	Element	Borehole Number
Replacement Structure	West Approach	P-07-64
	West Abutment	P-06-1
		P-06-2
	West Pier (Pier 1)	P-07-1
	East Pier (Pier 2)	P-07-2
	East Abutment	P-06-5
		P-06-6
East Approach	P-07-65	
Detour Structure	West Approach	P-07-60
	West Abutment	P-06-2
		P-06-3
	Central Pier	P-07-3
	East Abutment	P-06-4
		P-06-5
East Approach	P-07-59	

Prior to commencing the field investigations, the borehole locations were cleared of underground utilities by the various utility companies.

Soil samples were recovered from the boreholes at regular intervals using a 50 mm Outside Diameter split-tube sampler by conducting Standard Penetration Tests (SPTs) in general accordance with the procedures outlined in ASTM specification D1586-99. Relatively undisturbed samples were obtained by pushing thin walled sample tubes in general accordance with ASTM D1587.

Where cohesive soils were encountered, in situ shear vane testing was carried out using a vane meeting the MTO N-Vane design requirements and following the procedures outlined in ASTM D2573-94.

Rock cores were obtained using standard NQ rock coring equipment.

Jacques Whitford field personnel recorded the conditions encountered in all boreholes at the time of the investigation. Soils were described in accordance with the MTO Soils Classification System for foundation reports.

The groundwater levels, where encountered and where practical, were measured in the boreholes during and on completion of drilling. All boreholes were backfilled in accordance with the Ontario Ministry of the Environment Regulation 903, using a cement/bentonite slurry.

All soil samples recovered from the boreholes were placed in moisture-proof bags and transported to our laboratory for detailed classification and testing as required. All rock cores were placed in rock core boxes and transported to our laboratory for detailed examination and selected laboratory testing.

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## 5.2 Survey

The borehole locations were established by Jacques Whitford personnel and referenced to the stations of the permanent alignment at centreline on Highway 11, as noted on the Record of Borehole sheets. Offsets were referenced looking up chainage. The borehole chainage and off-sets are provided on Drawing Nos. 1 to 4 in **Appendix A** and on the Record of Borehole sheets in **Appendix B**.

The ground surface elevation at the borehole locations were surveyed by Jacques Whitford Personnel. The boreholes were surveyed to the following benchmark:

- Geodetic Canada Benchmark No. 79U030, with a reported Geodetic elevation of 202.461 m.

The location of the benchmark is shown on the drawings in **Appendix A**.

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## 5.3 Laboratory Testing

All samples returned to the laboratory were subjected to detailed visual examination and classification. Approximately 25% of the soil samples were submitted for routine testing including a suite of moisture content determination, 33 grain size distribution and 23 Atterberg Limits tests. The laboratory results are provided on the Record of Borehole sheets in **Appendix B**. One of the thin wall Shelby tube samples was submitted to Golder Associates Laboratories for consolidation testing.

The results of the grain size analyses, Atterberg Limits and Consolidation tests are shown on Figure Nos. 1 through 14 in **Appendix C**.

Unless requested in advance, all samples will be stored in our laboratory for a period of 12 months, from the issue date of this report.

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# 6.0 RESULTS OF THE INVESTIGATION

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## 6.1 Subsurface Conditions

The subsurface conditions encountered in the boreholes are summarized on the Record of Borehole sheets provided in **Appendix B**. An explanation of the terms used on the Record of Borehole sheets is also provided in **Appendix B**.

Borehole Location Plans and Strata Plots of the soils encountered in the boreholes are provided on Drawing No. 1 and Drawing No. 2 in **Appendix A**.

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

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## 6.2 Soil

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### 6.2.1 Pavement Structure

Pavement structure was encountered at the ground surface in Boreholes P-07-64 and P-07-65, which were advanced on the shoulder of the existing road alignment. The pavement structure consisted of approximately 50 mm of asphalt underlain by approximately 0.9 m to 1.2 m of granular material

generally consisting of sand fill with varying amounts of gravel. The pavement structure extended to an elevation of approximately 201.1 m to 202.1 m

Laboratory testing performed on two samples of the granular material sand fill consisted of moisture content tests. The test results are as follows:

- Moisture Content:
  - 8% and 9%

The results of the moisture content tests are provided on the Record of Borehole sheets in **Appendix B**.

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### 6.2.2 Topsoil

Topsoil was encountered at the ground surface in Boreholes P-06-1 to P-06-4 and P-07-59 and P-07-60. The thickness of the topsoil was variable ranging from approximately 50 mm in P-06-2 to 600 mm in P-06-3.

Laboratory testing performed on a single sample of the topsoil consisted of a moisture content test. The test result is as follows:

- Moisture Content:
  - 29%

The result of the moisture content test is provided on the Record of Borehole sheets in **Appendix B**.

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### 6.2.3 Sand Fill (SM)

Sand fill was encountered in Boreholes P-06-5, P-06-6 and P-07-59. The sand fill ranged in thickness from approximately 1.0 m to 2.3 m and extended to elevations of approximately 198.2 m to 199.6 m.

The sand fill contained trace gravel, varying amounts of silt, trace clay and was moist to wet.

Based on the N-Values obtained from four Standard Penetration Tests (SPT), the compactness of the sand fill was determined to be loose to compact.

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

- Moisture Content:
  - 9% to 27%
- Grain Size Distribution
  - 3% gravel;
  - 47% sand;
  - 45% silt; and,
  - 5% clay.

The results of the moisture content tests and grain size distribution are provided on the Record of Borehole sheets in **Appendix B**. The results of the grain size distribution test are provided on Figure 1 in **Appendix C**.

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#### 6.2.4 Clayey Silt Fill (CL-ML)

A layer of clayey silt fill was encountered below the topsoil in P-06-1 and P-06-2. The clayey silt fill was approximately 400 mm to 2.0 m thick and extended to elevations of approximately 198.0 m to 198.4 m.

The clayey silt fill contained trace to some sand, trace gravel, organics and rootlets, and was generally moist.

Based on the N-values obtained from two SPTs, the consistency of the clayey silt fill was determined to be stiff.

Laboratory testing performed on three samples consisted of moisture content tests. The test results are as follows:

- Moisture Content:
  - 14% to 21%

The moisture content test results are provided on the Record of Borehole sheets in **Appendix B**.

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#### 6.2.5 Clayey Silt (ML – CL)

Clayey Silt was encountered in Boreholes P-06-1 to P-06-6, P-07-60 and P-07-65. The thickness of the clayey silt ranged from approximately 0.4 m to 3.1 m and extended to elevations of approximately 194.9 m to 200.5 m.

The clayey silt contained trace sand, trace organics, rootlets, wood fragments and was moist.

Based on the N-Values obtained from the SPTs, the consistency of the clayey silt was determined to be stiff to very stiff.

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

- Moisture Content:
  - 13% to 26%
- Grain Size Distribution:
  - 0% gravel;
  - 1% to 5% sand;
  - 75% to 81% silt; and,
  - 17% to 19% clay
- Atterberg Limits:
  - Liquid Limit: 25% to 23%
  - Plastic Limit: 20% to 17%
  - Plasticity Index: 5% to 6%

The results of the moisture content, grain size distribution and Atterberg Limits tests, are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution tests are provided on Figure 2 in **Appendix C**. The results of the Atterberg Limits tests are provided on Figure 3 in **Appendix C**.

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### 6.2.6 Sand (SM to SW)

A layer of sand was encountered underlying the clayey silt in Boreholes P-06-4, P-06-5, and P-06-6, at the bottom of the river in Borehole P-07-1 and in Borehole P-07-65. The thickness of the sand layer varied from approximately 1.9 m to 3.1 m and extended to elevations in the range of about 191.7 m to 198.0 m.

The sand contained some gravel, trace silt and clay and was generally saturated. Wood fragments and organics were encountered in the samples from Borehole P-07-1 advanced in the river.

Based on the N-values obtained from the SPTs, the sand was determined to be loose to compact.

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

- Moisture Content:
  - 7% to 21%
- Grain Size Distribution:
  - 3% to 23% gravel;
  - 56% to 78% sand;
  - 9% to 36% silt; and,
  - 1% to 4% clay

The results of the moisture content and grain size distribution tests are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution tests are provided on Figure 4 in **Appendix C**.

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### 6.2.7 Silty Clay (CL)

Layers of silty clay were encountered underlying the surficial soils in all boreholes. The layers of silty clay were interbedded with layers of silt and sandy silts. The thickness of the various silty clay layers ranged from approximately 1.5 m to 12.2 m. Boreholes P-07-59 and P-07-65 were terminated in the silty clay layer at a depth of approximately 11.6 m and 11.3 m, elevations of about 190.3 m and 190.7 m, respectively.

In situ shear vane testing was carried out in the silty clay. The results of the testing indicated that the shear strength of the silty clay was variable ranging from approximately 24 kPa to more than 100 kPa (the upper limit of the equipment), with sensitivities in the range of approximately 1.8 to 5. The in situ shear vane and SPT testing indicated that the consistency of the silty clay could be described as soft to hard.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and Atterberg Limits tests. In addition to the routine testing one sample (Borehole P-07-2 Sample 7) was submitted for consolidation testing. The laboratory test results are as follows:

- Moisture Content:
  - 17% to 40%

- Grain Size Distribution:
  - 0% to 3% gravel;
  - 5% to 16% sand;
  - 50% to 76% silt; and,
  - 22% to 46% clay
- Atterberg Limits:
  - Liquid Limits: 22% to 32%
  - Plastic Limits: 12% to 17%
  - Plasticity Indices: 7% to 16%
- Consolidation Test Results:
  - Initial Void Ratio: 0.671
  - Pre-consolidation Pressure: 110 kPa
  - Consolidation Index  $C_c$ : 0.18
  - Reconsolidation Index  $C_r$ : 0.029
  - Co-efficient of Consolidation  $C_v$ :  $7 \times 10^{-7}$  m<sup>2</sup>/sec

The results of the moisture content, grain size distribution and Atterberg Limits tests, are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution tests are provided on Figures 5 and 6 in **Appendix C**. The results of the Atterberg Limits tests are provided on Figures 7 and 8 in **Appendix C**. The results of the consolidation test are provided on Figure 9 in **Appendix C**.

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#### 6.2.8 Silt to Sandy Silt (ML)

Layers of silt to sandy silt were encountered in all boreholes between the layers of silty clay, clayey silt and sand noted herein. The silt to sandy silt ranged in thickness from approximately 1.3 m to 9.1 m and extended to elevations ranging from about 191.3 m to 193.6 m. Boreholes P-07-60 and P-07-64 were terminated in the silty to sandy silt stratum at depths of approximately 11.3 m, elevations of about 191.3 m and 192.0 m, respectively.

The silt to sandy silt contained seams of silty clay, some organics and was moist to saturated.

Based on the N-Values obtained from the SPTs, silt ranged from very loose to compact.

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

- Moisture Contents:
  - 14% to 35%
- Grain Size Distribution:
  - 0% gravel;
  - 0% to 9% sand;
  - 81% to 94% silt; and,
  - 5% to 14% clay.

The results of eight (8) Atterberg Limits tests indicated that the soil was non-plastic.

The results of the moisture content tests and grain size distribution tests are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution tests are provided on Figures 10 and 11 in **Appendix C**.

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#### 6.2.9 Sandy Silt to Silty Sand (ML to SM)

Sandy silt to silty sand strata was encountered at depth in Boreholes P-06-1 to P-06-6, and P-07-1 to P-07-3. The top of this layer ranged from elevations of approximately 171.1 m to 180.9 m, while the base was encountered at elevations of approximately 176.3 m to 170.4 m. Boreholes P-06-1, P-06-4 to P-06-6 were terminated within this unit.

The sandy silt to silty sand strata contained trace to some clay and gravel and was moist to saturated. Rock fragments, cobbles and boulders were also noted.

Based on the N-Values obtained from the SPTs, the sandy silt to silty sand was generally very dense.

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

- Moisture Contents:
  - 4% to 18%
- Grain Size Distribution:
  - 14% to 17% gravel;
  - 19% to 70% sand;
  - 13% to 54% silt; and,
  - 3% to 10% clay.

The results of the moisture content tests and grain size distribution test are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution test are also provided on Figure 12 in **Appendix C**.

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#### 6.2.10 Clayey Silt Till (CL-ML)

Clayey silt till was encountered in Borehole P-07-2 at a depth of approximately 30.2 m below existing grade, an elevation of approximately 167.6 m. Borehole P-07-2 was terminated in the clayey silt till stratum at a depth of approximately 33.2 m, an elevation of approximately 164.6 m.

The clayey silt till generally contained with to some sand and trace gravel and was moist. Cobbles and boulders were encountered in the clayey silt till stratum.

Based on the N-Values obtained from the SPTs, the consistency of the clayey silt was hard.

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

- Moisture Content:
  - 7% to 9%

- Grain Size Distribution:
  - 5% gravel;
  - 26% sand;
  - 48% silt; and,
  - 21% clay; and,
- Atterberg Limits:
  - Liquid Limit: 22%
  - Plastic Limit: 18%
  - Plasticity Index: 4%

The results of the moisture content, grain size distribution and Atterberg Limits tests, are provided on the Record of Borehole sheets in **Appendix B**.

The results of the grain size distribution tests are provided on Figure 13 in **Appendix C**. The results of the Atterberg Limits tests are provided on Figure 14 in **Appendix C**.

### 6.3 Boulders

A layer of boulders were encountered in Boreholes P-07-1, P-07-2 and P-07-3, at depths in the range of approximately 24.7 m to 27.4 m below existing grade, elevations of about 170.4 m to 173.1 m. The thickness of the boulder layer was approximately 1.5 m in P-07-1 and 2.8 m in P-07-2. Borehole P-07-3 was terminated in the boulder layer at a depth of approximately 27.7 m below existing grade, elevation of about 169.6 m.

The boulders were cored using NQ coring equipment.

### 6.4 Bedrock

Bedrock, generally consisting of pink and grey gneiss, was encountered in Boreholes P-06-2, P-06-3 and P-07-1 at depths of approximately 21.9 m to 29.9 m below existing grade, elevations of about 167.9 m to 176.3 m. The boreholes were terminated in the rock at depths of approximately 25.4 m to 31.1 m, elevations of about 166.7 m to 172.7 m.

Core samples of the bedrock were obtained from Boreholes P-06-2, P-06-03 and P-07-1. The observations of the rock cores are summarized as follows:

- Total Core Recovery (TCR): 87% to 100%, average of approximately 93%
- Solid Core Recover (SCR): 36% to 91%, average of approximately 74%
- Rock Quality Designation (RQD): 45% to 100%, average of approximately 79%

The results of the rock core analysis are provided on the Record of Borehole sheets in **Appendix B**.

### 6.5 Groundwater

It was not practical to measure the depth to groundwater on completion of drilling, given that the methods employed to drill the boreholes included the use of drilling mud. However, water was encountered on the spoon during drilling at the depths and elevations noted in the following table:

Borehole Number	Groundwater First Encountered	
	Depth Below Existing Grade (m)	Elevation (m)
P-06-1	1.5	197.5
P-06-2	3.0	197.1
P-06-3	4.6	193.6
P-06-4	2.9	196.2
P-06-5	3.0	196.6
P-06-6	3.0	196.5
P-07-1	River Surface	197.8
P-07-2	River Surface	197.8
P-07-3	River Surface	197.3
P-07-59	2.7	199.2
P-07-60	0.8	201.8
P-07-64	3.3	200.0
P-07-65	3.4	198.6

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## 7.0 CLOSURE

A soil investigation is a limited sampling of a site. The information is gathered at specific borehole locations and can only be extrapolated to an undefined limited area around the borehole locations. The extent of the limited area depends on the variability of the soil and groundwater conditions as influenced by geological processes, as well as the history of the site reflecting natural conditions, construction activities and site use. Should any conditions at the site be encountered which differ from those at the borehole locations, we request that we be notified immediately in order to assess the additional information.

We trust the above information meets with your present requirements. Should you have any questions or require further information, please do not hesitate to contact us at your convenience.

Regards,

**JACQUES WHITFORD LIMITED**

*Original Signed by:*

Geoffrey Creer, P. Eng.  
Geotechnical Engineer

*Original Signed by:*

Fred J. Griffiths, Ph. D., P. Eng.  
Designated Principal  
MTO Foundations Contact

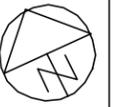
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# Appendix A

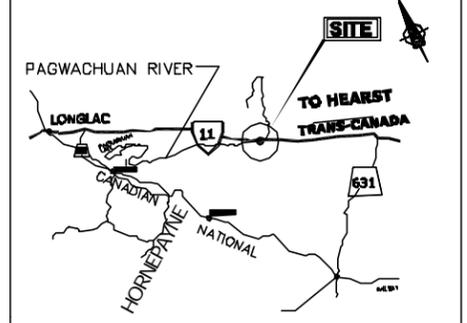
## Drawings

CONT No 2007-5105  
WP No 5412-04-00



PAGWACHUAN RIVER  
REPLACEMENT BRIDGE  
BOREHOLE LOCATIONS AND  
SOIL STRATA

SHEET

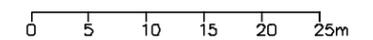


KEY PLAN N.T.S

BOREHOLE  
 GROUNDWATER LEVEL  
 LEGEND:

BOREHOLE No.	STATION	OFFSET	ELEVATION
P-06-1	17+837	11m Rt	199.0 m
P-06-2	17+822	16m Lt	200.1 m
P-06-3	17+843	27m Lt	198.2 m
P-06-4	17+904	19m Lt	199.1 m
P-06-5	17+907	9m Lt	199.6 m
P-06-6	17+905	12m Rt	199.5 m
P-07-1	17+854	7m Lt	197.8 m
P-07-2	17+891	7m Lt	197.8 m
P-07-3	17+871	26m Lt	197.3 m
P-07-59	17+938	13m Lt	201.9 m
P-07-60	17+812	18m Rt	202.6 m
P-07-64	17+812	6m Rt	203.3 m
P-07-65	17+948	5m Rt	202.0 m

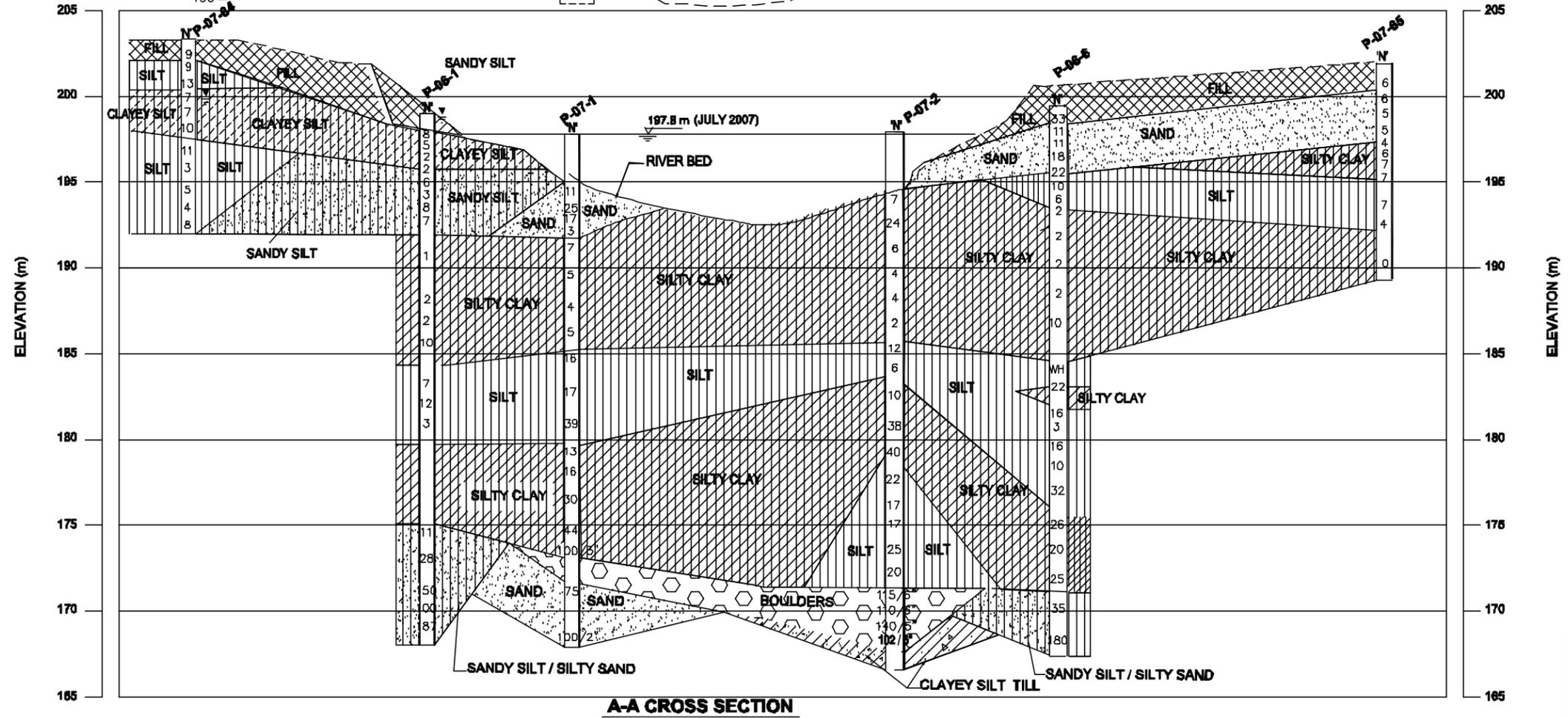
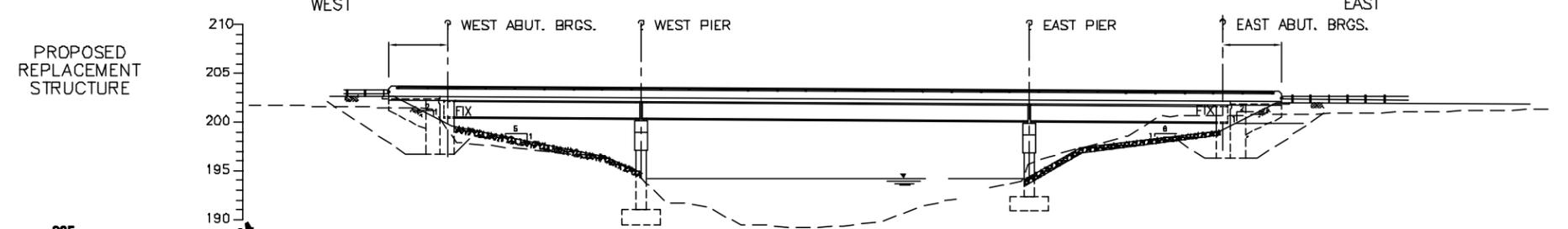
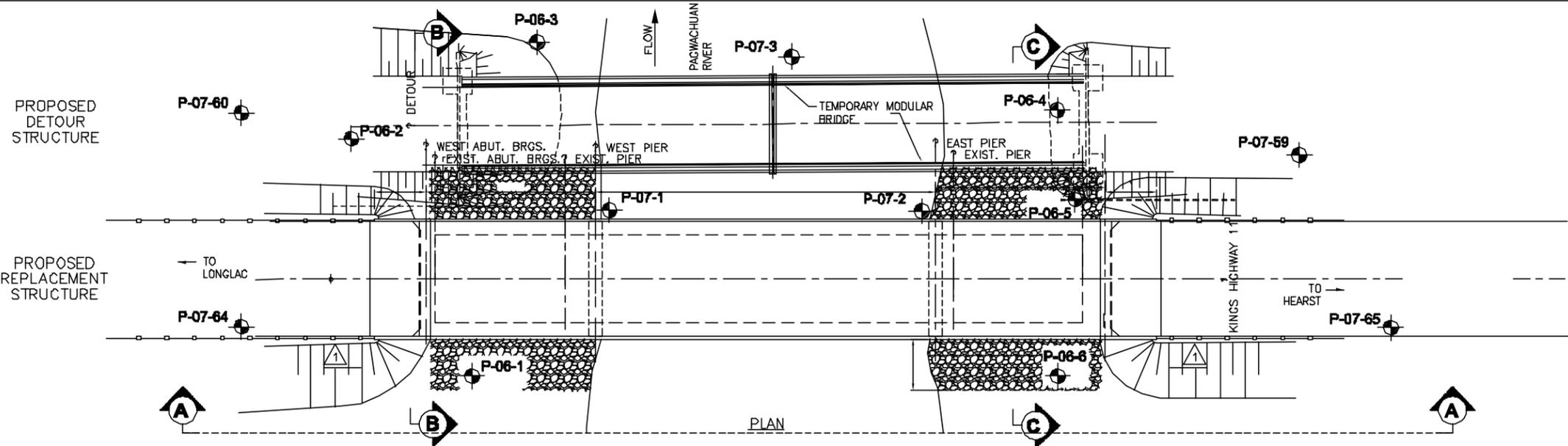
- NOTES:
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REVISIONS	DATE	BY	DESCRIPTION

DESIGN	AA	CHK	GC	CODE	CHBDC-00	LOAD	ONT CL-825	DATE	2007/12/13
DRAWN	AA	CHK	GC	SITE	39W-001	STRUCT	SCHEME	DWG	1



A-A CROSS SECTION

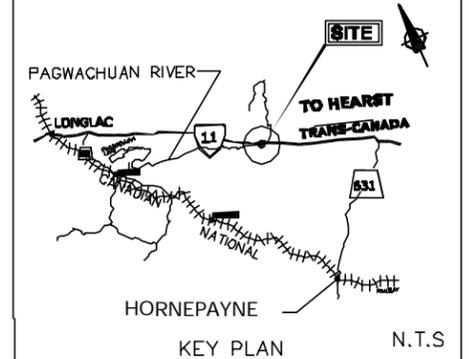
METRIC  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

CONT No 2007-5105  
 WP No 5412-04-00



PAGWACHUAN RIVER  
 REPLACEMENT BRIDGE  
 SOIL STRATA  
 SECTION B-B & C-C

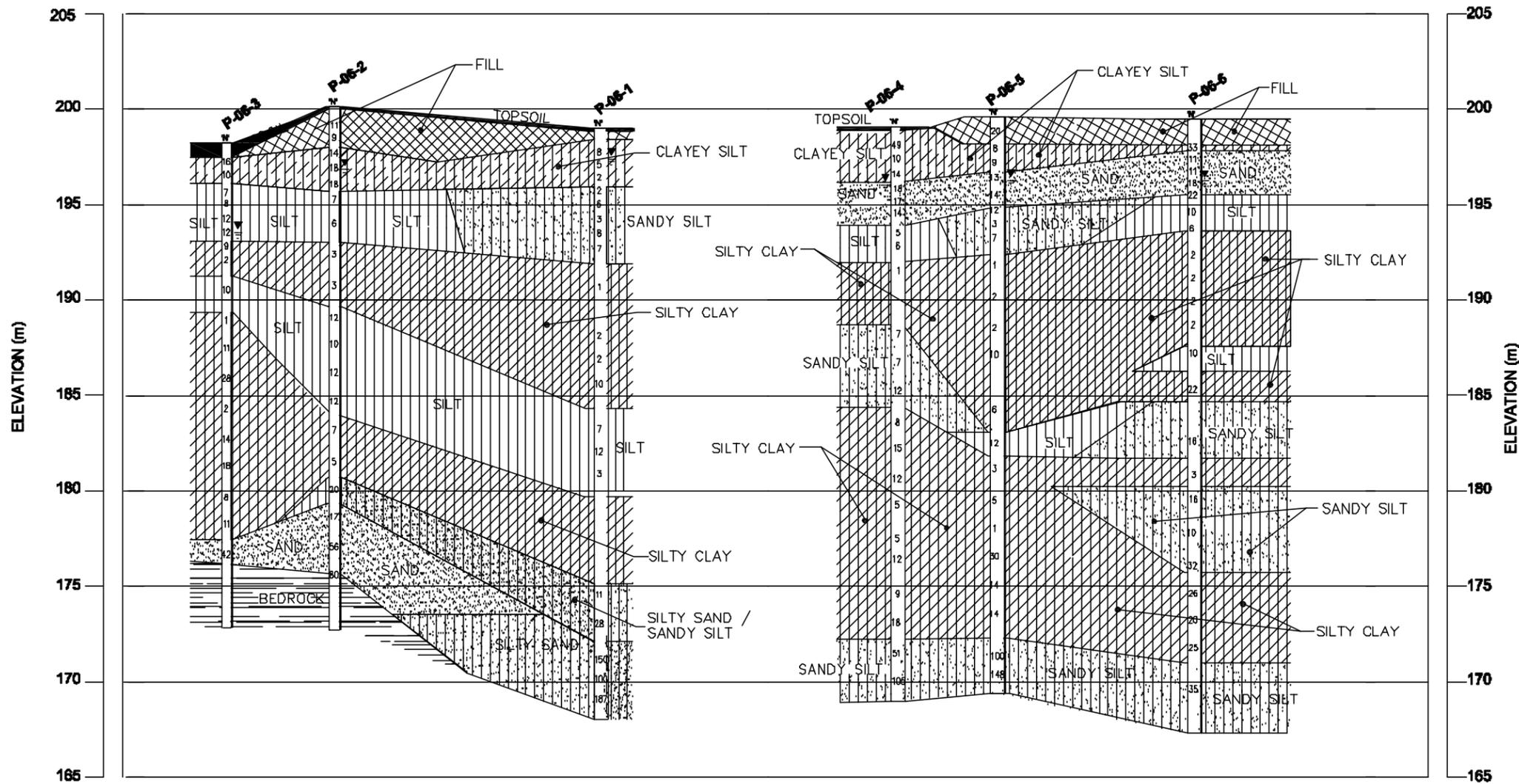
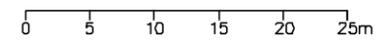
SHEET



LEGEND:  
 BOREHOLE  
 GROUNDWATER LEVEL

BOREHOLE No.	STATION	OFFSET	ELEVATION
P-06-1	17+837	11m Rt	199.0 m
P-06-2	17+822	16m Lt	200.1 m
P-06-3	17+843	27m Lt	198.2 m
P-06-4	17+904	19m Lt	199.1 m
P-06-5	17+807	9m Lt	199.6 m
P-06-6	17+905	12m Rt	199.5 m
P-07-1	17+854	7m Lt	197.8 m
P-07-2	17+891	7m Lt	197.8 m
P-07-3	17+871	26m Lt	197.3 m
P-07-59	17+938	13m Lt	201.9 m
P-07-60	17+812	18m Lt	202.6 m
P-07-64	17+812	6m Rt	203.3 m
P-07-65	17+948	5m Rt	202.0 m

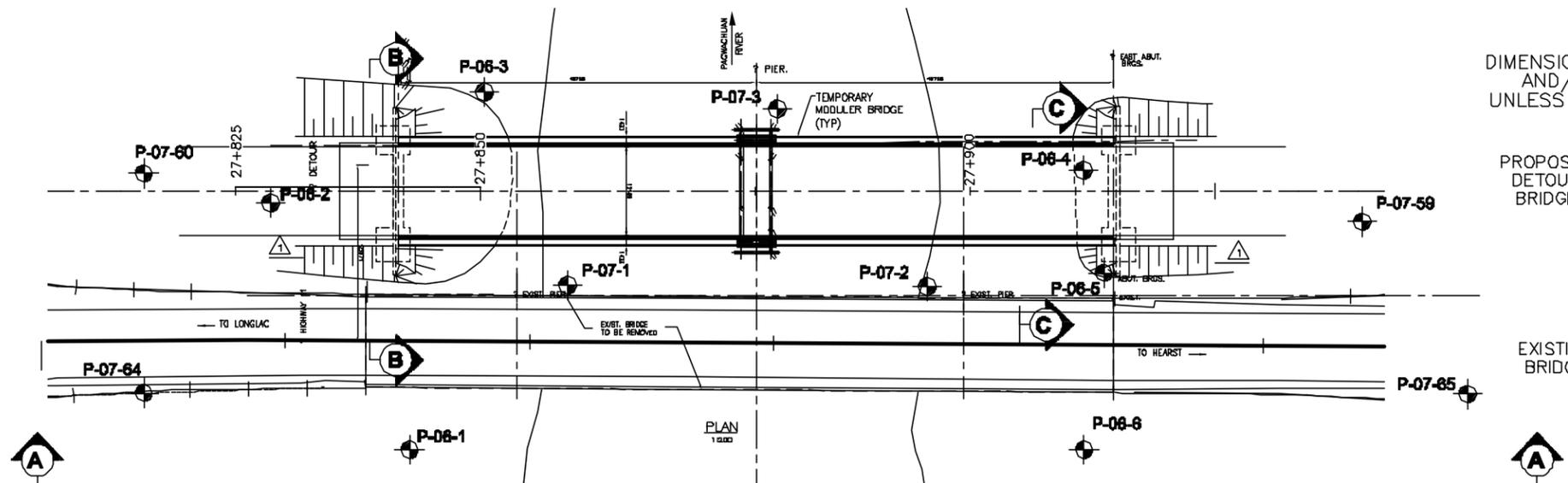
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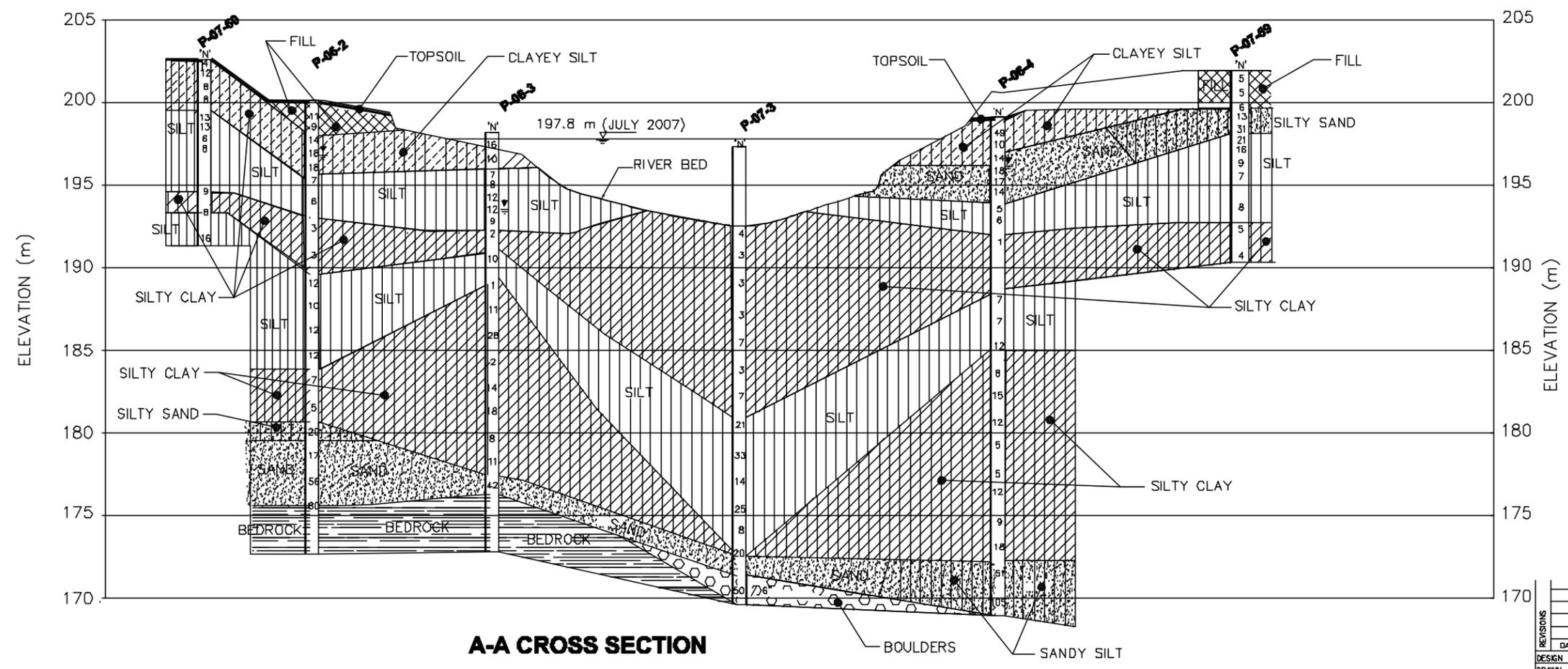
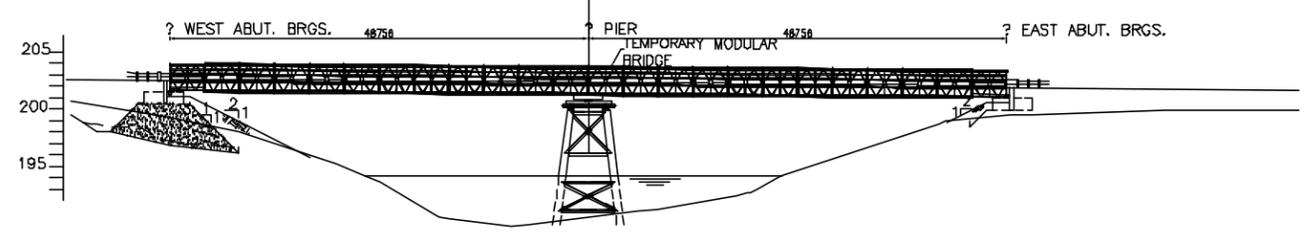
**B-B CROSS SECTION**

**C-C CROSS SECTION**

REVISIONS	DATE	BY	DESCRIPTION
DESIGN AA	CHK EC	CODE CHBDC-00	LOAD ONT CL-825/DATE 2007/12/13
DRAWN AA	CHK CC	SITE 38W-001	STRUCT SCHEME DWG 2



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



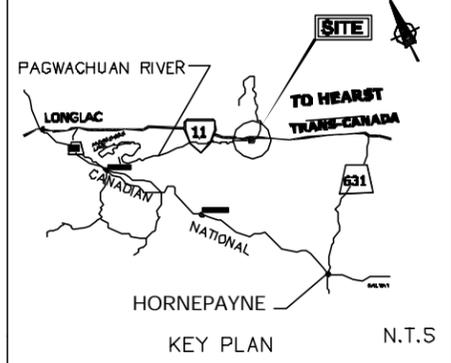
**A-A CROSS SECTION**

CONT No 2007-5105  
WP No 5412-04-00



PAGWACHUAN RIVER DETOUR BRIDGE  
BOREHOLE LOCATIONS AND  
SOIL STRATA

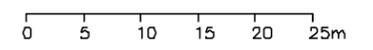
SHEET



LEGEND:  
 BOREHOLE  
 GROUNDWATER LEVEL

BOREHOLE No.	STATION	OFFSET	ELEVATION
P-06-1	17+837	11m Rt	199.0 m
P-06-2	17+822	16m Lt	200.1 m
P-06-3	17+843	27m Lt	198.2 m
P-06-4	17+904	19m Lt	199.1 m
P-06-5	17+907	9m Lt	199.6 m
P-06-6	17+905	12m Rt	199.5 m
P-07-1	17+854	7m Lt	197.8 m
P-07-2	17+891	7m Lt	197.8 m
P-07-3	17+871	28m Lt	197.3 m
P-07-59	17+938	13m Lt	201.9 m
P-07-60	17+812	18m Lt	202.6 m
P-07-64	17+812	6m Rt	203.3 m
P-07-65	17+948	5m Rt	202.0 m

- NOTES:
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REVISIONS	DATE	BY	DESCRIPTION

DESIGN	AA	CHK	GC	CODE	CHBDC-00	LOAD	ONT CL-623	DATE	2007/11/12
DRAWN	AA	CHK	GC	SITE	39W-001	STRUCT	SCHEME	DWG	3

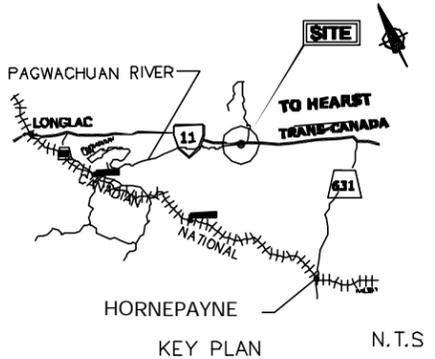
METRIC  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

CONT No 2007-5105  
 WP No 5412-04-00



PAGWACHUAN RIVER DETOUR BRIDGE  
 SOIL STRATA  
 SECTION B-B & C-C

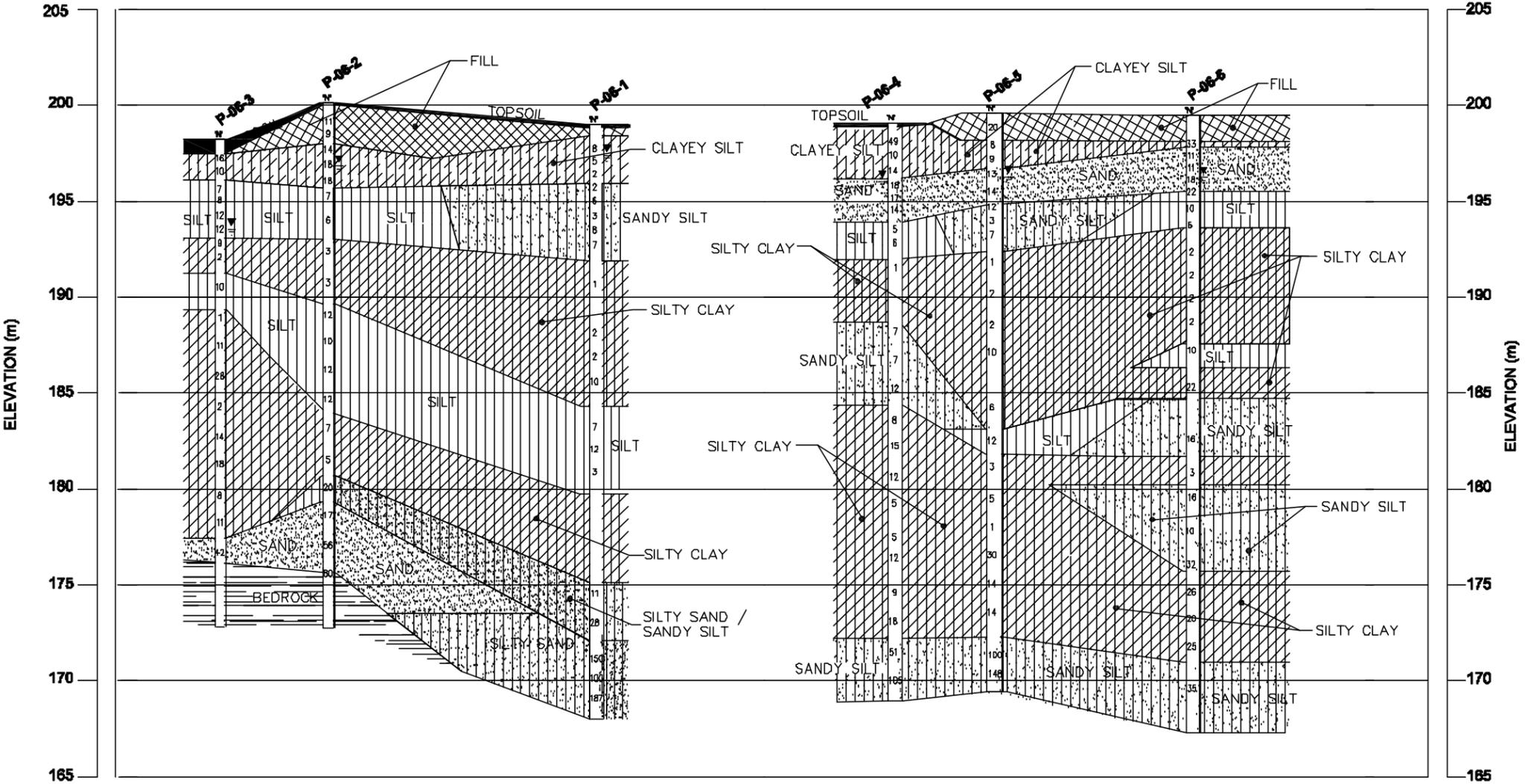
SHEET



LEGEND:  
 BOREHOLE  
 GROUNDWATER LEVEL

BOREHOLE No.	STATION	OFFSET	ELEVATION
P-06-1	17+837	11m Rt	199.0 m
P-06-2	17+822	16m Lt	200.1 m
P-06-3	17+843	27m Lt	198.2 m
P-06-4	17+904	19m Lt	199.1 m
P-06-5	17+907	8m Lt	199.6 m
P-06-6	17+905	12m Rt	199.5 m
P-07-1	17+854	7m Lt	197.8 m
P-07-2	17+891	7m Lt	197.8 m
P-07-3	17+871	26m Lt	197.3 m
P-07-59	17+938	13m Lt	201.9 m
P-07-60	17+812	18m Lt	202.6 m
P-07-64	17+812	6m Rt	203.3 m
P-07-65	17+948	5m Rt	202.0 m

- NOTES:
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**B-B CROSS SECTION**

**C-C CROSS SECTION**

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	AA	CHK	GC	CODE	CHBDC-00	LOAD	ONT	CL-625	DATE	2007/12/13	
DRAWN	AA	CHK	GC	SITE	3PW-001	STRUCT		SCHEME		DWG	4

# Appendix B

Terms and Symbols Used on the Record of Borehole Sheet  
Record of Borehole Sheets

## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

### SOIL DESCRIPTION

Terminology describing common soil genesis:

<i>Topsoil</i>	-	mixture of soil and humus capable of supporting good vegetative growth
<i>Peat</i>	-	fibrous fragments of visible and invisible decayed organic matter
<i>Till</i>	-	unstratified and unsorted glacial deposit which may include particle sizes from clay to boulders
<i>Fill</i>	-	materials not identified as deposited by natural geological processes

Terminology describing soil structure:

<i>Desiccated</i>	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	-	material breaks along plane of fracture
<i>Varved</i>	-	composed of regular alternating layers of silt and clay
<i>Stratified</i>	-	alternating layers or beds greater than 6mm (1/4") thick
<i>Laminated</i>	-	alternating layers or beds less than 6mm (1/4") thick
<i>Blocky</i>	-	material can be broken into small and hard angular lumps
<i>Lensed</i>	-	irregular shaped pockets of soil with differing textures
<i>Seam</i>	-	a thin, confined layer of soil having different particle size, texture, or color from materials above and below
<i>Well Graded</i>	-	having wide range in grain sizes and substantial amounts of all intermediate particles sizes
<i>Uniformly Graded</i>	-	predominantly one grain size

Soil descriptions and classification are based on the Unified Soil Classification System (USCS) (ASTM D-2488), which classifies soils on the basis of engineering properties. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with the standard of the Ministry of Transportation of Ontario:

<i>Trace or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>With</i>	20-30%

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N'-value\*.

Compactness	'N'-value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

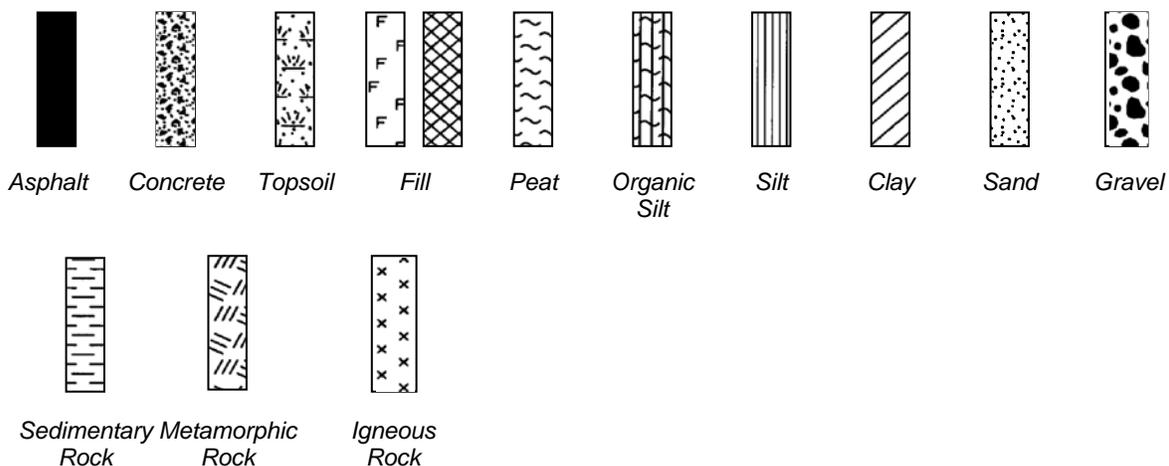
The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis. Standard Penetration Test 'N'-values\* can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils.

Consistency	Undrained Shear Strength (kPa)	'N'-Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

**Note: \*\*N'-VALUE-** The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in millimeters (e.g. 50/75).

### STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



### WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

### SAMPLE TYPE

SS	Split spoon sample (obtained from the Standard Penetration Test)	BS	Bulk sample
TW	Thin Wall Sample or Shelby Tube	WS	Wash sample
PS	Piston sample	HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits.
GS	Grab sample		
AS	Auger sample		
VT	Vane Test		



RECORD OF BOREHOLE No P07-1

2 OF 3

METRIC

W.P. 5412-04-00 LOCATION Sta. 17+854 o/s 7 m LL CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.11.07 - 7.13.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa				WATER CONTENT (%)			
						20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	10 20 30	10 20 30	10 20 30		
178.4	SILT (ML), some clay trace gravel, wet Compact to dense Grey (continued)		11	SS	17										
19.4	Silty CLAY (CL), trace gravel, some sand Stiff Grey		12	SS	39										
176.9	Sandy SILT (ML), some gravel, some sand Compact Grey		13	SS	13										
20.9	Silty CLAY (CL), trace gravel, some sand Very stiff Grey		14	SS	16										
175.3	SAND (SM) with rock fragments Very dense Grey		15	SS	30									17 19 54 10	
22.5	BOULDERS		16	SS	44										
173.1			17	SS	100/3"										
24.7			1	NQ											
171.6	- rock and boulders		18	SS	75										
26.2			19	SS	100/2"										
			2	NQ											
			3	NQ											
			4	NQ											
			5	NQ											
167.9															

ONTARIO MOT 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDT 11/27/07

Continued Next Page

$\times^3, \times^3$ : Numbers refer to Sensitivity       $\circ^3$  STRAIN AT FAILURE

RECORD OF BOREHOLE No P07-1

3 OF 3

METRIC

W.P. 5412-04-00 LOCATION Sta. 17+854 o/s 7 m Lt. CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.11.07 - 7.13.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100					GR SA SI CL	
29.9	GNEISS BEDROCK TCR = 87% SCR = 77% RQD = 77% (continued)	///	6	NQ												
166.7		///				167										
31.1	END OF BORHOEL at approximately 31.1 m.															

ONTARIO MOT 1015345 PAGWA JULY 07 GPJ ONTARIO MOT.GDI 11/27/07

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

**RECORD OF BOREHOLE No P07-2**

1 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+891 o/s 9 m Lt. CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.14.07 - 7.15.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	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	10	20	30	GR SA SI CL	
197.8	River Water Surface														
0.0	WATER - Pagwachuan River														
194.6	Stiff silty CLAY (CL), trace sand, trace gravel, wet Very soft to very stiff Grey		1	SS	7										
194			2	SS	24										
193			3	SS	6										
192			4	SS	4										
191			5	SS	4										
190			6	SS	2										
189			7	TW											
188			8	SS	12										
187			9	SS	6										
186.0	SILT (ML), trace sand, wet Compact Grey														
11.7															
184.7	Silty CLAY (CL), trace sand, wet Firm to hard Grey														
13.1															
183															

ONTARIO MOT 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDT 11/27/07

Continued Next Page

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

**RECORD OF BOREHOLE No P07-2**

2 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+891 o/s 9 m LL CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.14.07 - 7.15.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						WATER CONTENT (%)
180.0	Silty CLAY (CL), trace sand, wet Firm to hard Grey (continued)		10	SS	10									
181			11	SS	38									
180	SILT (ML), some clay, trace sand, wet Compact to dense Grey		12	SS	40								0 1 86 13	
179			13	SS	22									
178														
177														
176			14	SS	17									
175			15	SS	17									
174			16	SS	25									
173														
172														
171.1	SAND (SM) some gravel Very dense Grey		17	SS	20									
26.7			1	NQ										
170.4	BOULDERS		2	NQ										
27.4			3	NQ										
169														
168														

ONTARIO MOT. 1015345 PAGWA JULY 07.GPJ ONTARIO.MOT.GDT 11/27/07

Continued Next Page

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

**RECORD OF BOREHOLE No P07-2**

3 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+891 o/s 9 m LL CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.14.07 - 7.15.07 CHECKED BY GTC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100						
167.6 30.2	Clayey SILT TILL (CL-ML) with sand, trace gravel. Hard Grey		4	NQ													
			18	SS	115/ 6"												
			19	SS	110/ 6"												
			20	SS	140/ 5"												
			5	NQ													
			21	SS	102/ 6"												
164.6 33.2	END OF BOREHOLE at approximately 33.2 m																

ONTARIO MOT 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDI 11/27/07

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



**RECORD OF BOREHOLE No P07-3**

2 OF 2

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+871 o/s 20 m Lt. CL ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.16.07 - 7.16.07 CHECKED BY GTC

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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20					
180.9	Silty CLAY (CL), some sand, trace gravel Soft to firm Grey (continued)		7	SS	7								
16.5	SILT (ML), trace clay and sand Loose to dense Grey		8	SS	21								
			9	SS	33								
			10	SS	14								
			11	SS	25								
			12	SS	8								
			13	SS	20								
171.7	SAND (SM), some gravel, trace sand and clay Very dense Grey BOULDERS		14	SS	50/ 6"								16 73 (11)
171.4			1	NQ									
171.4			2	NQ									
169.6	END OF BOREHOLE at approximately 27.7 m												

ONTARIO MOT 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDT 11/27/07

✕<sup>3</sup> ✕<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



**RECORD OF BOREHOLE No P07-60**

1 OF 1

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+812 o/s 15 m Lt. CL ORIGINATED BY NH  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.17.07 - 7.17.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)										
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20	40	60	80	100	10
202.6	Grass																						
202.0	200 mm TOPSOIL: silty sand with organics		1	SS	4																		
0.2	Clayey SILT (CL-ML) with sand, wet Firm to stiff Brown		2	SS	12																		
			3	SS	8																		
200.5			4	SS	8																		
2.1	SILT (ML), traces of clay and sand, wet Loose to compact Brown to grey		5	SS	13																		
			6	SS	13																		
			7	SS	6																		
			8	SS	8																		
194.6			9	SS	9																		
8.0	Silty CLAY (CL), trace sand, wet Firm Grey																						
193.3			10	SS	8																		
9.3	SILT (ML) trace sand, clay, wet Loose to compact Grey																						
			11	SS	16																		
191.3	END OF BOREHOLE at approximately 11.3 m  Groundwater level measured at a depth of approximately 0.8 m in open borehole on completion of drilling, elevation of approximately 201.8 m.																						

ONTARIO MOT. 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDI 11/27/07

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

**RECORD OF BOREHOLE No P07-64**

1 OF 1

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+752 o/s 5.5 m Rt. CL ORIGINATED BY RG  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.20.07 - 7.20.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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 60 80 100	10 20 30				GR SA SI CL		
203.3	Asphalt													
200.8	ASPHALT FILL: brown sand some silt with gravel, moist		1	AS										
202.1	SILT (ML) with sand to sandy silt, wet Loose to compact Brown		2	SS	9									
1.2			3	SS	9									
			4	SS	13									
200.4			2.9	5	SS	7	▽							0 2 76 22
	Clayey SILT (CL-ML), trace sand, wet - clayey silt at 3.9 m to 4.3 m Firm to stiff Brown		6	SS	7									
			7	SS	10									
198.0			5.3	8	SS	11								
			9	SS	3									
			10	SS	5									
	SILT (ML), trace sand, wet - clay at 9.1 m to 9.2 m Very loose to compact Brown & grey		11	SS	4									
			12	SS	8									
192.0	11.3													
	END OF BOREHOLE at approximately 11.2 m  Groundwater first encountered on spoon during drilling at a depth of approximately 3.3 m, elevation of approximately 200.0 m.													

ONTARIO MOT 1015345 PACSWA JULY 07 GPJ ONTARIO MOT.GDT 11/27/07

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

**RECORD OF BOREHOLE No P07-65**

1 OF 1

**METRIC**

W.P. 5412-04-00 LOCATION Sta. 17+954 o/s 4.9 m RL CL ORIGINATED BY RG  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger, Split Spoon COMPILED BY NH  
 DATUM Geodetic DATE 7.19.07 - 7.19.07 CHECKED BY GTC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)													
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20	40	60	80	100	10	20	30	GR
202.0	Asphalt																									
201.1	50 mm ASPHALT FILL: brown sand some gravel, moist		1	AS																						
201.1	SAND (SM), some silt and clay trace gravel, damp - wet to 3.3 m Loose Brown		2	SS	6																					
200.9			3	SS	6																					
200.8			4	SS	5																					
200.7			5	SS	5																					
200.6			6	SS	4																					
198.0	Clayey SILT (CL-ML), trace sand, wet Firm Brown		7	SS	6																					
197.8			8	SS	7																					
197.6			9	SS	7																					
197.4			10	SS	7																					
194.9	SILT (ML), trace sand trace clay, wet Loose Grey		11	SS	4																					
191.8			12	SS	0																					
190.7	Silty CLAY (CL-ML), trace sand, wet Very soft Grey																									
11.3	END OF BOREHOLE at approximately 11.2 m  Groundwater first encountered on spoon during drilling at a depth of approximately 3.4 m, elevation of approximately 198.6 m.																									

ONTARIO MOT 1015345 PAGWA JULY 07.GPJ ONTARIO MOT.GDT 11/27/07

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

**RECORD OF BOREHOLE No P-06-1**

1 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Pagwahun River Bridge Sta. 17+837 o/s 11 m Rt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY NH  
 DATUM Geodetic DATE 2.21.07 - 2.23.07 CHECKED BY GC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)											
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20						40	60	80	100	20	40	60	80	100	10	20
199.0																								
198.8	200 mm TOPSOIL		1	GS																				
0.2	Clayey SILT (FILL), trace to some sand, trace gravel, with organics, trace rootlets, organic odour, moist Dark brown Clayey SILT (CL-ML), some sand, trace clay, with organic, moist Stiff to soft Brown		2	SS	8																			
198.4			3	SS	5																			
0.6			4	SS	2																			
			5	SS	2																			
195.9	Sandy SILT (ML), seams of silty clay, trace shells, trace to some organics, seams of dark brown organic matter, saturated Very loose to loose Brown to grey  - trace peat		6	SS	6																		0 13 79 9	
3.0			7	SS	3																			
			8	SS	8																			0 22 71 7
			9	SS	7																			
191.9	Silty CLAY (CL), trace sand, saturated Firm to stiff Grey - trace peat		10	SS	1																			
7.1			11	SS	WH																		0 5 63 32	
			12	SS	2																			
			13	SS	2																			
			14	SS	10																			
184.3																								
14.7																								

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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x<sup>3</sup>, x<sub>3</sub>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No P-06-1

2 OF 3

METRIC

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+837 o/s 11 m Rt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY NH  
 DATUM Geodetic DATE 2.21.07 - 2.23.07 CHECKED BY GC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			NUMBER	TYPE	"N" VALUES			20	40					
179.7	SILT (ML), seams of silty clay, wet Loose to compact Grey (continued)		15	SS	7									
			16	SS	12									0 0 93 7
	- loose		17	SS	3									
19.3	Silty CLAY (CL), trace sand, wet Stiff Grey		18	SS	WH									
			19	SS	WH									
			20	SS	WH									
175.1	Sandy SILT (ML), trace to some clay, moist Compact Grey		21	SS	11									
	- silty clay seams		22	SS	28									
172.1	Silty SAND (SM), some clay and gravel, moist Very dense Grey		23	SS	150									
	- auger refusal cored boulder		1	NQ										
			24	SS	100									

ONTARIO MOT. 1015345 PAGWA.GPJ ONTARIO MOT.GDT. 11/27/07

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

**RECORD OF BOREHOLE No P-06-1**

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**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+837 o/s 11 m Rt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY NH  
 DATUM Geodetic DATE 2.21.07 - 2.23.07 CHECKED BY GC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	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	60	80	100	10	20	30	GR	SA	SI	CL	
168.0	Silty SAND (SM), some clay and gravel, moist Very dense Grey (continued)		25	SS	187																		
30.9	END OF BOREHOLE at approximately 30.9 m  Groundwater first encountered on spoon during drilling at a depth of approximately 1.5 m, elevation of approximately 197.5 m																						

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO.MOT.GDT 11/27/07

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



**RECORD OF BOREHOLE No P-06-2**

2 OF 2

**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+822 o/s 16 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY NH  
 DATUM Geodetic DATE 3.17.07 - 3.19.07 CHECKED BY GC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
						20 40 60 80 100	20 40 60 80 100					GR SA SI CL	
183.9	SILT (ML), trace clay, wet Compact Grey (continued)		15	SS	12								
16.2	Silty CLAY (CL), trace sand, moist Stiff Grey		16	SS	7								
			17	SS	5								
180.7	Silty SAND (SM), wet Compact Grey		18	SS	20								
179.3	SAND (SM), trace silt and gravel, saturated Compact to very dense Grey		19	SS	17								
			20	SS	56								
175.6	- rock fragements		21	SS	80/3"								
24.5	GNEISS Bedrock Run 1 TCR = 89% SCR = 36% RQD = 45%		1	NQ									
	Run 2 TCR = 100% SCR = 81% RQD = 86%		2	NQ									
172.7	END OF BOREHOLE at approximately 27.4 m												
27.4	Groundwater first encountered on spoon during drilling at a depth of approximately 3.0 m, elevation of approximately 197.1 m.												

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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



**RECORD OF BOREHOLE No P-06-3**

2 OF 2

**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+843 o/s 27 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY NH  
 DATUM Geodetic DATE 3.16.07 - 3.17.07 CHECKED BY GC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20	40	60	80	100
177.4	Silty CLAY (CL), trace sand, wet Firm to stiff Grey (continued)		15	SS	14																	
			16	SS	18																	
			17	SS	8																	
			18	SS	11																	
			19	SS	42																	
176.3	SAND (SM), some gravel and silt, trace clay, wet Dense Grey		1	NQ																		
21.9			2	NQ																		
			3	NQ																		
172.8	END OF BOREHOLE at approximately 25.4 m  Groundwater first encountered during drilling on spoon at a depth of approximately 4.6 m, elevation of approximately 193.6 m																					
25.4																						

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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

RECORD OF BOREHOLE No P-06-4

1 OF 3

METRIC

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+904 o/s 18.5 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.25.07 - 3.26.07 CHECKED BY GC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
199.1	200 mm TOPSOIL		1	GS									
196.0	CLAYEY SILT (ML), some sand, some organics and topsoil, moist Brown  - hard  - stiff		2	SS	49								
			3	SS	10								
			4	SS	14								
196.2			5	SS	18								
2.9	SAND (SM), some gravel and silt, moist to saturated Compact Brown		6	SS	17							23 56 19 2	
			7	SS	14								
194.0			8	SS	5							0 2 85 14	
5.2	SILT(ML), damp Loose Grey		9	SS	6								
192.1			10	SS	1								
7.1	Silty CLAY (CL), trace sand, saturated Firm Grey		11	SS	WH								
188.8			12	SS	7								
10.4	Sandy SILT (ML), some to with clay, saturated Loose Grey		13	SS	7								
			14	SS	12								
184.4													
14.7													

ONTARIO MOT 1015345 PAGWA.GPJ\_ONTARIO.MOT.GDT 11/27/07

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✕<sup>3</sup>, ✕<sub>3</sub>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No P-06-4

2 OF 3

METRIC

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+904 o/s 18.5 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.25.07 - 3.26.07 CHECKED BY GC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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						
						20 40 60 80 100	20 40 60 80 100						
172.2	Silty CLAY (CL), trace sand, moist Stiff to firm Grey (continued)		15	SS	8								
			16	SS	15								
			17	SS	12							3 7 63 27	
			18	SS	5								
			19	SS	5		1.8						
	- seams of sandy silt - stiff		20	SS	12								
			21	SS	9								
			22	SS	18								
172.2	Sandy SILT (ML to SM), some clay, saturated Very dense Grey		23	SS	51								
26.9			24	SS	105								
	- trace rock fragments												
	- trace rock fragments												

ONTARIO MOT. 1015345 PAGWA.GPJ ONTARIO.MOT.GDT 11/27/07

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

**RECORD OF BOREHOLE No P-06-4**

3 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+904 o/s 18.5 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.25.07 - 3.26.07 CHECKED BY GC

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
169.0 30.2	END OF BOREHOLE at approximately 30.2 m  Groundwater first encountered on spoon during drilling at a depth of approximately 2.9 m, elevation of approximately 196.2 m		25	SS	120												

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

×<sup>3</sup>, ×<sub>3</sub>: Numbers refer to Sensitivity      ○<sup>3%</sup>: STRAIN AT FAILURE

RECORD OF BOREHOLE No P-06-5

1 OF 3

METRIC

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+907 o/s 9 m Lt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.24.07 - 3.25.07 CHECKED BY GC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			NUMBER	TYPE	"N" VALUES			20	40					
199.6 0.0	SAND (FM), trace to some silt, trace gravel and clay, moist Brown  - compact	[Pattern]	1	GS		▽								
			2	SS	20									3 47 45 5
198.2 1.4	Clayey SILT (ML), trace to some sand, moist Loose Brown	[Pattern]	3	SS	8									
			4	SS	9									
196.7 2.9	SAND (SW), some gravel, trace silt and clay, saturated Compact Brown	[Pattern]	5	SS	13									
			6	SS	14									20 70 9 1
194.8 4.8	Sandy SILT (ML), some clay, saturated Compact	[Pattern]	7	SS	12									
194.4 5.2	Brown - loose - grey	[Pattern]	8	SS	3									
			9	SS	7									
192.4 7.2	Silty CLAY (CL), trace sand, wet Soft to stiff Grey	[Pattern]	10	SS	1									
			11	SS	2									
			12	SS	2			2.6						2 11 56 32
			13	SS	10									
			14	SS	WH									

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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

**RECORD OF BOREHOLE No P-06-5**

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**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+907 o/s 9 m LI ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.24.07 - 3.25.07 CHECKED BY GC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			NUMBER	TYPE	"N" VALUES			20	40					
183.1	Silty CLAY (CL), trace sand, wet Soft to stiff Grey (continued)		15	SS	6									
16.5	SILT (ML), with clay, wet Compact Grey		16	SS	12									
181.8	Silty CLAY (CL), some sand, trace gravel, moist Firm to hard Grey		17	SS	3									
17.8			18	SS	5									
	- stiff		19	SS	1									
	- layers of silt - hard		20	SS	30									
	- damp to saturated - stiff		21	SS	14									
			22	SS	14									
172.4	Sandy SILT (ML to SM), some gravel and clay, saturated Very Dense Grey		23	SS	100									
27.2			24	SS	148									

ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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×<sup>3</sup>, ×<sub>3</sub>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE



RECORD OF BOREHOLE No P-06-6

1 OF 3

METRIC

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+905 o/s 20 m Rt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.22.07 - 3.23.07 CHECKED BY GC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100
199.5 0.0	SAND (FILL) (SM), trace gravel and silt, wet Brown	[Pattern]	1	GS													
198.5 1.0	- dense Clayey SILT (ML), some sand, some organics, moist	[Pattern]	2	SS	33												
198.2 1.4	Hard Brown SAND (SM), some silt, trace gravel and clay, wet Compact Brown	[Pattern]	3	SS	11												
		[Pattern]	4	SS	11												
		[Pattern]	5	SS	18												3 57 36 4
195.6 4.0	SILT (ML), trace to some sand and clay, moist Compact to loose Brown	[Pattern]	6	SS	22												
		[Pattern]	7	SS	10												0 2 91 7
194.3 5.2	- grey	[Pattern]	8	SS	6												
193.6 5.9	Silty CLAY (CL), trace sand, moist Firm Grey	[Pattern]	9	SS	2												
		[Pattern]	10	SS	2												
		[Pattern]	11	SS	2												1 9 50 40
		[Pattern]	12	SS	2												
187.6 11.9	SILT (ML), with clay, saturated Loose Grey	[Pattern]	13	SS	10												
186.3 13.2	Silty CLAY (CL), trace sand, moist Firm	[Pattern]	14	SS	WH												
184.7 14.8		[Pattern]															

ONTARIO MOT. 1015345 PAGWA GRJ ONTARIO MOT.GDT 11/27/07

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x<sup>3</sup>, x<sub>3</sub>: Numbers refer to Sensitivity      ○<sup>3%</sup> STRAIN AT FAILURE

**RECORD OF BOREHOLE No P-06-6**

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**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+905 o/s 20 m RI ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.22.07 - 3.23.07 CHECKED BY GC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80
	Fine Sandy SILT (ML), with clay, saturated Compact Grey (continued)		15	SS	22		184									
			16	SS	16		183									
181.8 17.8	Silty CLAY (CL), trace sand, moist Firm Grey		17	SS	3		181									
180.3 19.3	Fine Sandy SILT (ML), saturated Compact to dense Grey		18	SS	16		180									
			19	SS	10		179									
			20	SS	32		178									
175.7 23.9	Silty CLAY (CL), trace sand, saturated Very Stiff Grey		21	SS	26		177									
			22	SS	20		176									
			23	SS	25		175									
171.1 28.4	Sandy SILT to Silty SAND (ML-SM), some clay, trace gravel Dense to very dense Grey		24	SS	35		174									
							173									
							172									
							171									
							170									

ONTARIO MOT. 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

Continued Next Page

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

**RECORD OF BOREHOLE No P-06-6**

3 OF 3

**METRIC**

W.P. 5412-04-00 LOCATION Pagwachuan River Bridge Sta. 17+905 o/s 20 m Rt ORIGINATED BY DS  
 DIST New Liskeard HWY 11 BOREHOLE TYPE Hollow Stem Auger COMPILED BY JL  
 DATUM Geodetic DATE 3.22.07 - 3.23.07 CHECKED BY GC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Sandy SILT to Silty SAND (ML-SM), some clay, trace gravel Dense to very dense Grey (continued)		25	SS	102												
	- boulder		1	NQ													
	- boulder		2	NQ													
167.4			26	SS	180												
32.2	END OF BOREHOLE at approximately 32.2 m  Groundwater first encountered during drilling on spoon at a depth of approximately 3 m below existing grade, elevation 196.5 m																

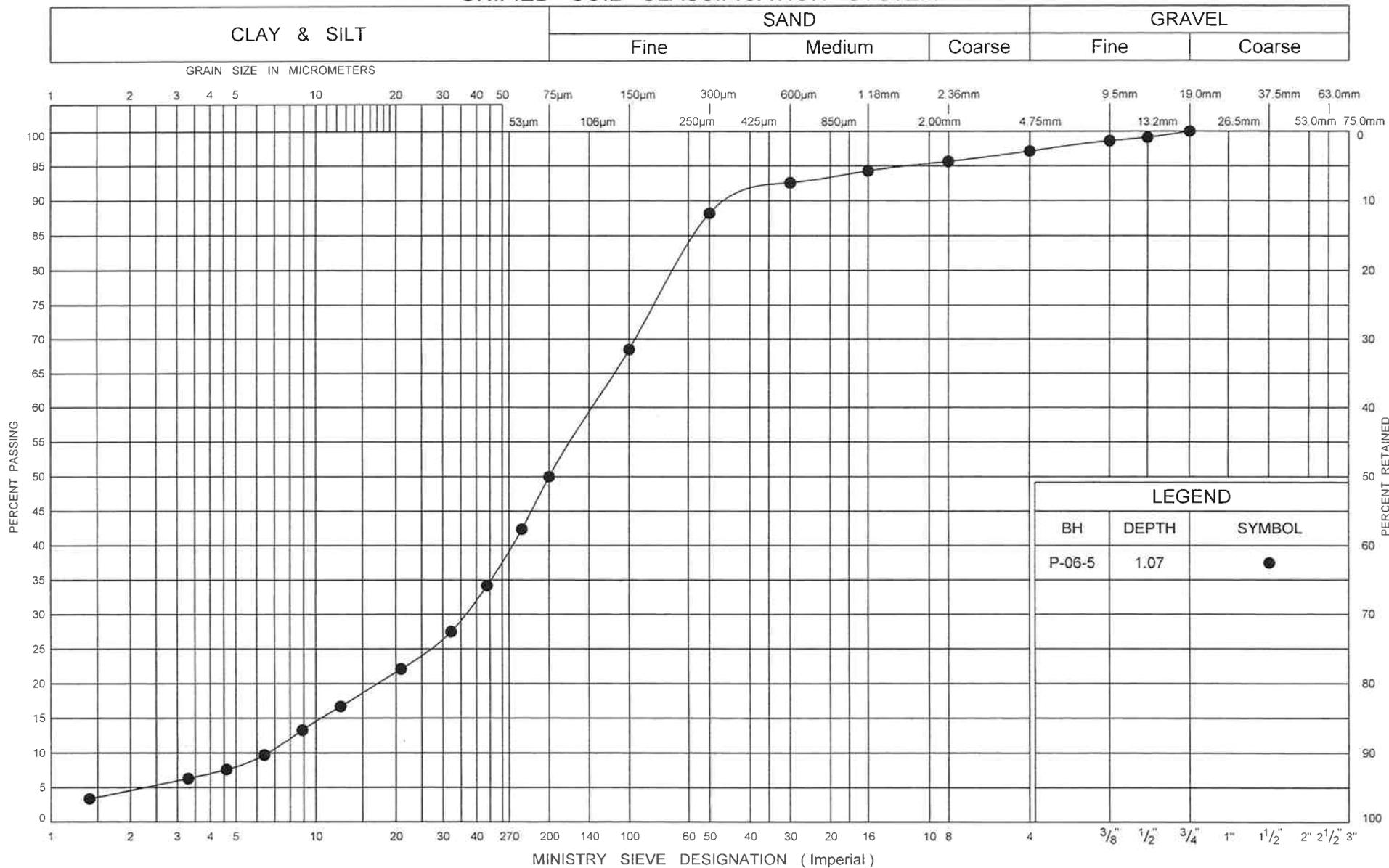
ONTARIO MOT 1015345 PAGWA.GPJ ONTARIO MOT.GDT 11/27/07

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

# Appendix C

## Geotechnical Laboratory Test Results

### UNIFIED SOIL CLASSIFICATION SYSTEM



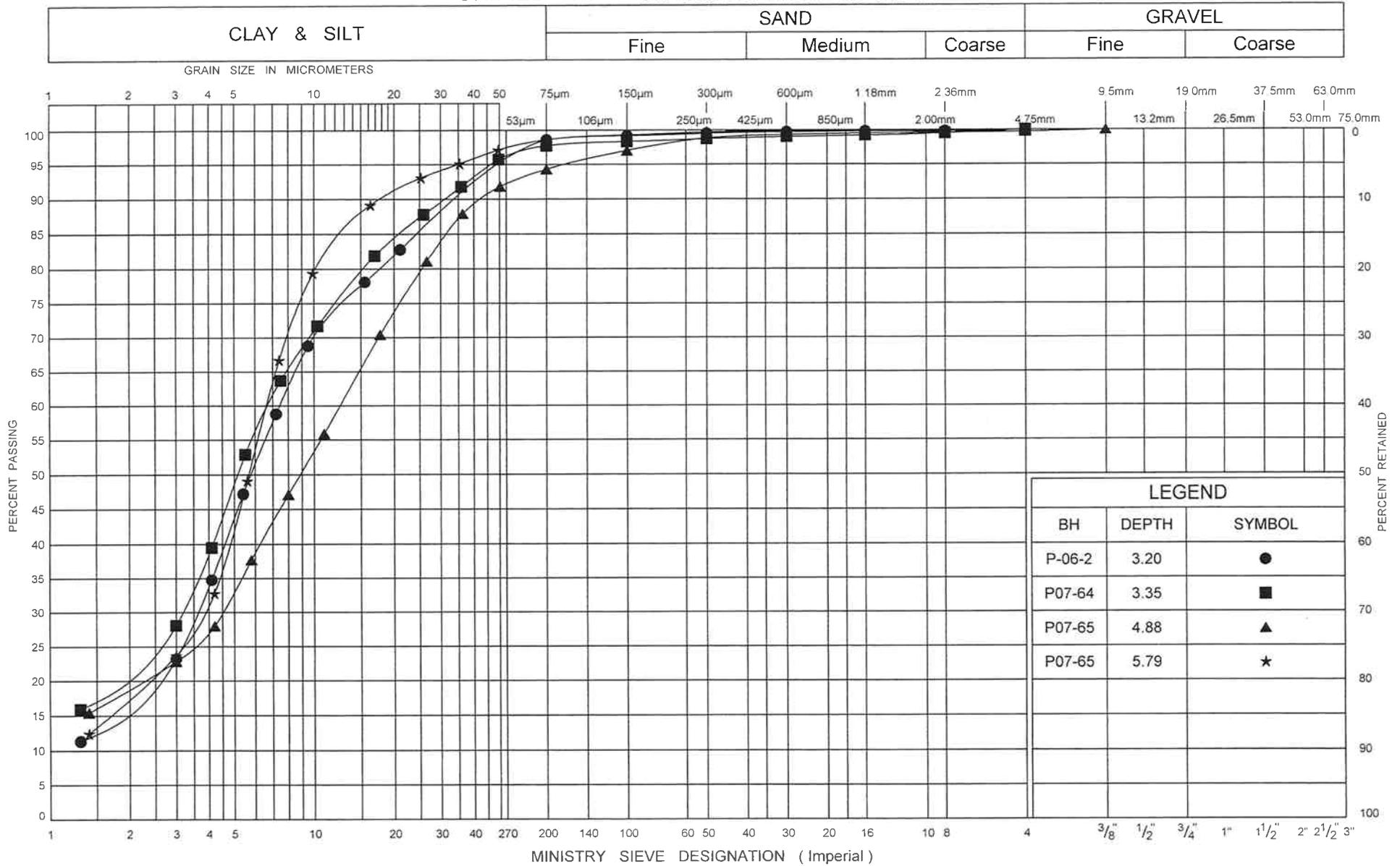
ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT.GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Sand Fill (SM)

FIG No 1  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

UNIFIED SOIL CLASSIFICATION SYSTEM

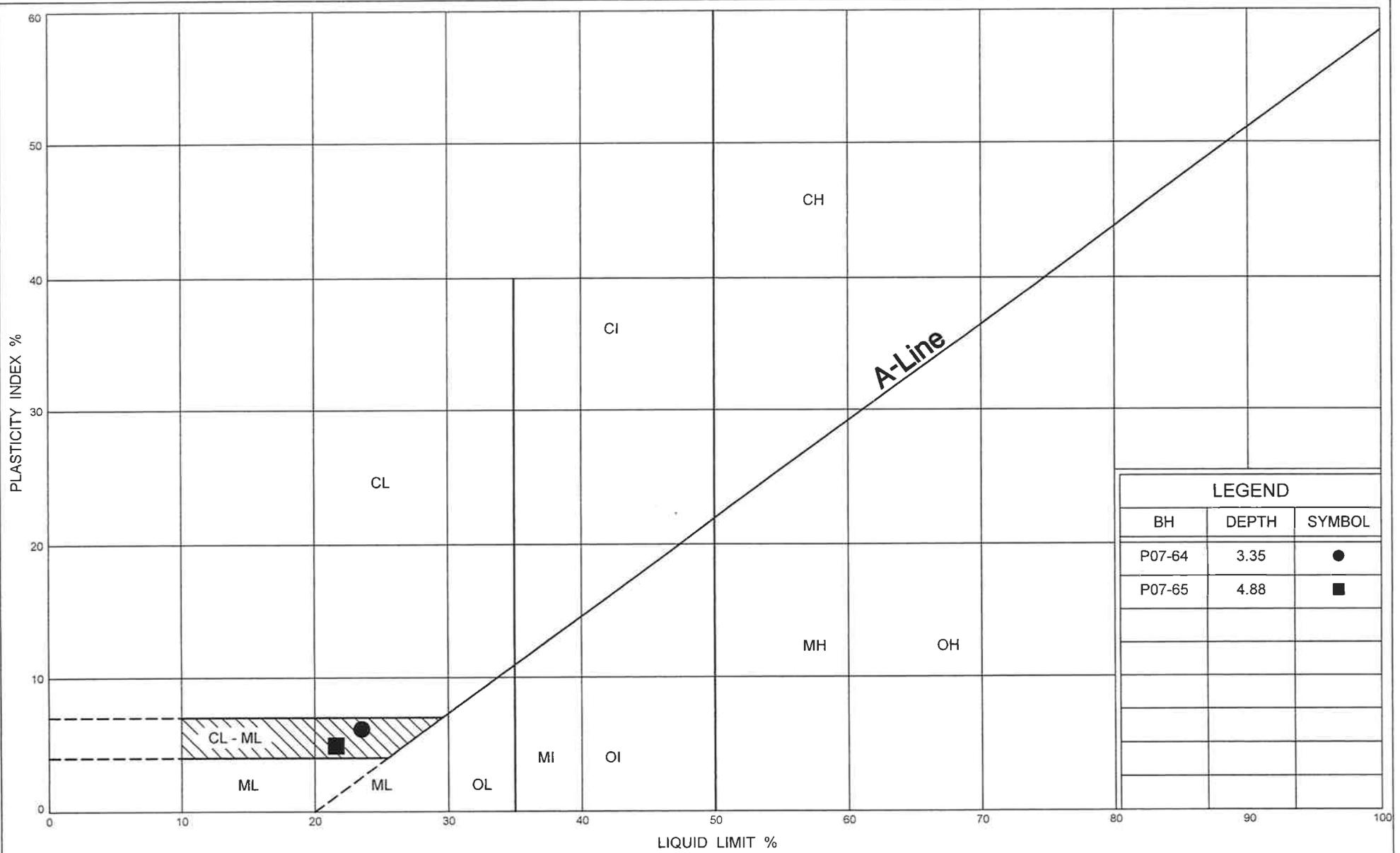


ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT GDT 07/10/03



GRAIN SIZE DISTRIBUTION  
Clayey Silt (CL - ML)

FIG No 2  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1



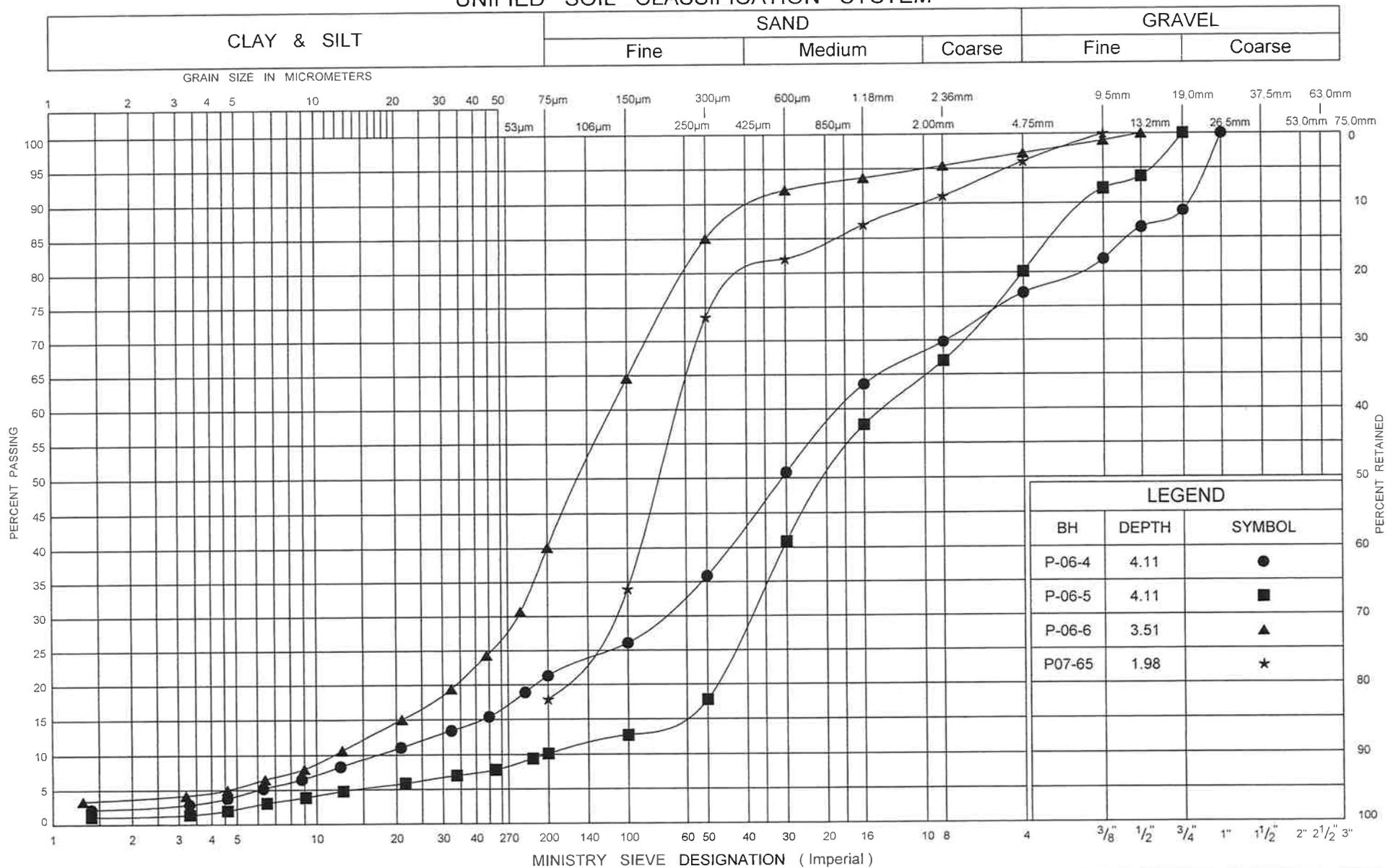
ONTARIO MOT PLASTICITY CHART 1015345 PAGWA GPJ ONTARIO MOT GDT 07/10/03



**PLASTICITY CHART**  
Clayey Silt (CL - ML)

FIG No 3  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

### UNIFIED SOIL CLASSIFICATION SYSTEM



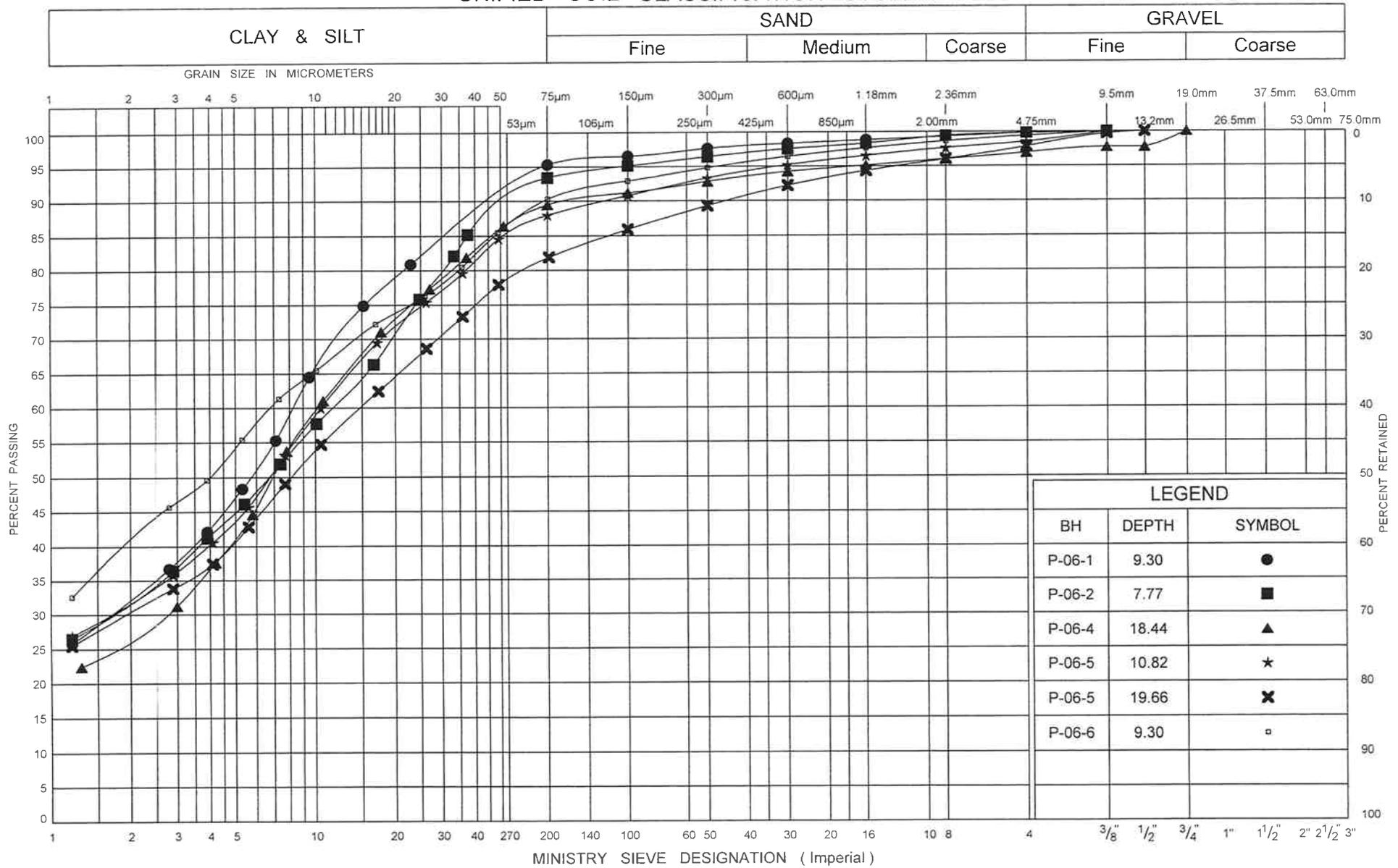
ONTARIO MOT GRAIN SIZE 1015345 PAGWA GPJ ONTARIO MOT\_GDT\_07/10/03



**GRAIN SIZE DISTRIBUTION**  
Sand (SM to SW)

FIG No 4  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

### UNIFIED SOIL CLASSIFICATION SYSTEM



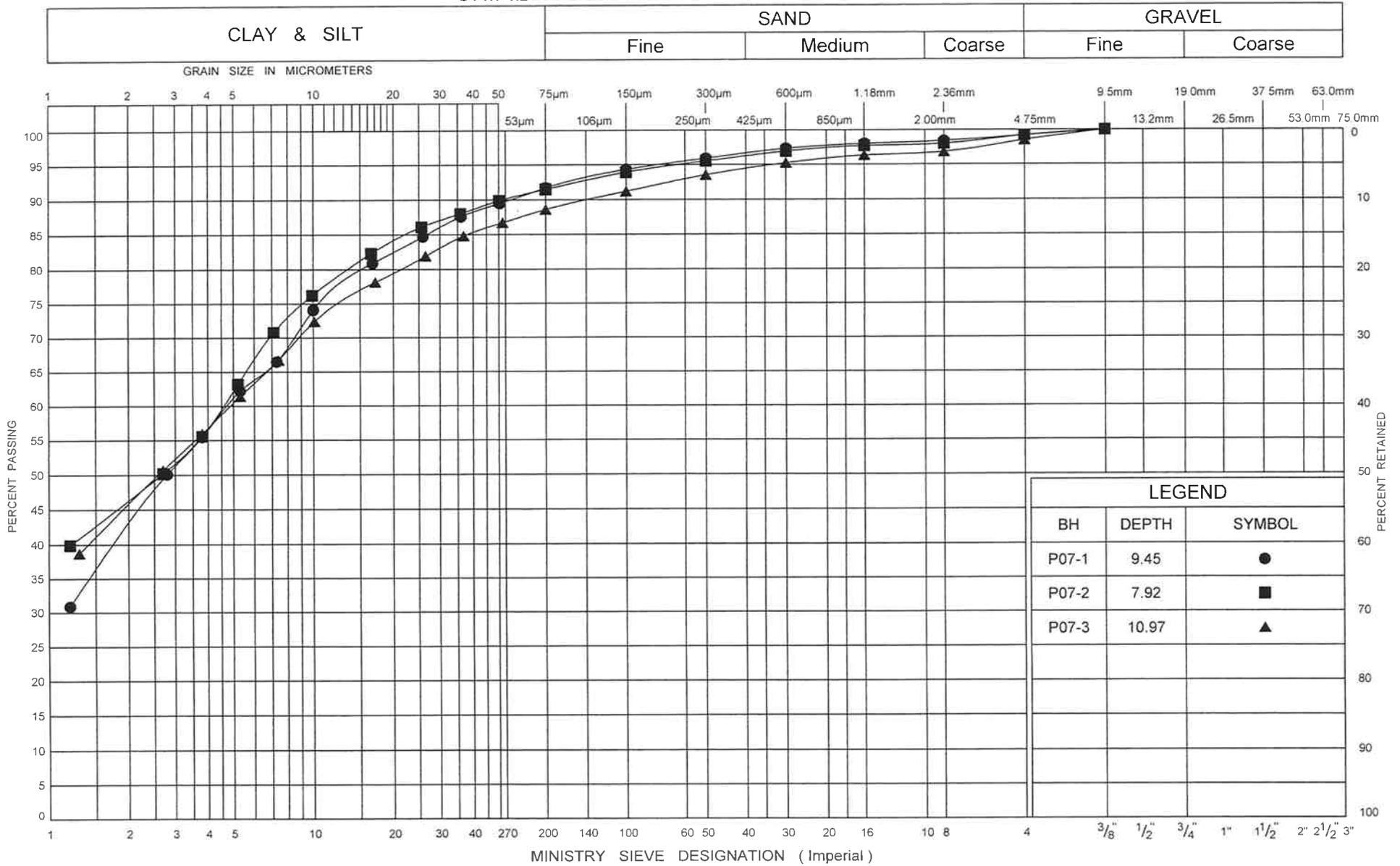
ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO.MOT.GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Silty Clay (CL)

FIG No 5  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

UNIFIED SOIL CLASSIFICATION SYSTEM

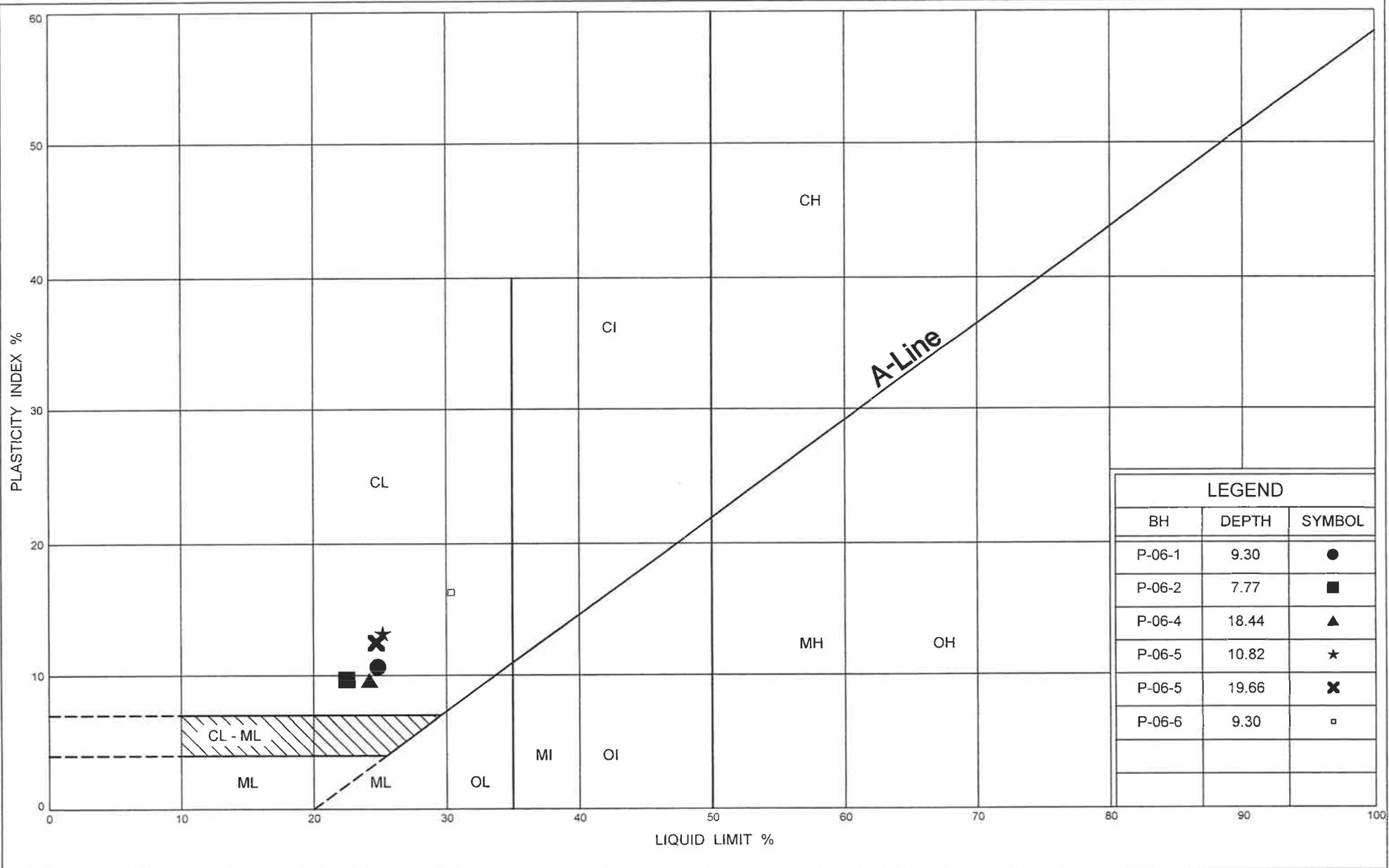


ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT.GDT 07/10/03



GRAIN SIZE DISTRIBUTION  
Silty Clay (CL)

FIG No 6  
W P 5412-04-00  
Pagwachuan River Bridge/Hwy 1

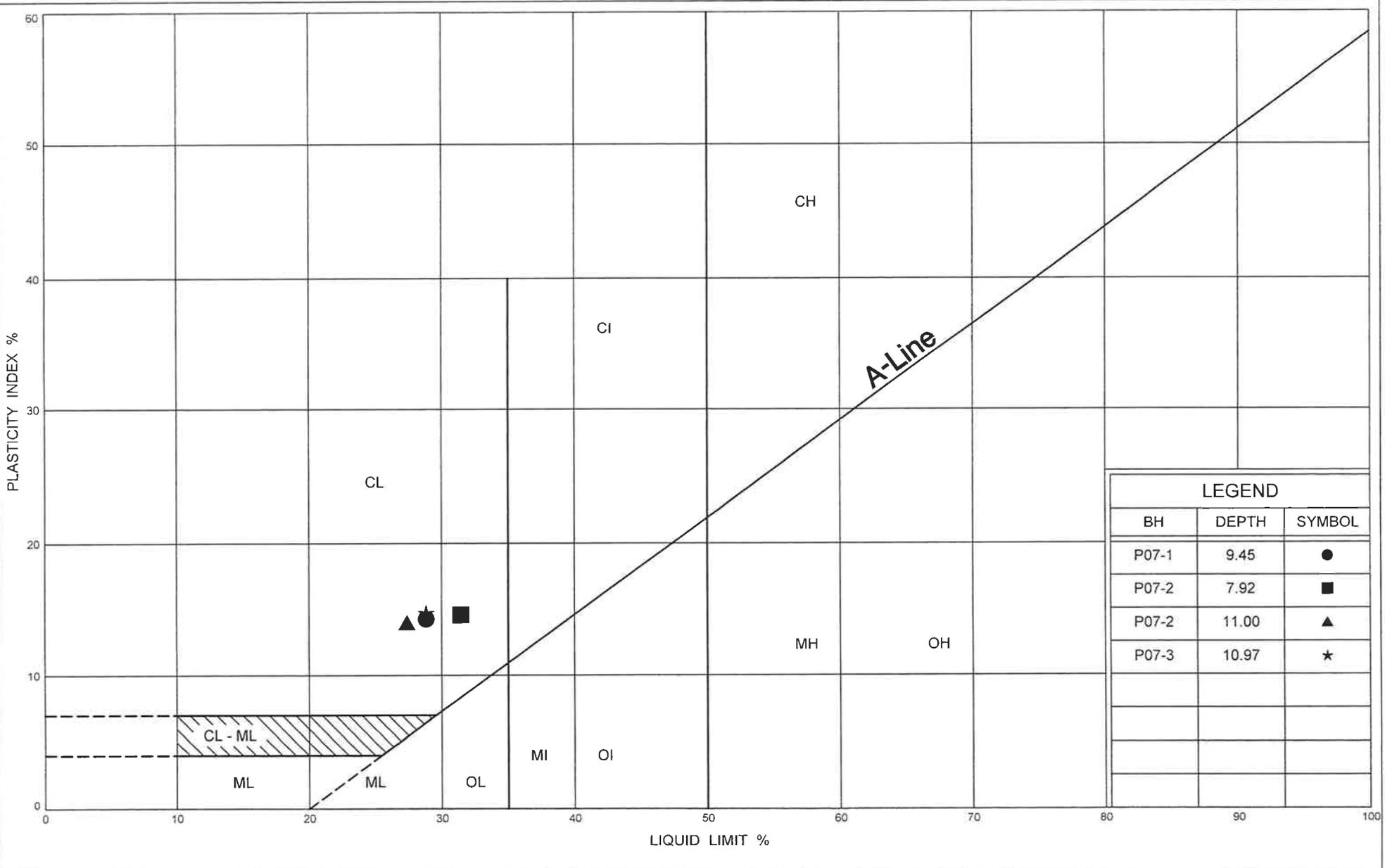


ONTARIO MOT PLASTICITY CHART 1015345 PAGWA GPJ ONTARIO MOT.GDT 07/10/03



PLASTICITY CHART  
Silty Clay (CL)

FIG No 7  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1



LEGEND		
BH	DEPTH	SYMBOL
P07-1	9.45	●
P07-2	7.92	■
P07-2	11.00	▲
P07-3	10.97	★

ONTARIO MOT PLASTICITY CHART 1015345 PAGWA GPJ ONTARIO MOT.GDT 07/10/09



PLASTICITY CHART  
Silty Clay (CL)

FIG No 8  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

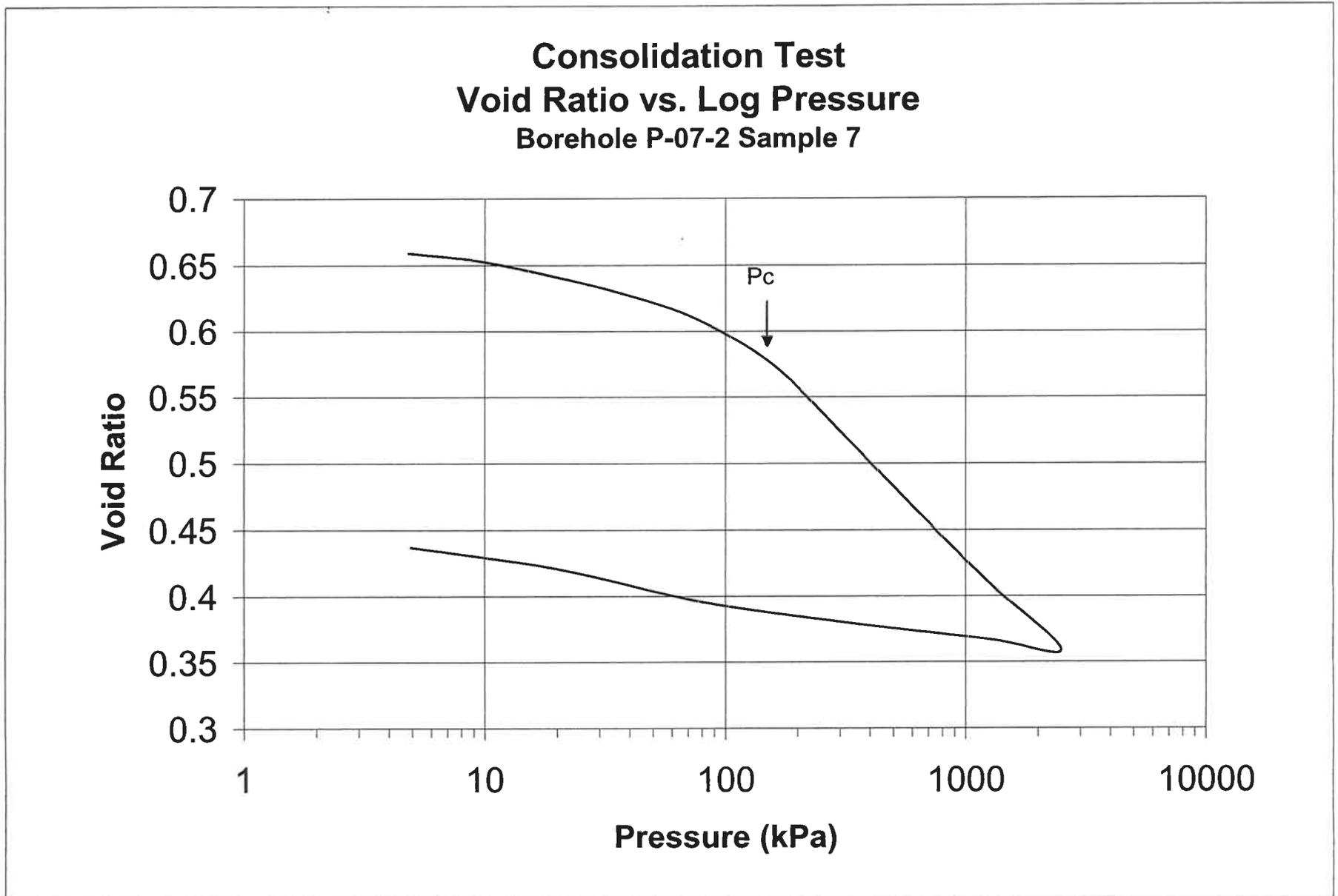
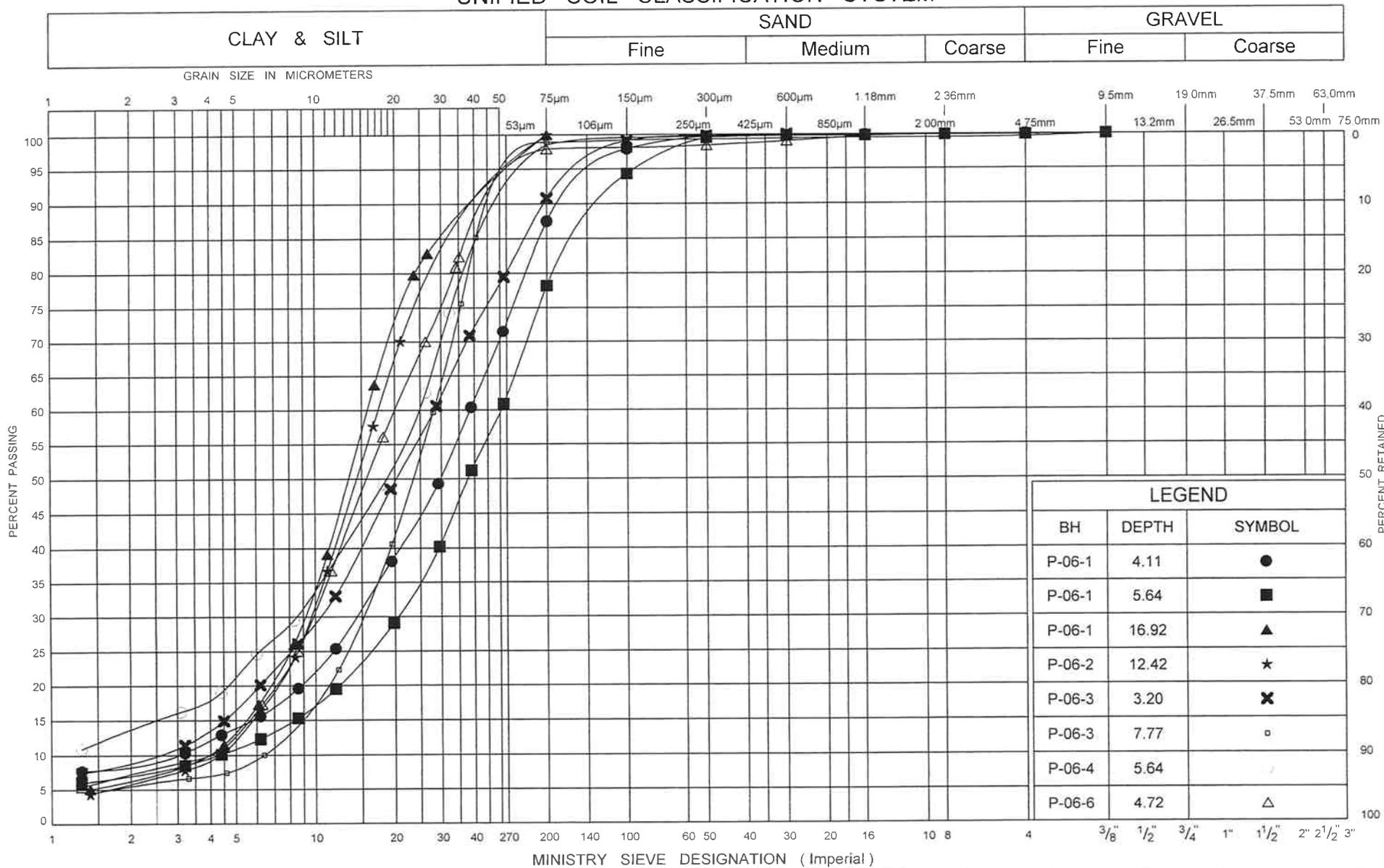


Figure 9

### UNIFIED SOIL CLASSIFICATION SYSTEM



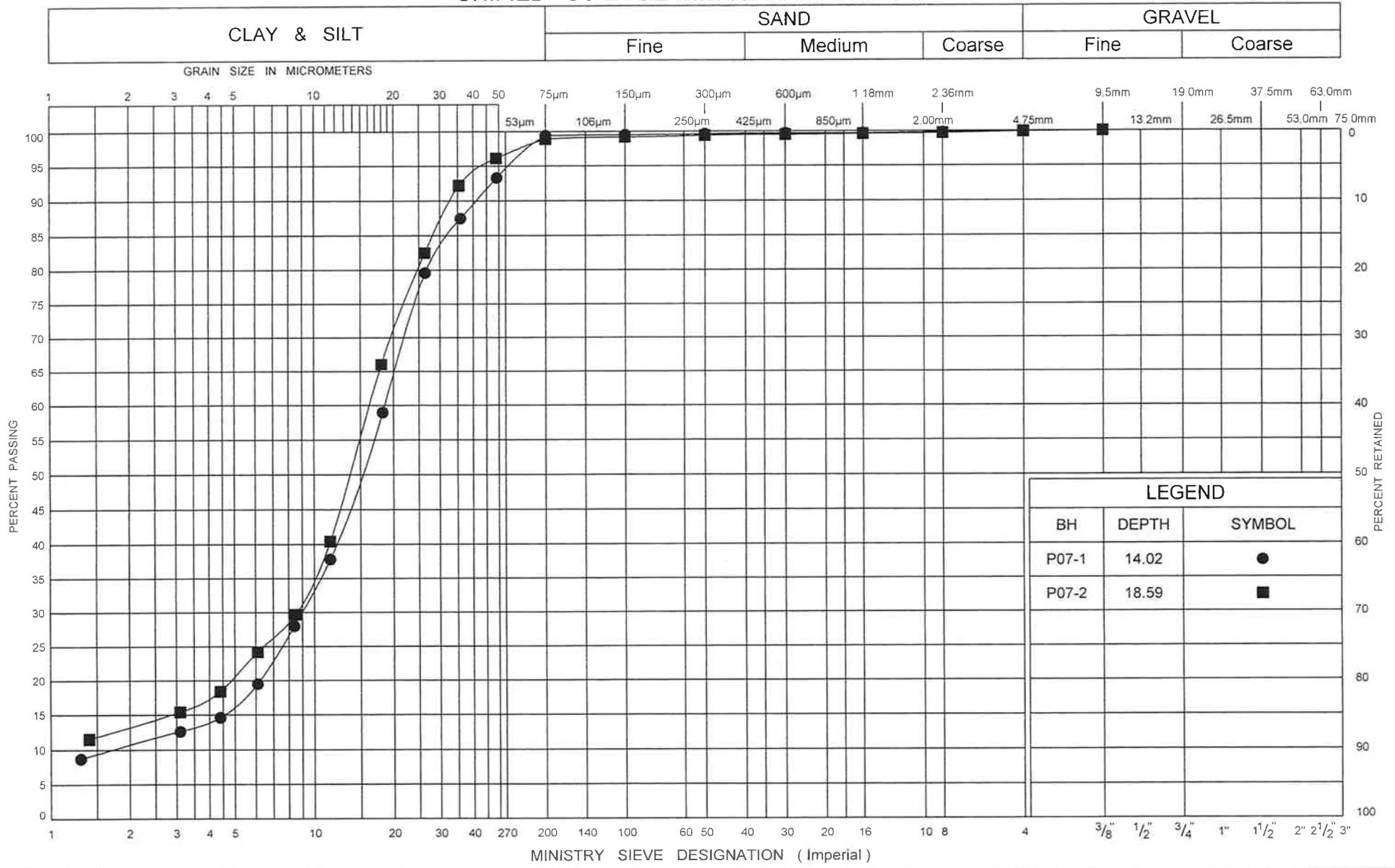
ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Silt to Sandy Silt (ML)

FIG No 10  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
BH	DEPTH	SYMBOL
P07-1	14.02	●
P07-2	18.59	■

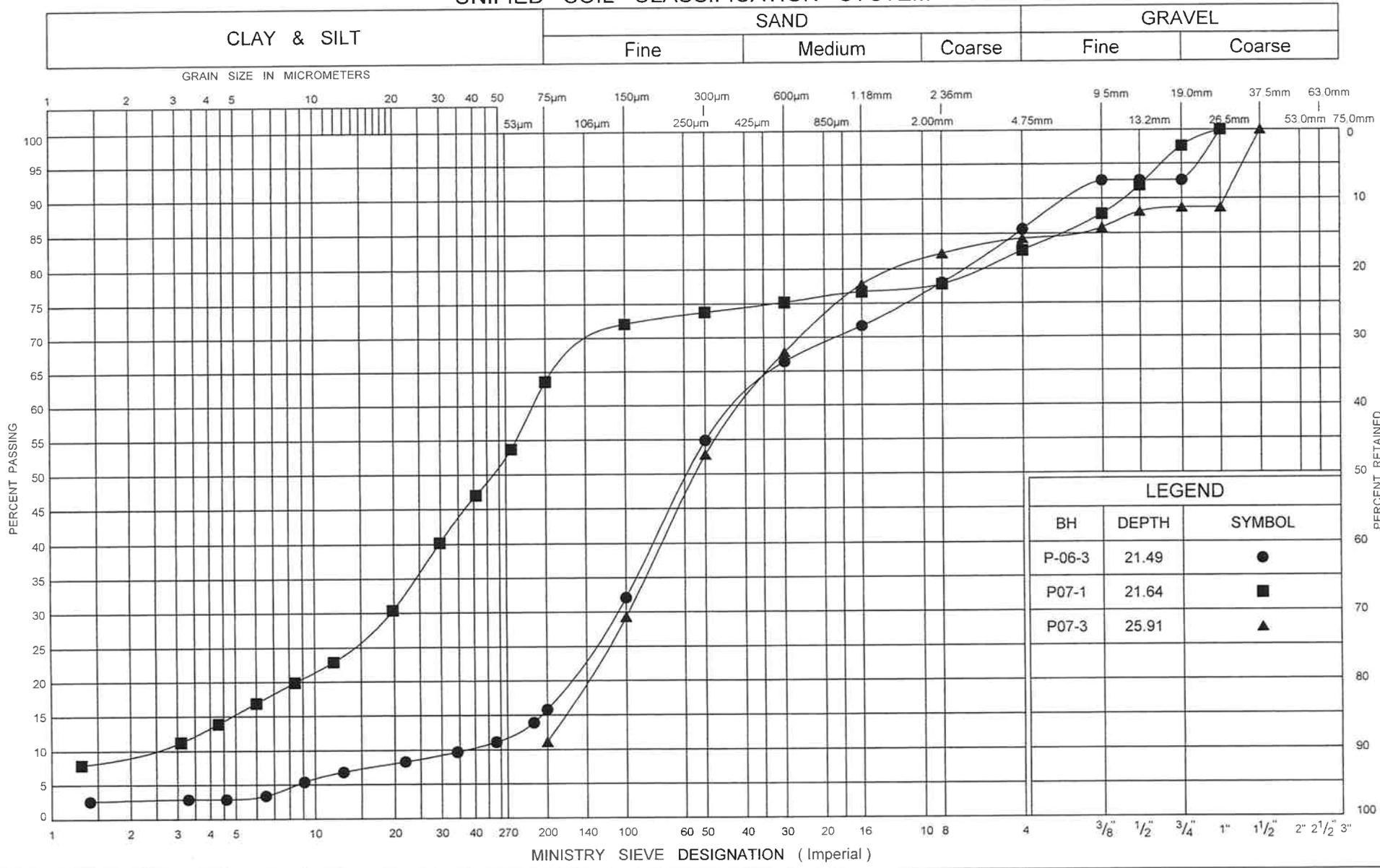
ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT.GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Silt to Sandy Silt (ML)

FIG No 11  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

### UNIFIED SOIL CLASSIFICATION SYSTEM



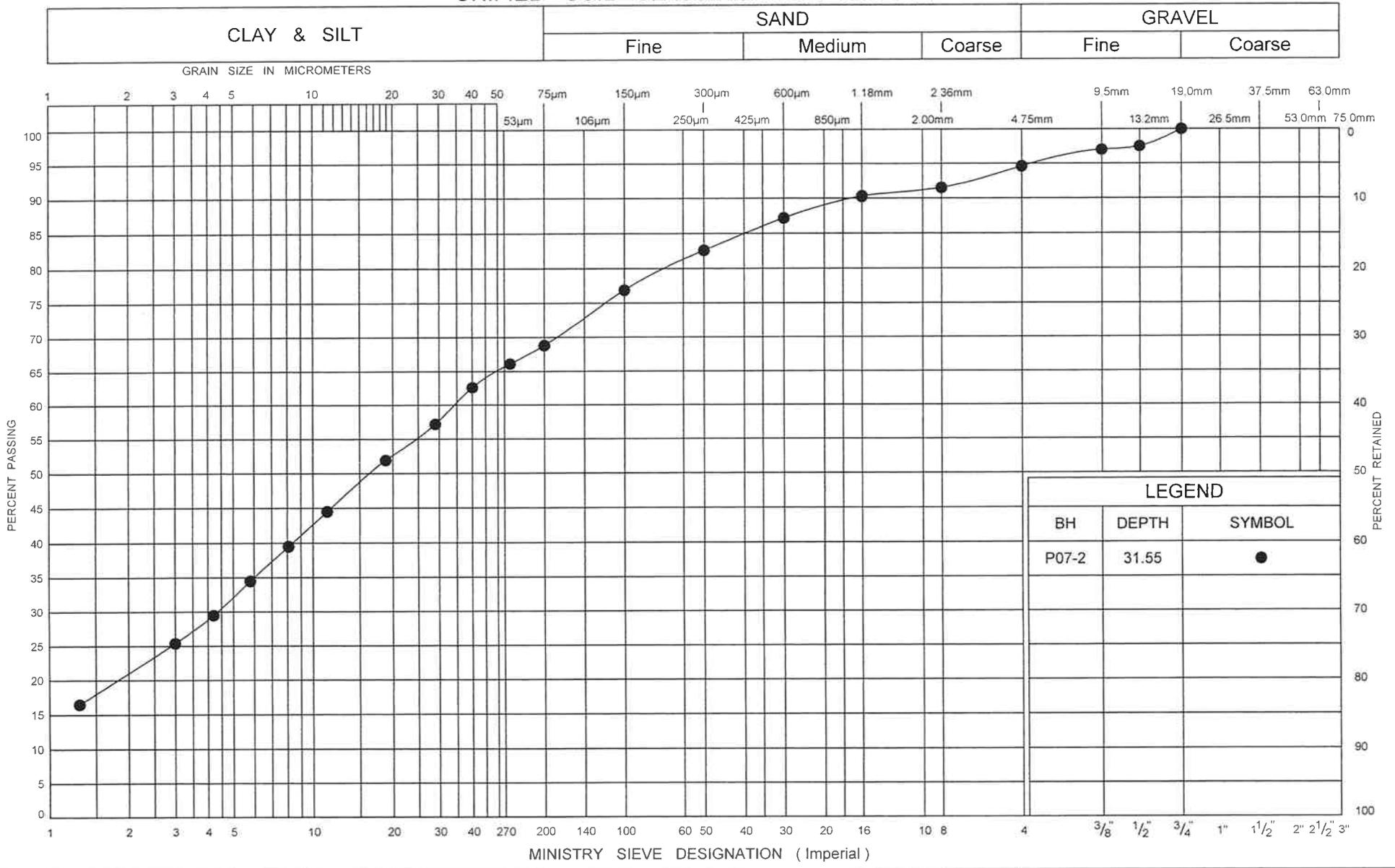
ONTARIO MOT GRAIN SIZE 1015345 PAGWA GPJ ONTARIO MOT.GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Silty Sand (ML - SM)

FIG No 12  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1

### UNIFIED SOIL CLASSIFICATION SYSTEM



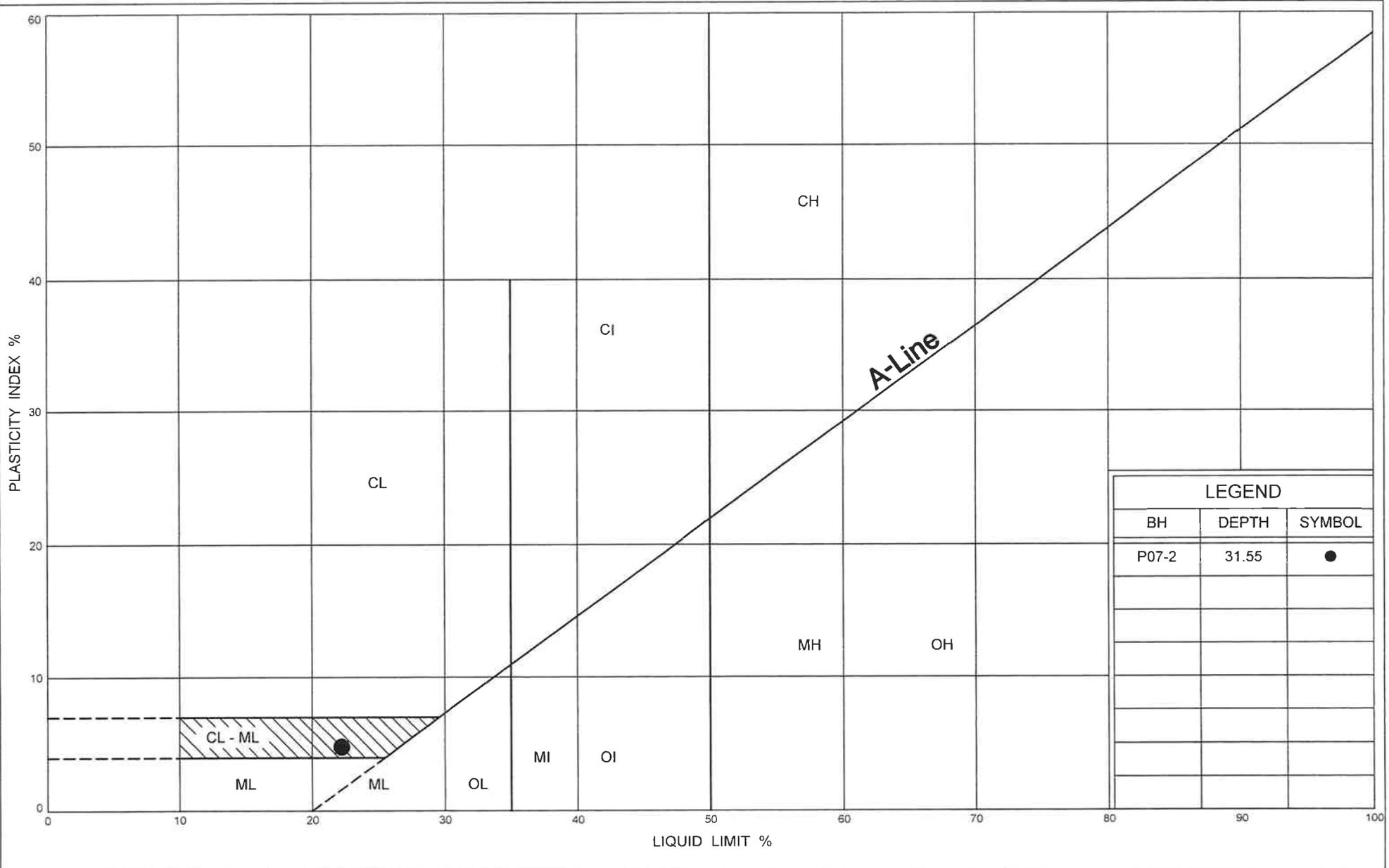
LEGEND		
BH	DEPTH	SYMBOL
P07-2	31.55	●

ONTARIO MOT GRAIN SIZE 1015345 PAGWA.GPJ ONTARIO MOT GDT 07/10/03



**GRAIN SIZE DISTRIBUTION**  
Clayey Silt Till

FIG No 13  
WP 5412-04-00  
Pagwachuan River Bridge/Hwy 1



LEGEND		
BH	DEPTH	SYMBOL
P07-2	31.55	●

ONTARIO MOT PLASTICITY CHART 1015345 PAGWA.GPJ ONTARIO MOT GDT 07/10/03



**PLASTICITY CHART**  
Clayey Silt Till

FIG No 14  
W P 5412-04-00  
Pagwachuan River Bridge/Hwy 1