

FOUNDATION INVESTIGATION REPORT
PROPOSED RECONSTRUCTION OF
SEVENTEEN (17) NON-STRUCTURAL CULVERTS
TOWNSHIP OF ST. VINCENT AND COLLINGWOOD
HIGHWAY 26 FROM MEAFORD TO THORNBURY

G.W.P. 57-00-00
Agreement # 3006-E-0002



I.E.
Group



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PART A – FOUNDATION INVESTIGATION

1.0 INTRODUCTION

This report presents the results of a foundation investigation carried out in July, August and September 2007 by Infrastructure Engineering Group Inc. (IEG) on behalf of Stantec Consulting Ltd. (Stantec).

This assignment involves the rehabilitation of the pavement structure on Highway 26 from 0.2 km east of the Thornbury west limit (Peel Street) westerly 10.06 km to the Town of Meaford east limit.

It includes the rehabilitation and extension of two existing structural culverts, as well as many non-structural culvert extensions and replacements. The project also includes intersection realignments, intersection improvements, construction of two new 1.5 km long passing lanes, minor horizontal and vertical alignment improvements and electrical work. The original assignment included the re-alignment of the Blue Mountains/Meaford Town Line which has been deleted from the assignment.

Foundation investigation and recommendations are required for the design and construction of culvert replacements and extension as part of the improvement of Highway 26. Two (2) structural culverts, twenty-four (24) non-structural culverts, two shale bin replacements, and a high cut area are to be investigated. There is a change in the scope of work to include two additional culvert extensions which were not part of the original scope of work for foundation investigations, and re-allocation of the foundations investigation work for three (3) CSP culverts to the geotechnical investigation portion of this assignment. This report covers the seventeen (17) non-structural culverts in the St. Vincent and Collingwood Township.

Seventeen (17) non-structural culverts are proposed for extensions at one or both ends as per the information supplied by the RFP documents and subsequent changes to the scope of work. The reinforced concrete shale bin at the upstream (south) end of Culvert 11A is to be replaced with a new permanent shale bin. The locations of these structures are shown in Appendix A, Borehole Location Plan, Drawings 1 and 2, and summarized in Table 1 which also indicates the locations, dimensions, existing structure types and the intended work for these culverts.

The purpose of the investigation was to obtain information about the subsurface conditions at the site by means of boreholes and, based on the findings, to provide geotechnical recommendations for the foundation elements.

The work presented herein was undertaken under MTO G.W.P. 57-00-00, Agreement No. 3006-E-0002. Authorization to complete this assignment was given by Mr. Dan Green, P. Eng., of Stantec Consulting Ltd., the TPM Consultant who is completing this assignment for MTO under Agreement # 3006-E-0002.

Table 1
Summary of Existing Location, Structure Type, Dimensions

Culvert #	New Chainage (m)	Existing Culvert Type and Size (W X H X L)	Existing Overfill (m)	Intended Work
Township of St. Vincent				
01A	23+476	910 x 910 x 24.53 RFO	2.6	Extend north (outlet) end of culvert by 2.9 m Extend south (inlet) end of culvert by 3.2 m Off-take ditching
04A	24+527	1520 x 910 x 23.43 NRFO	1.0	Extend south (inlet) end of culvert
07A	25+720	910 x 910 x 18.29 NRFO	0.6	Extend north (outlet) end of culvert by 6.1 m Rip rap protection at inlet
08A	26+027	910 x 910 x 18.30 NRFO	0.6	Extend north (outlet) end of culvert by 4.7 m Off-take ditching, structural repair to end
09A	26+371	910 x 910 x 18.37 NRFO	0.6	Extend north (outlet) end of culvert by 3.4 m Off-take ditching, structural repair to end
10A	26+606	1520 x 910 x 25.5 NRFO	2.3	Extend north (outlet) end of culvert by 1.7 m Extend south end (inlet) end of culvert by 3.8 m Rip rap protection required at both ends and through culvert
11A	26+874	2440 x 1220 x 19.7 NRFB	1.1	Extend north (outlet) end of culvert by 3.2 m Extend south (inlet) end of culvert by 3.6 m Provide new permanent shale bin at upstream end (south) to replace existing shale bin
13A	27+293	910 x 1220 x 20.99 NRFO	1.8	Extend north (outlet) end of culvert by 2.2 m Structural repair to north end
14A	27+500	1520 x 910 x 20.01 NRFO	1.3	Extend north (outlet) end of culvert by 4.7 m Structural repair to north end
15A	27+868	1520 x 910 x 17.96 NRFB	1.7	Extend north (outlet) end of culvert by 7.6 m Extend south (inlet) end of culvert by 2.1 m
16A	28+126	1220 x 910 x 19.12 NRFB	1.3	Extend north (outlet) end of culvert by 5.0 m
17A	28+292	910 x 910 x 17.82 NRFB	1.2	Extend north (outlet) end of culvert by 6.0 m Off-take ditching
18A	28+402	1520 x 910 x 19.20 NRFB	1.4	Extend north (outlet) end of culvert by 6.0 m
19A	28+672	1520 x 910 x 19.20 NRFB	1.2	Extend north (outlet) end of culvert by 4.9 m Off-take ditching
Township of Collingwood				
23A	10+623	900 x 900 x 17.68 NRFO	1.2	Extend north (outlet) end of culvert by 2.7 m Extend south (inlet) end of culvert by 2.0 m
28A	13+863	900 x 900 x 24.10 NRFO	1.0	Extend south (inlet) end of culvert
29A	14+160	1520 x 900 x 17.51 NRFO	0.9	Extend south (inlet) end of culvert

2.0 SITE DESCRIPTION

2.1 Site Location

These seventeen (17) non-structural culverts are located on Highway 26, approximately 0.3 km to 19.9 km east of the east town limit of Meaford (STA 23+206). Table 1 summarizes the locations, existing structure types and dimensions of the existing culverts and the intended work for each culvert, as recommended by the PDR and provided in the RFP documents, and subsequent changes in the scope of work to include Culverts 28A and 29A. Locations of the individual culverts are illustrated in the Borehole Location Plan, Drawings 1 and 2 presented in Appendix A.

The existing concrete culverts are in good conditions and have adequate hydraulic capacity. The extensions are required in order to accommodate the pavement widening as well as intersection and geometric improvements.

These culvert sites are generally located within drainage valleys or surface water flow paths. The overfill heights range approximately between 0.6 m and 2.6 m. The embankment slopes are typically 2.5H to 3H:1V and are grass covered. No signs of embankment slope instability were observed at the time of this foundation investigation. Site photographs taken during a site visit in March 2006 by Stantec and during the field work by IEG are provided in Appendix C.

2.2 Physiography and Topography

The Town of Meaford is situated at the mouth of the Bighead River where the river enters Nottawasaga Bay, part of the Georgian Bay of Lake Huron.

The subsurface of the Town of Meaford is comprised of predominately silty clay, and smooth to gently sloping topography. Pockets of sand and gravelly sands exist which also exhibit smooth to gently sloping topography.

The Town is located on the coastal plain left by glacial Lake Algonquin. East of Meaford, the Algonquin shore cliff coincides with the base of the Niagara Escarpment. The coastal plain in this area consists of sand and gravel beach terraces overlying the bedrock. Overburden thickness is generally less than 5 m. Bedrock consists of the shale and limestones of the Georgian Bay Formation. Grey, impure carbonate beds (limestone and dolomite) alternate with grey and blue/grey shale.

West of Meaford, the coastal plain consists of the same beach deposits as found in the east. To the west away from the Lake, overburden becomes glacio-lacustrine derived silt to clayey till. Numerous drumlins of calcareous till with red shale inclusions are found in the Meaford area.

Progressing west on Highway 26 toward Owen Sound and the Niagara Escarpment, the bedrock types progress from Queenston shales, the Clinton and Cataract shales and dolomites to the cap rock of the Amabel dolomites and limestones. Overburden thickness can be as much as 15 m, but is generally less than 5 m.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

In July, August and September, 2007, a Bombardier-mounted Diedrich drill rig and a truck-mounted CME 55 drill rig, supplied and operated by London Soil Test Ltd. of London, were used on site for drilling and Standard Penetration Testing (SPT, following the procedures of ASTM D 1586). Two boreholes (extension on one end) to three boreholes (extensions on both ends) at each site were drilled and sampled to obtain data for foundation and bedding design of the proposed culvert extensions. The boreholes were drilled to a minimum depth of 3.0 m for these non-structural culverts (or deeper if required) below the culvert inverts to provide sufficient subsurface information for the evaluation of bearing resistances or support of bedding material for the proposed culvert extension and shale bin replacements.

The boreholes were advanced using continuous flight solid stem and hollow stem augers. Soil samples were retrieved at selected intervals throughout the depths of the boreholes in conjunction with Standard Penetration Tests (SPT). Samples were generally taken at intervals of depth of 0.75 m to the maximum depth of exploration.

The culvert borehole numbering system was established from the catchment area numbering system used in the Drainage Report of this project, as agreed with Stantec. A letter "A" or "B" was also added after the culvert numbers to delineate Part A or Part B of this assignment.

For the purpose of proper management of the Borehole Logs within gINT, the borehole logging software, a preceding 0 was added to the culverts with a letter "A" or "B", and the last number being the borehole at the culvert site, i.e., "01A-1" refers to Borehole 1 at the location of Culvert 01A, etc.

Field pocket penetrometer was used on the retrieved SPT samples, where applicable, to determine the undrained shear strength of the cohesive soil deposits. These undrained shear strengths are used to supplement the properties of the cohesive soils. It is noted that the measured shear strength value would be slightly lower than the actual value due to sampling disturbance.

At the site of Culvert 01A, dynamic cone penetration tests were carried out to confirm the compactness condition of the saturated sand and silt deposits, as the SPT values were suspected to have been affected by the hydrostatic pressure during sampling. Where soft to firm silty clay deposit was encountered at Culvert 29A, the shear strength was determined by in situ shear vane tests. Thin-walled Shelby tube samples were obtained for laboratory consolidation test.

Seepage and water levels were noted in each borehole during and at the completion of drilling and sampling. All boreholes were grouted with a bentonite/cement mix at completion of

sampling in accordance with Ontario Regulation 903.

Our field engineer, Mr. Ralph Billings, P. Eng., working under the direction of the project engineer, Mr. Eric Chung, P. Eng., supervised the fieldwork. Our field staff cleared the location of buried utilities and logged the boreholes. The soil samples obtained were placed in labeled containers and transported to our London Office for further examination and laboratory testing.

The stations, offsets and ground surface elevations at the as drilled borehole locations were surveyed by AGM London and provided to IEG for the purpose of this report.

The results of the drilling, sampling, in-situ testing and groundwater observations are summarized on the Record of Borehole sheets and enclosed in Appendix B.

3.2 Laboratory Analysis

Geotechnical laboratory testing consisted of natural moisture content determinations and visual classifications of all retrieved soil samples. In addition, grain size analyses, Atterberg Limit tests and unit weight tests were performed on selected samples. The results of the laboratory testing are presented on the Record of Borehole sheets and in the respective figures presented in Appendix B.

A one-dimensional consolidation test (ASTM D 2435) was conducted on a relatively undisturbed thin-walled (Shelby tube) sample obtained from Borehole 29A-2A at a depth of 4.57 m. The consolidation test was carried out by Trow Associates Inc. of Brampton and the results are provided in a Void Ratio versus Pressure Curve plot enclosed in Appendix B as Figure C-29A.7.

4.0 SUBSURFACE CONDITIONS

Reference is made to the respective appendix of each culvert site for the Record of Borehole sheets and Laboratory Test Results (Appendix B) for detailed subsurface soil and groundwater conditions encountered in the boreholes. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling and, consequently, represent transitions between soil types rather than exact planes of geological change.

In general, the subsurface deposits encountered in the boreholes put down on the shoulder area at the culvert sites consist of loose to compact embankment fill placed on loose to compact sandy silt and compact sand and gravel at Culverts 01A and 04A. At the other fifteen (15) culverts, the topsoil and embankment fill were placed on stiff to hard silty clay till. Locally at Culverts 28A and 29A, there were frequent clayey silt layers within the silty clay till deposit. Localized stiff layers of limited thickness were encountered at Boreholes 10A-3, 11A-2, 11A-3, 13A-1, 17A-1, 17A-2 and 28A-1 and firm to stiff layers (approximately 3 to 4 m thick) in Boreholes 29A-1 and 29A-2.

4.1 Fill, Topsoil

The boreholes at the shoulders generally encountered a 0.23 to 0.76 m thick layer of granular fill (shoulder gravel). The shoulder gravel is underlain by mixed fill materials consisting of predominantly silty clay to clayey silt with sand, gravel and localized zones of organic inclusions, and extended to or slightly below the bottom of the culverts. Locally at Culvert 01, the fill extended to a depth of 6.71 m, much deeper than the anticipated culvert founding level.

The boreholes near the ends of the existing culverts generally encountered a 0.1 to 0.4 m thick layer of topsoil.

Standard penetration tests taken in the mixed fill yielded “N”-values from 1 to 33 blows per 0.3 m. The fill materials were typically loose to compact with very loose condition uncovered at a few locations, particularly at Culvert 01A.

The measured natural moisture contents of the mixed fill ranged from 5 to 48%. The higher moisture contents reflect the presence of topsoil and organic matters, as well as wet silty clay.

Grain size distributions of these fill materials are shown on the first figure of the corresponding culvert site in Appendix B, e.g. Figure C-01A.1 refers to the first figure of Culvert 01A, etc.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
01A	C-01A.1	C-01A.2
04A	C-04A.1	C-04A.2
07A	C-07A.1	N/A
08A	C-08A.1	N/A
10A	C-10A.1	C-10A.2
11A	C-11A.1	C-11A.2
13A	C-13A.1	C-13A.2
14A	C-14A.1	C-14A.2
15A	C-15A.1	C-15A.2
16A	C-16A.1	C-16A.2
23A	C-23A.1	C-23A.2
28A	C-28A.1	C-28A.2
29A	C-29A.1	C-29A.2

Eighteen (18) Atterberg Limits determinations were carried out and yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L), %	24.0	76.0	37.4
Plastic Limit (W_P), %	13.0	35.0	21.4
Plasticity Index (I_P), %	3.0	41.0	16.0

Unit weight of the fill was only determined on six samples due to the disturbance of the soil samples during sampling and sample retrieval. The unit weight of the silty clay to clayey silt fill was measured to be between 17.7 and 24.1 kN/m³, with an average of 22.1 kN/m³.

4.2 Silty Sand, Sandy Silt to Sand and Gravel (SM, ML, GM)

At Culverts 01A and 04A, granular deposits of sand and silt, gravelly sand to sand and gravel were encountered below the embankment fill and topsoil. Standard penetration tests yielded “N”-values of 3 to 15 blows per 0.3 m within the sand and silt or the sandy silt at Boreholes 01A-1, 01A-2 and 04A-1, indicative of very loose to compact compactness condition. Dynamic cone penetration tests in Boreholes 01A-2 and 01A-3 confirmed that the sand and silt deposit was in loose compactness condition. The natural moisture contents were between 9 and 21%.

At Boreholes 04A-1 and 04A-2, a gravelly sand to sand and gravel deposit was encountered below the embankment fill or the sandy silt layer. Standard penetration tests yielded “N”-values of 16 to over 100 blows per 0.3 m, indicative of compact to very dense compactness condition.

Minor and localized pockets of silty sand and gravel and sand were respectively encountered below the topsoil at Borehole 10A-1, and below the silty clay till stratum at Borehole 11A-2. The silty clay till was underlain by a fine sand layer (0.76 m thick) at the location of Borehole 13A-1.

Grain size analyses and Atterberg Limits determinations were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
01A	C-01A.3	C-01A.4
04A	C-04A.3	N/A
13A	C-13A.5	N/A

The results of the Atterberg Limits test on the sand and silt are provided below:

Liquid Limit (W_L)	17%
Plastic Limit (W_P)	13%
Plasticity Index (I_p)	4%

4.3 Silty Clay Till (CL-CH)

With the exception of Culverts 01A and 04A, the topsoil layer at the ends of the culvert and under the embankment fill were underlain by silty clay till stratum which typically extended to the full depths of boreholes. At Boreholes 11A-2 and 13A-1, the silty clay till was underlain by silty sand and gravel and sand pockets. Locally, at Culverts 28A and 29A, there were frequent clayey silt to sandy clayey silt layers (CL-ML) within the silty clay till deposit.

Grain size analyses and Atterberg Limits determinations were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
01A	C-01A.3	C-01A.4
07A	C-07A.2	C-07A.3
08A	C-08A.2	C-08A.3
09A	C-09A.1	C-09A.2
10A	C-10A.3	C-10A.4
11A	C-11A.3	C-11A.4
13A	C-13A.3	C-13A.4
14A	C-14A.3	C-14A.4
15A	C-15A.3	C-15A.4
16A	C-16A.3	C-16A.4
17A	C-17A.1	C-17A.2
18A	C-18A.1	C-18A.2
19A	C-19A.1	C-19A.2
23A	C-23A.3	C-23A.4
28A	C-28A.3	C-28A.4
29A	C-29A.3 & C-29A.5	C-29A.4 & C-29A.6

Sixty-two (62) Atterberg Limits determinations yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L), %	23.0	59.0	37.6
Plastic Limit (W_P), %	15.0	30.0	20.8
Plasticity Index (I_p), %	8.0	29.0	16.8

The natural moisture contents were between 8 and 26%. The unit weight of the silty clay till was measured between 17.1 and 25.5 kN/m³, with an average of 22.3 kN/m³.

Standard penetration tests taken within the silty clay till yielded “N”-values from 8 to over 100 blows per 0.3 m. Undrained shear strength of the silty clay till generally increased with increasing depths. Localized stiff layers of limited thickness were encountered at Boreholes 10A-3, 11A-2, 11A-3, 13A-1, 17A-1, 17A-2 and 28A-1 and firm to stiff layers (approximately 3 to 4 m thick) in Boreholes 29A-1 and 29A-2.

Based on the above field and laboratory test results, together with visual and tactile examination, the silty clay till deposit generally exhibited very stiff to hard consistency with localized stiff conditions.

A one-dimensional consolidation test (ASTM D 2435) was conducted on a relatively undisturbed thin-walled (Shelby tube) sample of the firm to stiff layer taken from Borehole 29A-2A at a depth of 4.57 m. These results are shown in Figure C-29A.7 of Appendix B and summarized below:

Sample Depth:	4.57 m
Elevation:	189.95 m
Liquid Limit (W_L)	31%
Plastic Limit (W_P)	20%
Natural Moisture Content (W)	28 %
Compression Index (C_C)	0.192
Recompression Index (C_r)	0.026
Pre-consolidation Pressure (σ_p)	190 kPa
Effective Overburden Pressure (σ_{vo})	99 kPa

4.4 Shale Till Complex to Shale Bedrock

The sand and silt at Boreholes 01A-2 and 01A-3 was underlain by a shale till complex at depths of 8.69 m (207.82 m) and 4.88 m (elevation 207.86 m). At Borehole 13A-1, the sand pocket was underlain by grey weathered shale bedrock at a depth of 5.64 m (elevation 228.07 m).

A grain size analysis and Atterberg Limits determinations were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
01A	C-01A.5	C-01A.6

The results of the Atterberg Limits test are provided below:

Liquid Limit (W_L)	30%
Plastic Limit (W_P)	19%
Plasticity Index (I_p)	11%

Standard penetration tests yielded “N”-values over 100 blows per 0.3 m. The measured natural moisture contents ranged from 9 to 14%. The unit weight of a single sample was measured to be 24.1 kN/m³.

4.5 Groundwater

The groundwater condition was monitored during and upon completion of sampling. On completion of drilling, groundwater levels noted in the boreholes are summarized in the following table.

Culvert Number	Groundwater Levels - Depth/Elevation (m)		
	Borehole 1	Borehole 2	Borehole 3
01A	3.65/212.67	5.50/211.01	1.80/210.94
04A	BD&O	BD&O	Not Required
07A	3.35/227.62	1.05/227.93 *	Not Required
08A	BD&O	BD&O	Not Required
09A	4.15/227.97	1.00/229.60 *	Not Required
10A	0.45/235.51	2.75/230.40	1.65/227.99
11A	4.10/230.93	BD&O	BD&O
13A	2.30/231.41	1.65/229.37	Not Required
14A	2.90/229.56	3.00/227.71	Not Required
15A	BD&O	2.10/229.30	1.50/227.89
16A	BD&O	BD&O	Not Required
17A	2.30/230.20	BD&O	Not Required
18A	4.40/228.86	BD&O	Not Required
19A	BD&O	BD&O	Not Required
23A	2.00/232.92	5.50/229.39	1.30/231.45
28A	BD&O	BD&O	Not Required
29A	BD&O	6.00/188.52	Not Required

Note: BD&O means borehole dry and open at completion

* means potential hydrostatic condition

In general, the groundwater was encountered as perched condition within the upper fill materials and in the wet to saturated granular deposits.

At Culverts 07A and 09A, the water levels rose quickly after final sampling to depths of 1.05 and 1.00 m. This could suggest a hydrostatic connection between the upper and lower strata within the silty clay till, and a potential artesian condition exists.

The groundwater condition will fluctuate seasonally and in response to weather events.

5.0 STATEMENT OF LIMITATION

We recommend that once the details of the proposed structure are finalized, our recommendations should be reviewed for their specific applicability.

The Limitations of Report, as quoted in Appendix D, is an integral part of this report.

We trust that we have completed the assignment within the Terms of Reference for this project. If there are any questions concerning this report, please do not hesitate to contact our office.

Yours truly,
Infrastructure Engineering Group Inc.

Eric Y. Chung, M.Eng., P.Eng.
Designated MTO Contact



Joseph Law, P.Eng.
Project Manager

Tom O'Dwyer, P. Eng.
Quality Review Engineer



Ministry of Transportation/Stantec Consulting Ltd.
G.W.P. 57-00-00
Rehabilitation of Highway 26 from Meaford to Thornbury
Agreement # 3006-E-0002

07-6-IEG-A-NSCE
Final Report
Appendix A
April 17, 2009

Appendix A

Drawing 1 & 2

Borehole Location Plan

BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES	
		NORTH	EAST			NORTH	EAST			NORTH	EAST
C01A-1	216.32	4939877	219102	C04A-1	225.68	4939487	220069	C07A-1	230.98	4939207	221219
C01A-2	216.15	4939902	219111	C04A-2	226.40	4939500	220071	C07A-2	228.98	4939218	221225
C01A-3	212.74	4939908	219122								

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

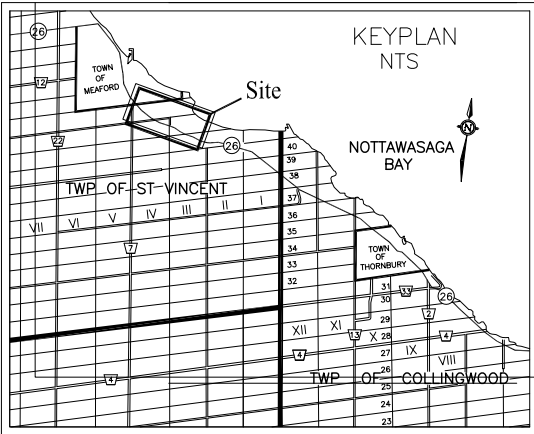
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NON-STRUCTURAL CULVERT
EXTENSION
Highway 26
BOREHOLE LOCATION PLAN

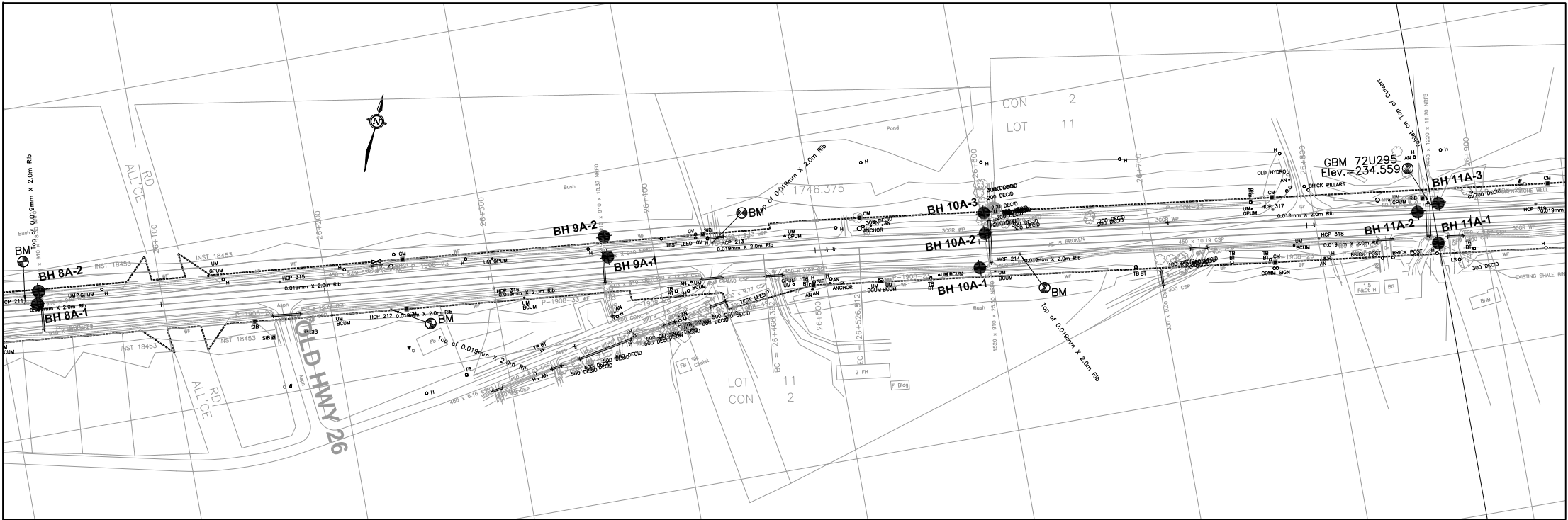
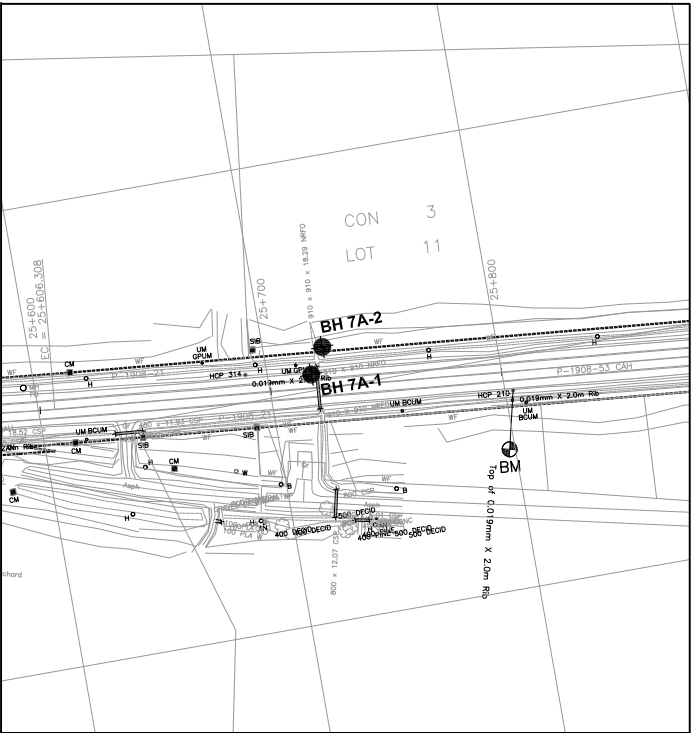
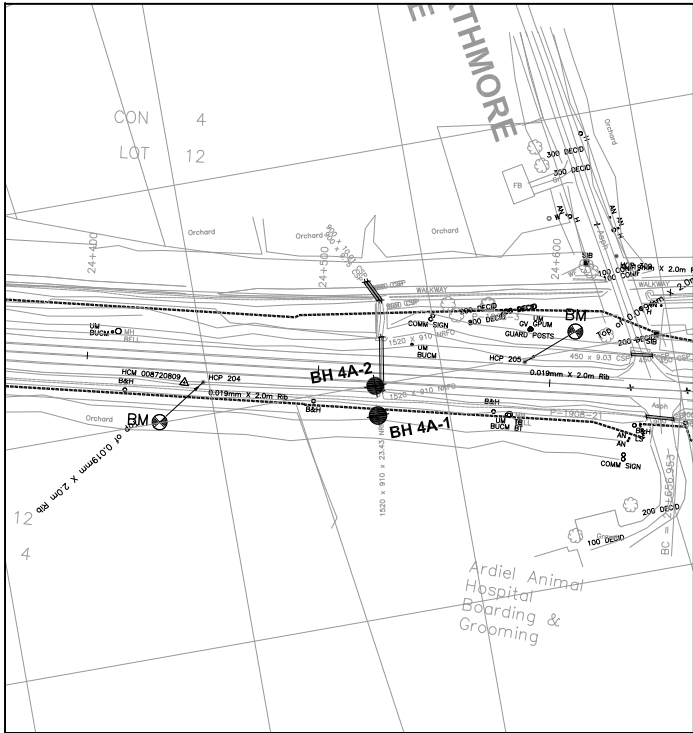
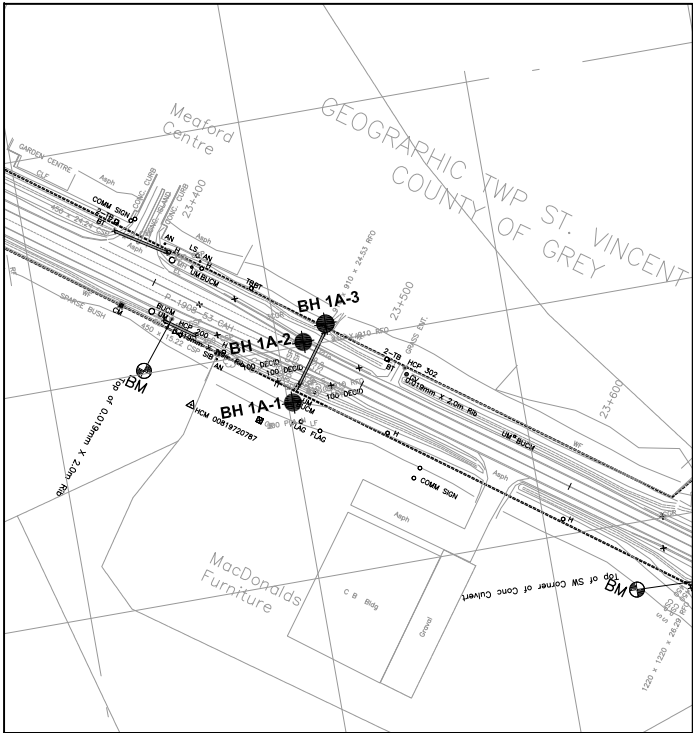
SHEET
1

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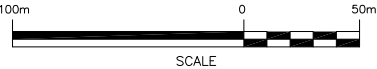


LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe



NOTES
1. 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 ARE SPECIFICALLY EXCLUDED IN ACCORDANCE WITH THE CONDITIONS OF SECTION GC2.01 of OPS GEN. COND.



BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES	
		NORTH	EAST			NORTH	EAST			NORTH	EAST			NORTH	EAST
C08A-1	230.76	4939179	221524	C09A-1	232.12	4939148	221872	C10A-1	230.96	4939102	222094	C11A-1	235.03	4939068	222372
C08A-2	229.27	4939191	221529	C09A-2	230.60	4939160	221872	C10A-2	233.16	4939122	222101	C11A-2	235.70	4939089	222363
								C10A-3	229.64	4939134	222102	C11A-3	224.85	4939092	222376

REVISIONS	DATE	BY	DISCRIPTION
	09/04/09	J.L.	Final
	08/05/08	J.L.	Draft
MTO GEORES No. 41A-207			
HWY No.	HWY 26		DIST Owen Sound
SUBM'D	J.L.	CHECKED E.C.	DATE 08/05/08
DRAWN	J.L.	CHECKED J.L.	APPROVED E.C.
			SITE C01A TO C11A
			DWG 1

Appendix B

Explanation of Terms Used in Report Record of Borehole Sheet Laboratory Test Results

Culvert Site	Borehole Logs	Grain Size	Atterberg Limits
01A	01A-1 to 3	Figures C-01A.1, 3 & 5	Figures C-01A.2, 4 & 6
04A	04A-1 & 2	Figures C-04A.1 & 3	Figure C-04A.2
07A	07A-1 & 2	Figures C-07A.1 & 2	Figure C-07A.3
08A	08A-1 & 2	Figures C-08A.1 & 2	Figure C-08A.3
09A	09A-1 & 2	Figure C-09A.1	Figure C-09A.2
10A	10A-1 to 3	Figures C-10A.1 & 3	Figures C-10A.2 & 4
11A	11A-1 to 3	Figures C-11A.1, 3 & 5	Figures C-11A.2 & 4
13A	13A-1 & 2	Figures C-13A.1, 3 & 5	Figures C-13A.2 & 4
14A	14A-1 & 2	Figures C-14A.1 & 3	Figures C-14A.2 & 4
15A	15A-1 to 3	Figures C-15A.1 & 3	Figures C-15A.2 & 4
16A	16A-1 & 2	Figures C-16A.1 & 3	Figures C-16A.2 & 4
17A	17A-1 & 2	Figure C-17A.1	Figure C-17A.2
18A	18A-1 & 2	Figure C-18A.1	Figure C-18A.2
19A	19A-1 & 2	Figure C-19A.1	Figure C-19A.2
23A	23A-1 to 3	Figures C-23A.1 & 3	Figures C-23A.2 & 4
28A	28A-1 & 2	Figures C-28A.1 & 3	Figures C-28A.2 & 4
29A	29A-1, 2 & 2A	Figures C-29A.1, 3 & 5	Figures C-29A.2, 4 & 6
		Figure C-29A.7, Consolidation Test Results	

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 1" 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:

RQD (%)	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
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	e	1. %	VOID RATIO	e_{min}	1. %	VOID RATIO IN DENSEST STATE
γ_s	kn/m ³	UNIT WEIGHT OF SOLID PARTICLES	n	1. %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m ³	DENSITY OF WATER	w	1. %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kn/m ³	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kn/m ³	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m ³	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m ³ /s	RATE OF DISCHARGE
γ_d	kn/m ³	UNIT WEIGHT OF DRY SOIL	i_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{i_p}$	i	1	HYDRAULIC GRADIENT
γ_{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
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	e_{max}	1. %	VOID RATIO IN LOOSEST STATE	j	kn/m ³	SEEPAGE FORCE
γ'	kn/m ³	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No 01A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939877, Easting - 219102 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 08.02.07 - 08.02.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	20						40	60	80
216.32 0.00	Ground 75 mm TOPSOIL.																GR SA SI CL			
			1	SPT	9												10 54 24 12 (37)			
	FILL Brown, damp, loose to compact, consisting mainly of silty sand to sandy silt, trace to some gravel, trace organics, occasional clayey layers.		2	SPT	16															
			3	SPT	11												27 45 18 9 (28)			
			4	SPT	7												Water level measured @ 3.65 m @ completion.			
212.66 3.66			5	SPT	13											23.7	22 24 34 20 (54)			
	Sandy SILT, ML Grey, wet, compact, with occasional silty sand and silty clay seams, some gravel.		6	SPT	17															
			7	SPT	20											24.1				
			8	SPT	21															
209.61 6.71	End of borehole.																			

JOE MTO 07-6-JEG1.GPJ ONTARIO MOT.GDT 04/12/09

+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 01A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939902, Easting - 219111 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 08.28.07 - 08.28.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)
216.51 0.00	Ground						20	40	60	80	100	10	20	30		GR SA SI CL	
	200 mm sand and gravel FILL.																
			1	SPT	5												
			2	SPT	6												
	FILL Brown, damp, loose to dense, consisting mainly of silt and silty sand, trace gravel.		3	SPT	30											3 61 27 9 (36)	
			4	SPT	13												
212.55 3.96			5	SPT	7												
			6	SPT	7												
	FILL Greenish grey, moist, very loose to loose, consisting of organic stained silt to silty clay with organic pockets.		7	SPT	2												
			8	SPT	3												
209.80 6.71	Brown		9	SPT	11												
	SAND & SILT, SM-ML Wet to saturated, very loose to compact, trace gravel, occasional grey silty clay seams		10	SPT	3											5 45 39 11 (51)	
	Grey		11	SPT	40												
207.82 8.69																	
	SHALE TILL COMPLEX Grey, moist, hard.																
207.21 9.30	End of borehole.		12	SPT	100+												

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+ 3, X 3: Numbers refer to
Sensitivity

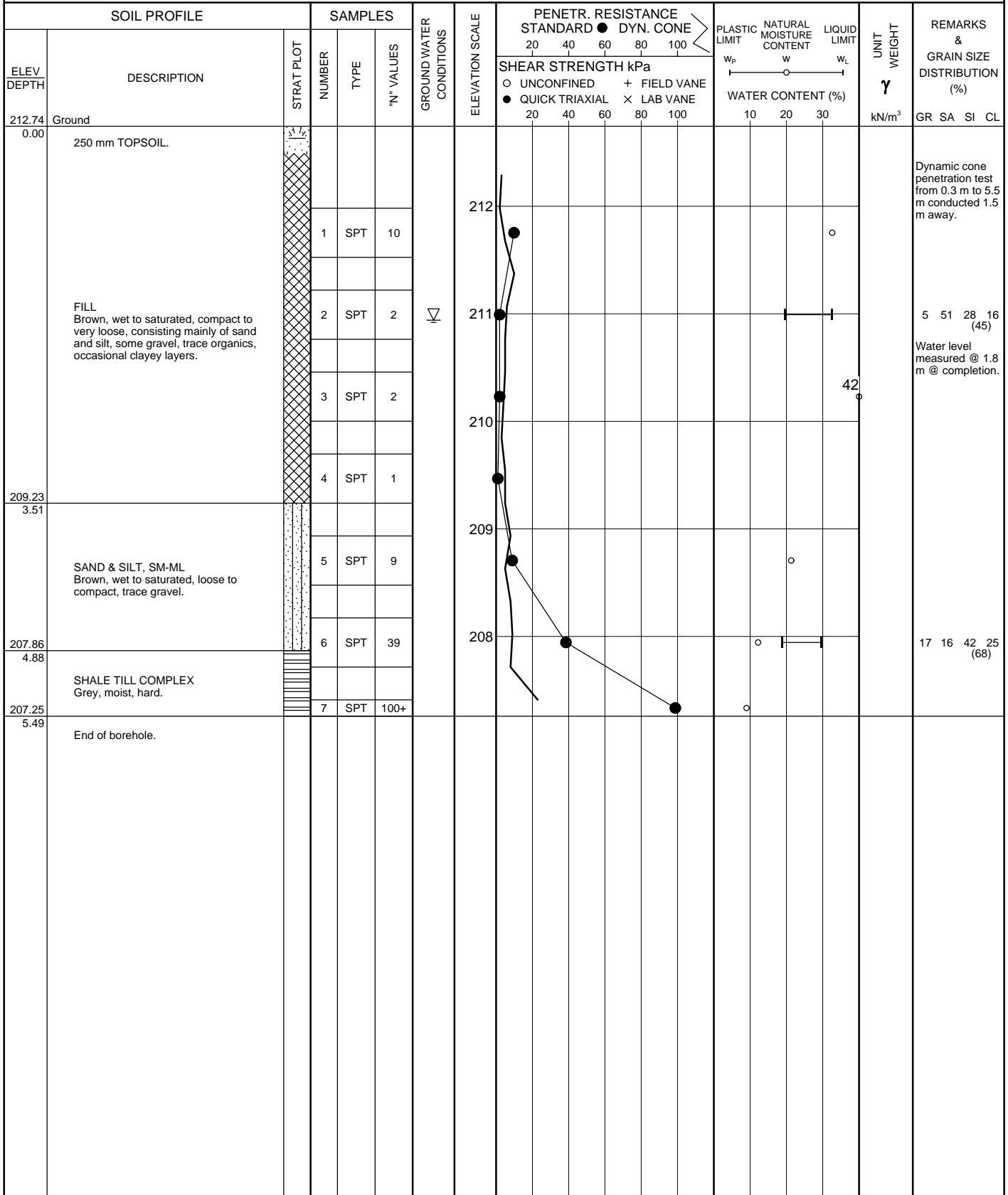
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 01A-3

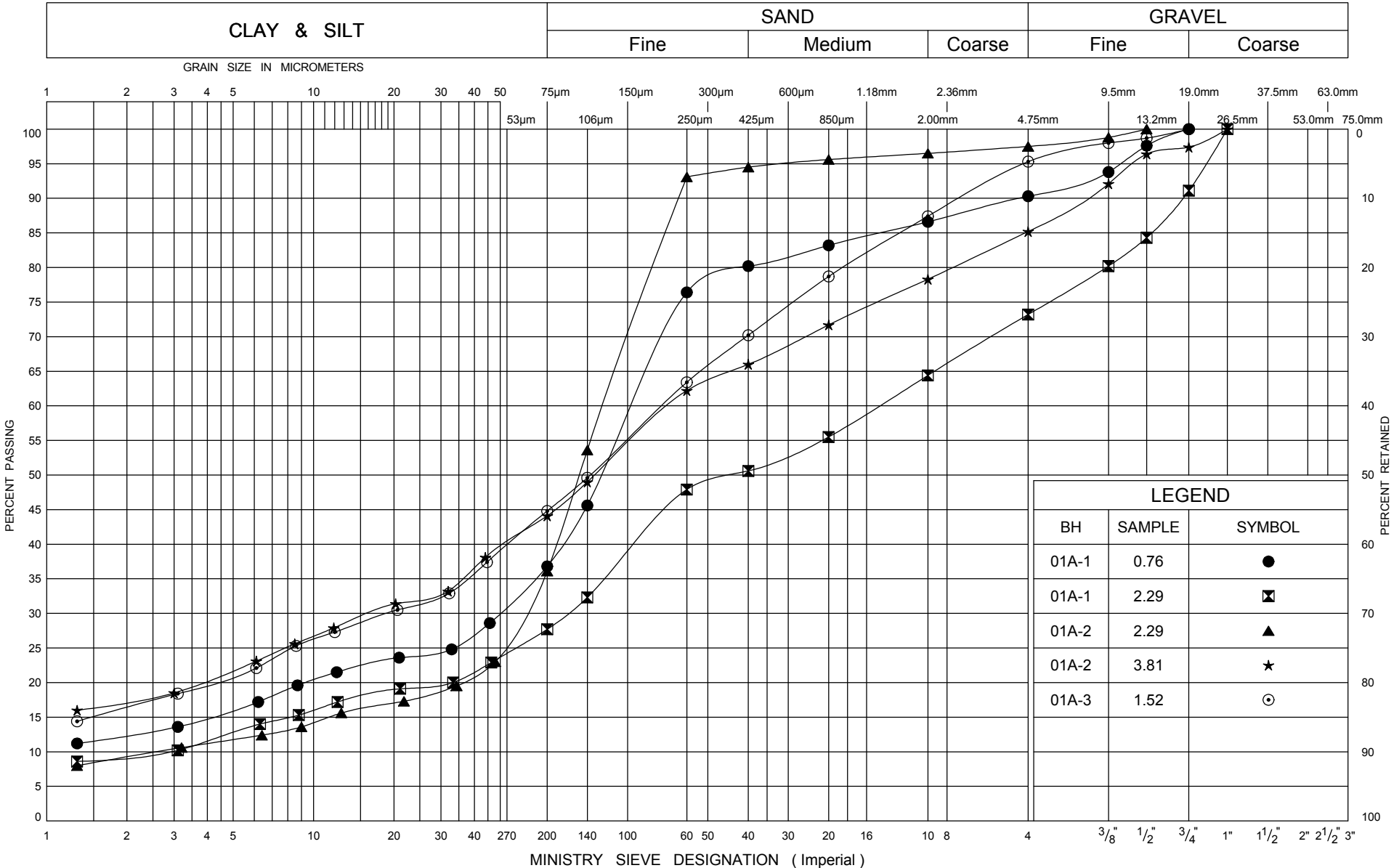
1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939908, Easting - 219122 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 08.01.07 - 08.01.07 CHECKED BY EC



UNIFIED SOIL CLASSIFICATION SYSTEM

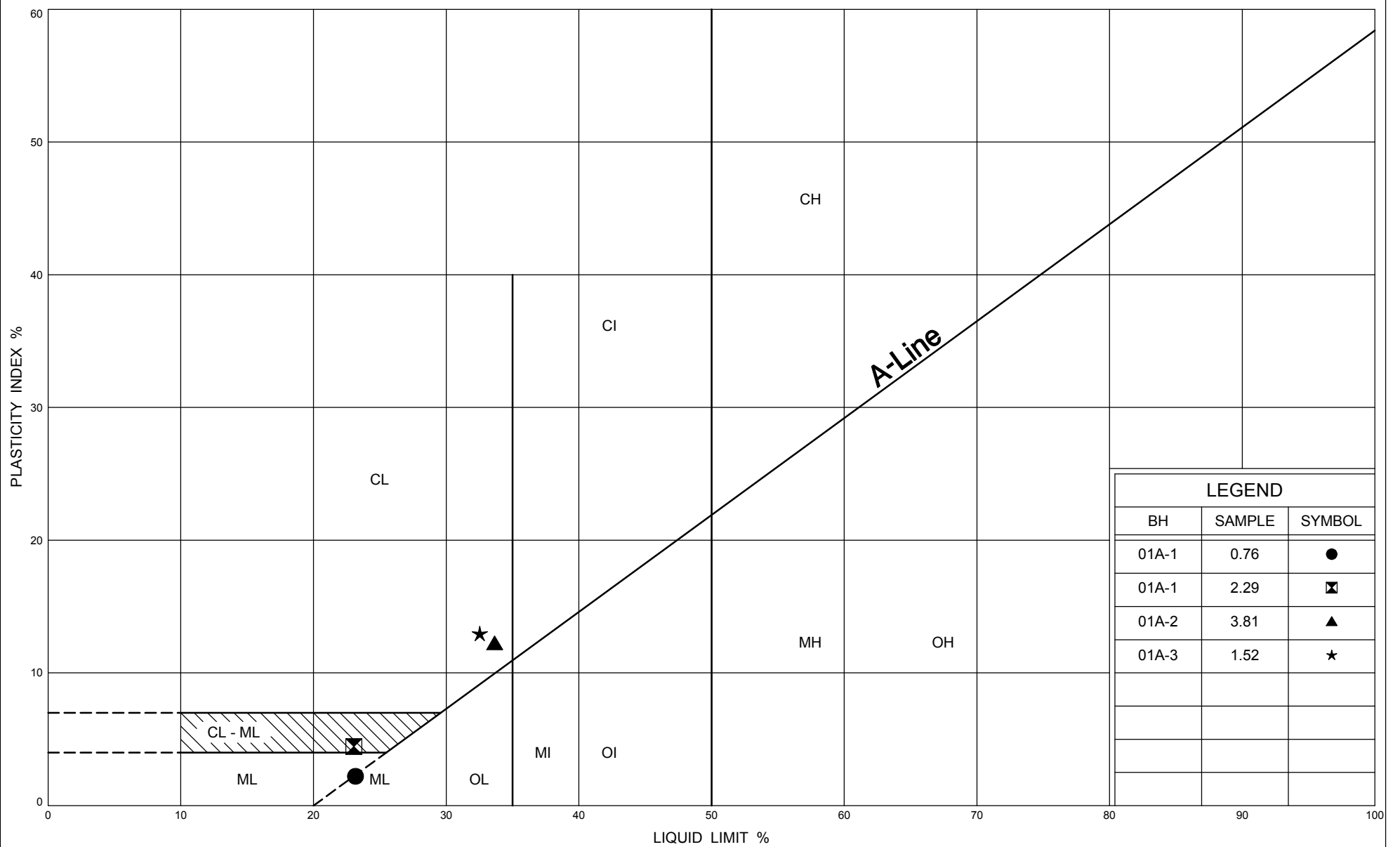


GRAIN SIZE DISTRIBUTION
FILL

FIG No C-01A.1

GWP 57-00-00

HWY 26, Thornbury to Meaford



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Transportation

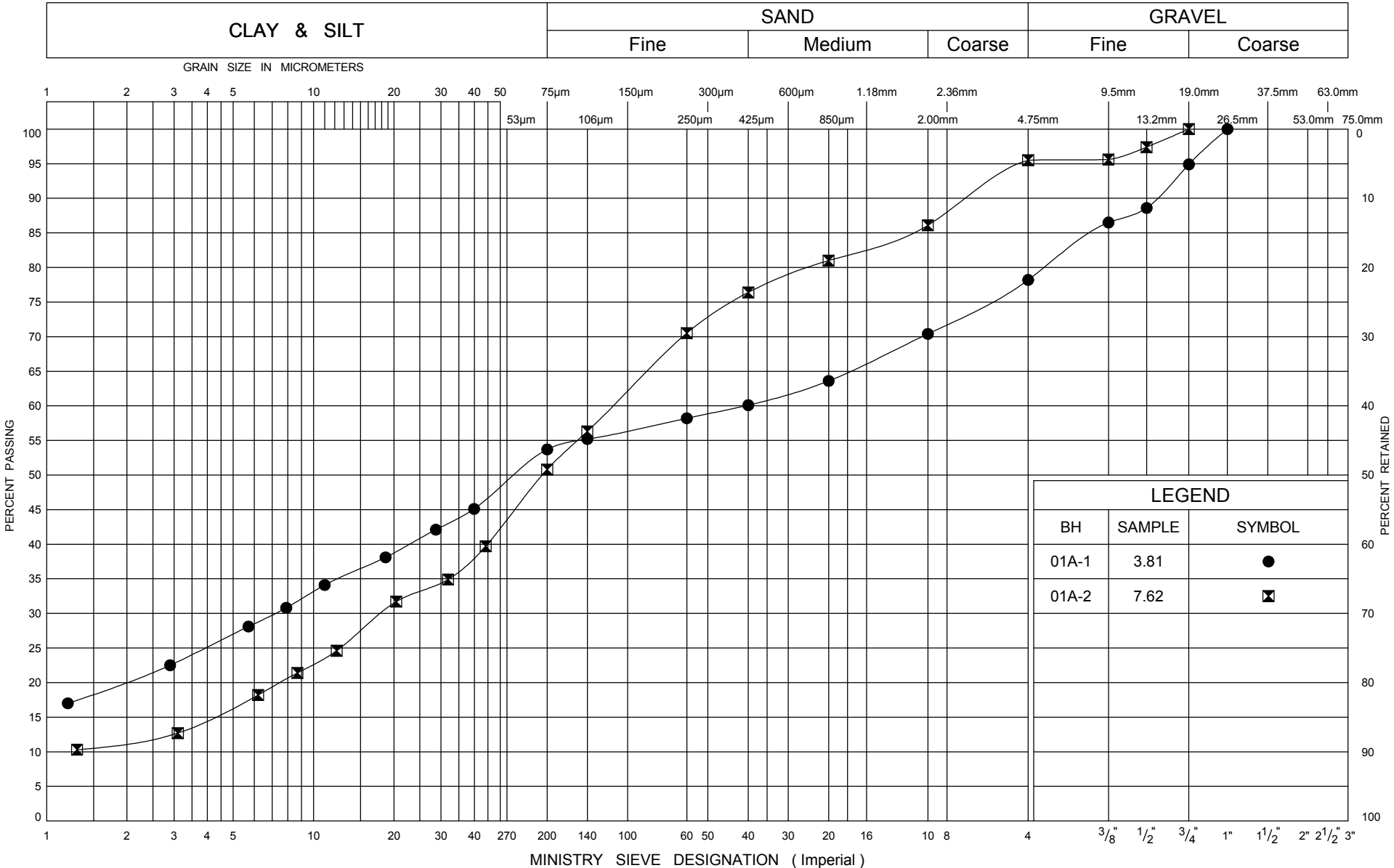
PLASTICITY CHART FILL

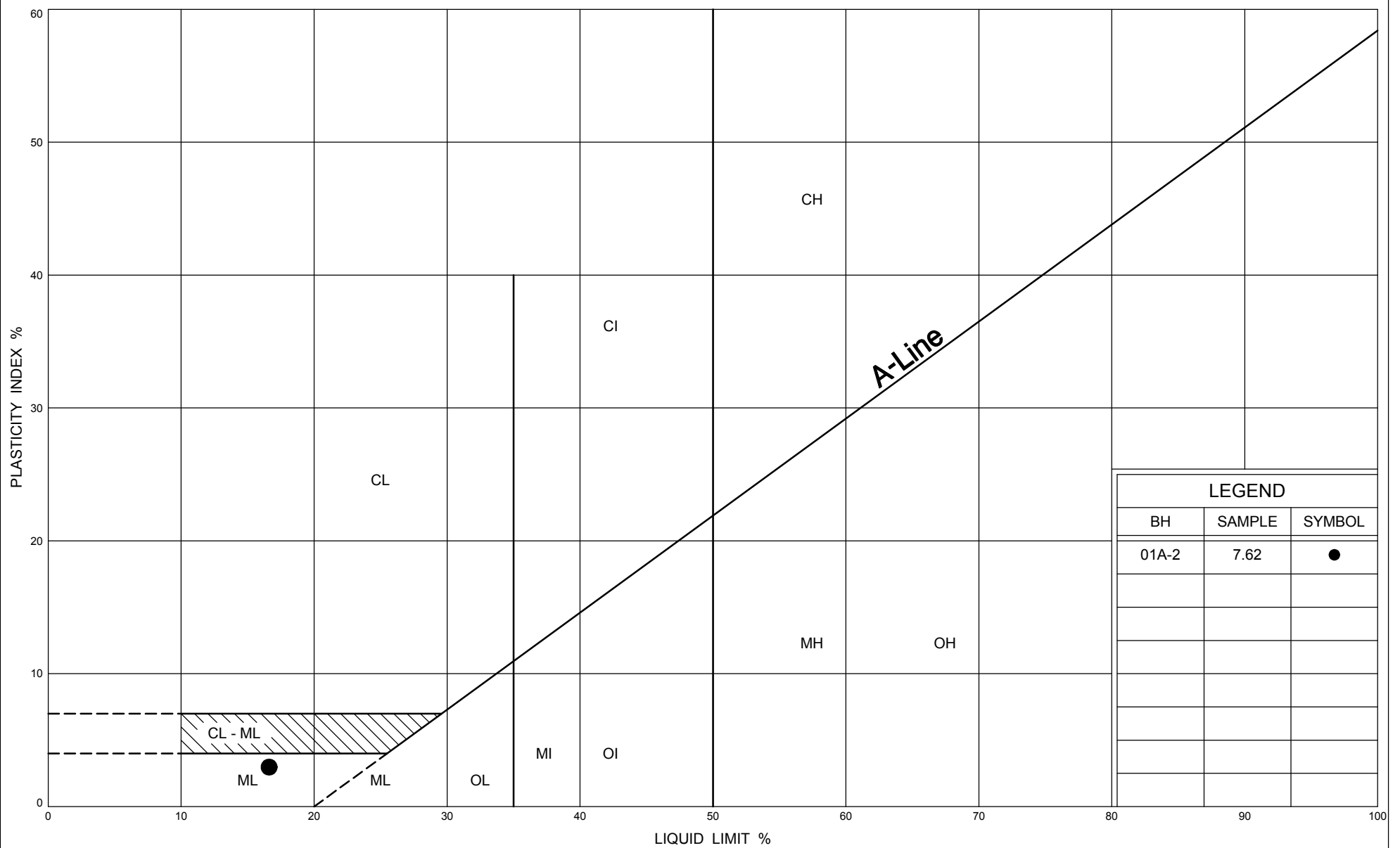
FIG No C-01A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM





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Transportation

PLASTICITY CHART SANDY SILT TO SAND AND SILT, ML-SM

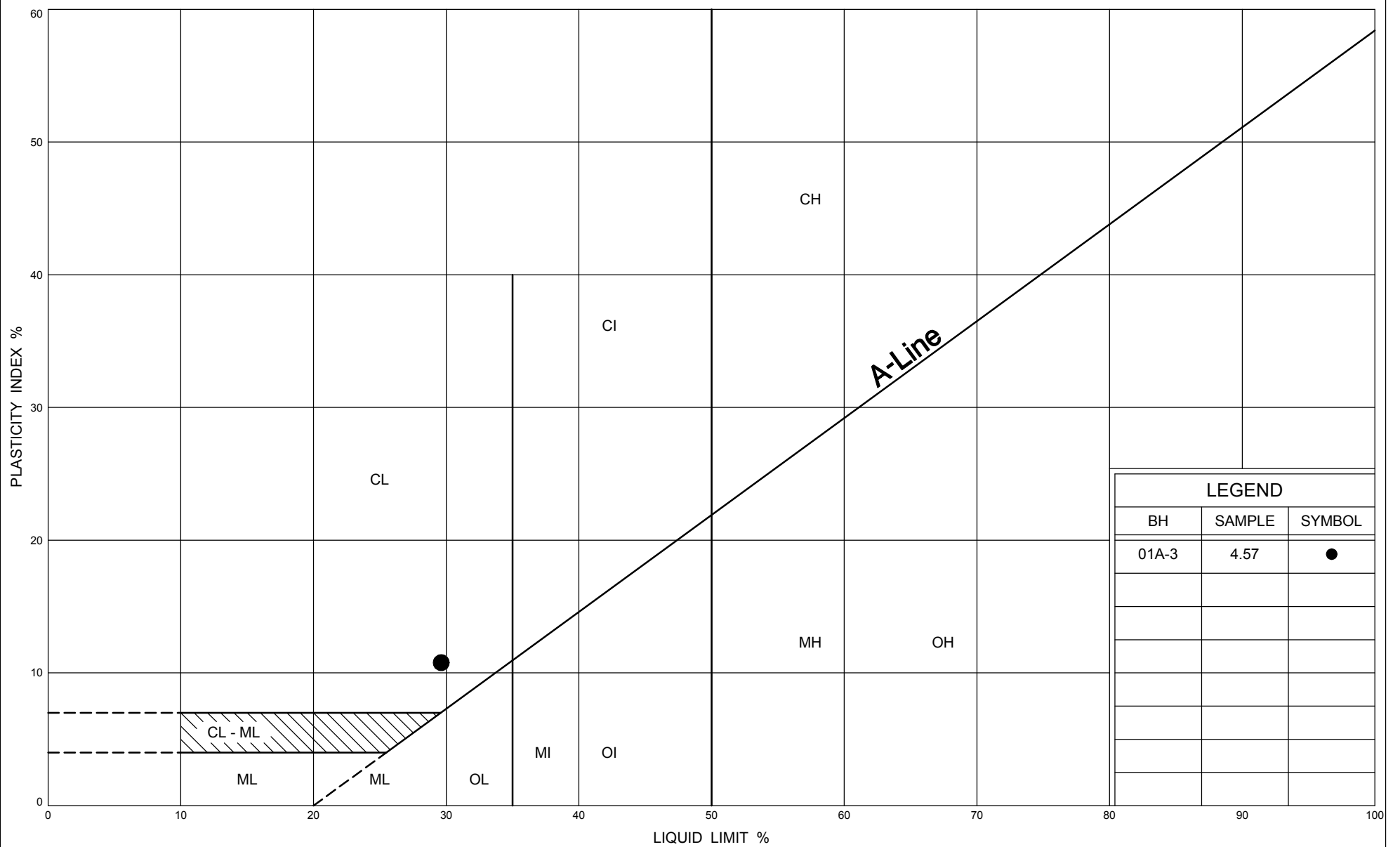
FIG No C-01A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford



HWY 26, Thornbury to Meaford



Ministry of
Transportation

PLASTICITY CHART SHALE TILL COMPLEX

FIG No C- 01A.6

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 04A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939487, Easting - 220069 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.31.07 - 07.31.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
225.68 0.00	Ground							20 40 60 80 100		10 20 30					
	150 mm TOPSOIL.						225								
	Sandy SILT, ML Brown, moist, compact to very dense, with embedded gravel and silty clay pockets.		1	SPT	100+									hit cobble @ 1.1m.	
			2	SPT	15		224								
223.24 2.44			3	SPT	30		223							41 39 14 6 (20)	
	Gravelley SAND TO SAND & GRAVEL, SW-GW Brown, moist, dense to very dense, some silt.		4	SPT	74		222							24 49 20 8 (27)	
221.72 3.96	End of borehole.		5	SPT	100+									Borehole dry and open @ completion.	

JOE MTO 07-6-JEG1.GPJ ONTARIO.MOT.GDT 04/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 04A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939500, Easting - 220071 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.31.07 - 07.31.07 CHECKED BY EC

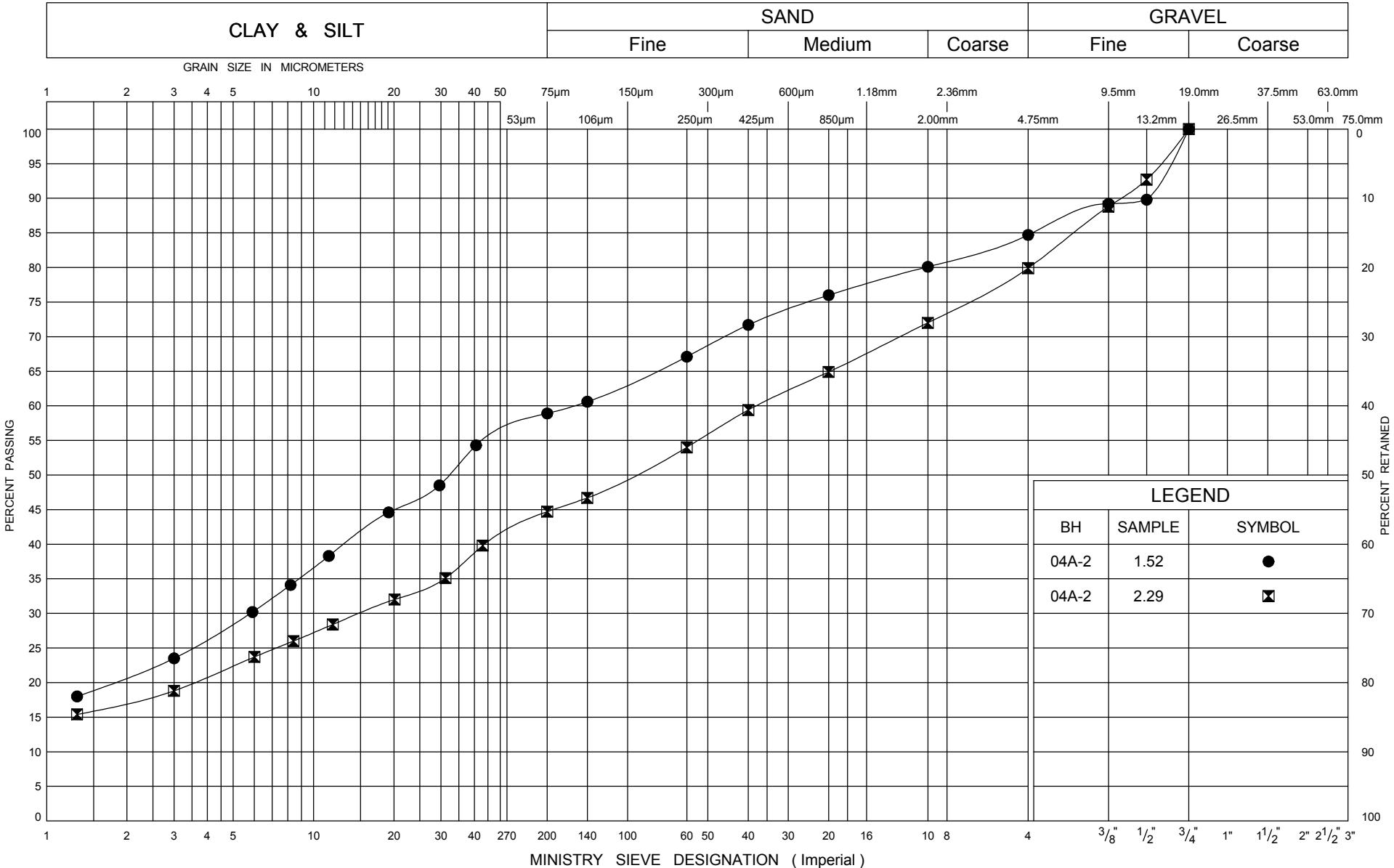
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)
226.40 0.00	Ground						20	40	60	80	100	10	20	30		GR SA SI CL	
	350 mm sand and gravel FILL.																
	FILL Brown, moist, compact to loose, consisting mainly of clayey sandy silt to clayey silty sand.		1	SPT	15												
			2	SPT	10											15 26 38 21 (59)	
			3	SPT	4											20 35 28 17 (45)	
223.50 2.90			4	SPT	16												
	GRAVELLY SAND TO SAND & GRAVEL, SW-GW Brown, moist, compact to very dense, some silt.		5	SPT	25												
			6	SPT	100+												
221.37 5.03	End of borehole.															Borehole dry and open @ completion.	

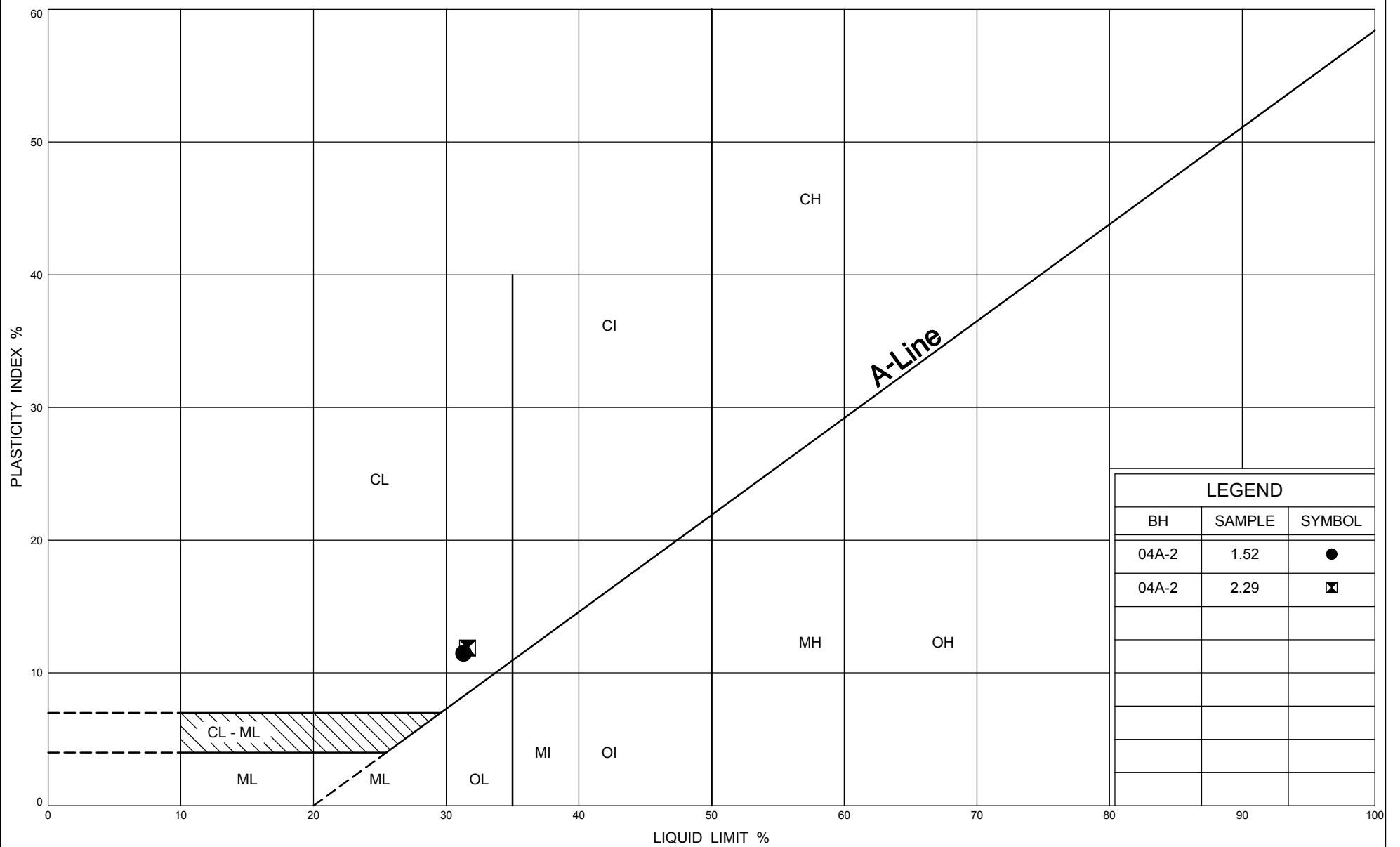
JOE MTO 07-6-JEG1.GPJ ONTARIO.MOT.GDT 04/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM





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Transportation

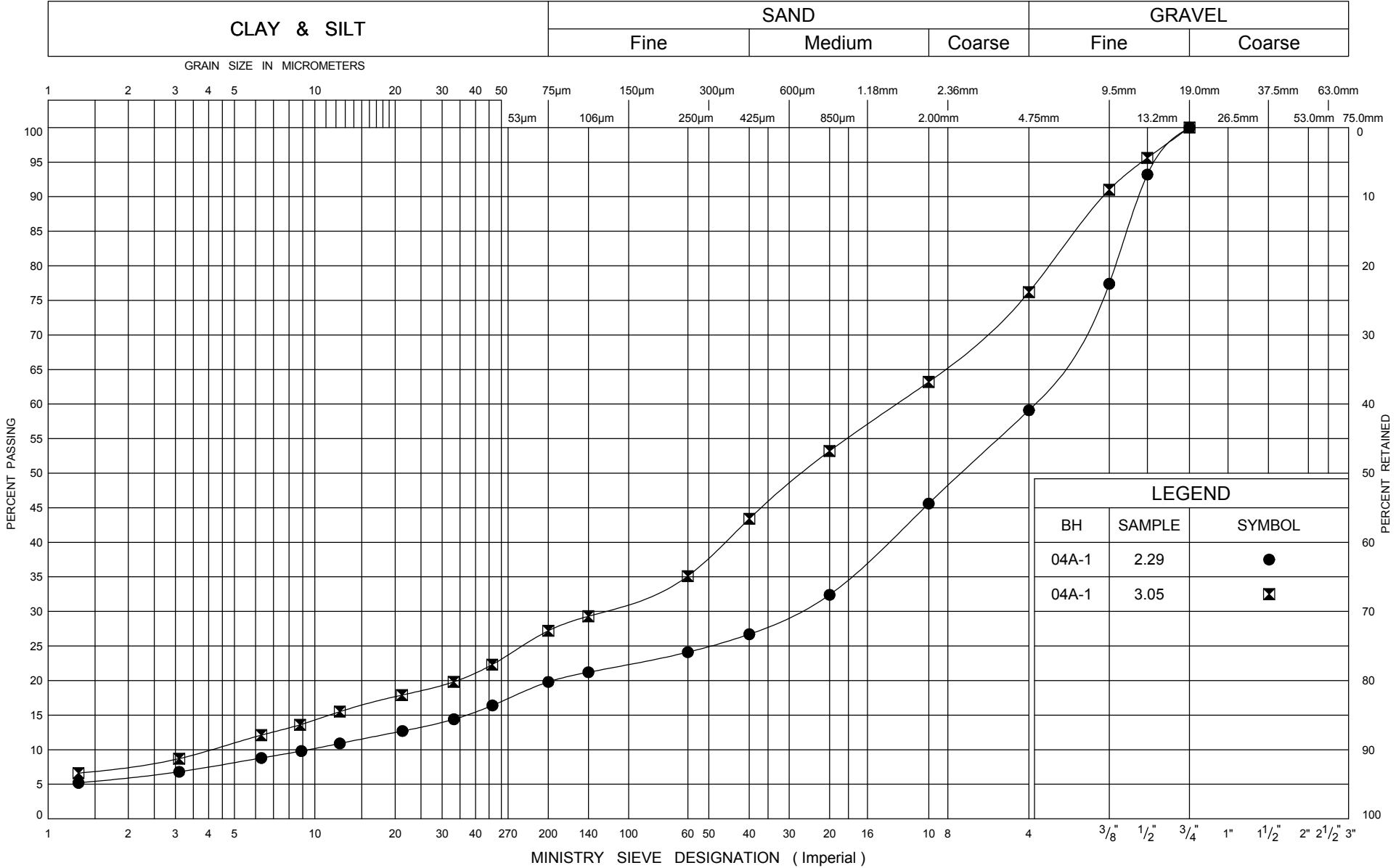
PLASTICITY CHART FILL

FIG No C- 04A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
BH	SAMPLE	SYMBOL
04A-1	2.29	●
04A-1	3.05	⊠



GRAIN SIZE DISTRIBUTION
GRAVELLY SAND TO SAND AND GRAVEL, SW-GW

FIG No C- 04A.3
GWP 57-00-00
HWY 26, Thornbury to Meaford

METRIC

[illegible]

1 OF 1

METRIC

[illegible]

Coarse

LEGEND

BH	SAMPLE	SYMBOL
07A-1	1.52	●

MINISTRY SIEVE DESIGNATION (Imperial)

Imperial (in)	Metric (mm)
1	25.4
2	50.8
3	76.2
4	101.6
5	127.0
10	254.0
20	508.0
30	762.0
40	1016.0
50	1270.0
60	1524.0
75	1905.0
100	2540.0
150	3810.0
200	5080.0
250	6350.0
300	7620.0
350	8890.0
425	10668.0
500	12700.0
600	15240.0
750	19050.0
1000	25400.0
1500	38100.0
2000	50800.0
2500	63500.0
3000	76200.0
3500	88900.0
4000	101600.0
4500	114300.0
5000	127000.0
5500	139700.0
6000	152400.0
6500	165100.0
7000	177800.0
7500	190500.0
8000	203200.0
8500	215900.0
9000	228600.0
9500	241300.0
10000	254000.0
10500	266700.0
11000	279400.0
11500	292100.0
12000	304800.0
12500	317500.0
13000	330200.0
13500	342900.0
14000	355600.0
14500	368300.0
15000	381000.0
15500	393700.0
16000	406400.0
16500	419100.0
17000	431800.0
17500	444500.0
18000	457200.0
18500	469900.0
19000	482600.0
19500	495300.0
20000	508000.0
20500	520700.0
21000	533400.0
21500	546100.0
22000	558800.0
22500	571500.0
23000	584200.0
23500	596900.0
24000	609600.0
24500	622300.0
25000	635000.0
25500	647700.0
26000	660400.0
26500	673100.0
27000	685800.0
27500	698500.0
28000	711200.0
28500	723900.0
29000	736600.0
29500	749300.0
30000	762000.0
30500	774700.0
31000	787400.0
31500	800100.0
32000	812800.0
32500	825500.0
33000	838200.0
33500	850900.0
34000	863600.0
34500	876300.0
35000	889000.0
35500	901700.0
36000	914400.0
36500	927100.0
37000	939800.0
37500	952500.0
38000	965200.0
38500	977900.0
39000	990600.0
39500	1003300.0
40000	1016000.0
40500	1028700.0
41000	1041400.0
41500	1054100.0
42000	1066800.0
42500	1079500.0
43000	1092200.0
43500	1104900.0
44000	1117600.0
44500	1130300.0
45000	1143000.0
45500	1155700.0
46000	1168400.0
46500	1181100.0
47000	1193800.0
47500	1206500.0
48000	1219200.0
48500	1231900.0
49000	1244600.0
49500	1257300.0
50000	1270000.0

BH	SAMPLE	SYMBOL
07A-1	1.52	●



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Transportation

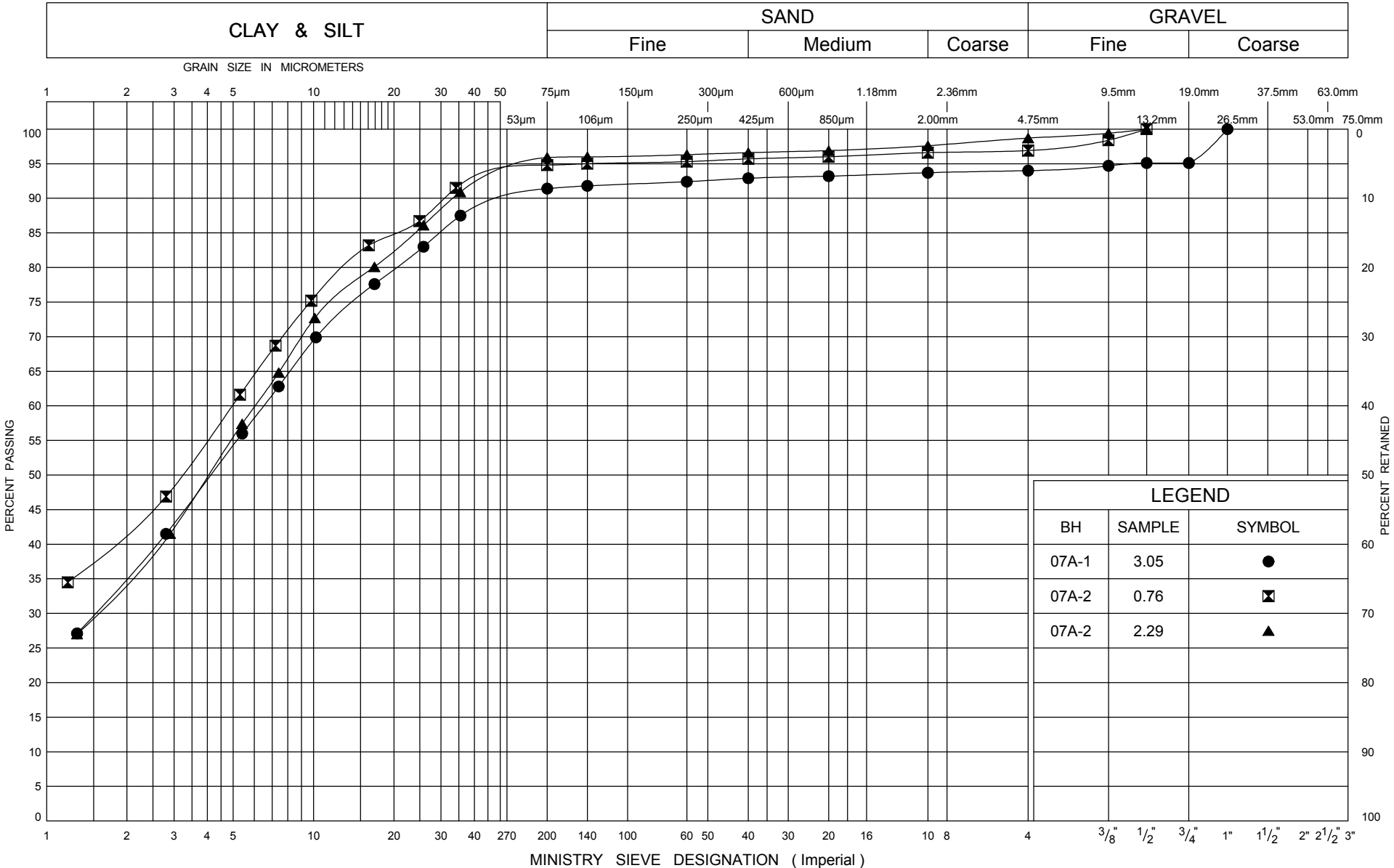
GRAIN SIZE DISTRIBUTION

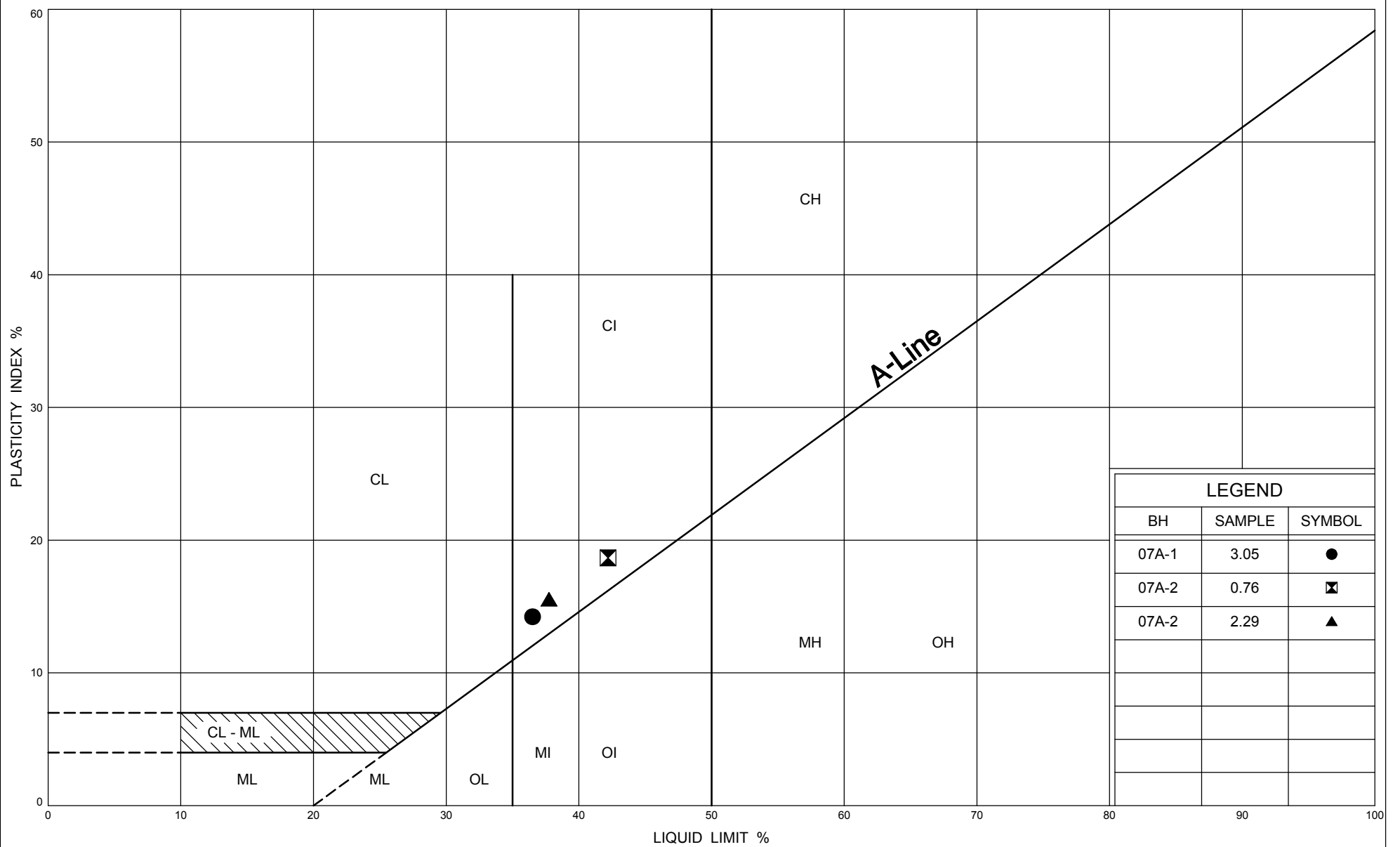
FIG No C- 07A.1

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TILL, CI

FIG No C- 07A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 08A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939179, Easting - 221524 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD ● DYN. CONE						
								SHEAR STRENGTH kPa						
							○ UNCONFINED + FIELD VANE							
							● QUICK TRIAXIAL × LAB VANE							
								WATER CONTENT (%)						
230.76 0.00	Ground							20	40	60	80	100		
230.15 0.61	FILL Brown, moist, consisting of sand and gravel.													
			1	SPT	15									60 27 9 4 (13)
			2	SPT	6									
	FILL Brown, moist, loose to compact, consisting mainly of sandy silty clay, gravel pieces.													
			3	SPT	23									
	greenish grey													
227.71 3.05		shale seams	4	SPT	100					162.5				32 22 30 16 (46)
	Silty CLAY TILL, CL Grey, moist, firm to hard, embedded sand and gravel, with shale seams.													
			5	SPT	73								24.8	
226.04 4.72	End of borehole.		6	SPT	100+									spoon wet at tip. Borehole dry and open @ completion.

RECORD OF BOREHOLE No 08A-2

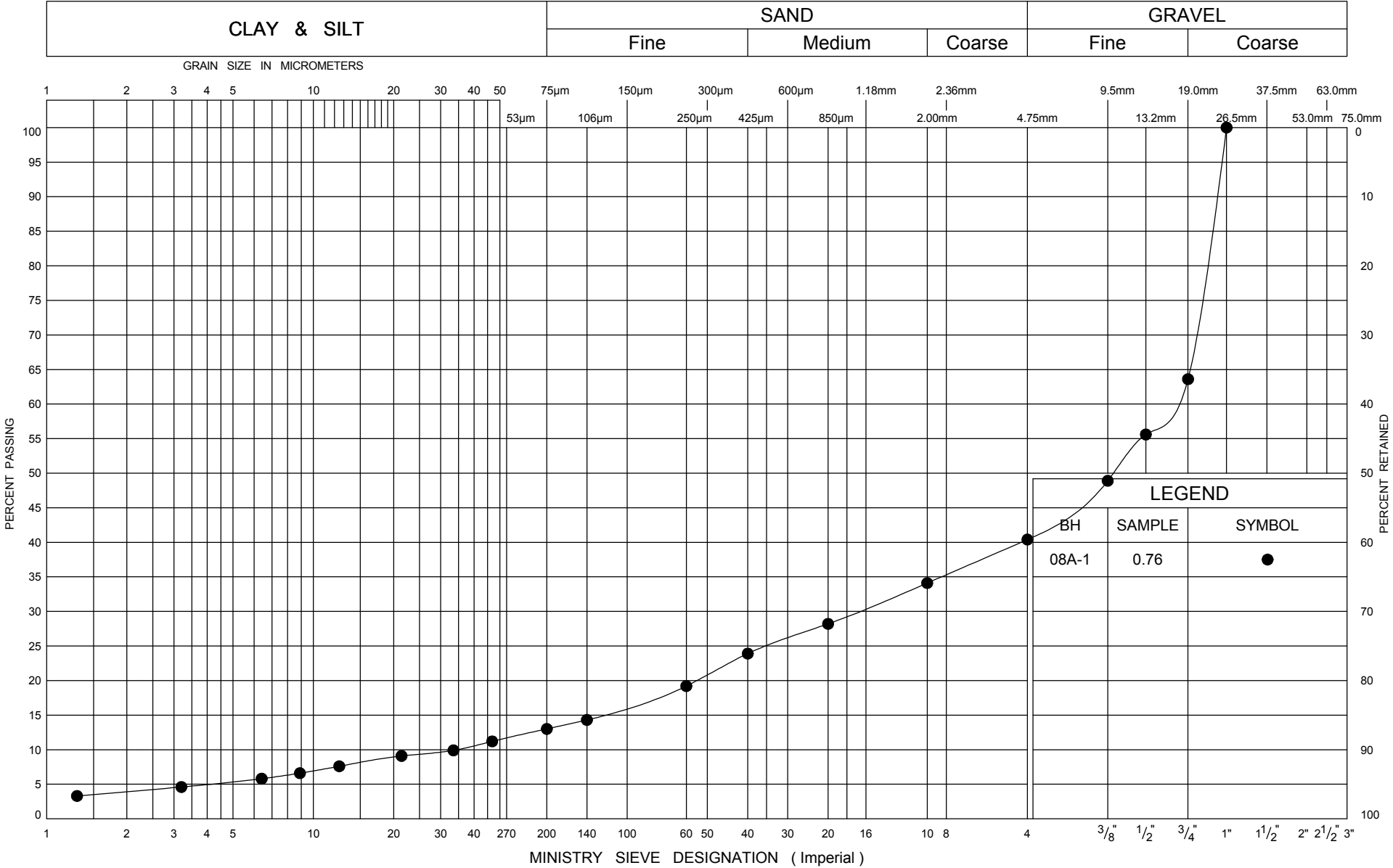
1 OF 1

METRIC

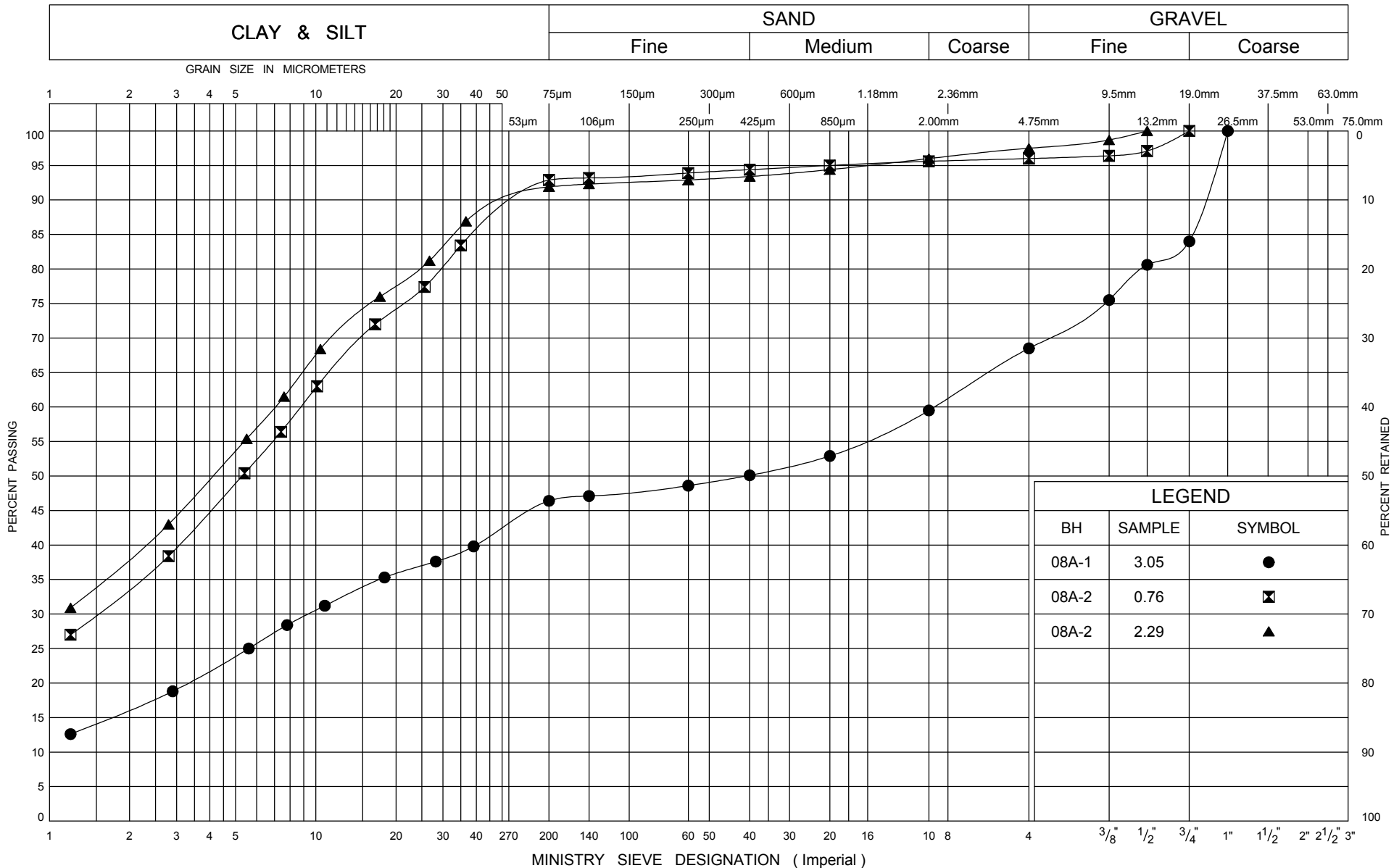
W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 439191, Easting - 221529 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.30.07 - 07.30.07 CHECKED BY EC

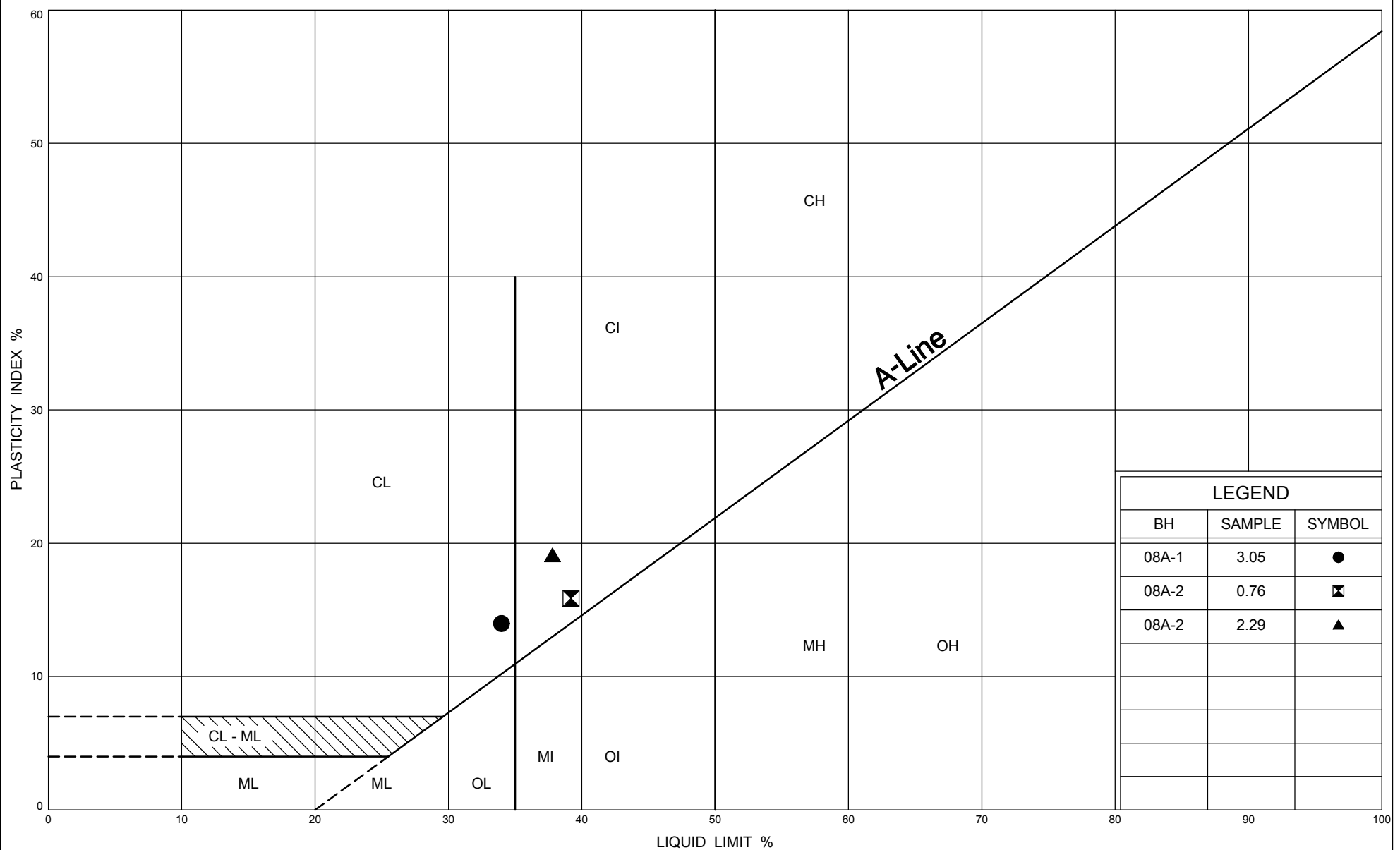
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)					
229.27 0.00	Ground						20 40 60 80 100							
	200 mm TOPSOIL.													
	brown		1	SPT	29					225+				4 3 59 34 (93)
	Silty CLAY TILL, CI Moist to wet, very stiff to hard, embedded sand and gravel, shale fragments.		2	SPT	35								24.9	
	grey		3	SPT	51									3 6 54 38 (92)
226.07 3.20	End of borehole.		4	SPT	100+									possibly shale or boulder. auger refusal. Borehole dry and open @ completion.

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM





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PLASTICITY CHART SILTY CLAY TILL WITH SHALE FRAGMENTS, CL-CI

FIG No C- 08A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 09A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939148, Easting - 221872 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)
232.12 0.00	Ground						232										
	360 mm sand and gravel FILL																
	FILL Brown, moist to wet, loose to compact, consisting mostly of silty clay, some sand, trace gravel.		1	SPT	6		231										
			2	SPT	11												
229.99 2.13							230										
	brown		3	SPT	24								23.9	7 19 40 34 (75)			
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		4	SPT	35		229							5 14 50 32 spoon wet (82)			
	grey		5	SPT	30												
227.85 4.27	End of borehole.						228						21.2	Water level measured @ 4.15 m @ completion.			

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 09A-2

1 OF 1

METRIC

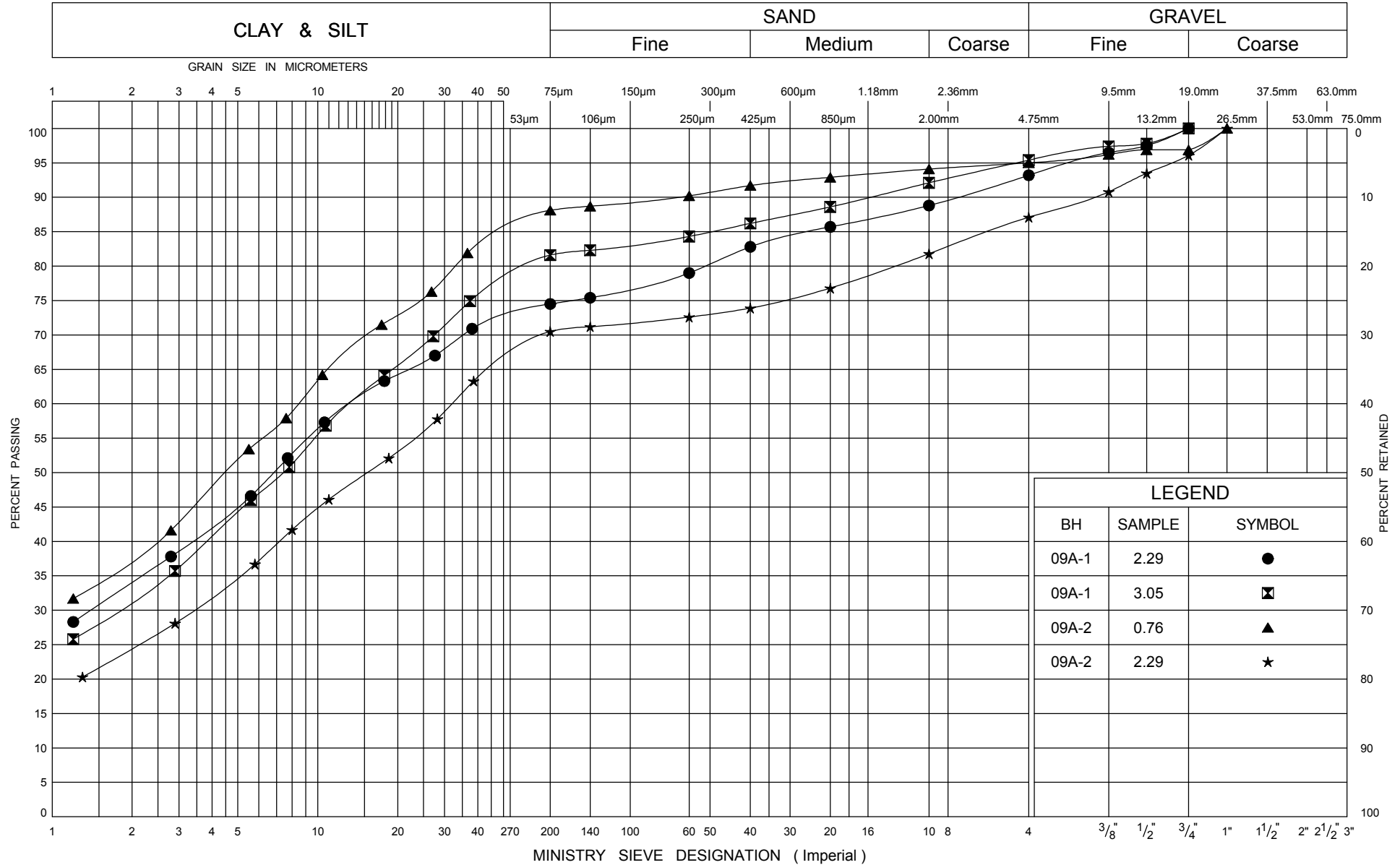
W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939160, Easting - 221872 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.30.07 - 07.30.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
230.60 0.00	Ground							20 40 60 80 100		10 20 30				GR SA SI CL	
	180 mm TOPSOIL.														
	brown		1	SPT	18	▽	230				○	——	19.1	5 7 50 38 (88)	
			2	SPT	100+		229								spoon bouncing on 150 mm diam cobble
	Silty CLAY TILL, CL-CI Moist to wet, very stiff to hard, embedded sand and gravel.		3	SPT	48		228				○	——			13 17 46 24 (71)
	grey		4	SPT	54						○			19.8	
			5	SPT	100+		227				○				spoon wet
226.41 4.19	End of borehole.													Borehole dry and open at completion. Water level measured @ 1 m approximately 3 hours after completion. Potential artesian condition.	

+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



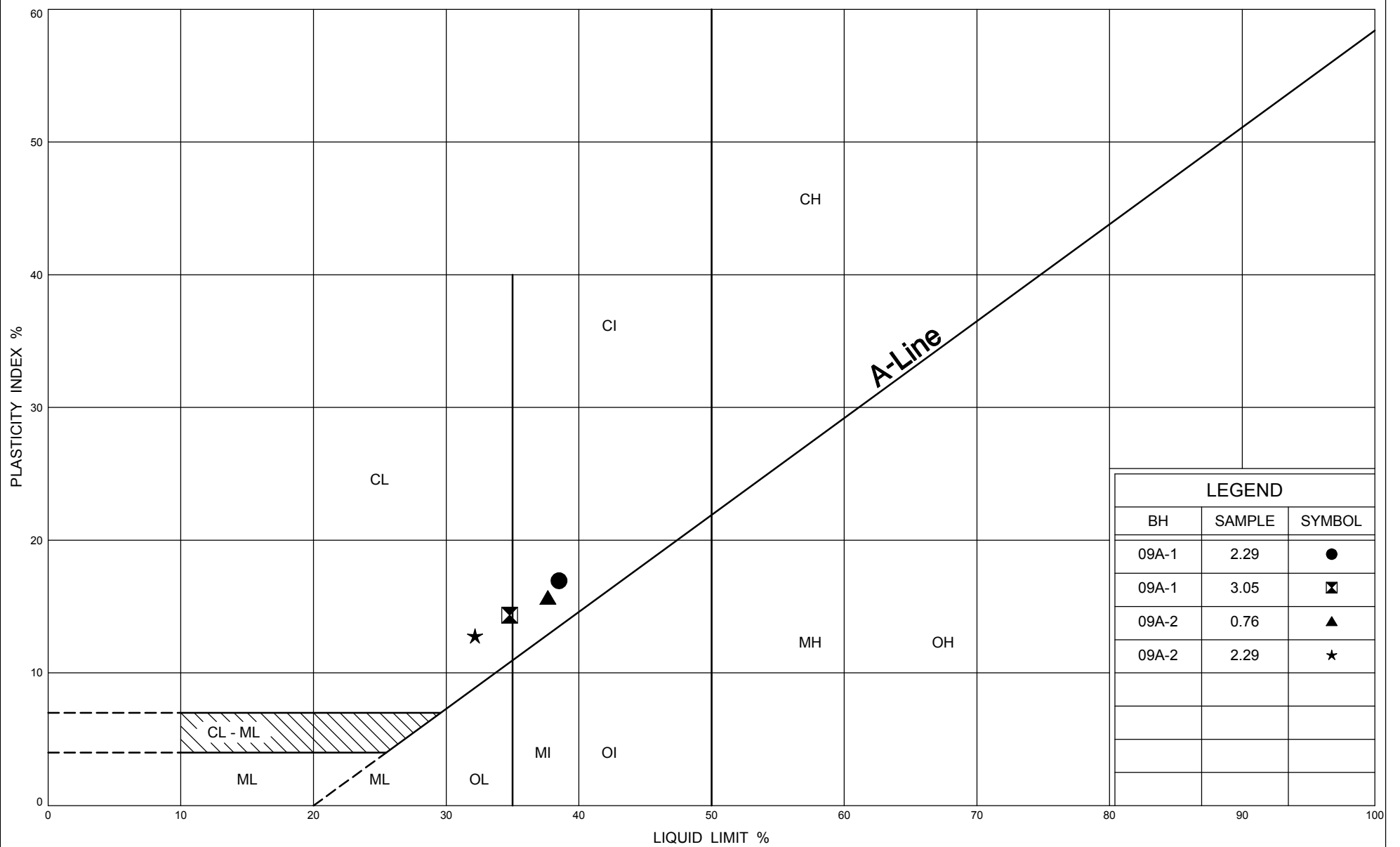
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GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL-CI

FIG No C- 09A.1

GWP 57-00-00

HWY 26, Thornbury to Meaford



Ministry of
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PLASTICITY CHART SILTY CLAY TILL, CL-CI

FIG No C- 09A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

1 OF 1

METRIC

W.P.	GWP 57-00-00	LOCATION	HWY 26, Thornbury to Meaford Northing - 4939102, Easting - 222094	ORIGINATED BY	JL
DIST	Owen Sound HWY 26	BOREHOLE TYPE	S/S Augering, 110 mm dia.	COMPILED BY	JL
DATUM	Geodetic	DATE	07.30.07 - 07.30.07	CHECKED BY	EC

[illegible]

RECORD OF BOREHOLE No 10A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939122, Easting - 222101 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.30.07 - 07.30.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE							
233.16 0.00	Ground															
232.55 0.61	FILL Brown, moist, consisting of sand and gravel.		1	SPT	13											
	FILL Brown, moist, compact to loose, consisting of silty clay with some sand , trace to some gravel.		2	SPT	6									25 14 30 31 (61)		
			3	SPT	6											
230.11 3.05	brown		4	SPT	32									Water level measured @ 2.75 m @ completion. 4 23 31 42 (73)		
			5	SPT	27									17 5 49 29 (78)		
	Silty CLAY TILL, CL-CI Moist, very stiff to hard, embedded sand and gravel.		6	SPT	33											
	grey		7	SPT	75											
			8	SPT	100+											
226.00 7.16	End of borehole.		9	SPT	100+											

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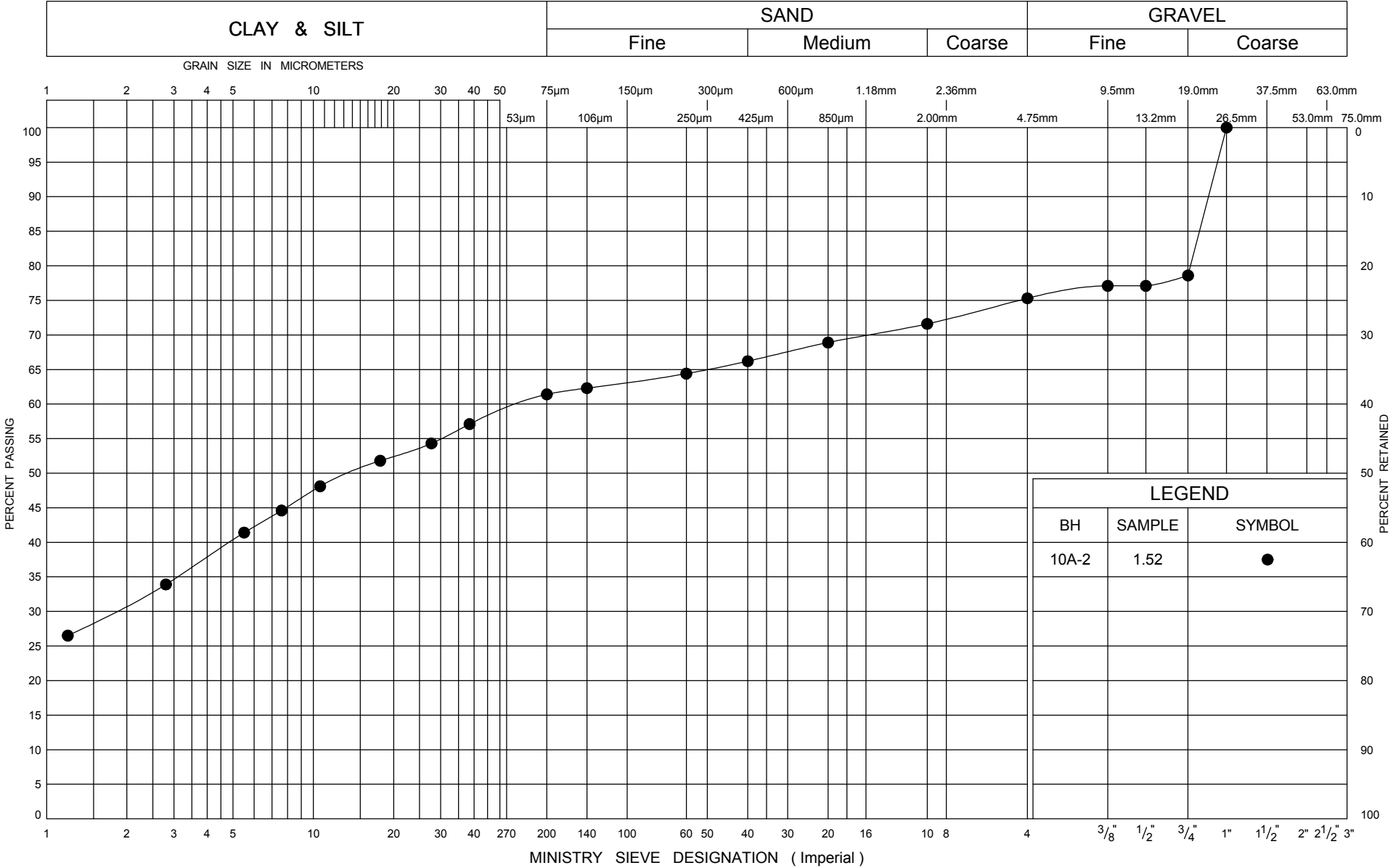
+ 3, X 3: Numbers refer to Sensitivity

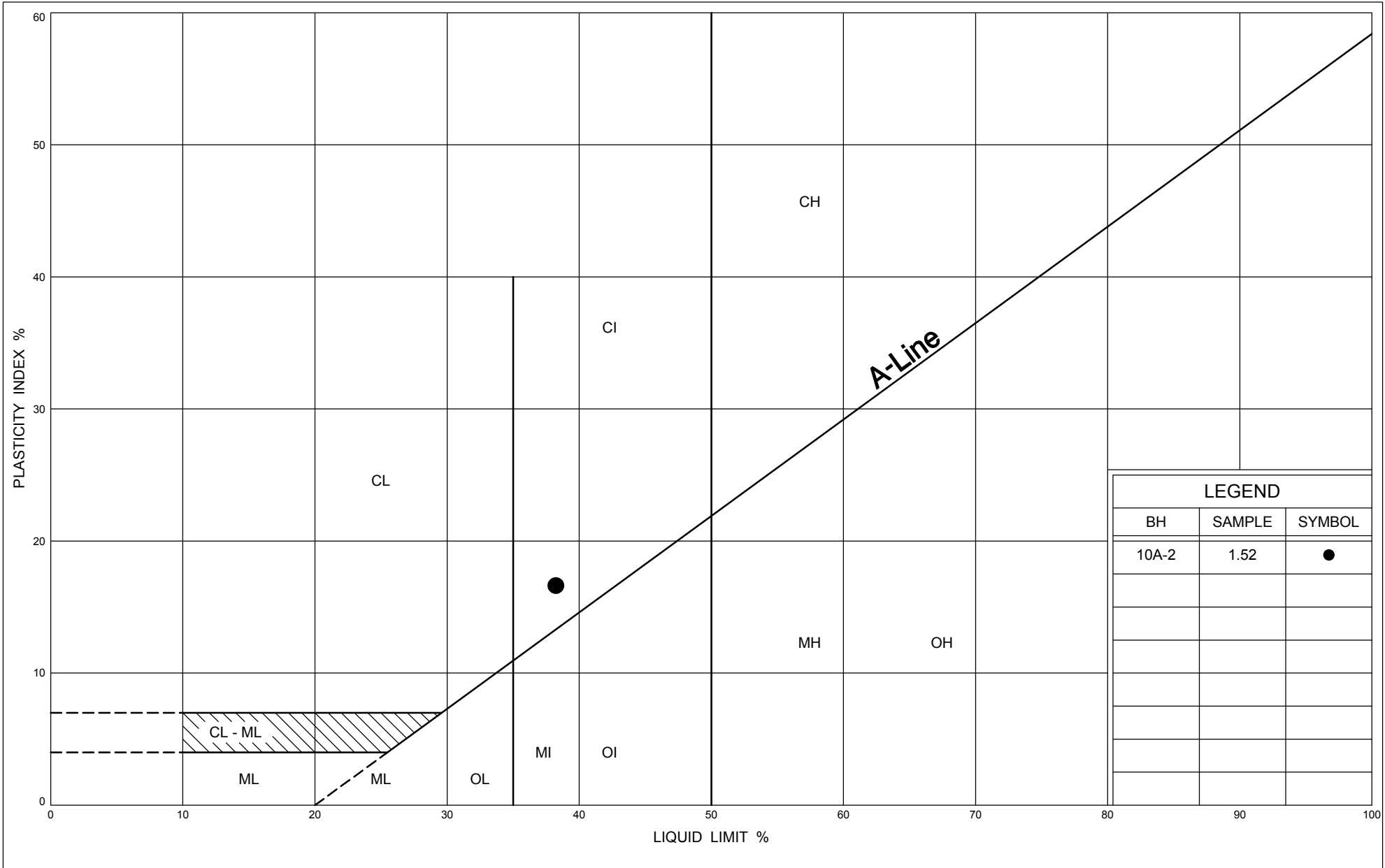
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		DYN. CONE				W
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
229.64 0.00	Ground 100 mm TOPSOIL.													
	brown		1	SPT	9							21.2	1 21 40 3 (78)	
227.66 1.98	Silty CLAY TILL, CL Moist, stiff to hard, embedded sand, gravel and shale fragments, with wet silty sand seams.	wet silty sand seams	2	SPT	4								Water level measured @ 1.65 m @ completion.	
			3	SPT	80								12 11 50 2 (78)	
	grey		4	SPT	100+							21.9		
225.53 4.11	End of borehole.		5	SPT	100+									

UNIFIED SOIL CLASSIFICATION SYSTEM





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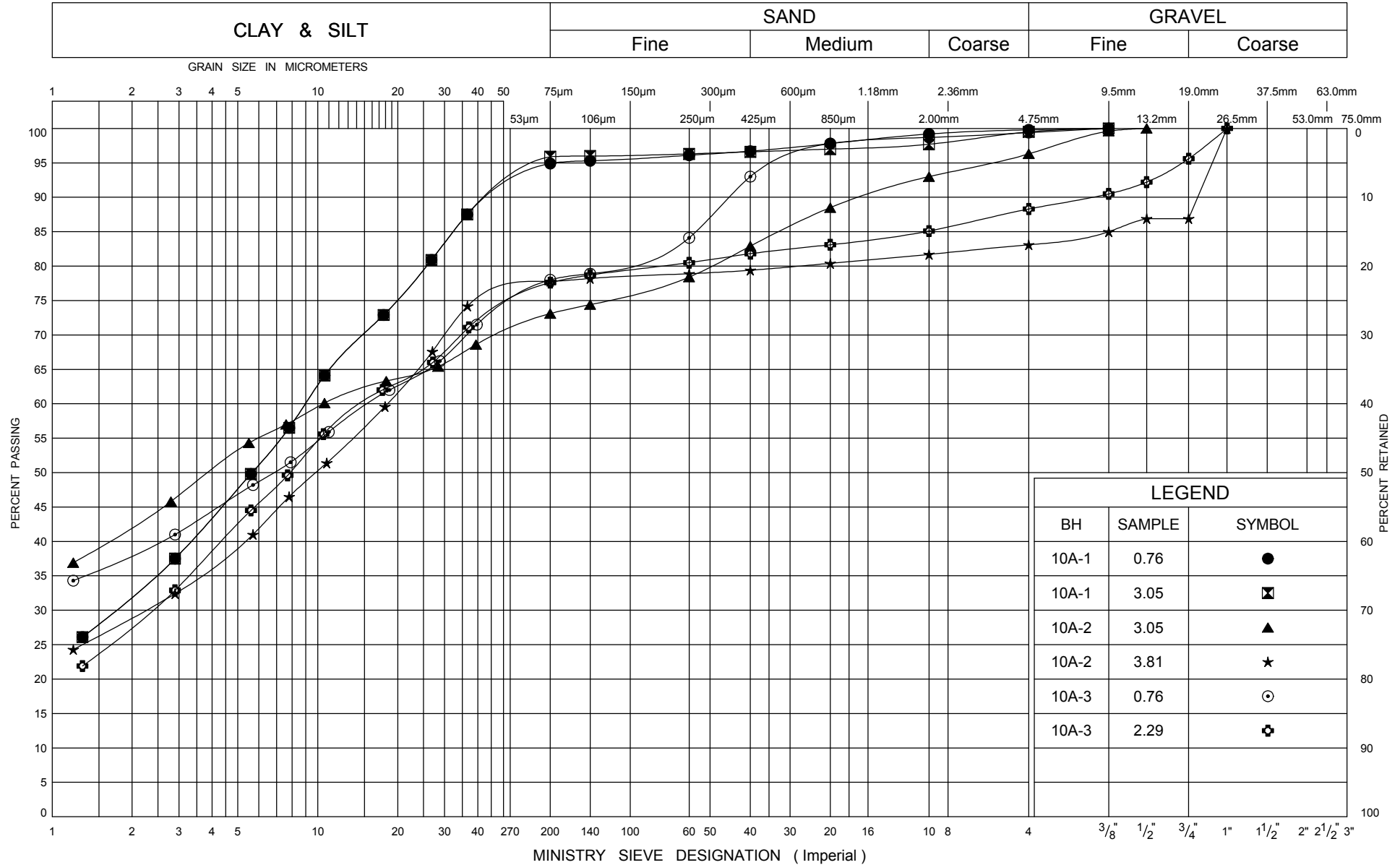
PLASTICITY CHART
FILL

FIG No C- 10A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL-CI

FIG No C- 10A.3

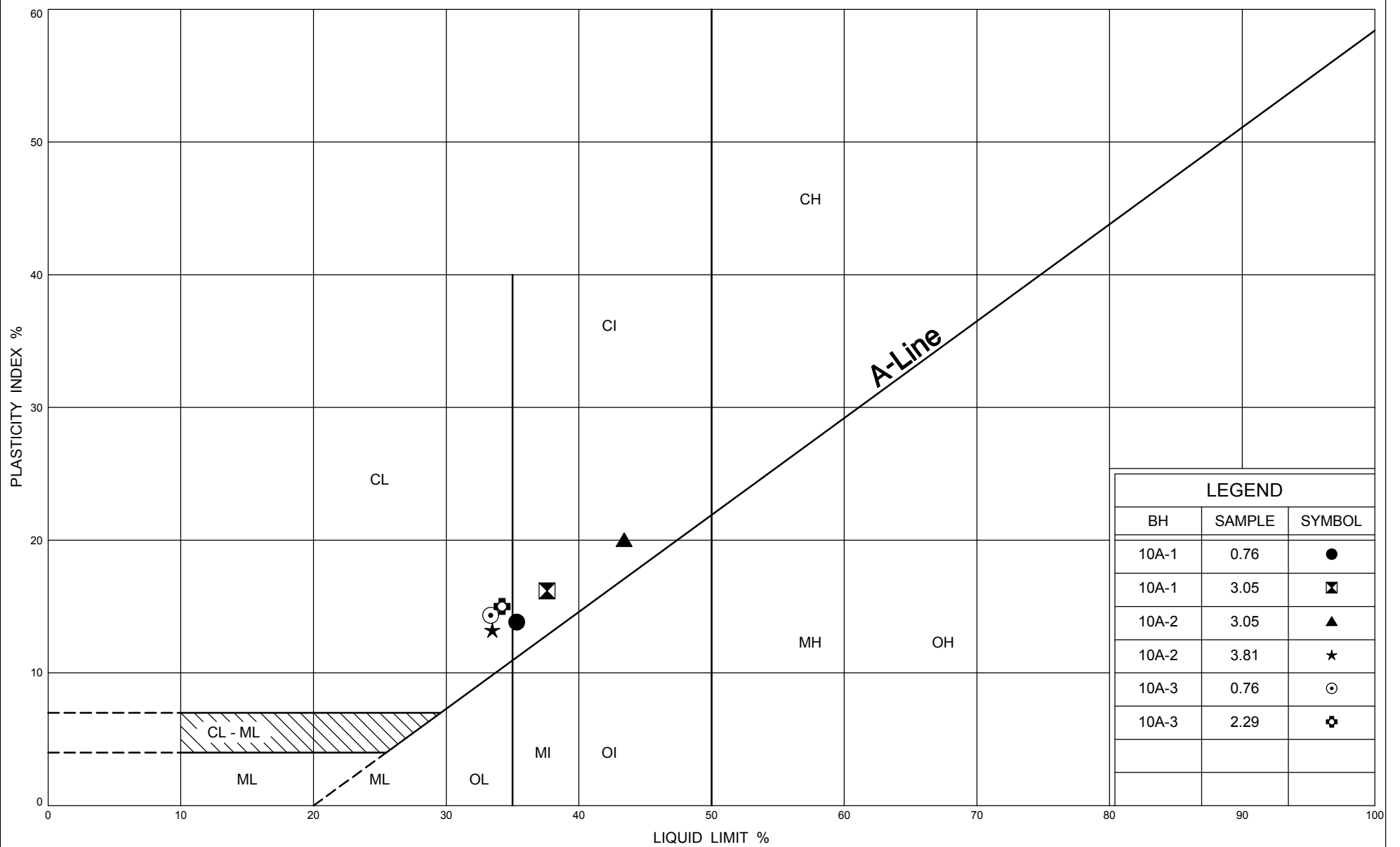
GWP 57-00-00

HWY 26, Thornbury to Meaford



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PLASTICITY CHART SILTY CLAY TILL, CL-CI

FIG No C- 10A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 11A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939068, Easting - 222372 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	● QUICK TRIAXIAL						+ FIELD VANE	× LAB VANE	WATER CONTENT (%)
235.03 0.00	Ground						20	40	60	80	100				GR SA SI CL		
	100 mm TOPSOIL.		1	SPT	7										15 17 38 30 (68)		
	POSSIBLE FILL Reddish brown, moist to wet, loose to compact, consisting of silty clay with embedded sand, and shale pieces.		2	SPT	9												
			3	SPT	12										35 15 30 20 (51)		
			4	SPT	14												
231.37 3.66			5	SPT											22 24 34 20 (54) spoon bouncing on cobble		
	brown		6	SPT	26												
	Silty CLAY TILL, CL-CI Moist, very stiff to hard, embedded sand, gravel and shale fragments, with wet silty sand seams.		7	SPT	45										15 16 40 30 (69)		
	grey	shale layers	8	SPT	56												
			9	SPT	56												
227.71 7.32	End of borehole.														Water level measured @ 4.1 m @ completion.		

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+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 11A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939089, Easting - 222363 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	20						40	60	80
235.70 0.00	Ground																GR SA SI CL			
234.94 0.76	FILL Brown, moist, consisting of sand and gravel.																			
233.87 1.83	FILL Brown, moist, compact to loose, consisting of silty clay with some sand, trace gravel.		1	SPT	8								○							
			2	SPT	6								○							
	brown		3	SPT	12											43 ○	37 18 25 19 (45)			
	--		4	SPT	12									○			19 19 33 29 (62)			
	Silty CLAY TILL, CL-CI Moist, stiff to very stiff, embedded sand and gravel.		5	SPT	13									○			45 18 23 14 (37)			
	reddish brown																			
			6	SPT	14									○						
230.37 5.33	Silty SAND & GRAVEL, GM-SM Brown, moist, compact, trace to some gravel.		7	SPT	16									○			33 28 25 14 (39)			
			8	SPT	27									○						
229.15 6.55	End of borehole.																Borehole dry and open @ completion.			

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+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 11A-3

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939092, Easting - 222376 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

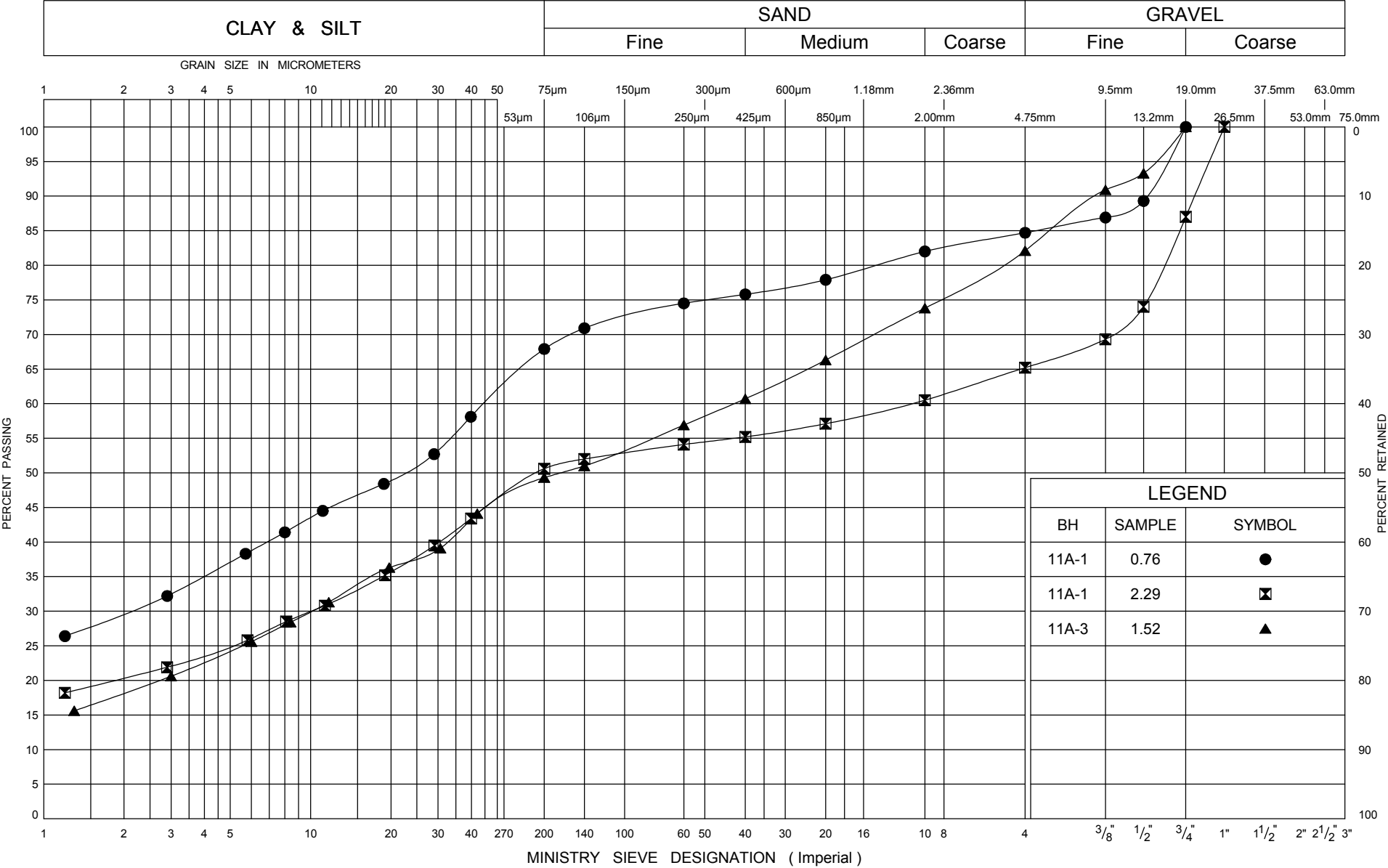
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD ● DYN. CONE							SHEAR STRENGTH kPa
234.85	Ground							20 40 60 80 100							
0.00	75 mm TOPSOIL.														
	POSSIBLE FILL Brown, moist to wet, compact to loose, consisting mainly of sand and gravel, with some silty clay lumps.		1	SPT	16		234								
			2	SPT	9		233							18 33 31 18 (49)	
232.72															
2.13			3	SPT	12		232								
			4	SPT	15		231						22.6	22 11 36 30 (66)	
	Silty CLAY TILL, CL-CI Brown, moist, stiff to very stiff, embedded sand, gravel and shale fragments, with wet silty sand seams.		5	SPT	21		230								
			6	SPT	22									31 23 30 17 (46)	
			7	SPT	28										
229.06		shale layers													
5.79	End of borehole.													Borehole dry and open @ completion.	

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+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
FILL

FIG No C- 11A.1

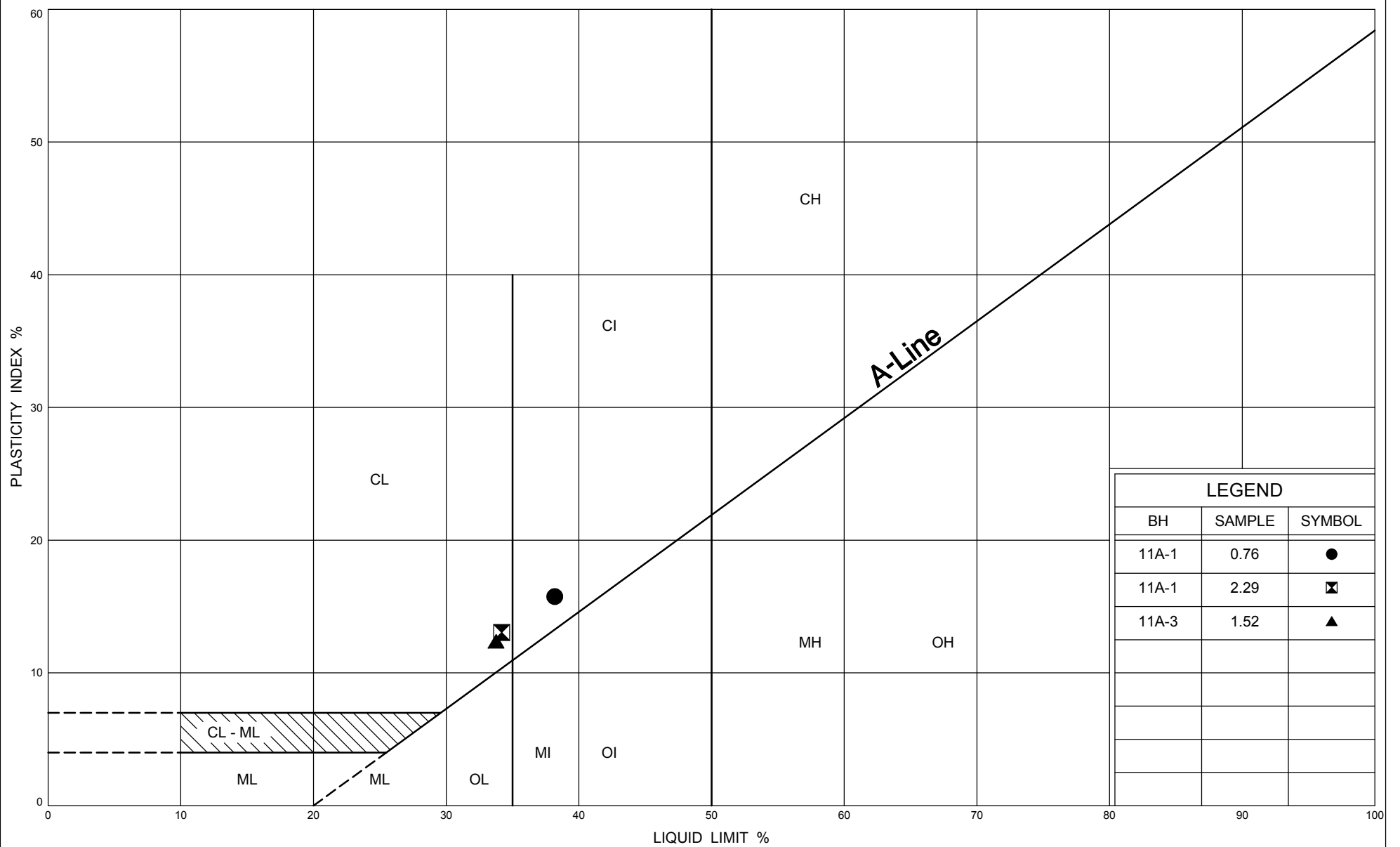
GWP 57-00-00

HWY 26, Thornbury to Meaford



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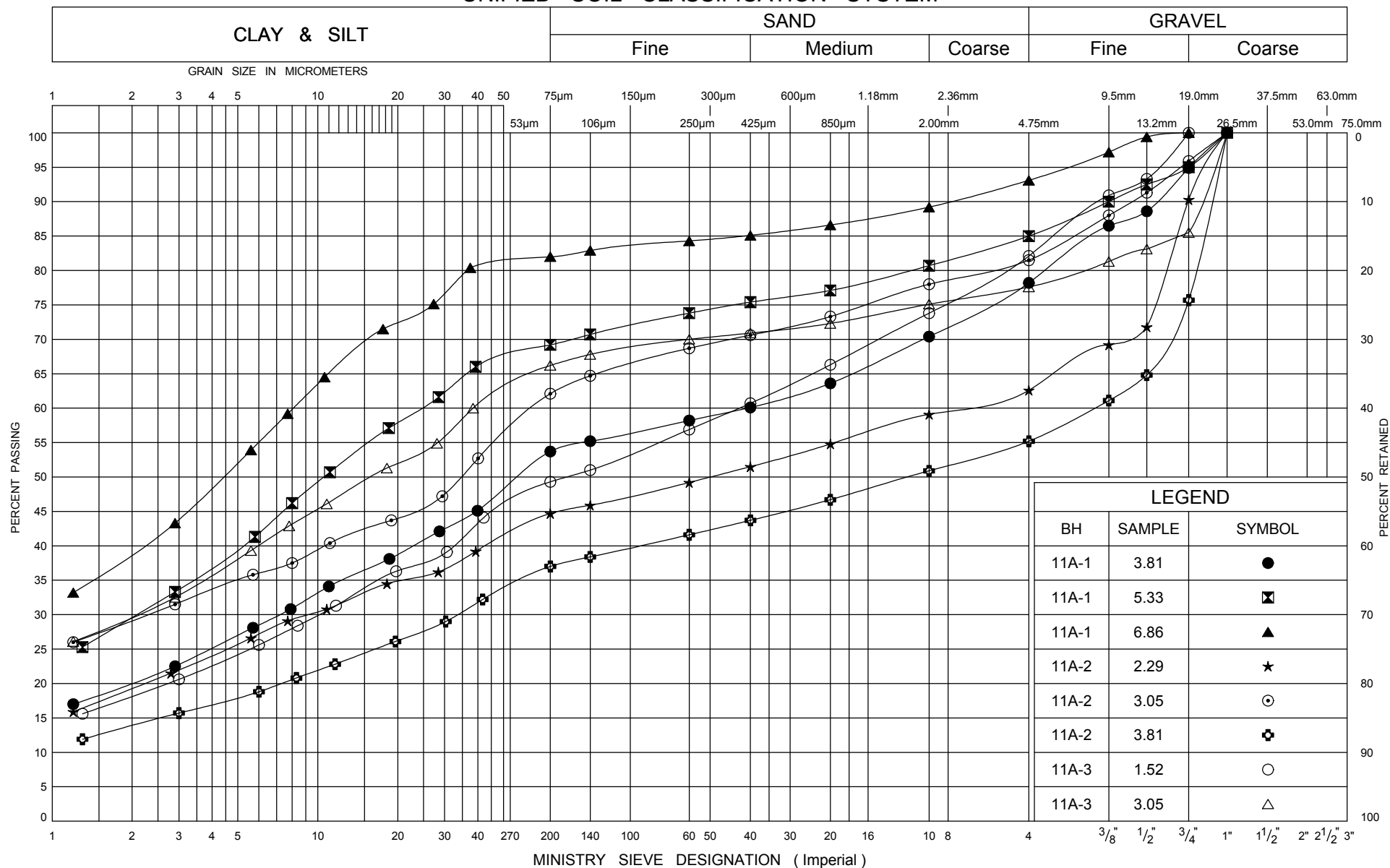
PLASTICITY CHART FILL

FIG No C- 11A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



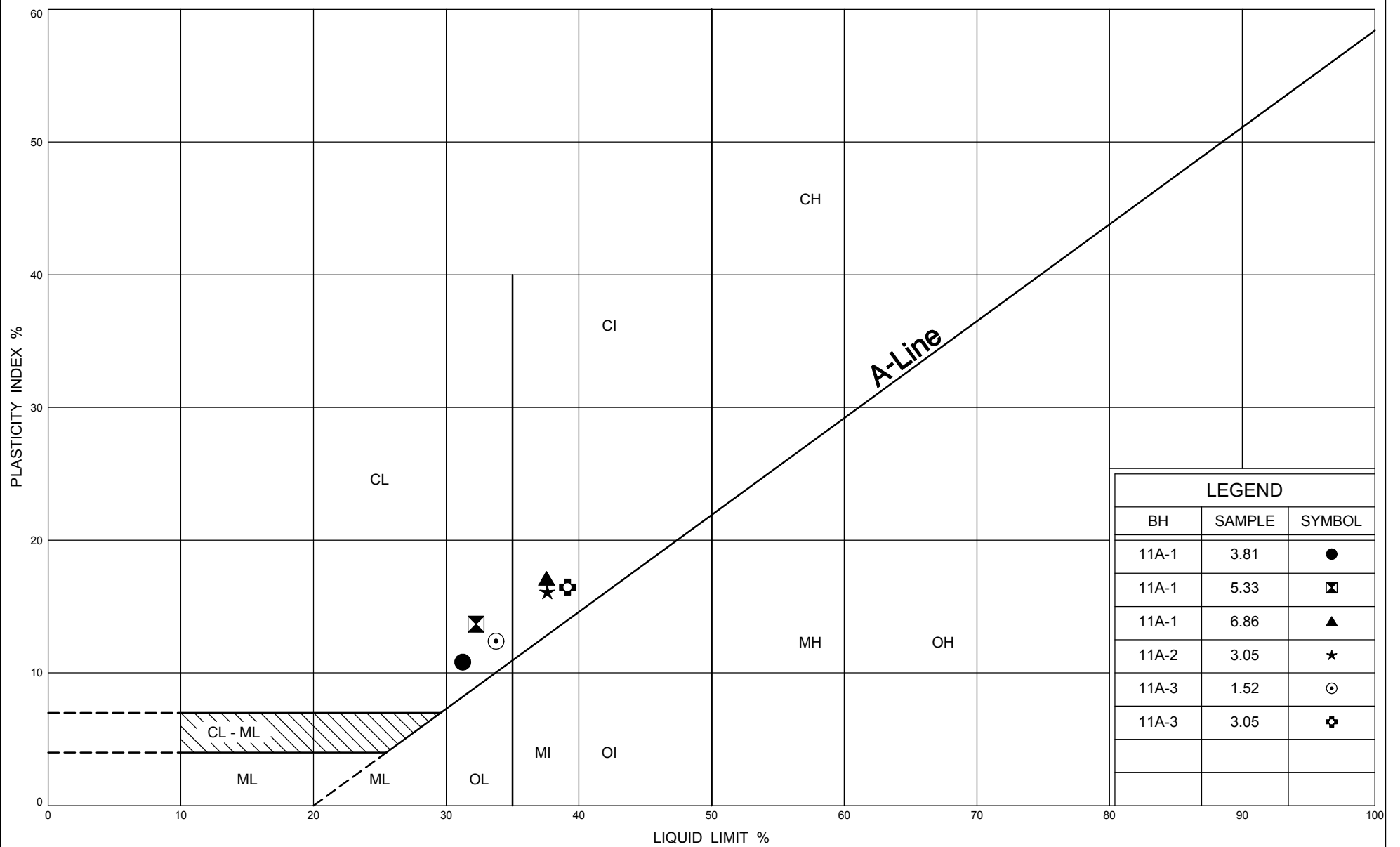
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GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL-CI

FIG No C- 11A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford



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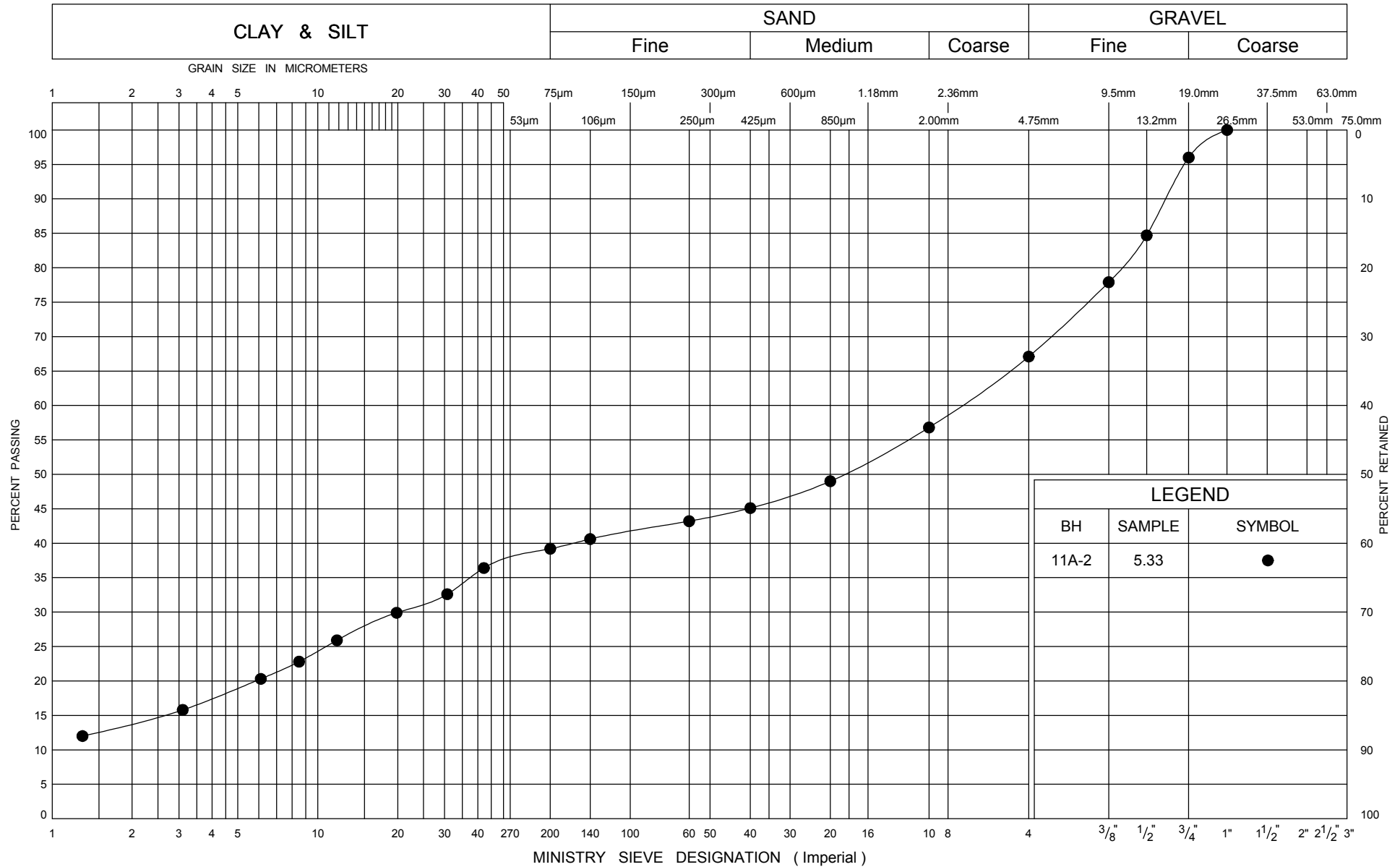
PLASTICITY CHART SILTY CLAY TILL, CL-CI

FIG No C- 11A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
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GRAIN SIZE DISTRIBUTION
SILTY SAND & GRAVEL, GM-SM

FIG No C- 11A.5

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 13A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939037, Easting - 222787 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.30.07 - 07.30.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE						
233.71 0.00	Ground						20	40	60	80	100	10	20	30			
232.95 0.76	FILL Brown, moist, consisting of sand and gravel.																
	FILL Brown, moist, compact to loose, consisting of silty clay with some sand, trace gravel.		1	SPT	20								○				
			2	SPT	10								○				
231.58 2.13	Silty CLAY TILL, CL-CH Brown, moist to wet, stiff to very stiff, embedded sand and gravel.		3	SPT	29								○			Water level measured @ 2.3 m @ completion.	
			4	SPT	14										○	17.1	
			5	SPT	11										59	3 6 28 63 (91)	
228.83 4.88	SAND, SW Grey, wet, compact to dense, SAND, some gravel and silt.		6	SPT	13								○				
228.07 5.64	Grey weathered SHALE BEDROCK.		7	SPT	36								○			15 63 16 7 (22)	
	End of borehole.																

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+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 13A-2

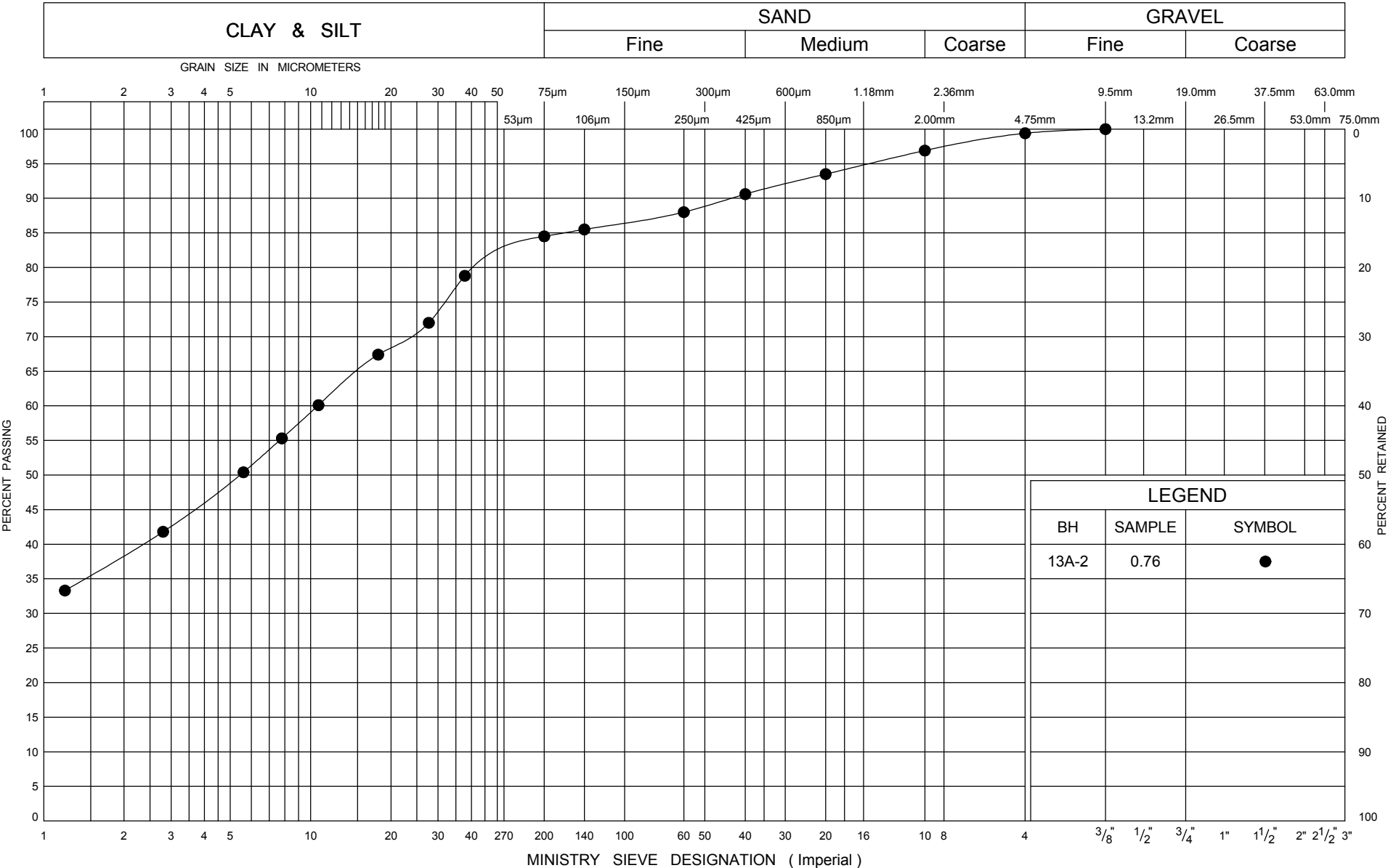
1 OF 1

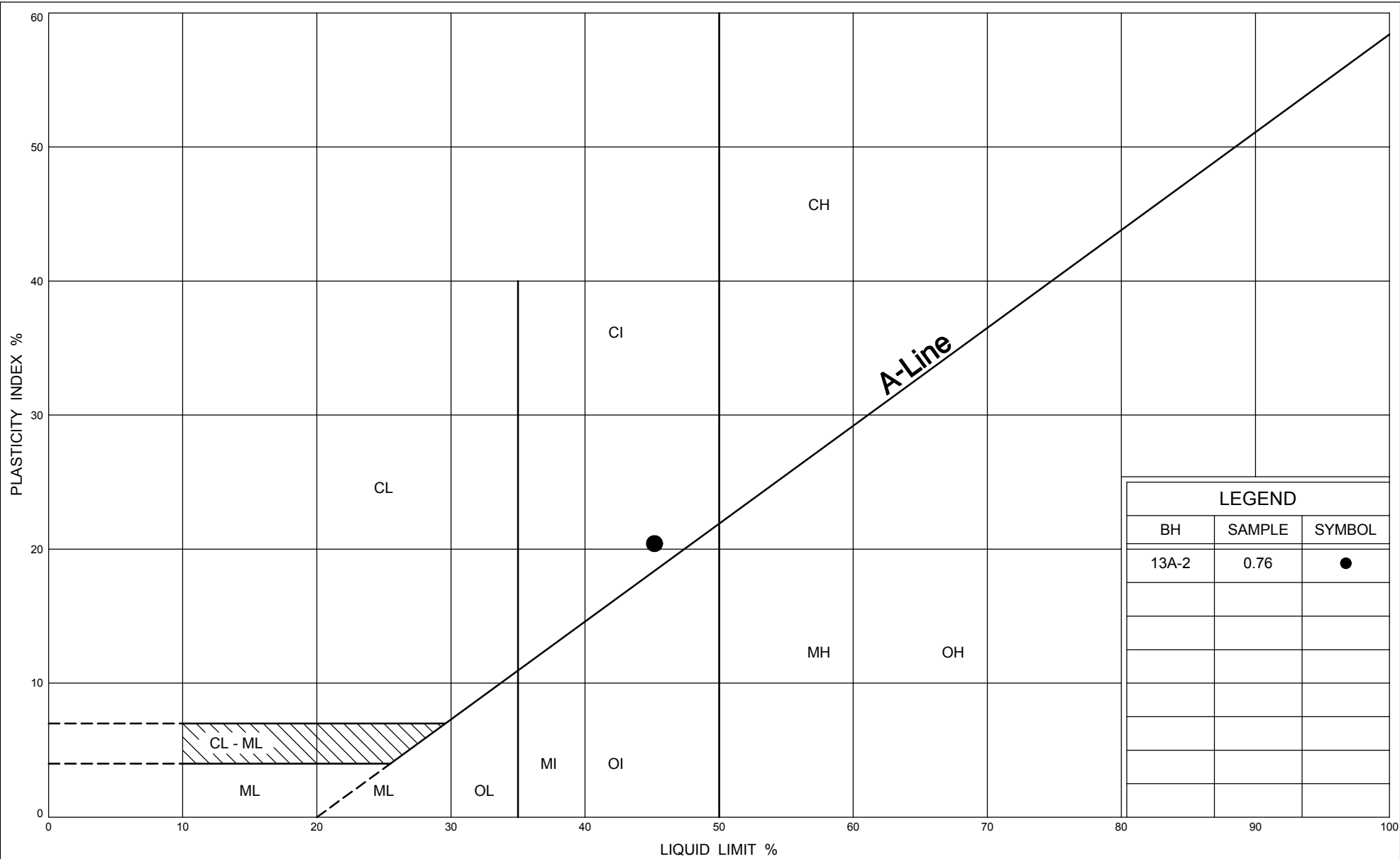
METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939045, Easting - 222784 ORIGINATED BY JL
DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

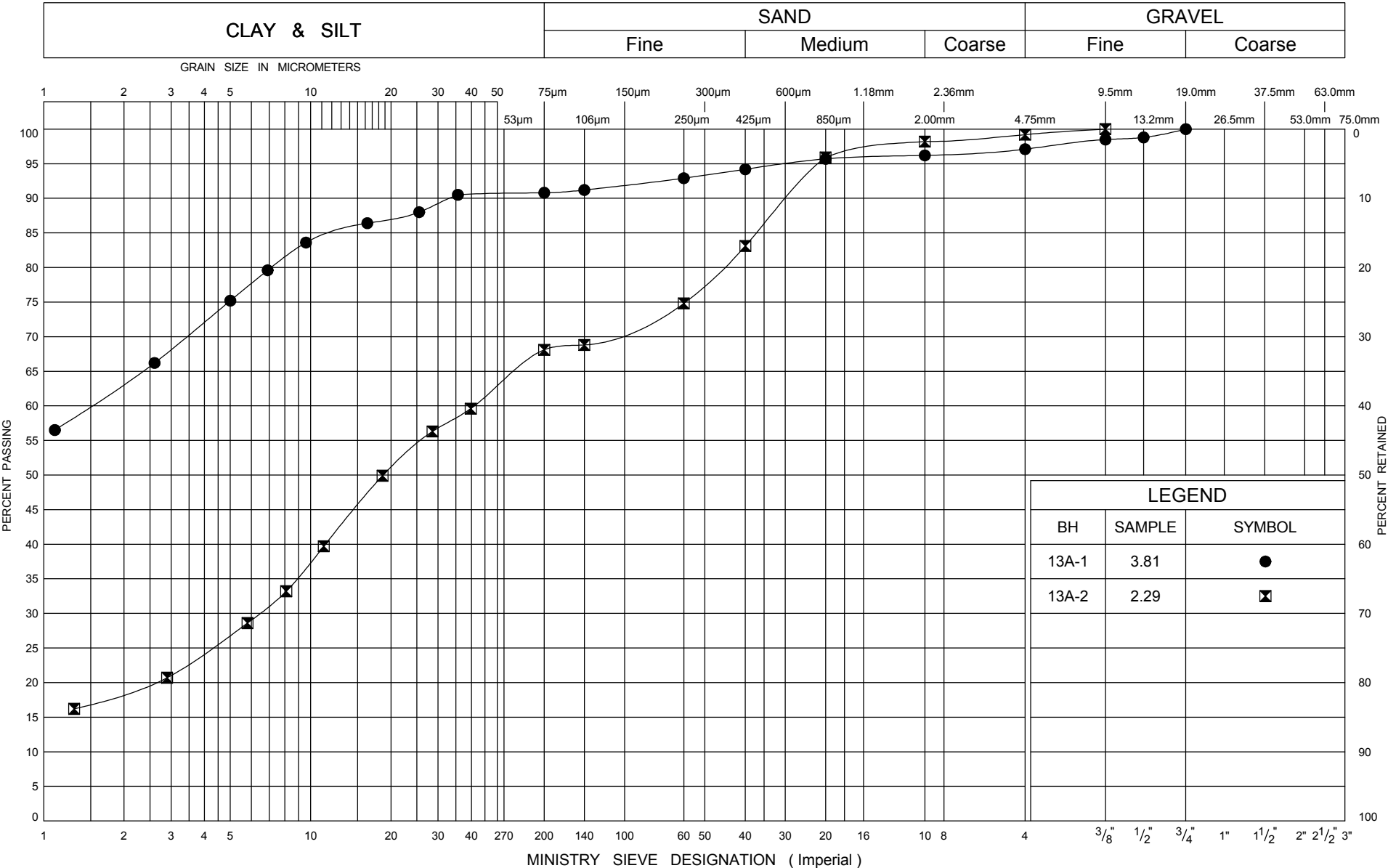
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE								
						● QUICK TRIAXIAL	× LAB VANE				WATER CONTENT (%)						
231.02 0.00	Ground							20	40	60	80	100	10	20	30	kN/m ³	GR SA SI CL
	FILL Brown, moist, very loose, consisting of silty clay with some sand, trace gravel.		1	SPT	3		230								48		1 15 46 38 (85)
229.34 1.68			2	SPT	13		229									20.6	Water level measured @ 1.65m @ completion.
	brown		3	SPT	15												1 31 49 19 (68)
	Silty CLAY TILL, CL Moist to wet, stiff to hard, embedded sand and gravel.		4	SPT	84		228									22.7	
	grey		5	SPT	100+		227										
226.14 4.88	End of borehole.		6	SPT	100+												

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GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL-CH

FIG No C- 13A.3

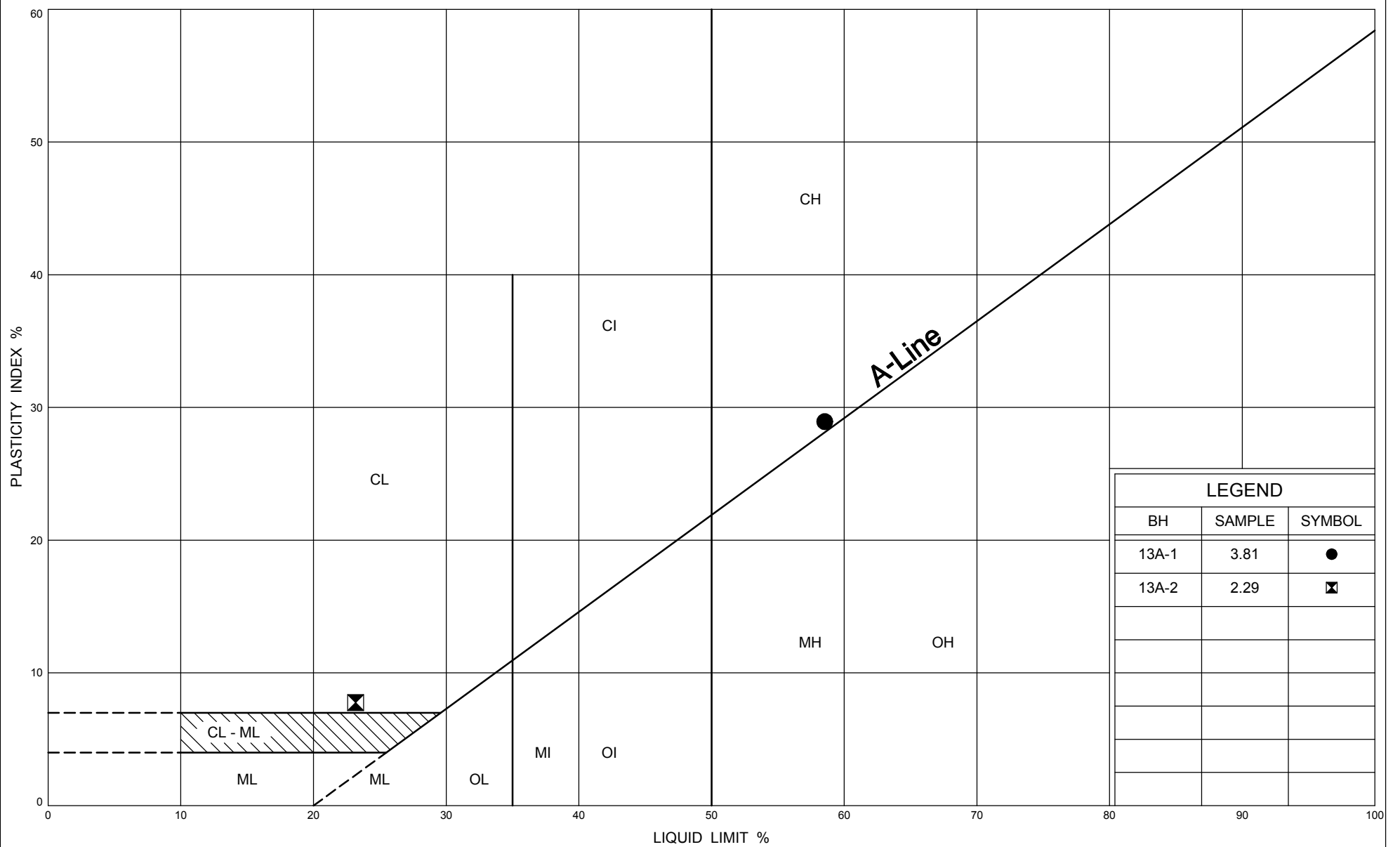
GWP 57-00-00

HWY 26, Thornbury to Meaford



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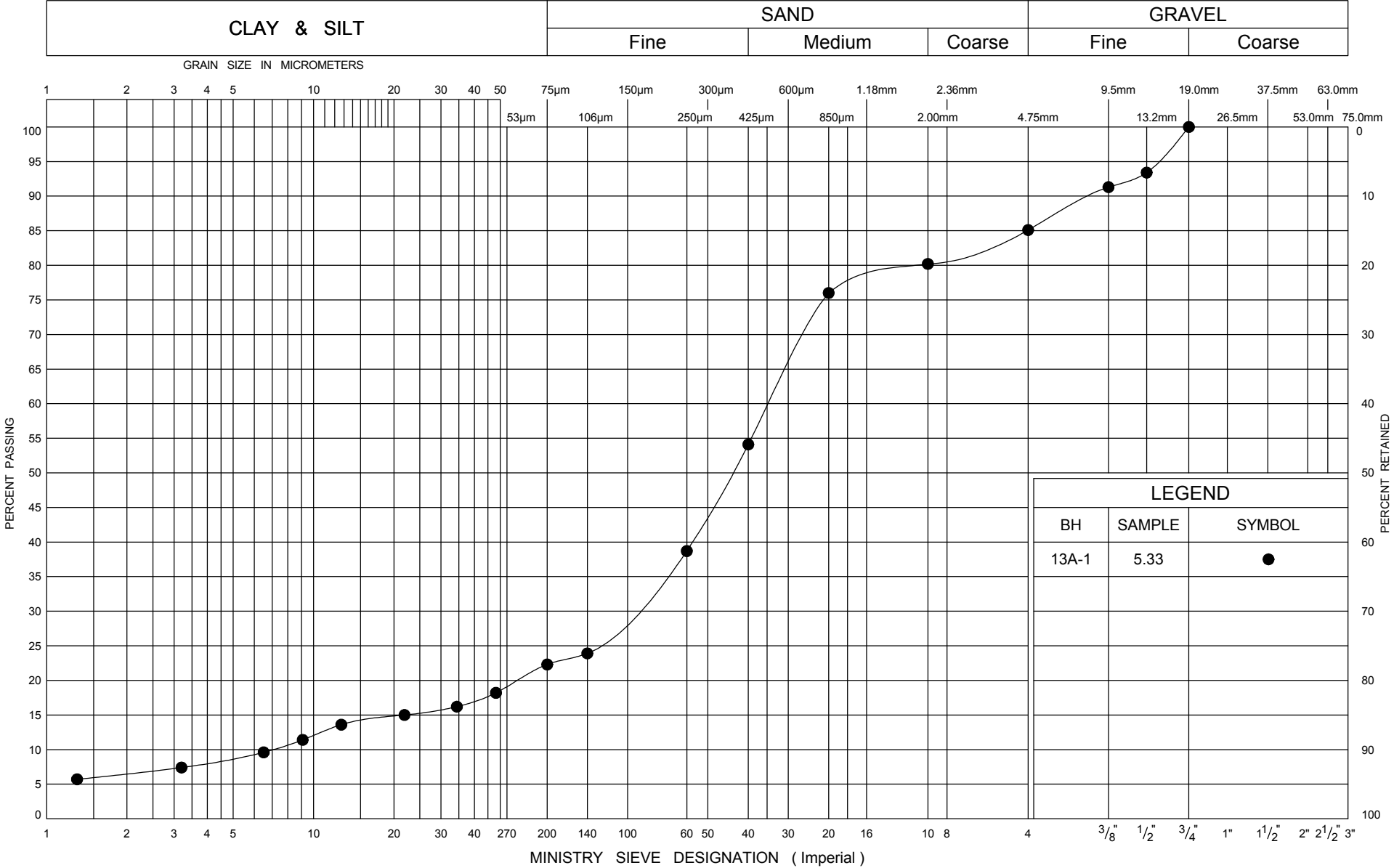
PLASTICITY CHART SILTY CLAY TILL, CL-CH

FIG No C- 13A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

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GRAIN SIZE DISTRIBUTION
SAND, SW

FIG No C- 13A.5

GWP 57-00-00

HWY 26, Thornbury to Meaford



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RECORD OF BOREHOLE No 14A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939011, Easting - 222997 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.26.07 - 07.26.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	● QUICK TRIAXIAL						+ FIELD VANE	× LAB VANE	WATER CONTENT (%)		
232.47 0.00	Ground						20	40	60	80	100	10	20	30					
	350 mm sand and gravel FILL.		1	SPT	9		232												
			2	SPT	7		231												
	FILL Brown, moist, loose to compact, consisting mainly of silty clay and organic pockets.		3	SPT	11		230												
			4	SPT	6	229													
228.81 3.66			5	SPT	29														
	Silty CLAY TILL, CI Grey, moist, very stiff to hard, embedded sand and gravel.																		
			6	SPT	60	228													
227.44 5.03	End of Borehole.																		

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+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 14A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4939021, Easting - 222994 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

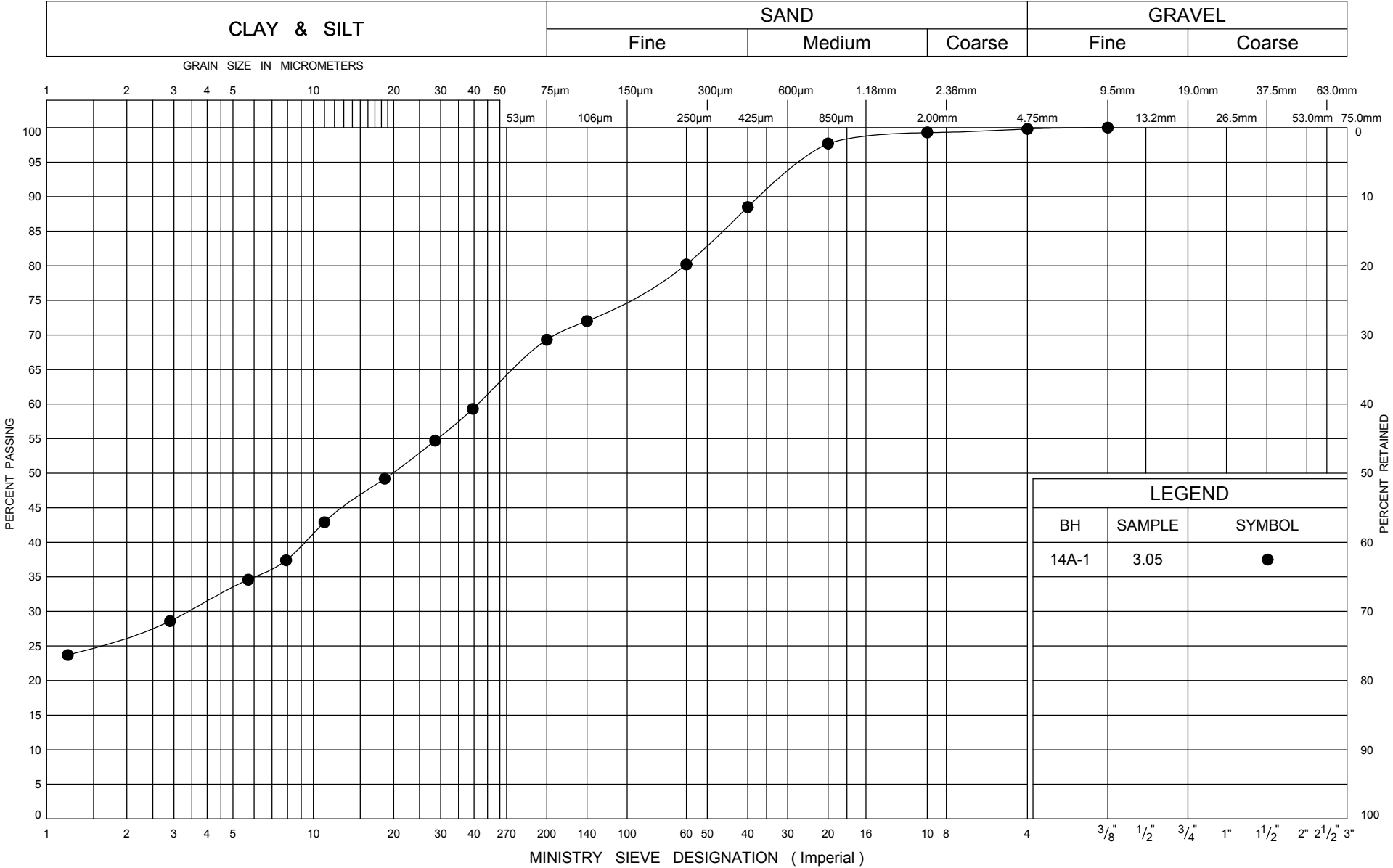
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
230.71 0.00	Ground							20 40 60 80 100	10 20 30						
	100mm TOPSOIL														
	Brown		1	SPT	15		230								
	Silty CLAY TILL, CI Moist to wet, very stiff to hard, embedded sand and gravel.		2	SPT	28		229					42		1 4 47 48 (95)	
	Grey		3	SPT	36		228							Water level measured @ 3 m @ completion.	
			4	SPT	39									3 4 60 34 (93)	
226.75 3.96	End of Borehole.		5	SPT	100+		227								

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+ 3, × 3: Numbers refer to
Sensitivity

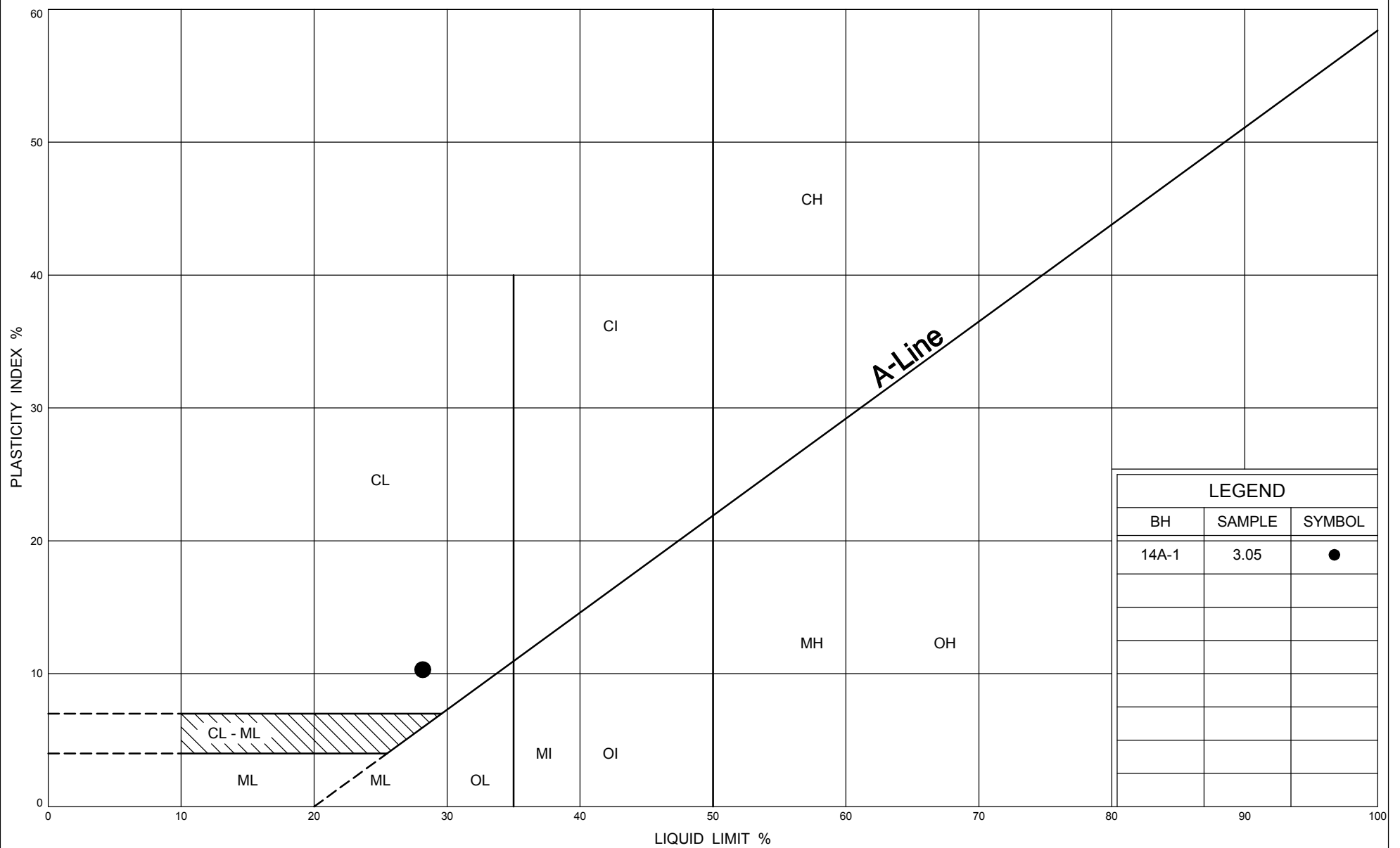
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM

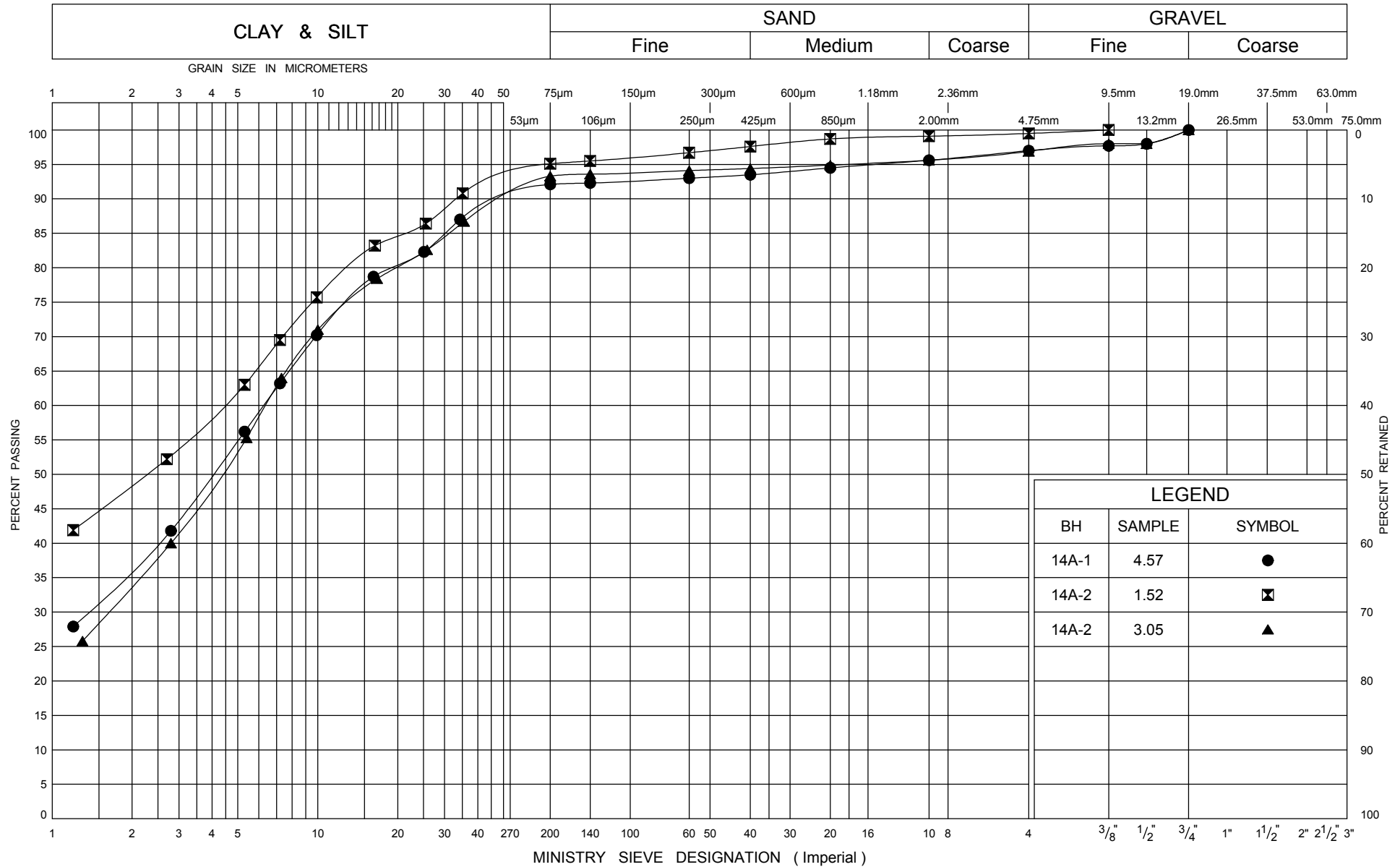


GRAIN SIZE DISTRIBUTION
FILL

FIG No C- 14A.1
GWP 57-00-00
HWY 26, Thornbury to Meaford



UNIFIED SOIL CLASSIFICATION SYSTEM



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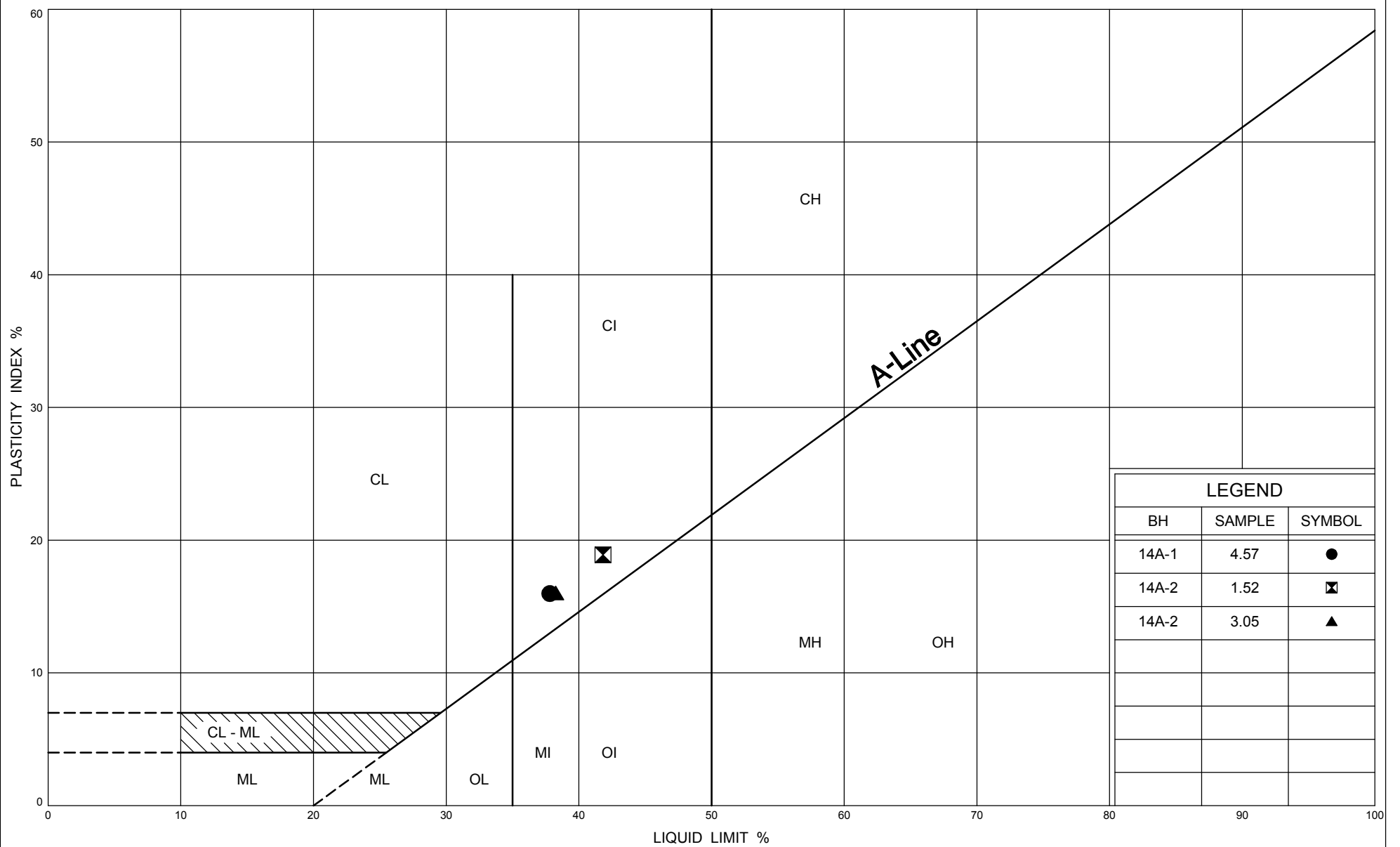
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL, CI

FIG No C- 14A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford



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PLASTICITY CHART SILTY CLAY TILL, CI

FIG No C- 14A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 15A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938906, Easting - 223342 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
230.01 0.00	Ground							20 40 60 80 100	10 20 30						
225.90 4.11	200 mm TOPSOIL														
	Brown		1	SPT	25	229	●			○	43	20.9	7 4 48 41 (89)		
			2	SPT	35	228	●			○					
	Silty CLAY TILL, CI Moist to wet, very stiff to hard, embedded sand and gravel.		3	SPT	48	227	●			○			0 2 59 39 (98)		
	Grey		4	SPT	100+	226	●			○					
			5	SPT	100+	226	●			○					
	End of Borehole.												Auger Refusal. Borehole dry and open @ completion.		

RECORD OF BOREHOLE No 15A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938926, Easting - 223351 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)
231.40 0.00	Ground						20	40	60	80	100	10	20	30			
230.64 0.76	FILL Brown, moist, consisting of sand and gravel.																
	150 mm ASPHALT		1	SPT	33												
			2	SPT	15												
	FILL Grey, moist to wet, consisting of silty clay and organic pockets.		3	SPT	12												
			4	SPT	25												
227.59 3.81			5	SPT	36												
	Silty CLAY TILL, CI Moist to wet, hard, embedded sand and gravel.		6	SPT	59												
			7	SPT	100												
225.61 5.79	End of Borehole.																

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 15A-3

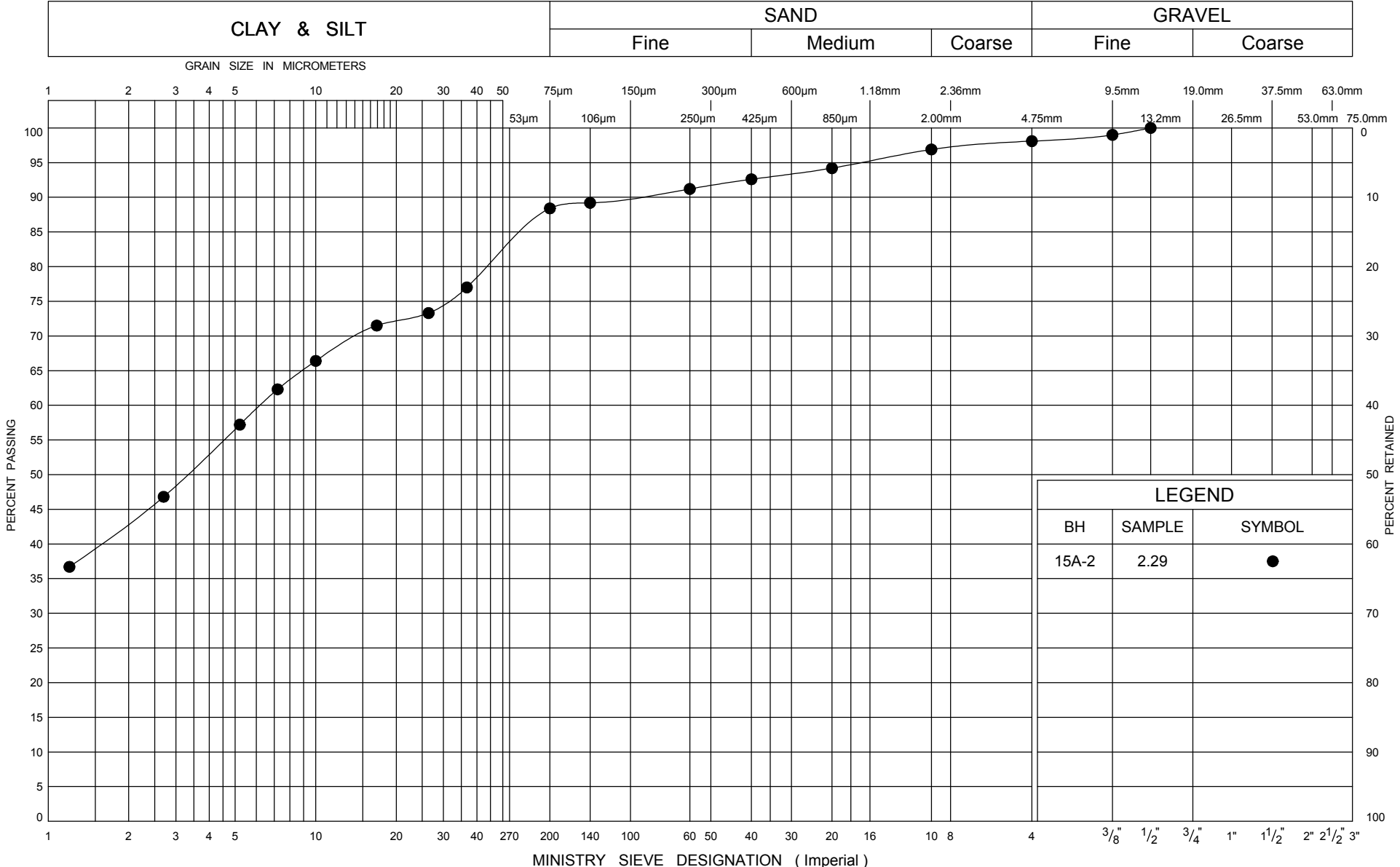
1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938933, Easting - 223348 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

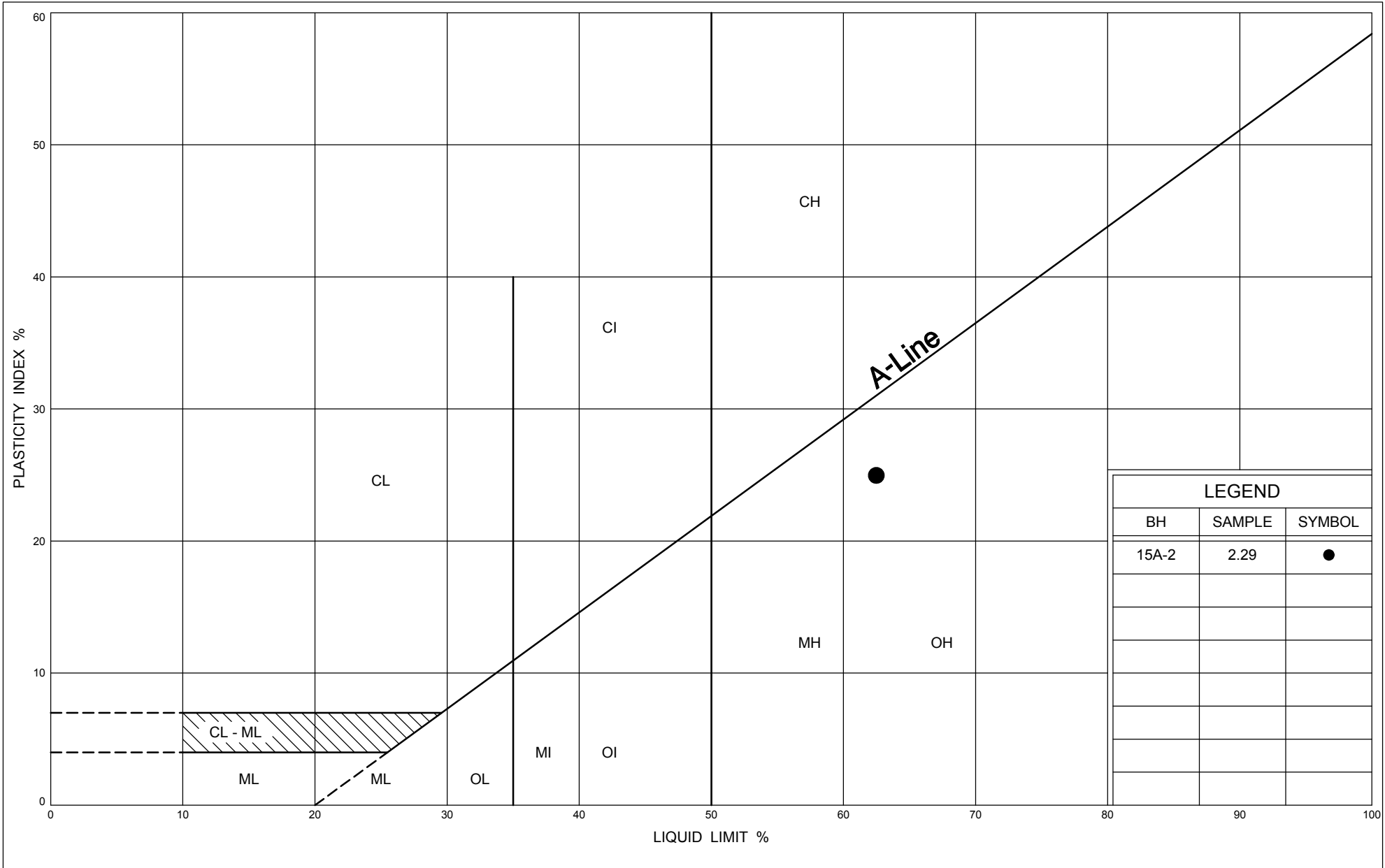
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE														
229.39 0.00	Ground 100 mm TOPSOIL							20 40 60 80 100		10 20 30				
	Brown		1	SPT	14	▽	229						53	0 1 45 54 (99)
			2	SPT	25		228						21.1	Water level measured @ 1.5 m @ completion.
	Silty CLAY TILL, CI-CH — Moist to wet, stiff to hard, embedded sand and gravel, shale fragments.		3	SPT	30		227						22.0	
	Grey		4	SPT	65		226						43	15 5 39 41 (81)
			5	SPT	100+									
225.28 4.11	End of Borehole.													

UNIFIED SOIL CLASSIFICATION SYSTEM

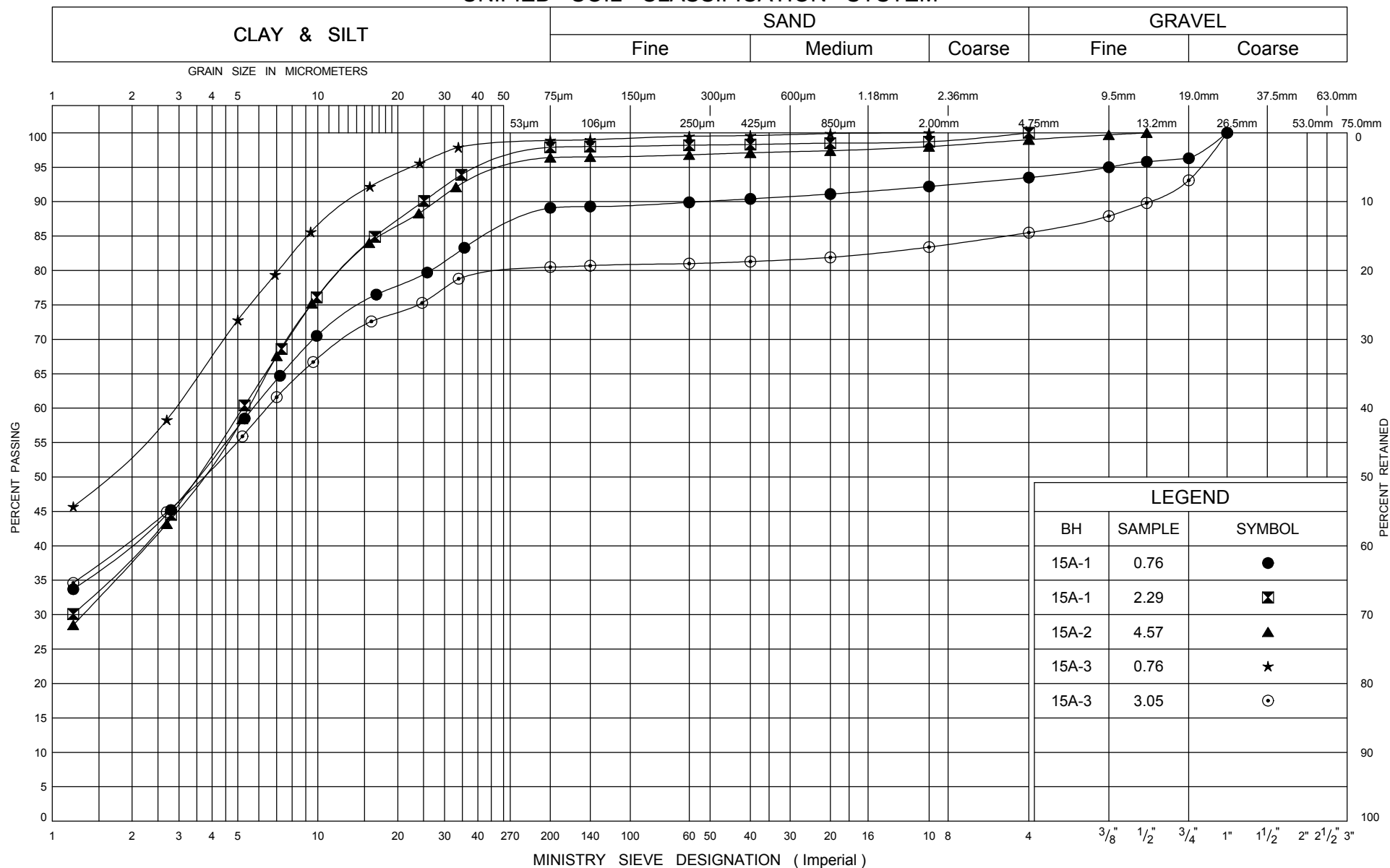


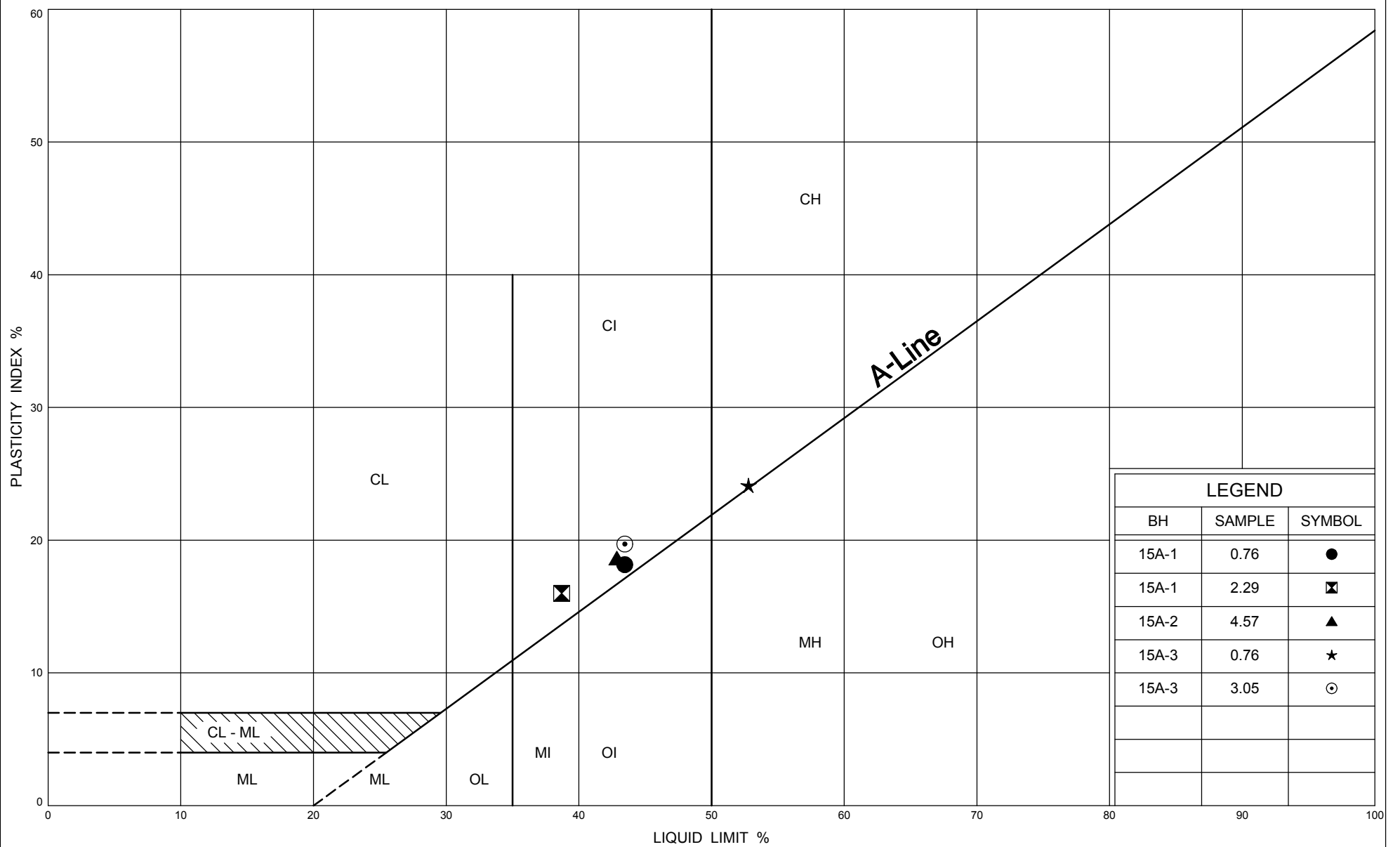
GRAIN SIZE DISTRIBUTION
FILL

FIG No C- 15A.1
GWP 57-00-00
HWY 26, Thornbury to Meaford



UNIFIED SOIL CLASSIFICATION SYSTEM





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PLASTICITY CHART SILTY CLAY TILL, CI-CH

FIG No C- 15A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 16A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938804, Easting - 223578 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	● QUICK TRIAXIAL						+ FIELD VANE	× LAB VANE	WATER CONTENT (%)
231.50 0.00	Ground						20	40	60	80	100	10	20	30		GR SA SI CL	
	230 mm sand and gravel FILL.																
	FILL Dark brown, moist, loose, consisting of silty clay and organic pockets.		1	SPT	9												
			2	SPT	6												
228.91 2.59			3	SPT	14												
	Brown		4	SPT	38												
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		5	SPT	59												
	Grey		6	SPT	100+												
226.47 5.03	End of Borehole															Borehole dry and open @ completion.	

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RECORD OF BOREHOLE No 16A-2

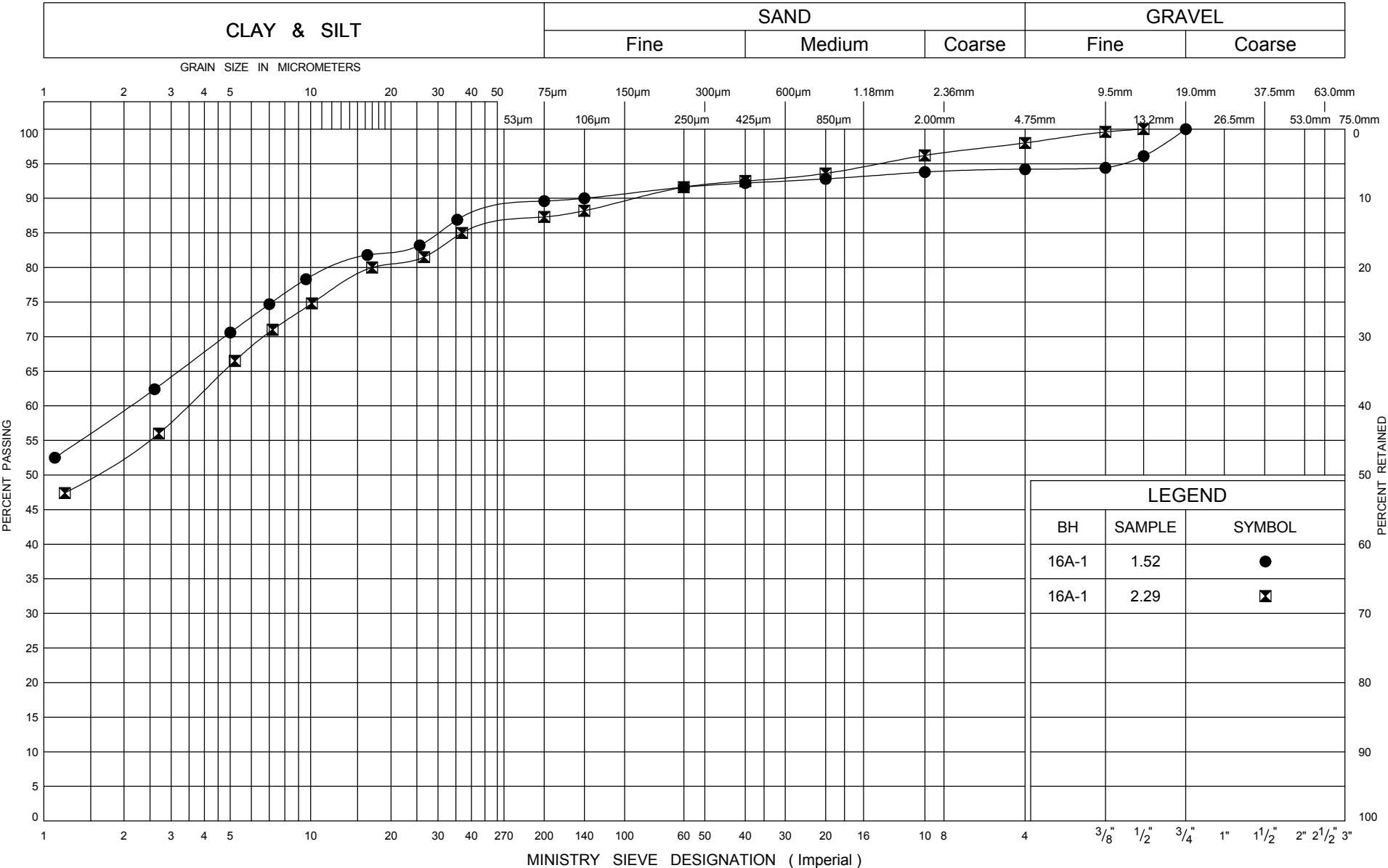
1 OF 1

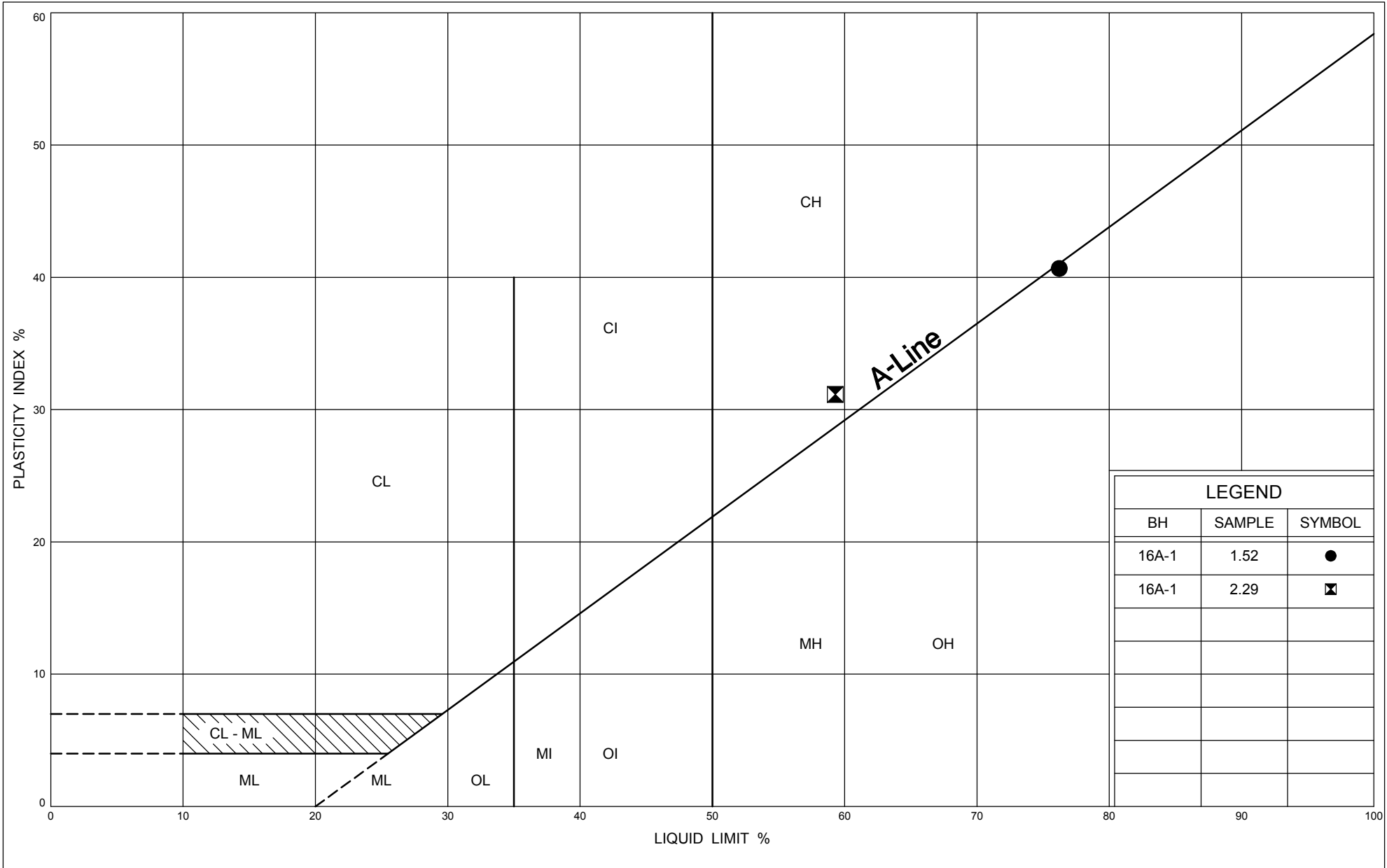
METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938814, Easting - 223591 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 09.17.07 - 09.17.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
230.08	Ground						230									
0.00	200 mm TOPSOIL															
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		1	SPT	23		229						20.8	0 1 50 49 (99)		
	Brown		2	SPT	27		228									
			3	SPT	100+									0 2 60 38 (98)		
	Grey		4	SPT	100+		227									
226.42	End of Borehole.													auger refusal Borehole dry and open @ completion.		
3.66																

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
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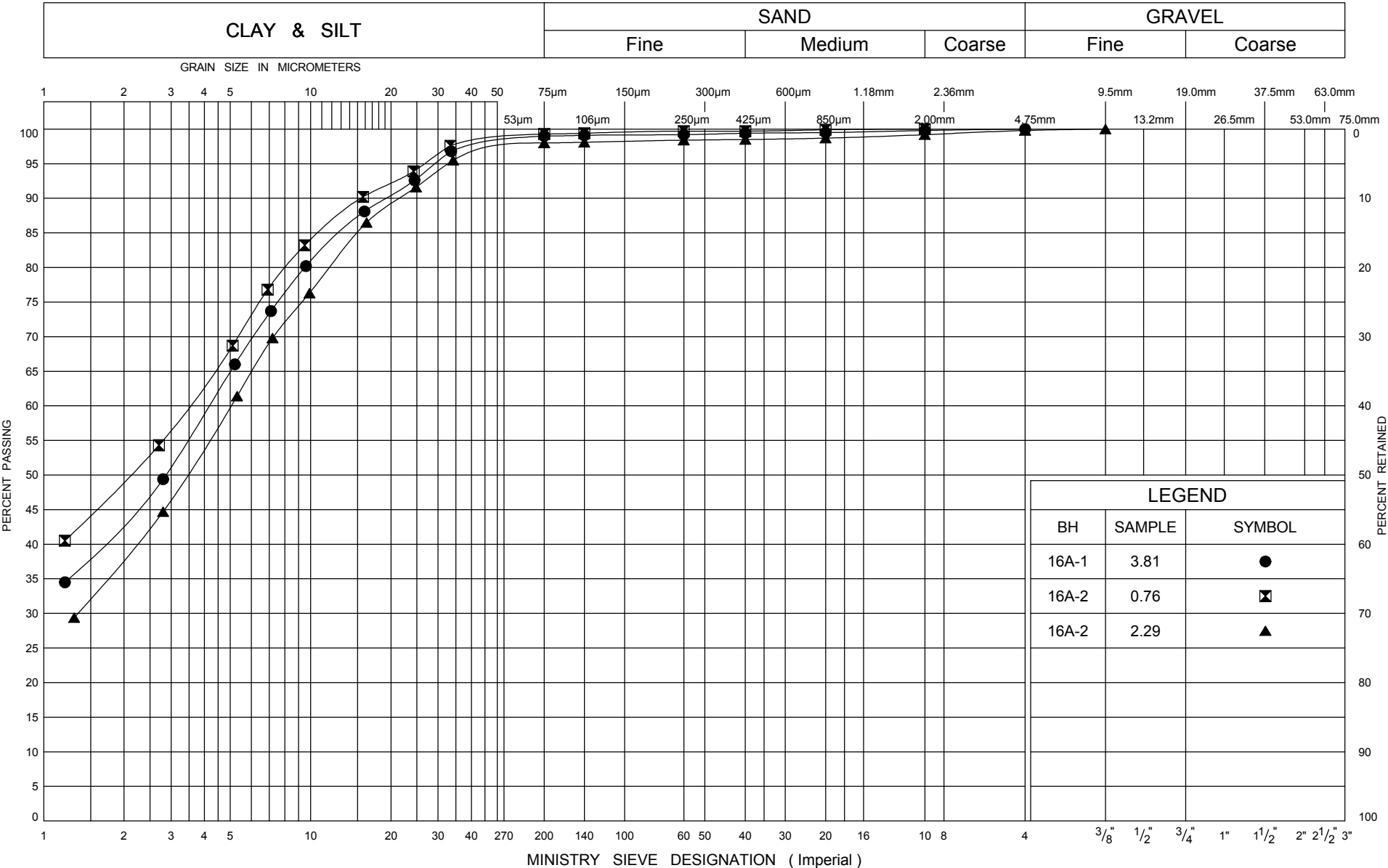
PLASTICITY CHART
FILL

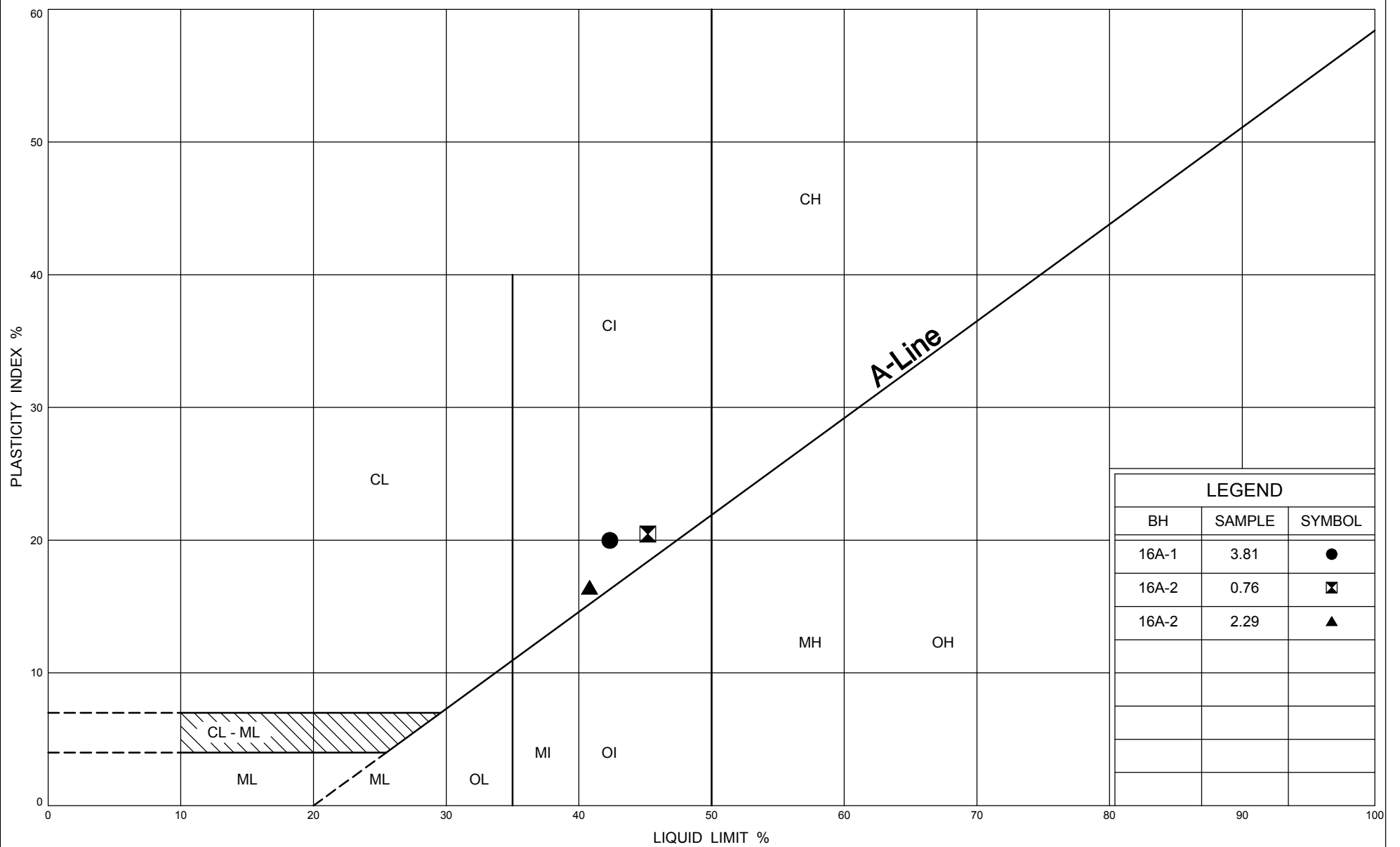
FIG No C- 16A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
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PLASTICITY CHART SILTY CLAY TILL, CI

FIG No C- 16A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 17A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938725, Easting - 223723 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
232.50 0.00	Ground							20 40 60 80 100							
231.74 0.76	FILL Brown, moist, consisting of sand and gravel, and cobbles.						232								
			1	SPT	11										
	FILL Brown, moist, compact, consisting of silty clay, trace fine sand.						231								
			2	SPT	13										
230.37 2.13	Brown		3	SPT	12		230						23.4	7 14 49 30 (80)	
	Silty CLAY TILL, CL-CI Moist, stiff to hard, embedded sand and gravel.		4	SPT	38		229						23.5	2 1 52 45 (97)	
	Grey		5	SPT	34		228						22.8		
			6	SPT	88										
227.47 5.03	End of Borehole.													Water level measured @ 2.3 m @ completion.	

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 17A-2

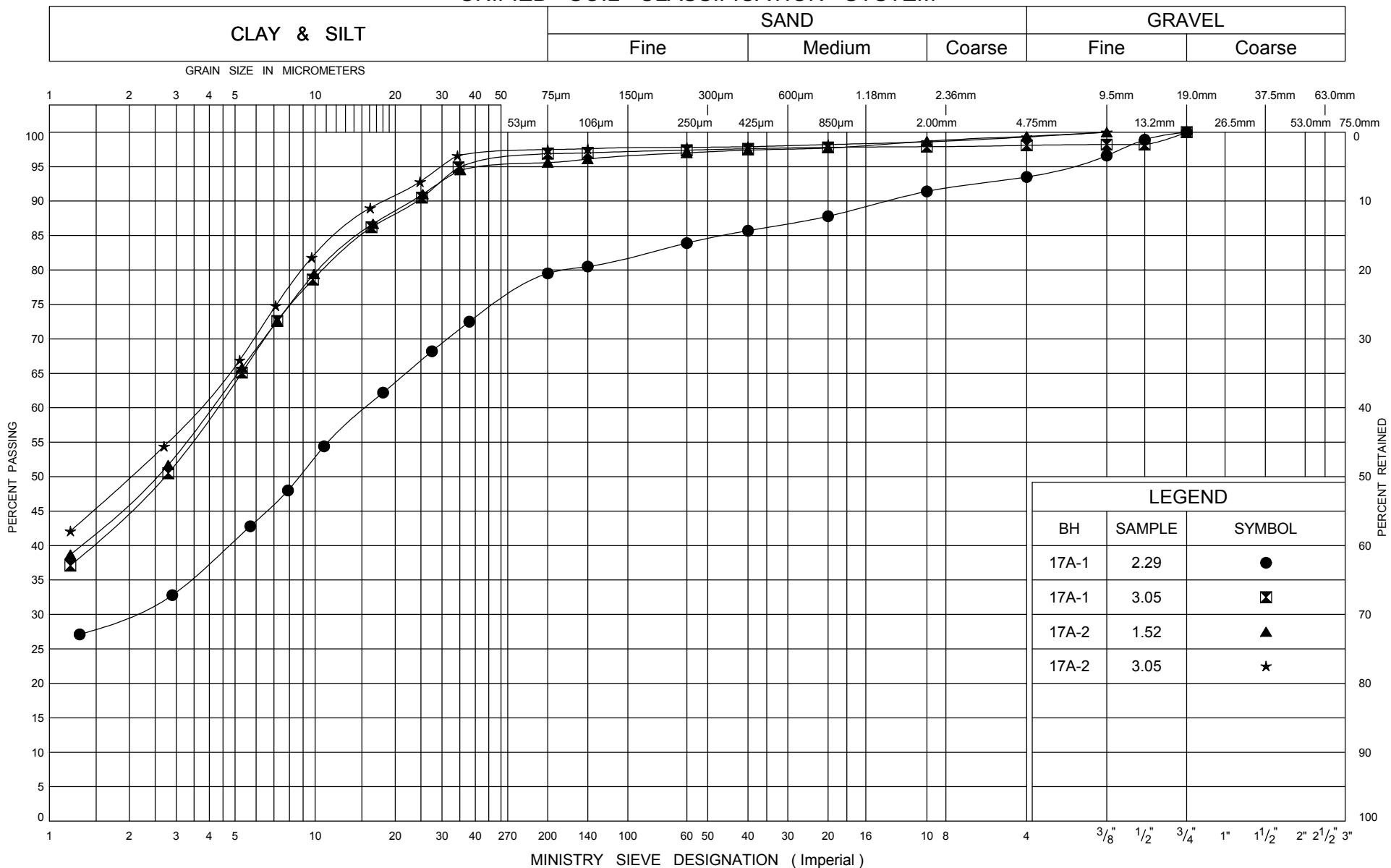
1 OF 1

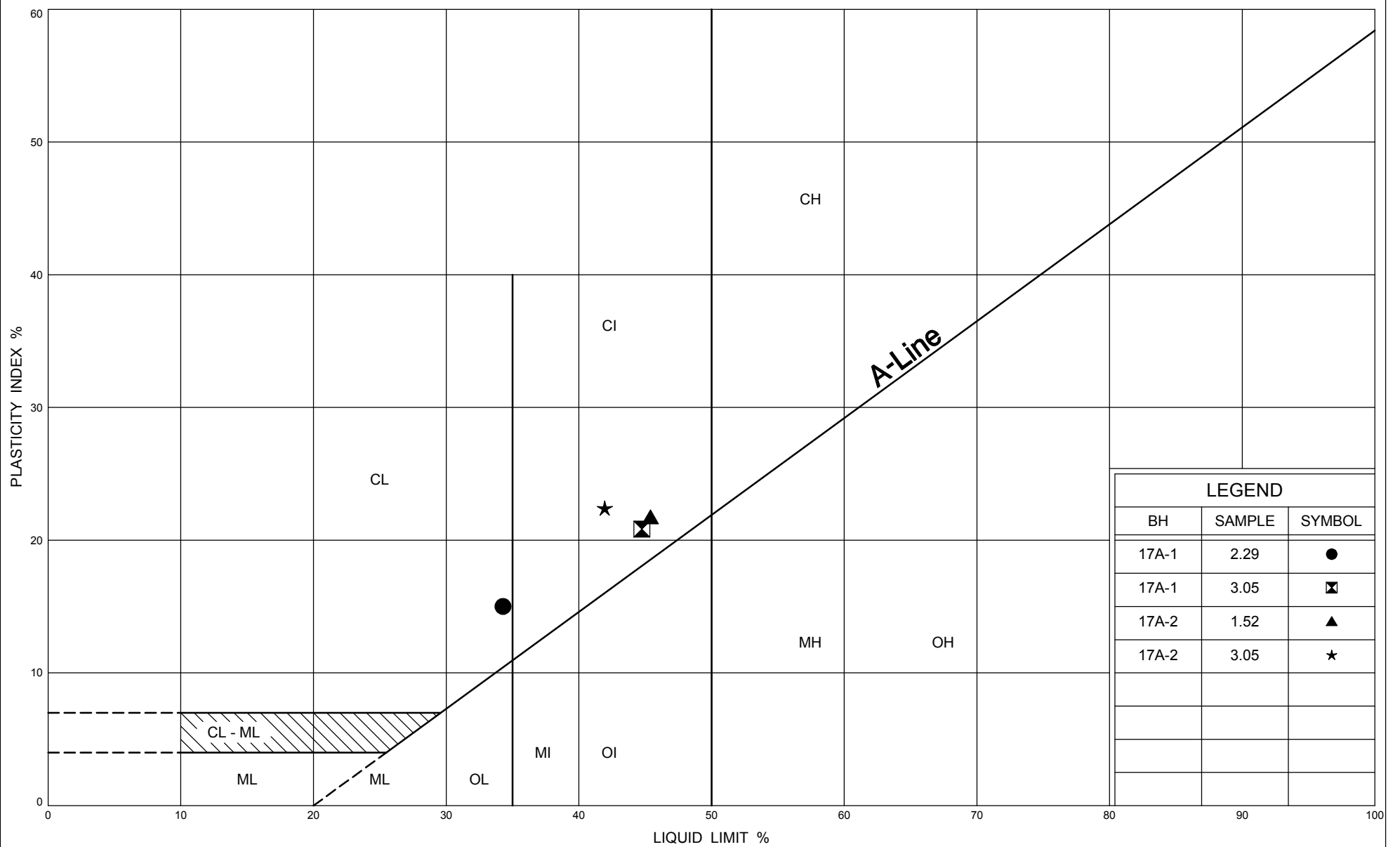
METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938729, Easting - 223727 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE														
230.91 0.00	Ground							20 40 60 80 100		10 20 30				
	250 mm TOPSOIL													
	Brown		1	SPT	14		230						21.1	1 4 49 47 (96)
			2	SPT	29		229							
	Silty CLAY TILL, CI Moist, stiff to hard, embedded sand and gravel.		3	SPT	41		228							
	Grey		4	SPT	100+								42	1 2 48 50 (98)
226.64 4.27			5	SPT	95		227							
	End of Borehole.													Borehole dry and open @ completion.

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
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PLASTICITY CHART SILTY CLAY TILL, CL-CI

FIG No C- 17A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 18A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938671, Easting - 223820 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
233.26 0.00	Ground						20 40 60 80 100									
	300 mm sand and gravel FILL.															
	FILL Brown, moist, loose to compact, consisting of silty sand and gravel.		1	SPT	16											
			2	SPT	6											
231.13 2.13																
	Brown		3	SPT	20								43	23.4 3 5 48 44 (92)		
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		4	SPT	87									22.3		
	Grey		5	SPT	83									7 4 54 35 (89)		
228.23 5.03	End of Borehole.		6	SPT	90									Water level measured @ 4.4 m @ completion.		

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+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 18A-2

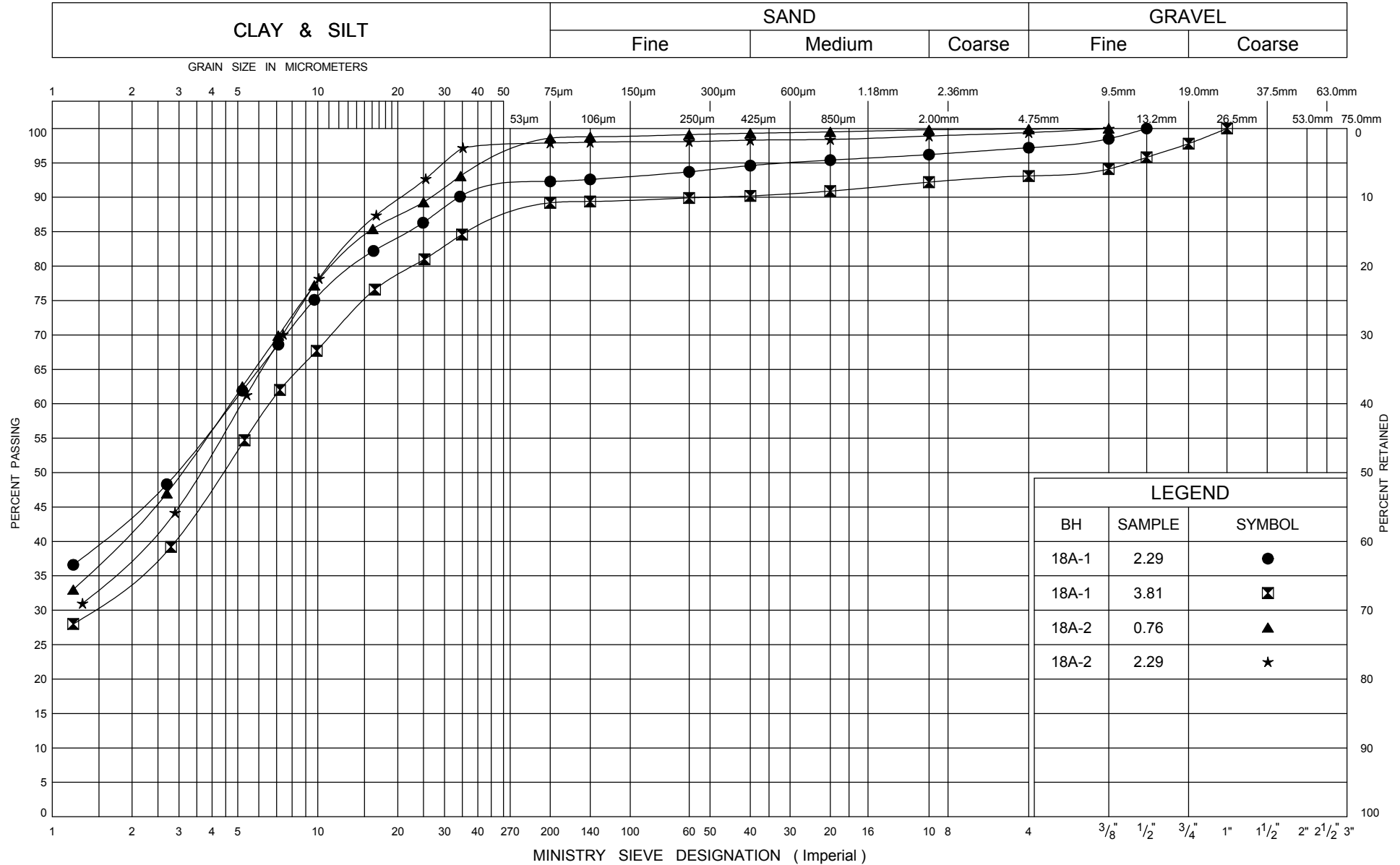
1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938676, Easting - 223823 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
231.63 0.00	Ground							20 40 60 80 100		10 20 30					
	250 mm TOPSOIL.														
	Brown		1	SPT	27		231	●			○	45	22.6	0 1 57 42 (99)	
			2	SPT	36		230	●			○		22.6		
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		3	SPT	83		229	●			○	41		1 2 60 38 (98)	
	Grey		4	SPT	100+			●			○				
227.59 4.04	End of Borehole.		5	SPT	100+		228	●			○			Borehole dry and open @ completion.	

UNIFIED SOIL CLASSIFICATION SYSTEM



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Transportation

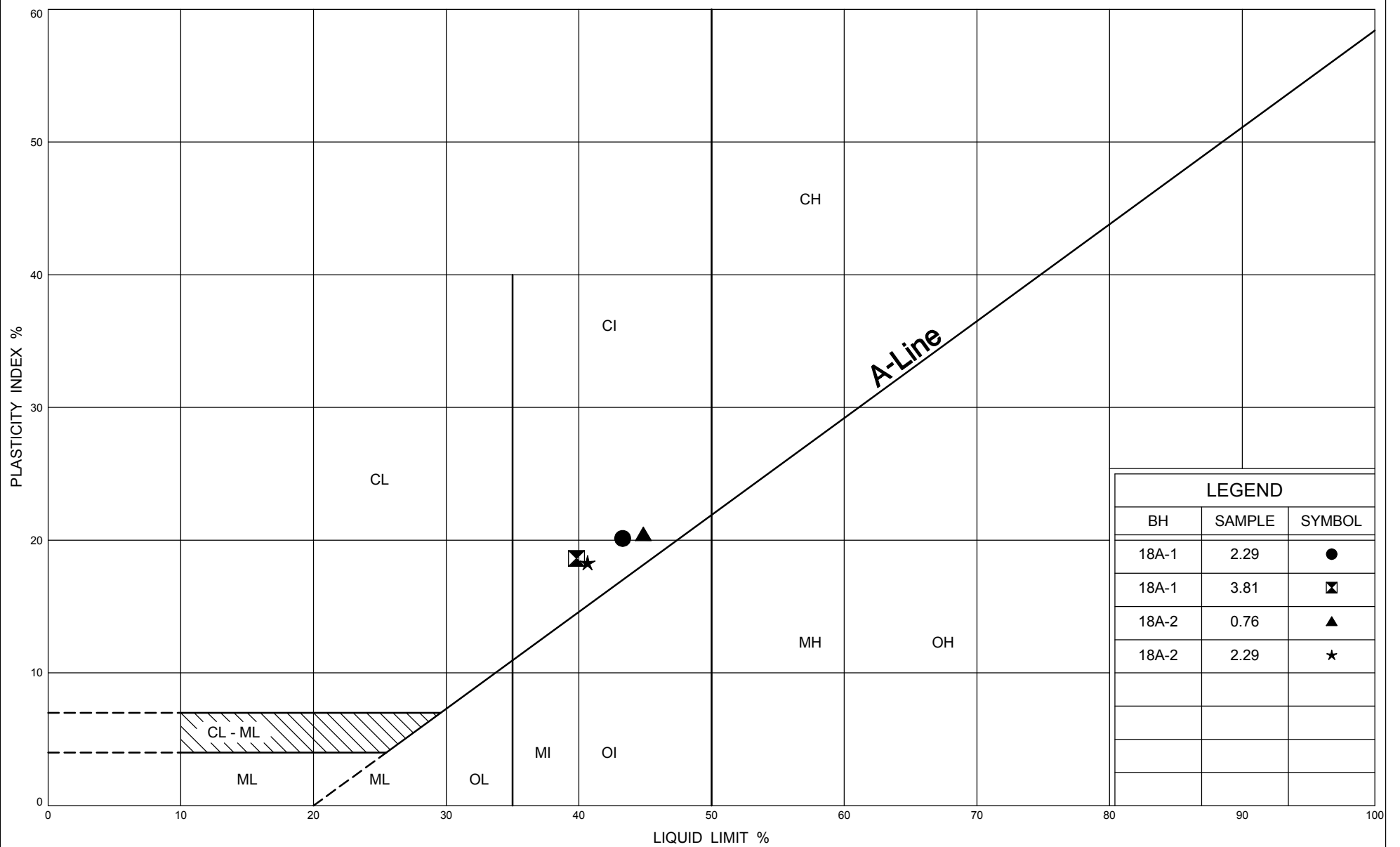
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL, CI

FIG No C- 18A.1

GWP 57-00-00

HWY 26, Thornbury to Meaford



Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TILL, CI

FIG No C- 18A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 19A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938541, Easting - 224057 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.25.07 - 07.25.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD ● DYN. CONE						
								SHEAR STRENGTH kPa						
							20	40	60	80	100			
							○ UNCONFINED	+ FIELD VANE						
							● QUICK TRIAXIAL	× LAB VANE						
									WATER CONTENT (%)					
233.62	Ground						20	40	60	80	100	10	20	30
0.00	300 mm sand and gravel FILL.													
233.27														
0.35														
	FILL Grey, moist, loose to compact, consisting of silty clay.		1	SPT	7									
			2	SPT	16									
231.49														
2.13	Brown		3	SPT	18									
	Silty CLAY TILL CI Moist, very stiff to hard, embedded sand and gravel.		4	SPT	40									
	Grey		5	SPT	51									
228.82			6	SPT	100+									
4.80	End of Borehole.													
									</					

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+ 3, X 3: Numbers refer to
Sensitivity










○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 19A-2

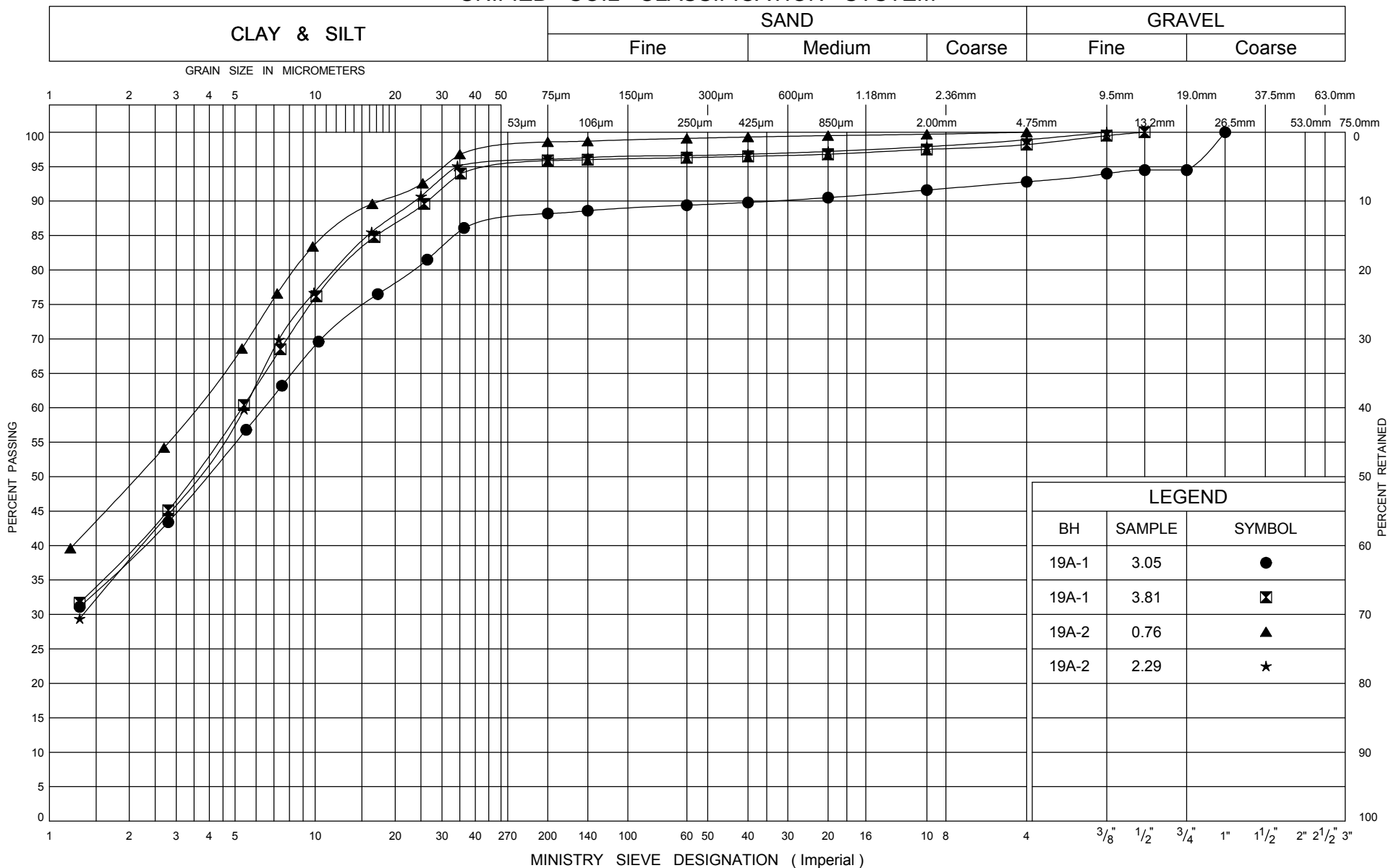
1 OF 1

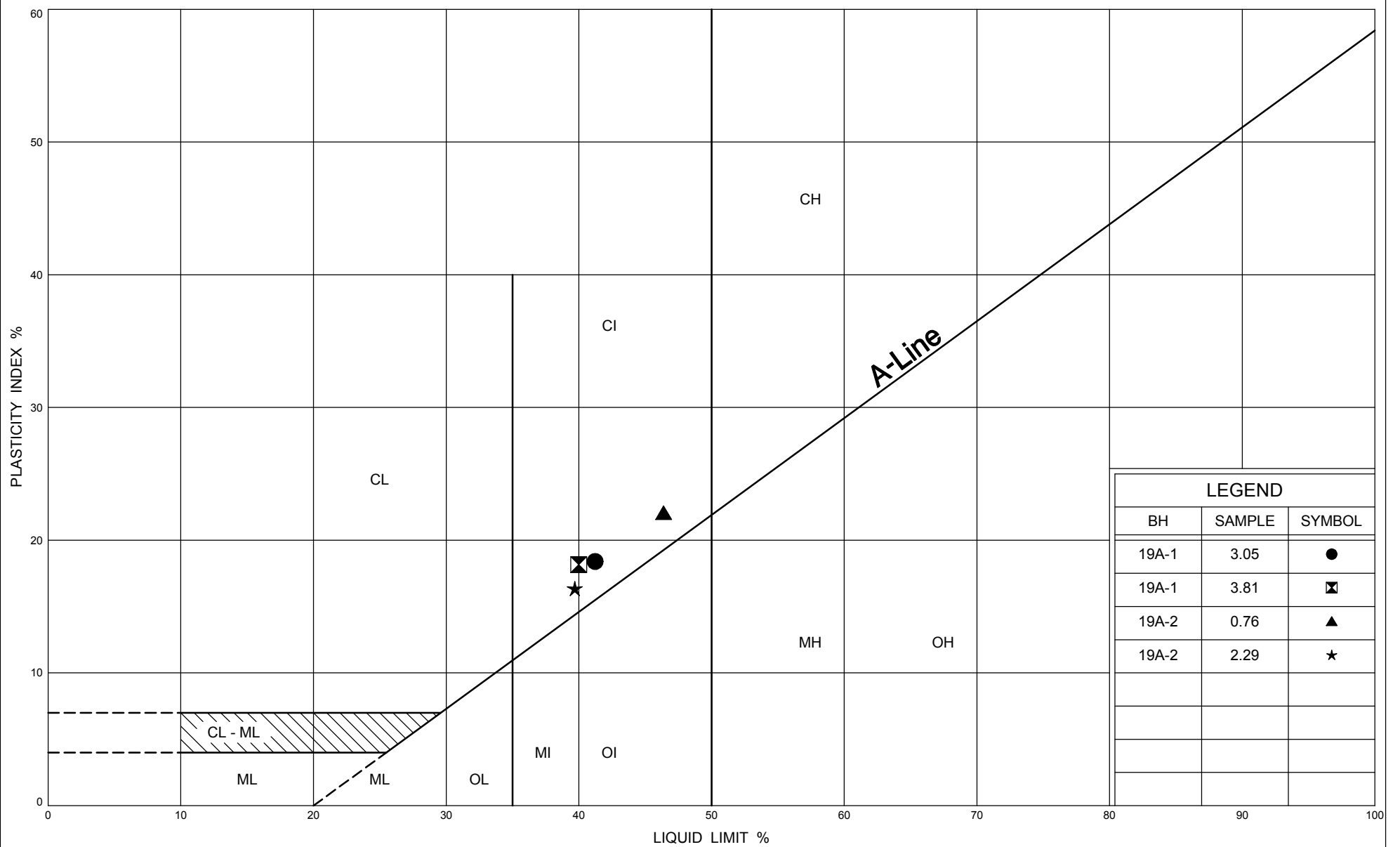
METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938553, Easting - 224070 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 09.17.07 - 09.17.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE														
231.97 0.00	Ground 150 mm TOPSOIL							20 40 60 80 100		10 20 30				
	Brown		1	SPT	19		231						23.7	0 1 50 49 (99)
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		2	SPT	42		230						19.8	
	Grey		3	SPT	52									1 3 58 38 (96)
228.62 3.35	End of Borehole.		4	SPT	100+		229							Borehole dry and open @ completion.

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TILL, CI

FIG No C- 19A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 23A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938066, Easting - 224882 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.24.07 - 07.24.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
234.92 0.00	Ground							20 40 60 80 100	10 20 30						
	300 mm sand and gravel FILL.														
	FILL Brown, moist to wet, compact, consisting of gravelly sand, some silt.		1	SPT	100+		234							hit cobbles.	
			2	SPT	15		233							44 41 9 5 (14)	
232.79 2.13			3	SPT	12		232							Water level measured @ 2 m @ completion.	
	FILL Brown, moist to wet, compact, consisting of clayey sand and silt.														
231.72 3.20			4	SPT	29		231							7 4 55 33 (88)	
	Brown														
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		5	SPT	42		230							5 7 57 31 (88)	
	Grey		6	SPT	86										
229.43 5.49			7	SPT	100+										
	End of Borehole.														

JOE MTO 07-6-JEG1.GPJ ONTARIO MOT.GDT 04/12/09

+ 3, X 3: Numbers refer to
Sensitivity



○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 23A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938074, Easting - 224889 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.24.07 - 07.24.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
234.89 0.00	Ground 200 mm sand and gravel FILL.					▽										
	FILL Brown, moist to wet, loose to compact, consisting of gravelly sand.		1	SPT	16		234	●			○					
			2	SPT	6		233	●			○					
232.76 2.13	FILL Brown, moist to wet, stiff, consisting of clayey sand and silt, some gravel.	3	SPT	10	232		●				┌───┐ └───┘				19 34 33 14 (48)	
231.84 3.05	Brown Silty CLAY TILL, CL-CI Moist, very stiff to hard, embedded sand and gravel.		4	SPT	26		231	●			○	┌───┐ └───┘		24.0	7 5 53 35 (88)	
			5	SPT	65		230	●			○	┌───┐ └───┘			15 12 47 26 (73)	
	Grey		6	SPT	80		230	●			○					
			7	SPT	100+		229	●			○					
228.64 6.25	End of Borehole.		8	SPT	100+				○					Water level measured @ 5.5 m @ completion.		














JOE MTO 07-6-JEG1.GPJ ONTARIO MOT.GDT 04/12/09

RECORD OF BOREHOLE No 23A-3

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4938093, Easting - 224890 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.24.07 - 07.24.07 CHECKED BY EC

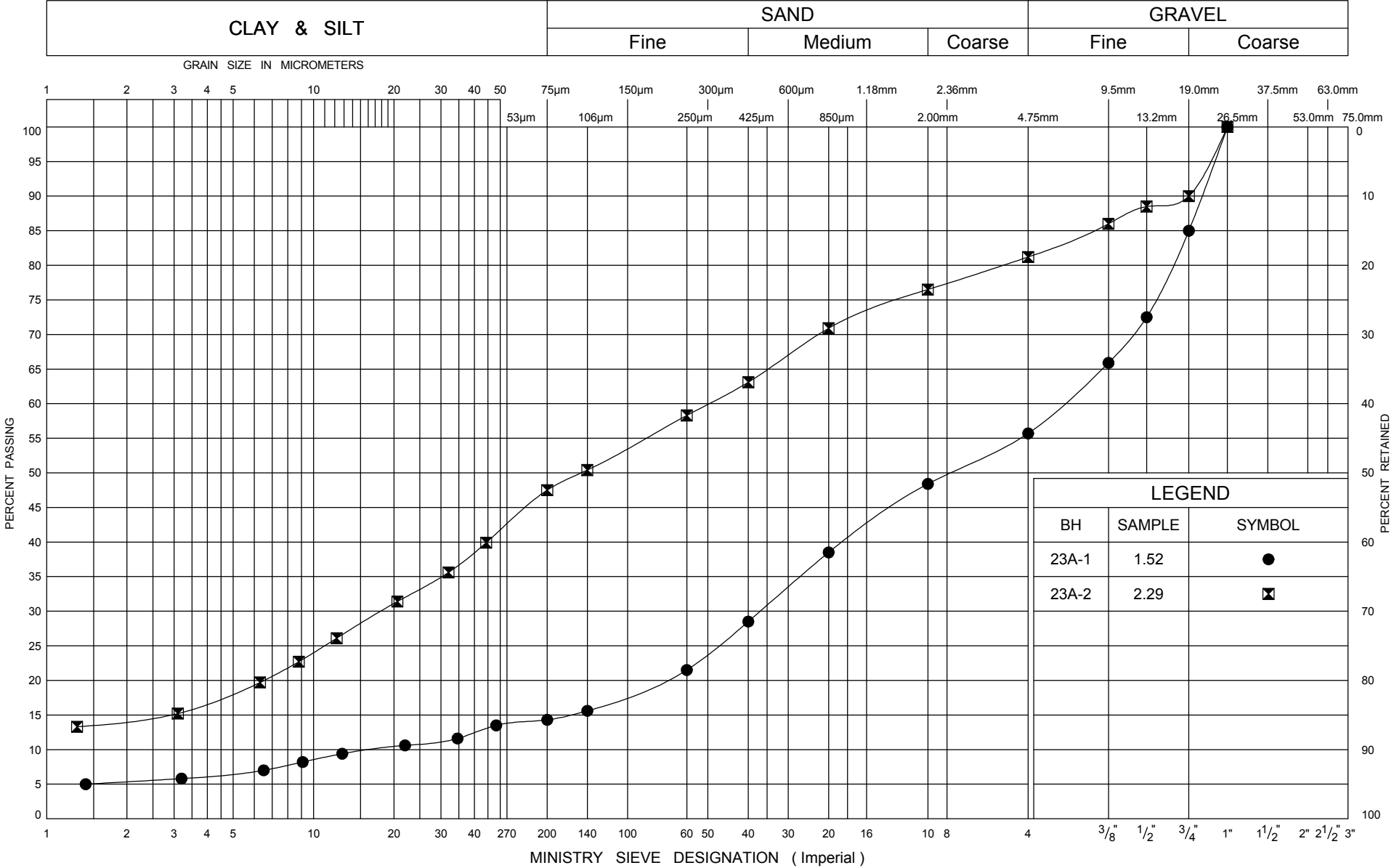
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
232.75 0.00	Ground 150 mm TOPSOIL												25.5	Water level measured @ 1.3 m @ completion. 1 5 56 38 (95)	
	Brown		1	SPT	38		232								
	--		2	SPT	27		231								
	Silty CLAY TILL, CI Moist, very stiff to hard, embedded sand and gravel.		3	SPT	77		230								
	Grey		4	SPT	100+										
228.64 4.11	End of Borehole.		5	SPT	100+							1 8 60 31 (92)			

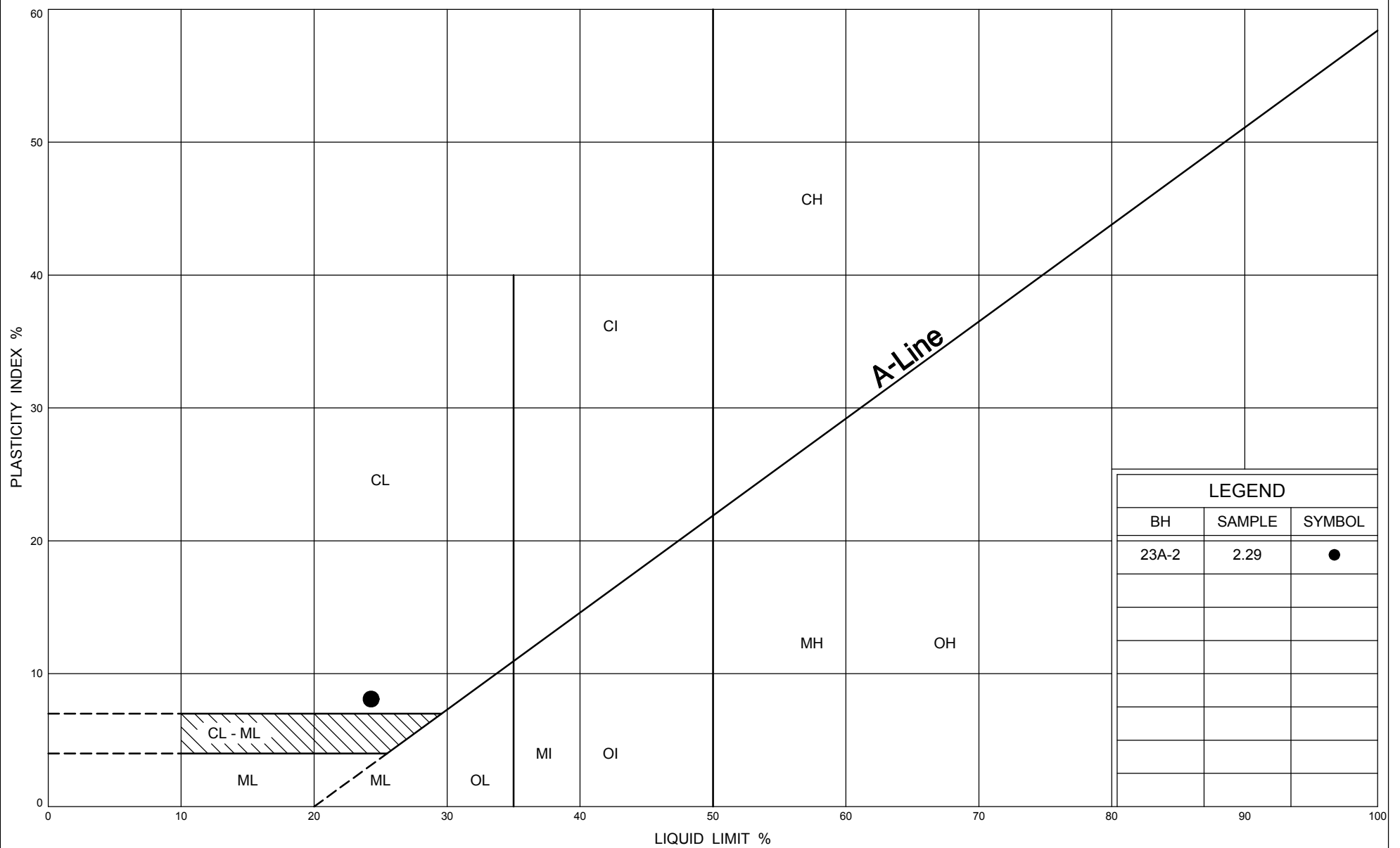
Water level
measured @ 1.3
m @ completion.
1 5 56 38
(95)

25.5

1 8 60 31
(92)

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
Transportation

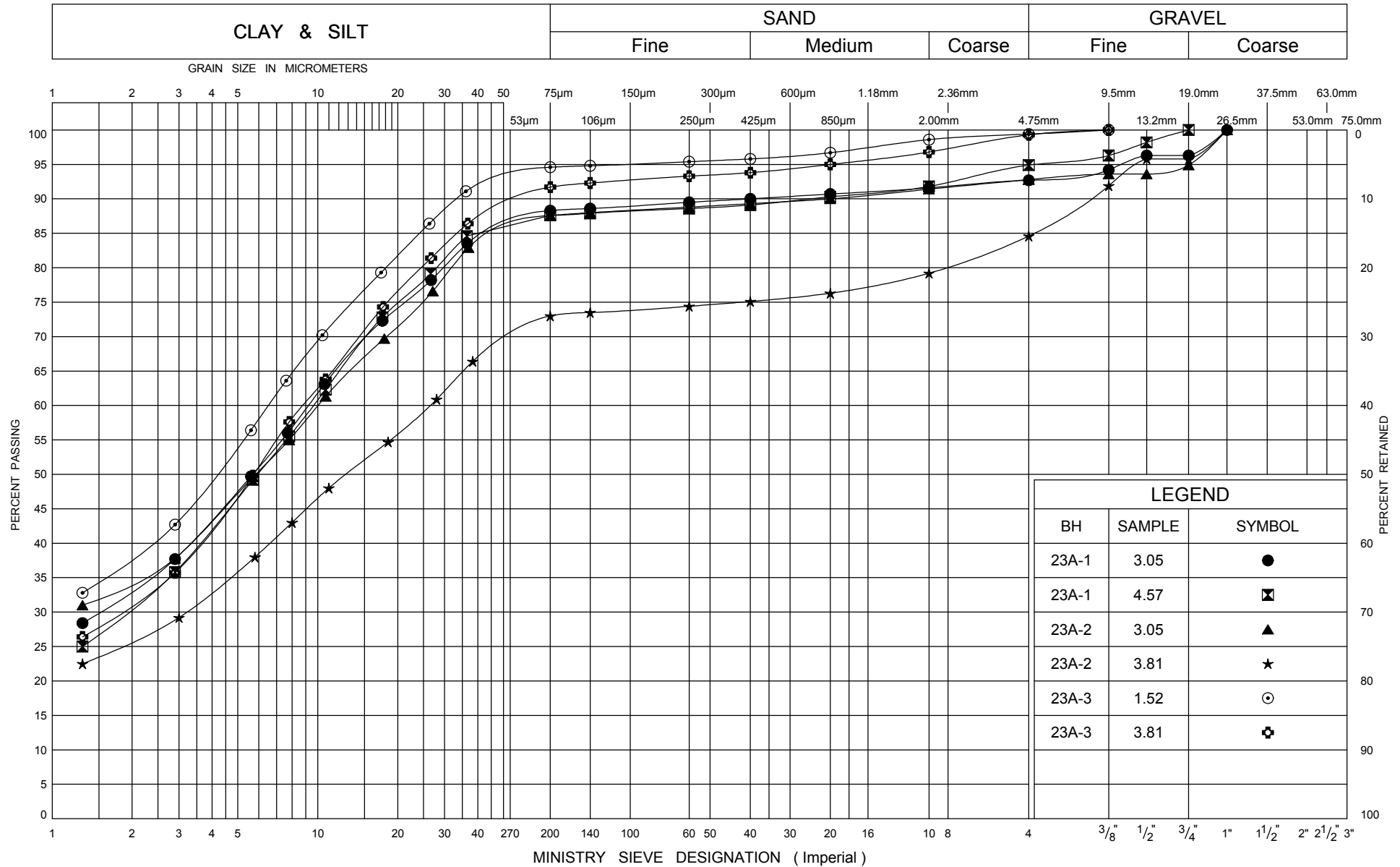
PLASTICITY CHART FILL

FIG No C- 23A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



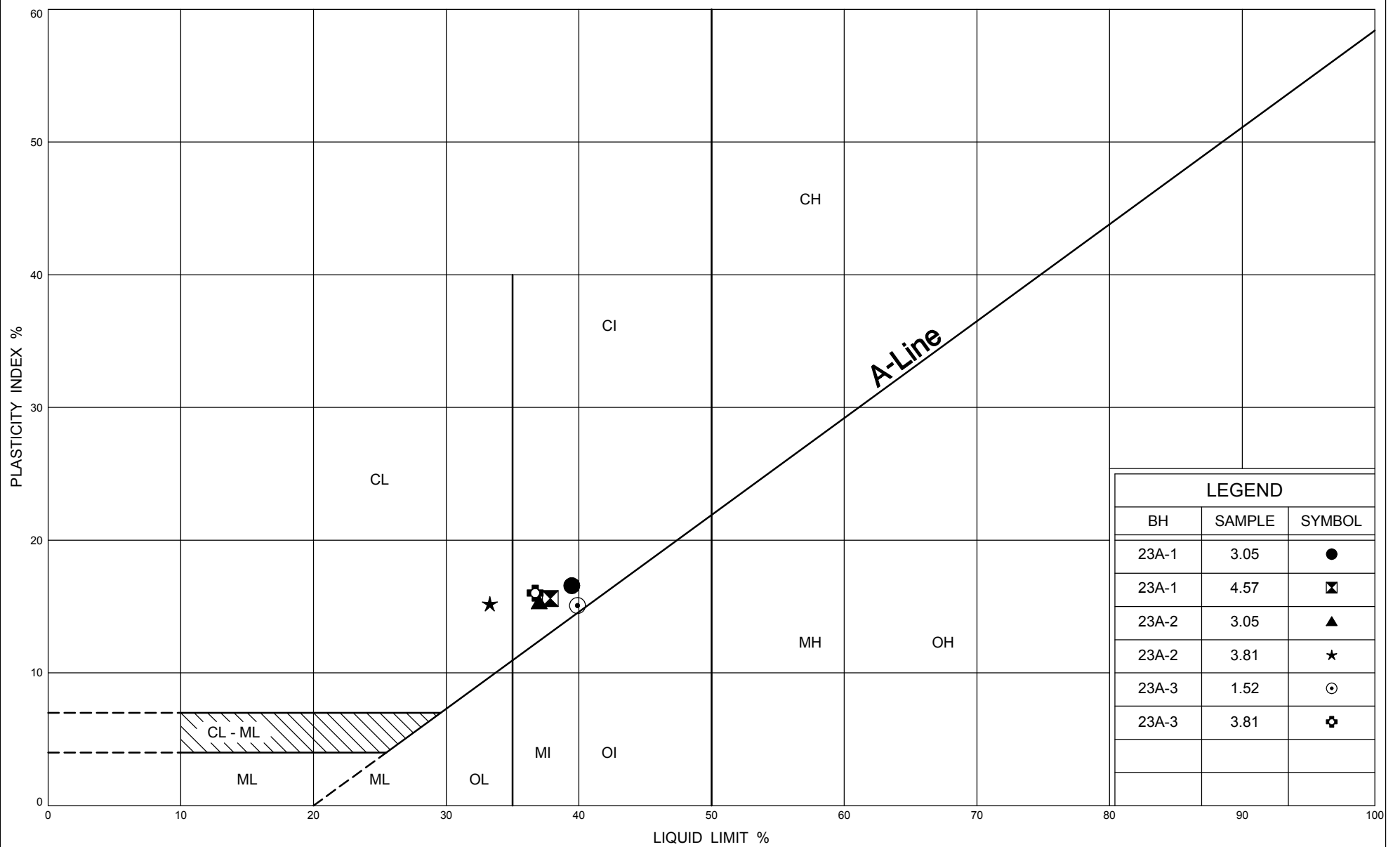
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL-CI

FIG No C- 23A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford



Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TILL, CL-CI

FIG No C- 23A.4

GWP 57-00-00




HWY 26, Thornbury to Meaford

RECORD OF BOREHOLE No 28A-1

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4936970, Easting - 227905 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.23.07 - 07.23.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD	● DYN. CONE					
								SHEAR STRENGTH kPa						
							○ UNCONFINED	+ FIELD VANE						
							● QUICK TRIAXIAL	× LAB VANE						
194.62	Ground													
0.00	350mm TOPSOIL													
194.26														
0.36														
	Brown			1	SPT	9								
				2	SPT	21								
	Silty CLAY to Clayey SILT TILL, CI to CL-ML Moist, very stiff to hard, frequent silt layers.		3	SPT	19									
			4	SPT	39									
	Grey		5	SPT	49									
190.35														
4.27	End of Borehole.													Borehole dry and open @ completion.

JOE MTO 07-6-JEG1.GPJ ONTARIO MOT.GDT 04/12/09

+ 3, × 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 28A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4936980, Easting - 227914 ORIGINATED BY JL
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
 DATUM Geodetic DATE 07.18.07 - 07.18.07 CHECKED BY EC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)				
								○ UNCONFINED	● QUICK TRIAXIAL						+ FIELD VANE	× LAB VANE			
196.17 0.00	Ground							20 40 60 80 100		10 20 30									
195.87 0.30	300 mm sand and gravel FILL.																		
	FILL Brown, moist, compact, consisting of sandy silty clay, some gravel, trace organics.		1	SPT	14									7 26 46 21 (67)					
			2	SPT	16														
193.88 2.29	Brown		3	SPT	33								22.8	0 8 63 29 (92)					
	Silty CLAY to Clayey SILT TILL, CL to CL-ML. Moist, very stiff to hard, frequent silt layers.		4	SPT	36														
	Grey		5	SPT	18								23.1	0 0 80 20 (100)					
			6	SPT	38														
191.14 5.03	End of Borehole.													Borehole dry and open @ completion.					

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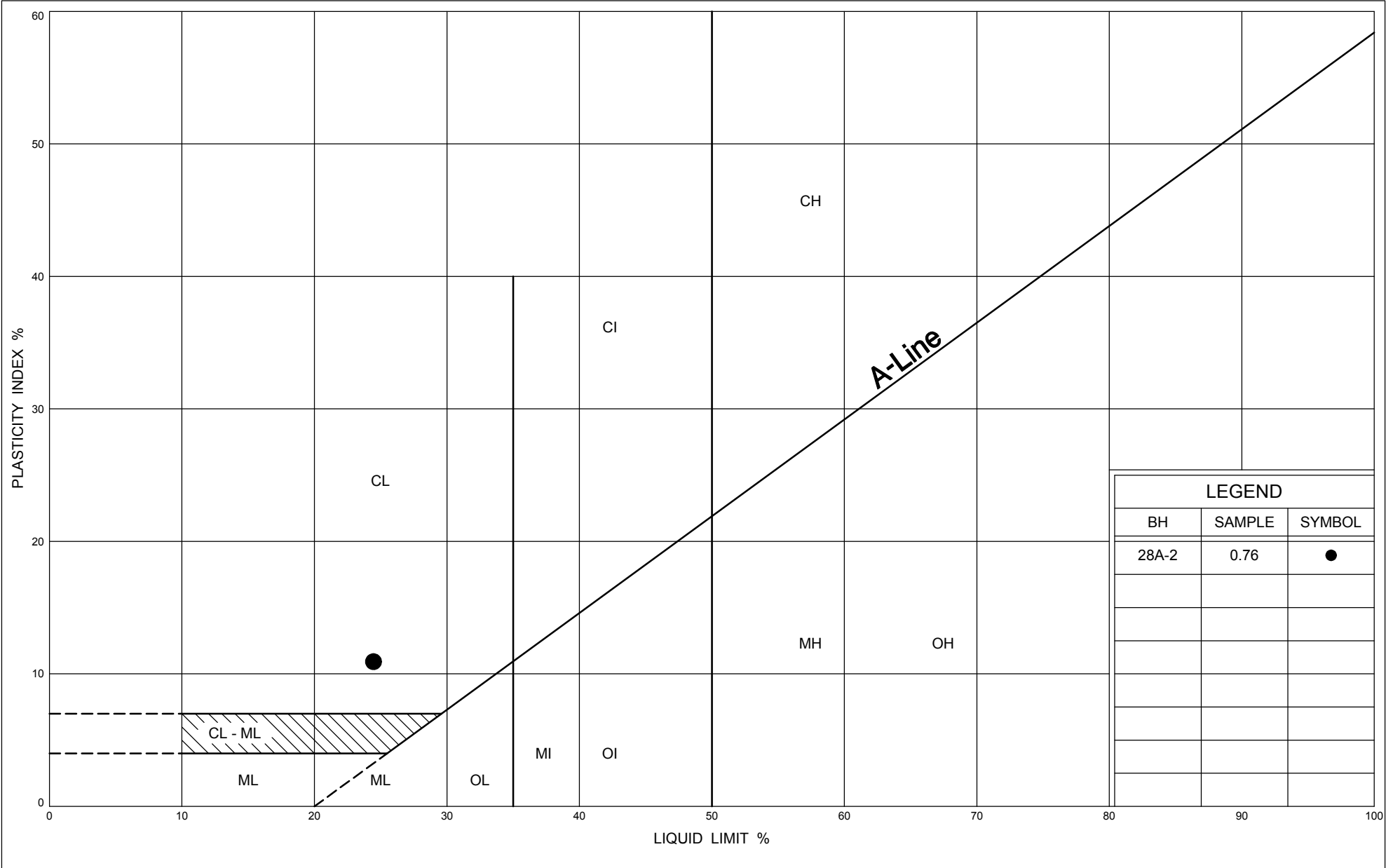
+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

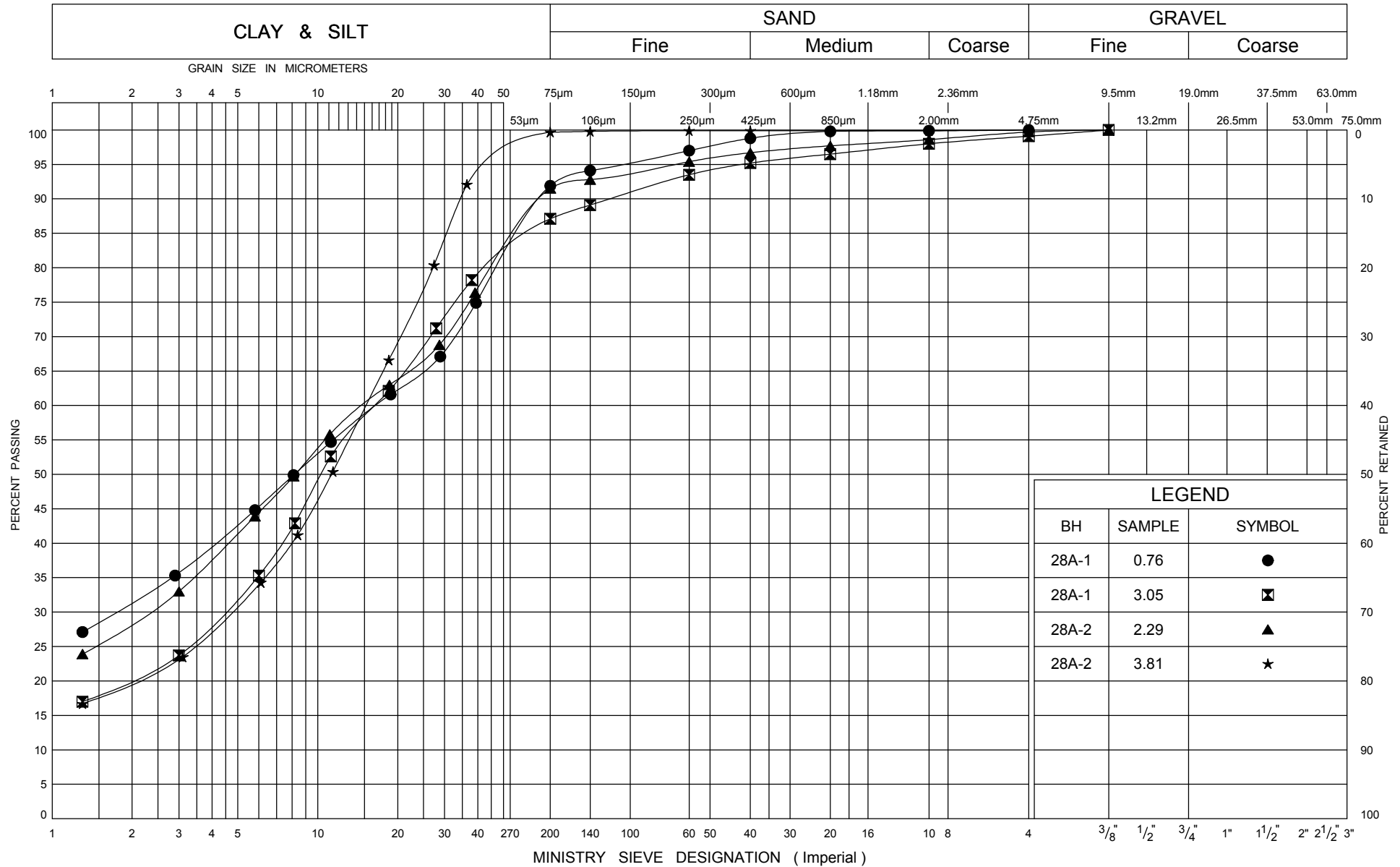
GRAIN SIZE IN MICROMETERS



HWY 26, Thornbury to Meaford



UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

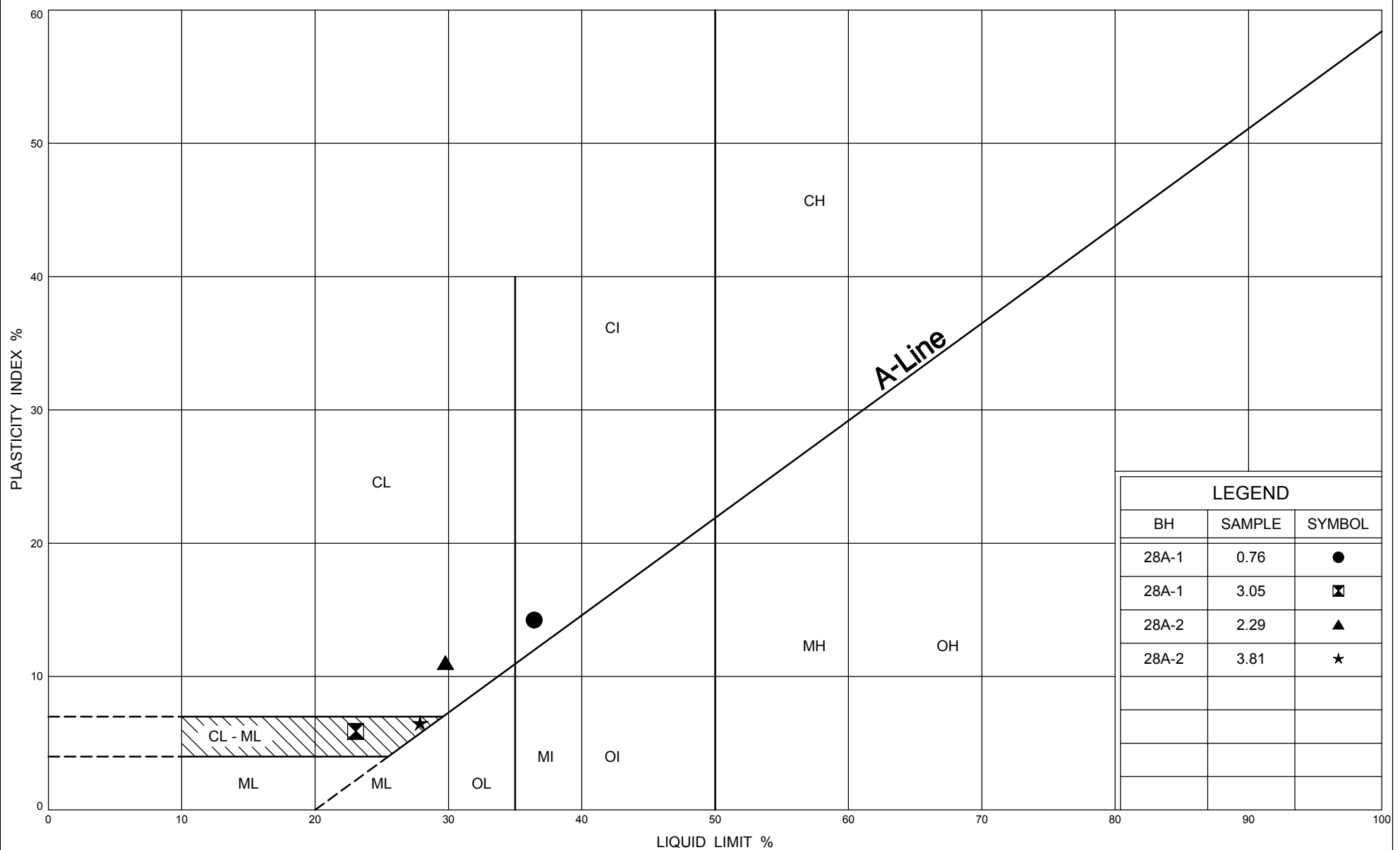
SILTY CLAY TILL WITH FREQUENT SILT LAYERS

CI TO CL TO CL-ML

FIG No C- 28A.3

GWP 57-00-00

HWY 26, Thornbury to Meaford



Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TILL WITH FREQUENT SILT LAYERS CI TO CL TO CL-ML

FIG No C- 28A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

1 OF 1

METRIC

DATUM	Geodetic	DATE	07.23.07 - 07.23.07	CHECKED BY	EC
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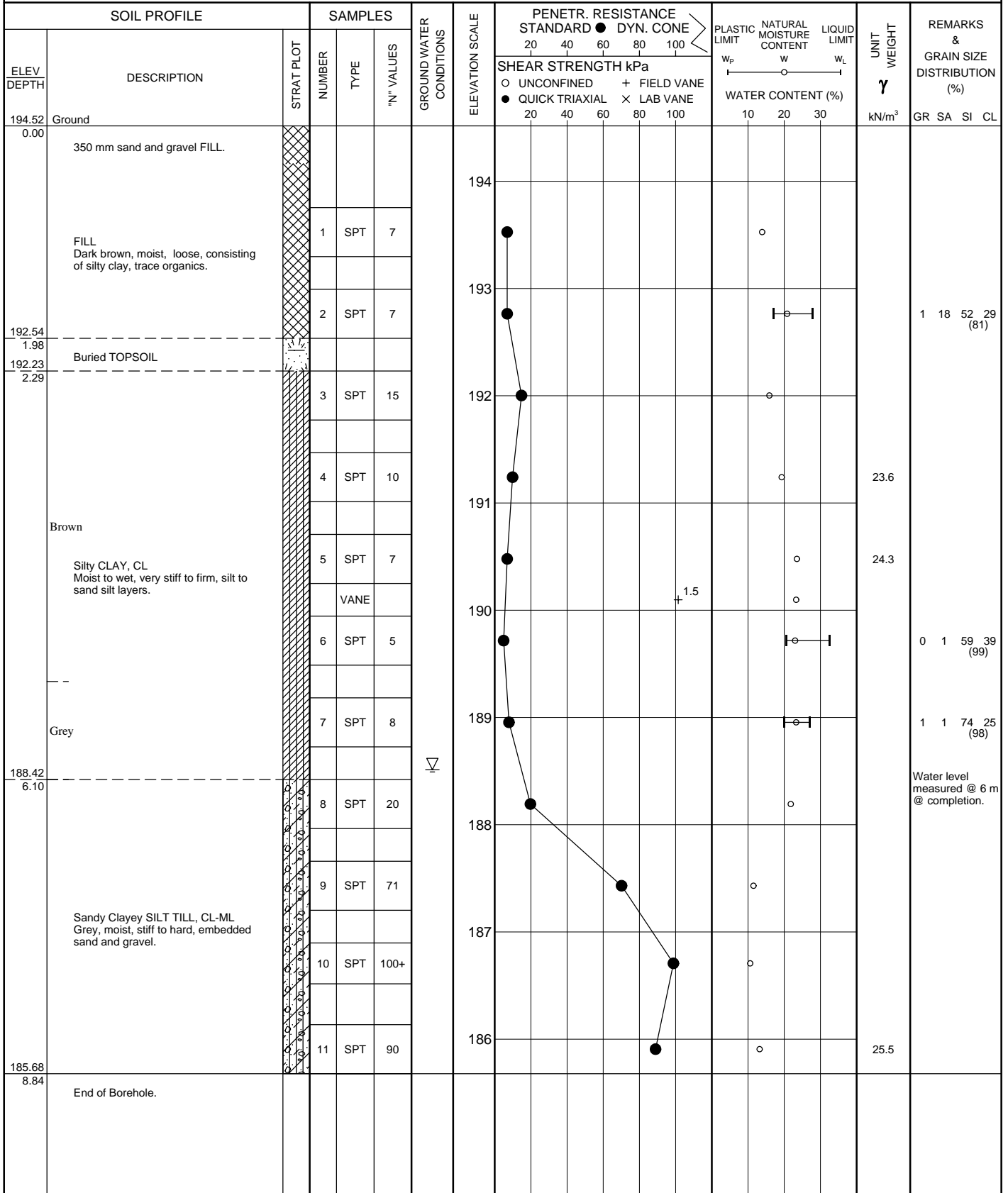
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
193.58 0.00	Ground														
	300 mm Organic TOPSOIL														
	Brown		1	SPT	11								22.2		
			2	SPT	19								22.2	0 2 67 31 (98)	
			3	SPT	6								20.9		
	Silty CLAY, CL Moist to wet, very stiff to firm, silt to sand silt layers.		4	SPT	8										
	Grey			VANE				1.2							
			5	SPT	6									0 0 63 36 (100)	
188.63 4.95			6	SPT	11								24.8		
			7	SPT	61									10 31 40 20 (59)	
	Sandy Clayey SILT TILL, CL-ML Grey, moist, stiff to hard, embedded sand and gravel.		8	SPT	42										
			9	SPT	60										
185.50 8.08			10	SPT	53								24.6		
	End of Borehole.													Borehole dry and open @ completion.	

RECORD OF BOREHOLE No 29A-2

1 OF 1

METRIC

W.P. GWP 57-00-00 LOCATION HWY 26, Thornbury to Meaford Northing - 4936831, Easting - 228178 ORIGINATED BY JL
DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY JL
DATUM Geodetic DATE 07.23.07 - 07.23.07 CHECKED BY EC



JOE MTO 07-6-JEG1.GPJ ONTARIO MOT.GDT 04/12/09

+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

1 OF 1

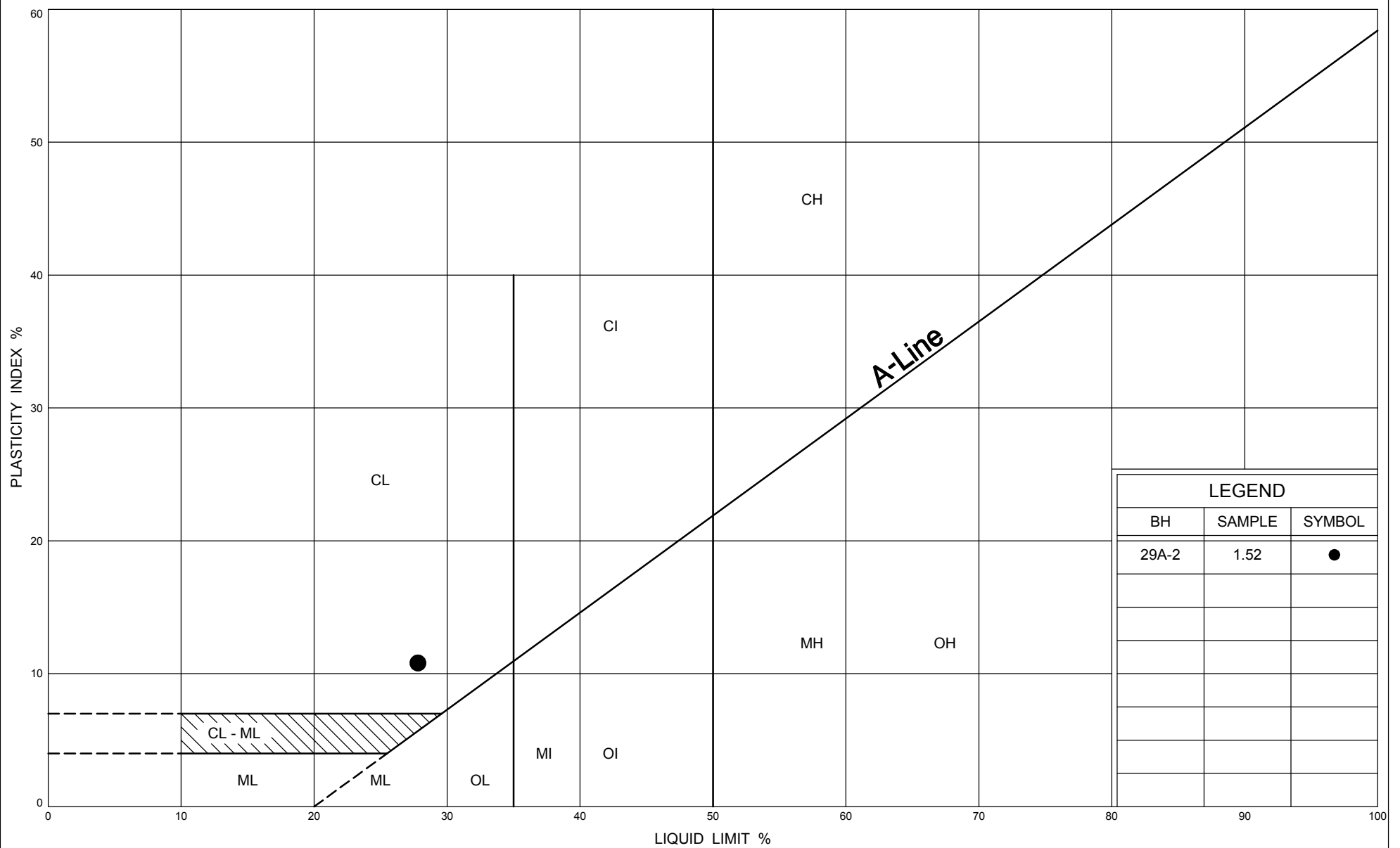
METRIC

W.P.	GWP 57-00-00	LOCATION	HWY 26, Thornbury to Meaford Northing - 4936831, Easting - 228179	ORIGINATED BY	JL
DIST	Owen Sound HWY 26	BOREHOLE TYPE	S/S Augering, 110 mm dia.	COMPILED BY	JL
DATUM	Geodetic	DATE	08.29.07 - 08.29.07	CHECKED BY	EC

[illegible]



HWY 26, Thornbury to Meaford



Ministry of
Transportation

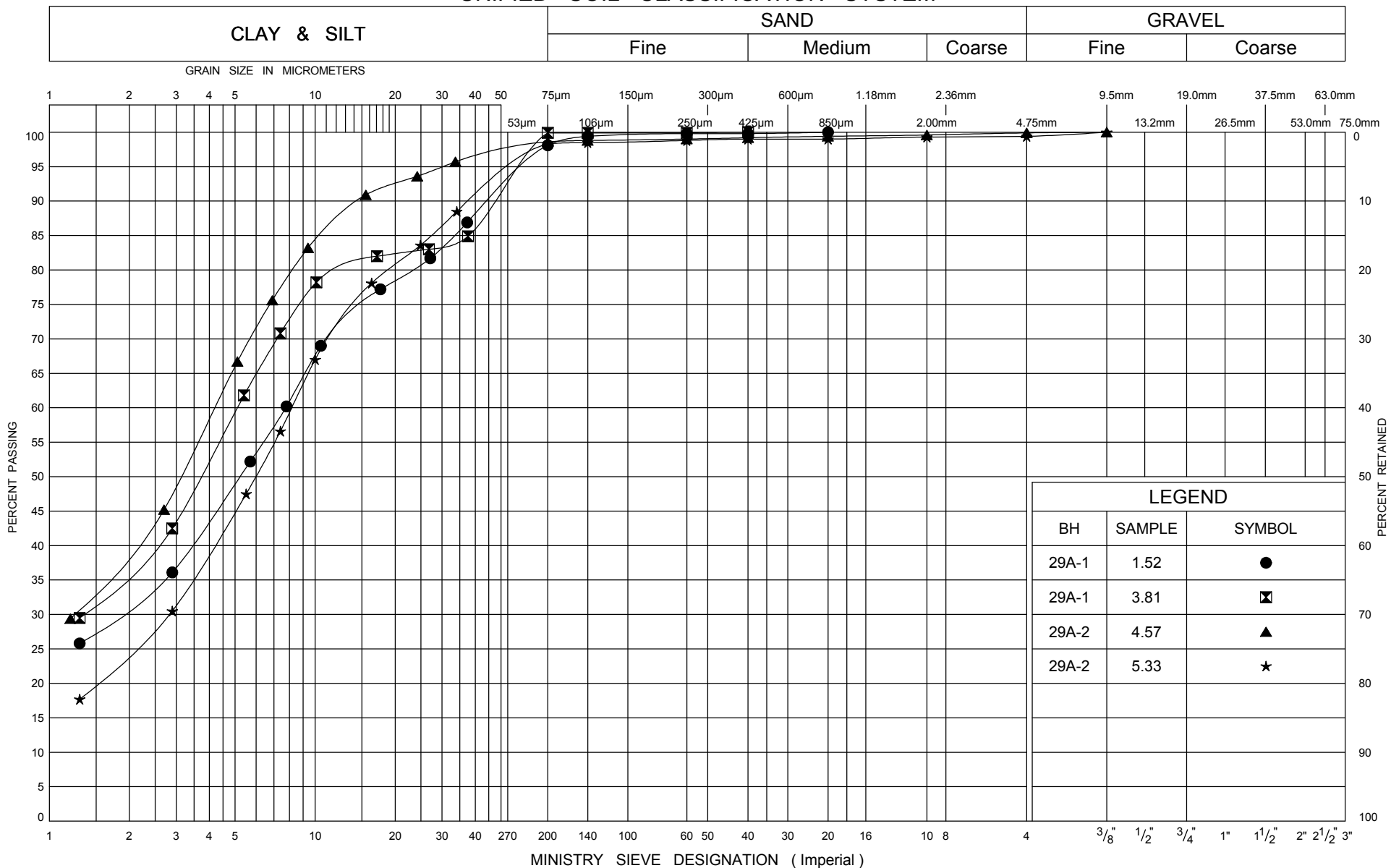
PLASTICITY CHART FILL

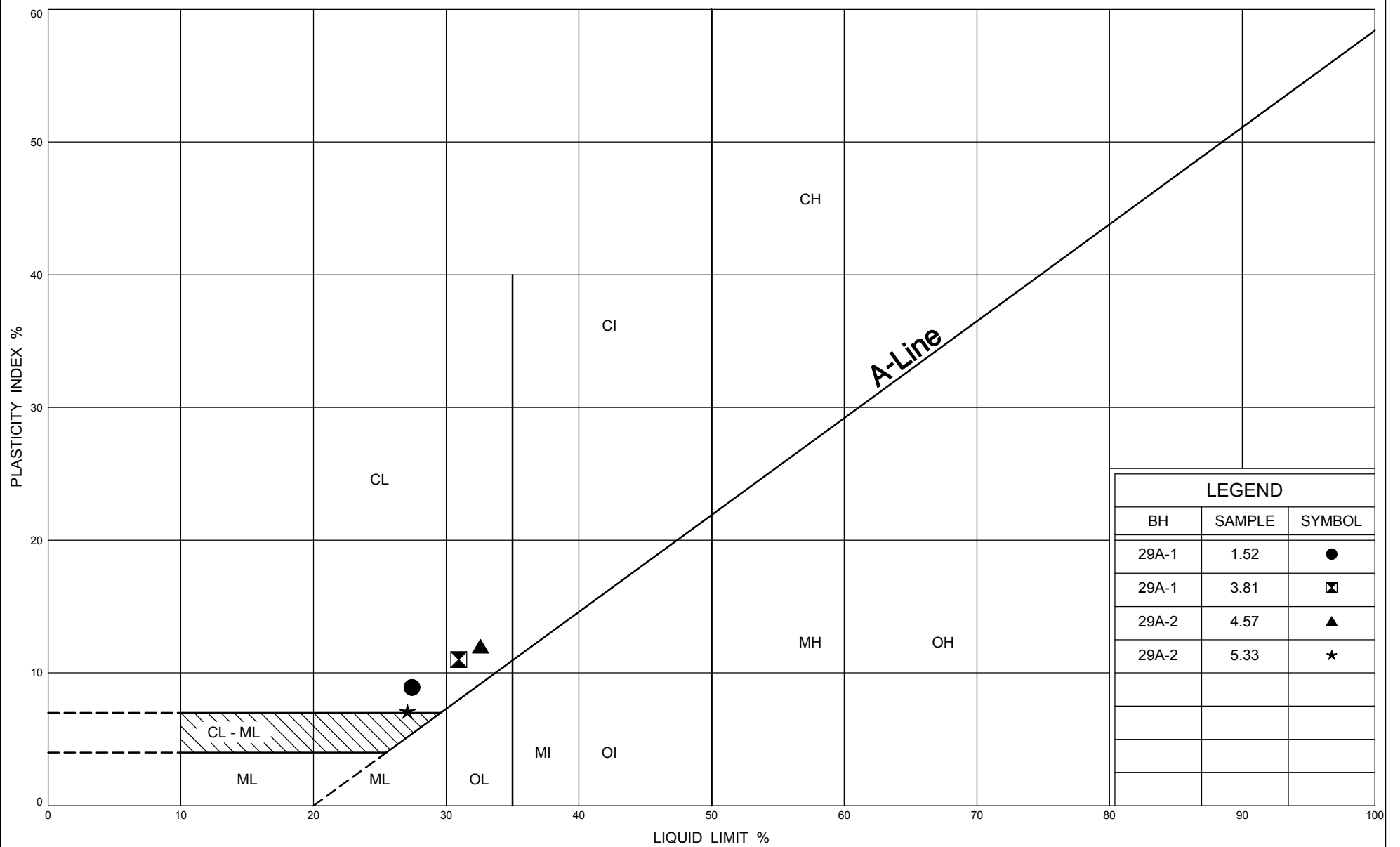
FIG No C- 29A.2

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
Transportation

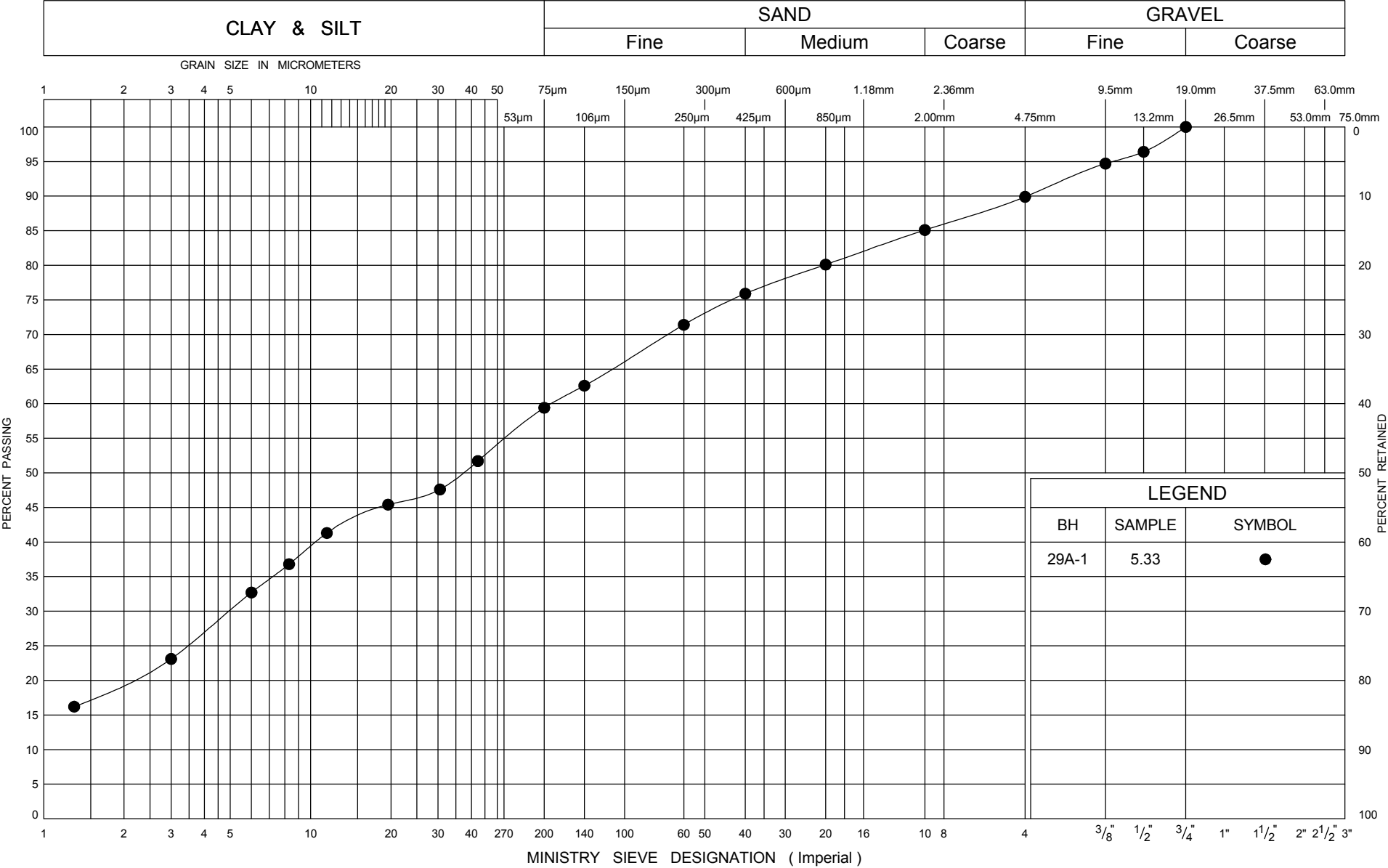
PLASTICITY CHART SILTY CLAY, CL

FIG No C- 29A.4

GWP 57-00-00

HWY 26, Thornbury to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM

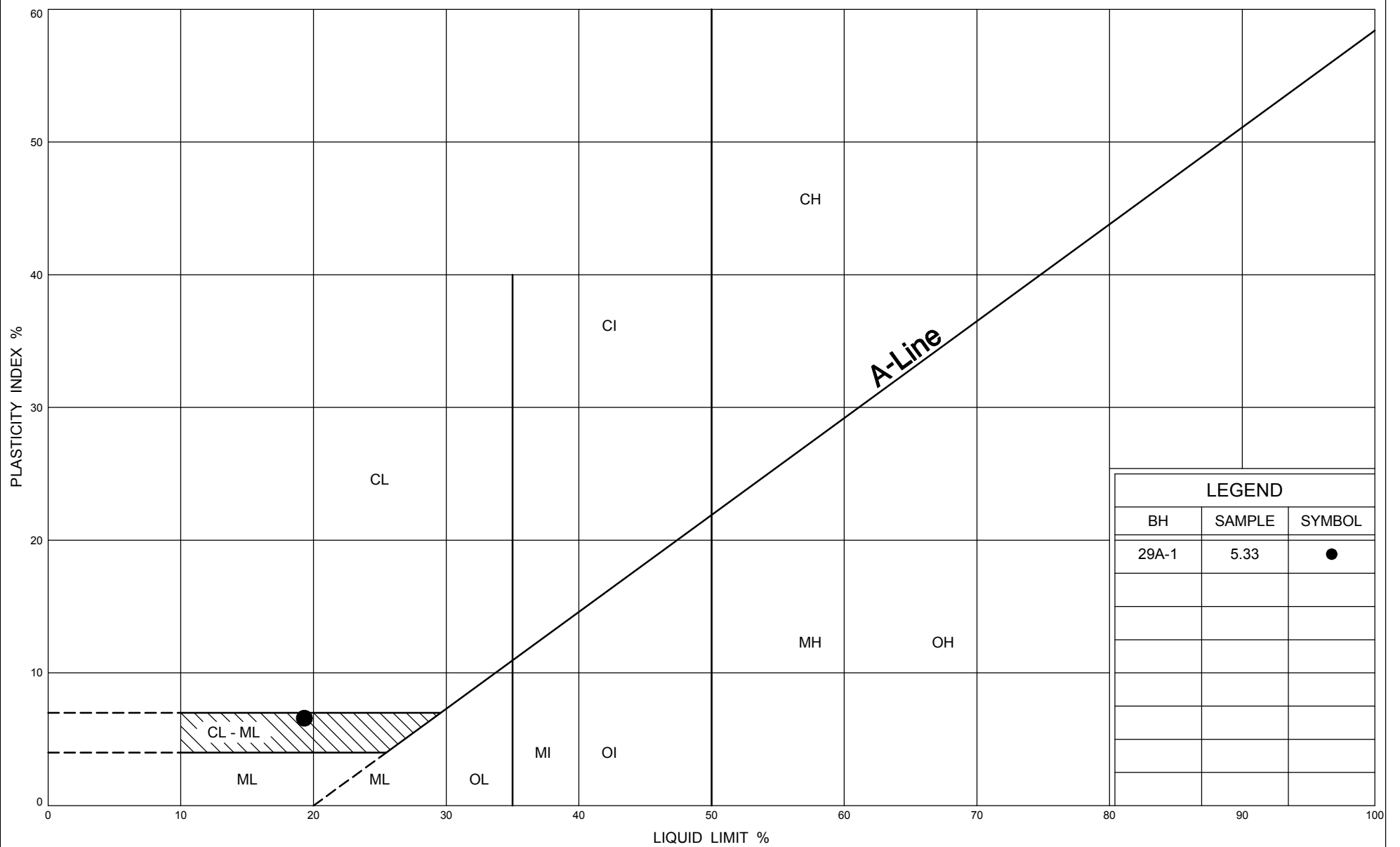


GRAIN SIZE DISTRIBUTION
SANDY CLAYEY SILT TILL, CL-ML

FIG No C- 29A.5

GWP 57-00-00

HWY 26, Thornbury to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
29A-1	5.33	●



Ministry of
Transportation

PLASTICITY CHART SANDY CLAYEY SILT TILL, CL-ML

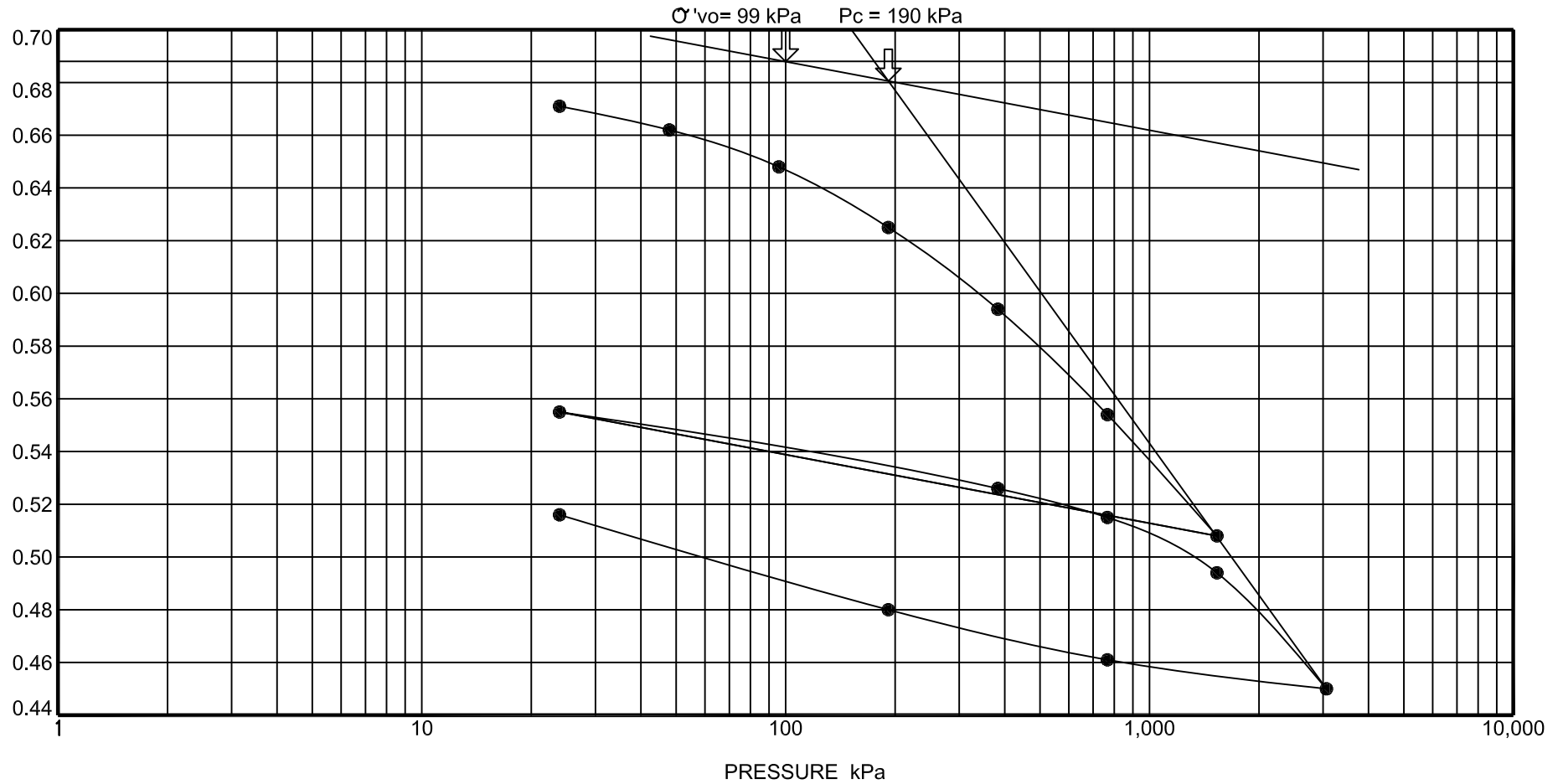
FIG No C- 29A.6

GWP 57-00-00

HWY 26, Thornbury to Meaford

MTD CONSOLIDATION - VOID RATIO LANDSCAPE 07-6-1861.GPJ ONTARIO MTD.CPT 04/25/08

VOID
RATIO
e



	B H	DEPTH	ELEV.	WL	WP	W	Cc	Cr	σ'vo	γ _d	Classification
●	29A-2A	4.57	189.95	31	20	28	0.192	0.026	99	17.2	CL



Ministry of
Transportation

VOID RATIO - PRESSURE CURVE

FIG No C-29A.7

GWP 57-00-00

HWY 26, Thornbury to Meaford

Ministry of Transportation/Stantec Consulting Ltd.
G.W.P. 57-00-00
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Appendix C

Site Photographs



Station 23+476 – Looking downstream (north)



Station 23+476 – Downstream end (north)



Station 23+476 – Looking upstream (south)



Station 23+476 – Upstream end (south)



Station 24+527 – Looking downstream (north)



Station 24+527 – Looking upstream (south)



Station 24+527 – Downstream end (north)



Station 24+527 – Upstream end (south)



Station 25+720 – Looking downstream (north)



Station 25+720 – Looking upstream (south)



Station 25+720 – Downstream end (north)



Station 25+720 – Upstream end (south)



Station 26+027 – Looking downstream (north)



Station 26+027 – Looking upstream (south)



Station 26+027 – Downstream end (north)



Station 26+027 – Upstream end (south)



Station 26+371 – Looking downstream (north)



Station 26+371 – Looking upstream (south)



Station 26+371 – Downstream end (north)



Station 26+371 – Upstream end (south)



Station 26+606 – Looking downstream (north)



Station 26+606 – Looking upstream (south)



Station 26+606– Downstream end (north)



Station 26+606 – Upstream end (south)



Station 26+874 – Looking downstream (north)



Station 26+874 – Looking upstream (south)



Station 26+874 – Downstream end (north)



Station 26+874 – Upstream end (south)



Station 27+293 – Looking downstream (north)



Station 27+293 – Looking upstream (south)



Station 27+293 – Downstream end (north)



Station 27+293 – Upstream end (south)



Station 27+500 – Looking downstream (north)



Station 27+500 – Looking upstream (south)



Station 27+500 – Downstream end (north)



Station 27+500 – Upstream end (south)



Station 27+868 – Looking downstream (north)



Station 27+868 – Looking upstream (south)



Station 27+868 – Downstream end (north)



Station 27+868 – Upstream end (south)



Station 28+126 – Looking downstream (north)



Station 28+126 – Looking upstream (south)



Station 28+126 – Downstream end (north)



Station 28+126 – Upstream end (south)



Station 28+292 – Looking downstream (north)



Station 28+292 – Looking upstream (south)



Station 28+292 – Downstream end (north)



Station 28+292 – Upstream end (south)



Station 28+402 – Looking downstream (north)



Station 28+402 – Looking Upstream (south)



Station 28+402 – Downstream end (north)



Station 28+402 – Upstream end (south)



Station 28+672 – Looking downstream (north)



Station 28+672 – Looking upstream (south)



Station 28+672 – Downstream end (north)



Station 28+672 – Upstream end (south)



Station 10+548 – Looking downstream (north)



Station 10+548 – Looking upstream (south)



Station 10+548 –Downstream end (north)



Station 10+548 – Upstream end (south)



Culvert 28A - STA 13+862, South Side



Culvert 29A - STA 14+160, south side

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Appendix D

Limitations of Report

APPENDIX D

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Infrastructure Engineering Group Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, IEG recommends that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.