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FOUNDATION INVESTIGATION REPORT

TEMPORARY BRIDGE SUPPORT STRUCTURES
QUEEN ELIZABETH WAY BRIDGE REHABILITATIONS
FROM GRAY'S ROAD TO FIFTY ROAD
CITY OF HAMILTON, ONTARIO
MINISTRY OF TRANSPORTATION, ONTARIO
G.W.P 2088-08-00

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REPORT



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PART A

FOUNDATION INVESTIGATION REPORT
TEMPORARY BRIDGE SUPPORT STRUCTURES
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G.W.P. 2088-08-00



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by Morrison Hershfield Limited (Morrison Hershfield) on behalf of Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the design of temporary bridge deck support structures and protection systems associated with the proposed rehabilitation of six structures crossing the Queen Elizabeth Way (QEW) between Gray's Road and Fifty Road, in the City of Hamilton, Ontario as follows:

- Gray's Road underpass;
- Millen Road underpass;
- Fruitland Road underpass;
- Glover Road underpass;
- Winona Road underpass; and
- Fifty Road underpass.

The terms of reference and scope of work are outlined in MTO's Request for Proposal, dated May 5, 2009. Golder's proposal for foundation engineering services associated with the temporary support structures is contained in Section 6.8 of Morrison Hershfield's Technical Proposal for this assignment. The work was carried out in accordance with Golder's Supplementary Specialty Quality Control Plan for foundation engineering services for this project dated November 2, 2009.

2.0 SITE DESCRIPTION

The site(s) of the proposed temporary bridge deck support structures are located at six (6) bridge structures crossing the QEW at Gray's Road, Millen Road, Fruitland Road, Glover Road, Winona Road, and Fifty Road in the City of Hamilton in the Region of Hamilton / Wentworth as shown on the index plan (Figure 1). The QEW is a divided highway (with a concrete barrier separating Eastbound and Westbound traffic) with three lanes in each direction at the above noted bridge locations.

The overall surface topography along this area of the QEW (Gray's Road to Fifty Road) is generally flat-lying to gently sloping. The QEW generally runs parallel to the south shore line of Lake Ontario with residential and commercial buildings in the vicinity of each bridge crossing. Ground surface elevations along the QEW within the project area vary between about Elevation 79 m at the west project limit (Gray's Road) and Elevation 85 m at the east project limit (Fifty Road). A more detailed description of each bridge site is provided below.

Gray's Road Underpass

The four-span Gray's Road Underpass structure conveys northbound and southbound traffic (one lane in each direction) over the QEW, North Service Road and South Service Road. The bridge is located approximately 1.5 km east of Centennial Parkway and less than 500 m south of Lake Ontario's south shore line. There are grass covered ditch/median areas with fencing between the QEW and the North and South Service Roads. The existing approach embankment side-slopes are grass covered and about 5.5 m high with open abutment front slopes with concrete slope paving for erosion protection.



Millen Road Underpass

The four-span Millen Road Underpass structure conveys northbound and southbound traffic (one lane in each direction) over the QEW, North Service Road and South Service Road. The bridge is located approximately 1.5 km east of Gray's Road and about 300 m south of Lake Ontario's south shore line. There are grass covered ditch/median areas with fencing between the QEW and the North and South Service roads. The existing approach embankment side-slopes are grass covered and about 7 m high with open abutment front slopes with concrete slope paving.

Fruitland Road Underpass

The four-span Fruitland Road Underpass structure conveys northbound and southbound traffic (3 lanes in each direction) over the QEW, S-W Ramp (Toronto Bound) and N-E Ramp (Niagara Bound). The bridge is located approximately 1.8 km east of Millen Road and about 500 m south of Lake Ontario's south shore line. There are grass covered ditch/median areas between the QEW and the S-W and N-E Ramps. The existing approach embankment side-slopes are grass and tree covered and about 6.5 m high with open abutment front slopes with concrete slope paving.

Glover Road Underpass

The four-span Glover Road Underpass structure conveys northbound and southbound traffic (one lane in each direction) over the QEW, North Service Road and South Service Road. The bridge is located approximately 1.7 km east of Fruitland Road and about 400 m south of Lake Ontario's south shore line. There are grass covered ditch/median areas with fencing between the QEW and the North and South Service roads. The existing approach embankment side-slopes are grass covered and about 7.5 m high with open abutment front slopes with concrete slope paving.

Winona Road Underpass

The four-span Winona Road Underpass structure conveys northbound and southbound traffic (one lane in each direction) over the QEW, North Service Road and South Service Road. The bridge is located approximately 2.5 km east of Glover Road and less than 500 m south of Lake Ontario's south shore line. There are grass covered ditch/median areas with fencing between the QEW and the North and South Service roads. The existing approach embankment side-slopes are grass covered and about 7.5 m high with open abutment front slopes with concrete slope paving. There is an existing noise barrier wall that terminates on the approach embankment side-slope on the west side of the north abutment.

Fifty Road Underpass

The four-span Fifty Road Underpass structure conveys northbound and southbound traffic (3 lanes in each direction) over the QEW, S-W Ramp (Toronto Bound) and N-E Ramp (Niagara Bound). The bridge is located approximately 750 m east of Winona Road and less than 1 km south of Lake Ontario's south shore. There are grass covered ditch/median areas between the QEW and the S-W and N-E Ramps. The existing approach embankment are grass and tree covered and about 7 m high with open abutment front slopes with concrete slope paving.



3.0 INVESTIGATION PROCEDURES

3.1 Current Investigation

The fieldwork for the current investigation for the proposed temporary structure foundations was carried out between December 22, 2009 and February 19, 2010, at which time forty-eight boreholes were drilled at the six bridge sites at the locations shown on Drawings 1, 4, 7, 10, 13, and 16.

The current field investigation was carried out using a truck-mounted drill rig supplied and operated by Geo-Environmental Drilling Inc. of Milton, Ontario. The boreholes were advanced using 150 mm outside diameter hollow stem augers, 210 mm outside diameter hollow stem augers, and 150 mm outside diameter solid stem augers. Soil samples were generally obtained at 0.75 m and 1.5 m intervals of depth using 50 mm outside diameter split-spoon samplers driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). Field vane shear tests were conducted in cohesive soils for determination of undrained shear strengths using a MTO standard 'N' size vane.

The groundwater conditions in the open boreholes were observed throughout the drilling operations and piezometers were installed in selected boreholes to monitor the groundwater level at each of the six bridge sites. The piezometers consist of 50 mm diameter PVC pipe, with a slotted screen sealed at a select depth within the borehole. The boreholes and annulus surrounding the well pipe above the sand pack and around the slotted screen were backfilled to the surface with bentonite pellets in accordance with Ontario Regulation (O.Reg.) 903 as amended by O.Reg. 372/07 of the Ontario Water Resources Act. The piezometer installation details and water level readings are described on the Record of Borehole sheets included in Appendices A to F for each specific bridge site.

The field work was supervised on a full-time basis by a member of Golder's technical staff who arranged for service clearances, supervised the drilling, sampling and in-situ testing operations, logged the boreholes and examined and cared for the soil samples. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga and London for further examination and testing. All of the laboratory tests were carried out to MTO and/or ASTM Standards as appropriate. Classification tests (water content, Atterberg limits and grain size distribution) and organic content tests were carried out on select soil samples.

The boreholes were located in the field by members of Golder's technical staff using measured offsets from the existing bridge abutment and pier structures. The ground surface elevations were estimated from the digital terrain model provided by MH. The as-drilled borehole locations presented on the Record of Borehole sheets and shown on Drawings 1 to 18 are referenced to MTM NAD 83 co-ordinate system and the ground surface elevations are referenced to geodetic datum. A summary of the locations, ground surface elevations and depths of the current boreholes are provided below:



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QEW Bridge Location	Borehole Designation	Location (m)		Ground Surface Elevation (m)	Depth (m)
		Northing	Easting		
Gray's Road	G1	4789099.0	285601.8	79.5	6.7
	G2	4789094.5	285618.4	79.5	6.7
	G3	4789027.6	285577.8	79.5	6.7
	G4	4789020.7	285592.5	79.5	6.7
	G5	4789114.4	285611.8	85.0	9.8
	G6	4789005.7	285580.8	85.5	9.8
	G7	4789060.7	285588.4	79.0	6.7
	G8	4789054.9	285605.9	79.0	6.7
Millen Road	M1	4788611.2	287071.0	79.5	6.6
	M2	4788615.3	287057.9	79.5	6.6
	M3	4788629.4	287073.1	85.2	9.6
	M4	4788517.8	287043.7	86.5	9.6
	M5	4788535.6	287055.2	79.8	6.7
	M6	4788540.2	287040.8	79.8	6.7
	M7	4788575.1	287044.3	79.5	6.7
	M8	4788568.9	287062.7	79.5	6.7
Fruitland Road	F1	4788015.6	288864.3	80.5	6.7
	F2	4788028.5	288834.2	80.8	6.7
	F3	4788040.0	288845.5	86.3	9.8
	F4	4787937.8	288841.1	80.5	6.7
	F5	4787947.5	288809.8	80.5	6.7
	F6	4787917.6	288827.2	87.5	9.8
	F7	4787982.6	288820.4	80.5	6.7
	F8	4787972.7	288851.2	80.5	6.7
Glover Road	GL1	4787455.6	290529.6	81.3	6.7
	GL2	4787451.5	290543.5	81.3	6.7
	GL3	4787361.5	290510.5	88.0	9.8
	GL4	4787473.1	290540.2	86.9	9.8
	GL5	4787378.1	290522.4	81.5	6.7
	GL6	4787386.5	290507.8	81.5	6.7
	GL7	4787417.8	290517.9	81.5	6.7
	GL8	4787412.9	290531.5	81.5	3.1
Winona Road	W1	4786580.0	292916.8	84.0	6.7
	W2	4786583.8	292904.1	84.0	6.7
	W3	4786658.2	292925.1	83.4	6.7
	W4	4786653.8	292939.1	83.4	6.7
	W5	4786564.4	292907.6	89.6	9.8



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QEW Bridge Location	Borehole Designation	Location (m)		Ground Surface Elevation (m)	Depth (m)
		Northing	Easting		
Fifty Road	W6	4786676.3	292941.2	88.8	9.8
	W7	4786619.7	292914.2	83.0	6.7
	W8	4786614.8	292927.6	83.0	6.7
	FY1	4786304.7	293663.2	91.0	9.8
	FY2	4786417.4	293671.8	84.8	6.7
	FY3	4786407.0	293704.2	84.8	6.7
	FY4	4786429.1	293684.9	90.5	9.8
	FY5	4786321.1	293678.2	84.8	6.7
	FY6	4786331.9	293645.7	84.8	6.7
	FY7	4786370.2	293659.3	84.5	6.7
	FY8	4786359.7	292688.9	84.5	6.7

3.2 Previous Investigation

The information from the current investigation was supplemented with borehole and laboratory results from previous geotechnical investigations conducted by The Department of Highways, Ontario (DHO) in 1966 as part of the original design of each underpass structure.

The following previous geotechnical reports were obtained from the MTO GEOCREs library:

- Foundation Investigation Report for Gray's Side Road Underpass, Q.E.W., in the City of Hamilton, District No. 4, W.J. 66-F-1, W.P. 207-63, prepared by DHO, Foundations Section, dated March 7, 1966, GEOCREs No. 30M04-021;
- Foundation Investigation Report for Proposed Millen Road (Revised) Underpass at Q.E.W., Township of Saltfleet, District #4 (Hamilton), W.J. 66-F-7, W.P. 208-63, prepared by DHO, Foundations Section, dated March 9, 1966, GEOCREs No. 30M04-022;
- Foundations Investigation Report for Structure at the Crossing of Q.E.W. and Fruitland Rd., Twp. of Saltfleet, District #4 (Hamilton), W.J. 66-F-10, W.P. 209-63 prepared by DHO, Foundations Section, dated February 24, 1966, GEOCREs No. 30M04-023;
- Foundation Investigation Report for Glover Road Underpass of Q.E.W., District #4 (Hamilton), W.J. 66-F-6, W.P. 210-63, prepared by DHO, Foundations Section, dated February 1, 1966, GEOCREs No. 30M04-025;
- Foundation Investigation Report for Proposed Winona Road Underpass and Q.E.W., Twp of Saltfleet, County of Wentworth, District #4 (Hamilton), W.J. 66-F-49, W.P. 216-63, prepared by DHO, Foundations Section, dated July 7, 1966, GEOCREs No. 30M04-26: and



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- Foundation Investigation Report for Proposed Fifty Road Underpass and Q.E.W., Twp. of Saltfleet, Co. of Wentworth, District #4 (Hamilton), W.J. 66-F-55, W.P.217-63, prepared by DHO Foundations Section, dated July 14, 1966, GEOCREs No. 30M04-036.

The fieldwork for the previous investigations was carried out between March 11, 1965 and June 13, 1966, at which time thirty-four (34) boreholes were drilled at the six proposed bridge sites at the approximate locations shown on Drawings 1, 4, 7, 10, 13 and 16 for Gray's Road, Millen Road, Fruitland Road, Glover Road, Winona Road, and Fifty Road respectively.

The locations of the previous boreholes were taken from the drawings provided in the above referenced reports and plotted on the current drawings using the QEW and road crossing centreline as reference points. As a result, the borehole locations should be considered approximate. The geodetic elevations were converted directly from imperial units to metric units.

Copies of the Record of Borehole sheets from the previous investigations and associated laboratory test sheets, where available, are presented in Appendices A through F for Grays Road, Millen Road, Fruitland Road, Glover Road, Winona Road, and Fifty Road, respectively. A summary of the approximate locations, converted ground surface elevations and depths of the previous boreholes are provided below:

Bridge	Borehole	Approximate Location (m)		Ground Surface Elevation (m)	Depth (m)
		Northing	Easting		
Gray's Road (Geocres No. 30M04-021)	1	4789113.0	285615.9	77.9	22.9
	2	4789102.6	285607.1	78.2	7.0
	3	4789082.1	285608.3	78.6	14.6
	4	4789042.8	285600.9	79.1	19.8
	4A	4789040.3	285595.4	78.9	7.0
	5	4789040.8	285582.3	79.2	7.0
	6	4789027.0	285580.5	79.2	27.9
Millen Road (Geocres No. 30M04-22)	1	4788521.7	287051.3	79.2	18.3
	2	4788552.6	287042.6	78.9	17.2
	3	4788627.4	287065.4	78.6	15.3
	4	4788596.7	287065.3	78.6	14.8
Fruitland Road (Geocres No. 30M04-023)	1	4787921.6	288828.8	78.6	15.7
	2	4788002.8	288834.8	79.6	15.5
	3	4788028.8	288868.7	79.6	16.6
	4	4787964.9	288821.7	79.9	15.7
Glover Road (Geocres No. 30M04-025)	1	4787369.3	290505.8	80.8	11.0
	2	4787458.9	290534.9	80.5	12.2
	3	4787438.8	290541.1	80.5	12.0
	4	4787392.6	290529.4	80.5	10.7
	5	4787448.7	290523.7	80.8	11.6



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Bridge	Borehole	Approximate Location (m)		Ground Surface Elevation (m)	Depth (m)
		Northing	Easting		
	6	4787374.7	290524.6	80.5	5.0
Winona Road (Geocres No. 30M04-026)	1	4786601.8	292908.5	82.2	21.8
	2	4786573.1	292901.2	82.6	24.8
	3	4786577.2	292918.9	82.5	24.5
	4	4786614.3	292934.2	82.4	15.7
	5	4786674.1	292927.5	81.9	24.9
	6	4786658.0	292941.5	82.0	25.5
	7	4786641.2	292921.0	82.3	25.0
Fifty Road (Geocres No. 30M04-036)	1	4786425.7	293680.1	82.7	10.7
	2	4786397.2	293671.4	82.9	11.6
	3	4786412.9	293695.5	82.7	10.0
	4	4786309.4	293675.1	83.4	10.2
	5	4786345.4	293684.3	83.3	11.3
	6	4786339.3	293651.0	83.1	9.3

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

The project area for this investigation lies within the Niagara Fruit Belt section of the Iroquois Plain as delineated in *The Physiography of Southern Ontario*¹. The soils in the Niagara Fruit Belt, which lies between the Niagara Escarpment and Lake Ontario and extends eastward from Hamilton to the Niagara River, consist of low permeability clayey soils that were deposited within a former glacial lake over reddish shale bedrock of the Queenston Formation. The shale is highly fissile and breaks easily parallel to the bedding planes. The Iroquois Plain represents the lake bottom of former Lake Iroquois.

4.2 Subsoil Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes and the results of the in-situ and laboratory tests are given on the Record of Borehole sheets and laboratory test plots provided in Appendices A to F for each of the six bridge sites between Gray's Road to Fifty Road, respectively. The appendices include current and previous investigation results.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests (SPTs). These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change.

¹ Chapman, L.J and Putnam, D.F. 1984. *The Physiography of Southern Ontario, Third Edition*, Ontario Geological Survey Special Volume 2. Accompanied by Map P.2715, Scale 1:600,000.



Subsoil conditions will vary between and beyond the borehole locations. The inferred soil stratigraphy based on the results of the boreholes is shown on Drawings 1 to 18.

A detailed description of each bridge site and subsurface conditions encountered in the boreholes advanced from the current and previous investigations at each site is provided in the following sections.

4.2.1 Gray's Road Underpass

The Gray's Road Underpass carries northbound and southbound traffic (one lane in each direction) over the QEW, North Service Road and South Service Road. The Gray's Road pavement surface at the north and south abutments are at approximately Elevation 85.0 m and Elevation 85.5 m, respectively. The QEW pavement surface is at approximately Elevation 79.0 m and the North Service Road and South Service Road pavement surface is at approximately Elevation 79.5 m.

Boreholes G1 and G2 were advanced near the toe of the north abutment front slope on the west and east limits of the abutment and on the north shoulder of North Service Road. Boreholes G3 and G4 were advanced at the toe of the south abutment front slope near the west and east limits of the abutment and on the south shoulder of South Service Road. Borehole G5 was advanced in the southbound lane of Gray's Road through the north approach embankment near the north abutment. Borehole G6 was advanced in the northbound lane of Gray's Road through the south approach embankment near the south abutment. Boreholes G7 and G8 were advanced at the west and east sides of the centre pier (Pier B) at the Gray's Road Underpass on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from previous Boreholes 1 to 6 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-021). Boreholes 1 and 2 were advanced near the north and south abutment locations. Borehole 3 was advanced at the east side of Pier A. Boreholes 4, 4A and 5 were advanced at the east and west sides of Pier C. Borehole 6 was advanced near the south abutment location.

The borehole locations and stratigraphic profile through the Gray's Road centreline are shown on Drawing 1. The sections through each pier centreline are shown on Drawing 2 and the sections through each abutment are shown on Drawing 3.

The stratigraphy at the site generally consists of surficial asphalt underlain by sand and gravel fill which overlies clayey silt to silty clay till, underlain by silt to sandy silt, which is underlain by shale bedrock. At the approach embankments along Gray's Road, the asphalt is underlain by concrete and sand and gravel fill that is underlain by clayey silt to silty clay embankment fill which in turn overlies the native clayey silt to silty clay till.

4.2.1.1 Asphalt / Concrete

A surficial layer of asphalt was encountered in Boreholes G1 to G3 and G5 to G8 and is 0.1 m to 0.2 m thick. A layer of concrete (about 0.2 m thick) was encountered directly below the asphalt in Boreholes G5 and G6, which were located within the Gray's Road approach embankments.

4.2.1.2 Sand and Gravel Fill

A layer of sand and gravel fill was encountered below the asphalt / concrete in Boreholes G1 to G3 and G5 to G8 and at the ground surface of Borehole G4. This layer typically contains trace to some silt and trace clay.



The surface of the sand and gravel fill was encountered at depths ranging from ground surface to 0.4 m below ground surface (Elevation 85.1 m to 78.8 m) and is 0.6 m to 1.7 m thick.

The measured SPT 'N' values within the sand and gravel fill range from 10 to 56 blows per 0.3 m of penetration, indicating a compact to very dense relative density.

The results of three grain size distribution tests carried out on samples of the sand and gravel fill from the current investigation are shown on Figure A1.

The measured water content of seven samples of the sand and gravel fill from the current investigation range from 3 to 11 percent.

4.2.1.3 Clayey Silt to Silty Clay Fill

A layer of clayey silt to silty clay fill was encountered below the sand and gravel fill in Boreholes G1, G4, G5 and G6. The clayey silt to silty clay fill typically contains some sand and trace gravel. Organics (wood fibres) and shale fragments were also noted in this layer in Borehole G1 and G5 respectively. The surface of the clayey silt to silty clay fill was encountered at depths ranging from 0.6 m to 2.1 m below ground surface (Elevation 84.1 m to 78.1 m) and is 0.6 m to 5.2 m thick. A 0.3 m thick layer of clayey silt fill was also encountered below the silty sand fill in Borehole G5 at a depth of 9.5 m below ground surface (Elevation 75.9 m).

The measured SPT 'N' values within the clayey silt to silty clay fill range from 4 to 23 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency. Three field vane tests carried out within the clayey silt to silty clay fill indicated shear strengths greater than 50 kPa.

The results of three grain size distribution tests performed on samples of the clayey silt to silty clay fill from the current investigation are shown on Figure A2.

Atterberg limits testing carried out on four samples of the clayey silt to silty clay fill from the current investigation measured liquid limits ranging from 29 to 39 percent, plastic limits ranging from 14 to 22 percent and plasticity indices ranging from 12 to 16 percent. The results of the Atterberg limits testing are shown on Figure A3 and indicate that the material is a clayey silt to silty clay of low to medium plasticity.

The measured water contents of samples of the clayey silt to silty clay fill from the current investigation range from 13 to 23 percent and are typically near the plastic limit of the material.

4.2.1.4 Silty Sand Fill

A layer of silty sand fill was encountered below the clayey silt to silty clay fill in Borehole G5. This layer contains some gravel. The surface of the silty sand fill was encountered at a depth of 7.3 m below ground surface (Elevation 77.7 m) and is 1.8 m thick.

The measured SPT 'N' value within the silty sand fill was 13 blows per 0.3 m of penetration, indicating a compact relative density.

4.2.1.5 Clayey Silt to Silty Clay Till

A deposit of clayey silt to silty clay till was encountered in all boreholes advanced at this site (G1 to G8, 1 to 4, 4A, 5, and 6), however, the deposit was not classified as "Till" in the previous Record of Borehole sheets. The clayey silt to silty clay till typically contains trace to some sand and gravel. The surface of the clayey silt to silty



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clay till was encountered at depths ranging from ground surface (during the previous investigation) to 9.8 m below ground surface (at the Gray's Road embankment location during the current investigation) corresponding to Elevations ranging from 79.2 m to 75.6 m. The till deposit was 18.2 m to 19.8 m thick in three deep boreholes advanced during the previous investigation. Boreholes G1 to G8, 2, 3, 4A and 5 penetrated 0.3 m to 14.6 m into the clayey silt to silty clay till and were terminated at depths ranging from 6.7 m to 14.6 m below ground surface (Elevation 75.8 m to 64.0 m).

The measured SPT 'N' values within the clayey silt to silty clay till typically range from 8 to 48 blows per 0.3 m of penetration, suggesting a stiff to hard consistency. Two higher 'N' values of 113 and 120 were measured at the bottom of this deposit near the transition to the underlying silt to sandy silt layer. Dynamic Cone Penetration Tests (DCPTs) carried out below a depth of about 1 m in Boreholes 1 to 5 measured blow counts ranging from approximately 10 blows per 0.3 m of penetration to 100 blows per 0.23 m of penetration. The DCPT's generally increased with depth and were terminated upon effective refusal (100 blows per 0.3 m of penetration) at depths ranging from approximately 3 m to 6 m below ground surface (Elevation 76.2 m to 73.1 m). Field vane tests from the previous investigation indicate shear strengths ranging from approximately 60 kPa to greater than 100 kPa. Unconfined compression tests and quick triaxial tests carried out on samples of the clayey silt till deposit during the previous investigation indicate shear strengths ranging from approximately 30 kPa to 120 kPa. A summary of the results of the unconfined compression tests, quick triaxial tests and field vane tests (as interpreted from the previous Record of Borehole sheets) are provided below and indicate the clayey silt till deposit generally has a stiff consistency below Elevation 76 m:

Elevation (m)	Approximate Unconfined Compression Test Shear Strength (kPa)	Quick Triaxial Test Shear Strength (kPa)	Approximate Field Vane Test Shear Strength (kPa)
75 – 76	50 - 120		>100
74 – 75	50 - 70		75 - 80
73 – 74	45 - 115		60 - >100
72 – 73	50 - 65		65 - >100
71 – 72	45 - 100	40	75 - >100
70 – 71	65		80 - >100
69 – 70	55 - 80	75	>100
68 - 69		65 - 110	95
67 – 68	65		>100
66 – 67	40 - 60	50	60 - 80
65 – 66	80		75 - >100
64 – 65			>100
63 – 64	50		>100
62 – 63	30 - 80		
61 – 62			>100
60 - 61	80		
59 – 60	100		



The results of six grain size distribution tests carried out on samples of the clayey silt to silty clay till from the current investigation are shown on Figure A4. The results of three grain size distribution tests from the previous investigation are shown on the Record of Borehole sheets (5 and 6) in Appendix A.

Atterberg limits testing carried out on forty-five samples of the clayey silt to silty clay till from the current and previous investigations measured liquid limits ranging from 22 to 42 percent, plastic limits ranging from 15 to 23 percent and plasticity indices ranging from 7 to 25 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure A5. The results of the Atterberg limits testing from the previous investigation are shown on the Record of Borehole sheets in Appendix A. The results from the current and previous investigations indicate that the material is a clayey silt to silty clay of low to medium plasticity.

The measured water contents of samples of the clayey silt to silty clay till from the current and previous investigations range from 13 to 27 percent.

4.2.1.6 Silt to Sandy Silt

A layer of silt to sandy silt was encountered below the clayey silt to silty clay till in Boreholes 1, 4 and 6. This layer typically contains trace gravel. The surface of the silt to sandy silt layer was encountered at depths ranging from 18.2 m to 19.8 m below ground surface (Elevation 60.8 m to 59.4 m) and is 5.0 m thick in Borehole 6. Boreholes 1 and 4 penetrated 4.8 m and 1.5 m into the silt to sandy silt layer and were terminated at depths of 23.0 m and 19.8 m below ground surface (Elevation 55.0 m and 59.3 m).

The measured SPT 'N' values within the silt to sandy silt layer range from 60 blows per 0.3 m of penetration to about 100 blows per 0.03 m of penetration, indicating a very dense relative density. An unconfined compression test carried out on a sample of the silt to sandy silt from the previous investigation indicates a shear strength of approximately 100 kPa.

Atterberg limits testing carried out on one sample of the silt to sandy silt from the previous investigation measured a liquid limit of 22 percent, a plastic limit of 16 percent and a plasticity index of 6 percent as shown on the Record of Borehole sheet (1) in Appendix A and indicates that the material is a silt of low plasticity.

The measured water contents of three samples of the silt to sandy silt from the previous investigation range from 9 to 16 percent.

4.2.1.7 Shale Bedrock

Shale Bedrock was encountered below the silt to sandy silt layer in Borehole 6 during the previous investigation. The bedrock surface was encountered at a depth of 24.8 m below ground surface (Elevation 54.4 m) and was cored using a B-size core barrel for a length of 3.1 m. Bedrock samples obtained from the coring were described as containing greenish, shale carbonate stratifications. The total core recovery (TCR) was 70% and 100% for the two runs advanced as shown on the Record of Borehole sheet. The borehole was terminated in the shale bedrock at a depth of 27.9 m below ground surface (Elevation 51.4 m).

4.2.1.8 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt to silty clay till in Borehole G4 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix A. The



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water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
G1	79.5	Dry	-	Jan. 21, 2010	Open Borehole
G2	79.5	Dry	-	Jan. 21, 2010	Open Borehole
G3	79.5	Dry	-	Jan. 21, 2010	Open Borehole
G4	79.5	Dry 2.8	- 76.7	Jan. 21, 2010 Mar. 19, 2010	Open Borehole Piezometer
G5	85.0	Dry	-	Jan. 22, 2010	Open Borehole
G6	85.5	Dry	-	Jan. 22, 2010	Open Borehole
G7	79.0	Dry	-	Feb. 1, 2010	Open Borehole
G8	79.0	Dry	-	Feb. 1, 2010	Open Borehole
1	77.9	1.2	76.7	Jan. 9, 1966	Open Borehole
2	78.2	3.4	74.8	Jan. 9, 1966	Open Borehole
3	78.6	1.6	77.0	Jan. 12, 1966	Open Borehole
4	79.1	1.7	77.4	Jan. 14, 1966	Open Borehole
4A	78.9	1.9	77.0	Jan. 17, 1966	Open Borehole
5	79.2	2.2	77.0	Jan. 17, 1966	Open Borehole
6	79.2	0.6	78.6	Mar. 11, 1965	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within the granular soils above the cohesive fill and till deposits.

4.2.2 Millen Road Underpass

The Millen Road Underpass carries northbound and southbound traffic over the QEW, North Service Road and South Service Road. The Millen Road pavement surface at the north and south abutments is at approximately Elevation 85.5 m and at Elevation 86.5 m, respectively. The QEW pavement surface is at approximately Elevation 79.5 m and the North Service Road and South Service Road pavement surface is at approximately Elevation 79.5 m and 79.8 m, respectively.

Boreholes M1 and M2 were advanced near the toe of the north abutment front slope on the east and west sides of the abutment and on the north shoulder of North Service Road. Boreholes M5 and M6 were advanced near the toe of the south abutment front slope on the east and west sides of the abutment and on the South Service Road. Borehole M4 was advanced in the southbound lane of Millen Road through the south approach embankment near the south abutment. Borehole M3 was advanced in the northbound lane of Millen Road



through the north approach embankment, near the north abutment. Boreholes M7 and M8 were advanced at the west and east sides of the Centre pier (Pier B) at the Millen Road Underpass on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from Boreholes 1 to 4 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-022). Boreholes 1 and 3 were advanced near the south and north abutment locations. Borehole 2 was drilled at the west side of Pier C and Borehole 4 was drilled at the east side of Pier A. The abutment and pier structures did not exist at the time of the previous investigation.

The borehole locations and stratigraphic profile through the Millen Road Underpass are shown on Drawing 4. The sections through each pier centreline are shown on Drawing 5 and the sections through each abutment are shown on Drawing 6.

The stratigraphy generally consists of surficial asphalt underlain by sand and gravel fill and clayey silt fill which overlies clayey silt till which is underlain by inferred bedrock. At the approach embankments along Millen Road, the asphalt is underlain by concrete and sand and gravel fill that is underlain by clayey silt to silty sand embankment fill which in turn is underlain by the native clayey silt till.

4.2.2.1 *Asphalt / Concrete*

A surficial layer of asphalt was encountered in Boreholes M3 to M8 and is 0.1 m to 0.4 m thick. A layer of concrete (about 0.3 m thick) was encountered directly below the asphalt in Boreholes M3 and M4, which were located within the Millen Road approach embankment.

4.2.2.2 *Gravelly Sand to Sand and Gravel Fill*

A layer of gravelly sand to sand and gravel fill was encountered in Boreholes M1, M3, M4, M6, M7 and M8. This layer typically contains trace to some silt and trace clay. The surface of the gravelly sand to sand and gravel fill layer was encountered at depths ranging from ground surface to 0.5 m below ground surface (Elevation 86.0 m to 79.4 m) and is 0.4 m to 3.3 m thick.

The measured SPT 'N' values within the gravelly sand to sand and gravel fill range from 6 to 65 blows per 0.3 m of penetration, indicating a loose to very dense relative density.

The results of four grain size distributions tests carried out on samples of the gravelly sand to sand and gravel from the current investigation are shown on Figure B1.

The measured water contents of six samples of the gravelly sand to sand and gravel fill from the current investigation range from 0.2 to 12 percent.

4.2.2.3 *Silty Sand to Sand and Silt Fill*

Layers of silty sand to sand and silt fill were encountered at the ground surface in Borehole M2, within the clayey silt embankment fill in Borehole M4, and below the asphalt and gravelly sand fill in Boreholes M5 and M6, respectively. The silty sand to sand and silt fill typically contains trace clay and trace gravel. Organics were also noted in this layer in Borehole M5. The surface of the silty sand to sand and silt fill was encountered at depths ranging from ground surface to 5.6 m below ground surface (Elevation 79.0 m to 80.9 m) and is 0.6 m to 1.5 m thick.



The results of two grain size distribution tests carried out on samples of the sand and silt fill from the current investigation are shown on Figure B2.

A laboratory organic content test carried out on a sample of the sand and silt fill in Borehole M5 from the current investigation shows 2.7 percent organic content.

The measured water contents of four samples of the silty sand to sand and silt fill from the current investigation range from 4 to 16 percent.

4.2.2.4 Clayey Silt Fill

A layer of clayey silt fill was encountered below the gravelly sand to sand and gravel fill and silty sand fill in Boreholes M1 to M4, M7 and M8. This layer typically contains trace to some sand and trace gravel. Organics were present within this layer in Boreholes M4, M7 and M8. The surface of the clayey silt fill was encountered at depths ranging from 0.5 m to 3.8 m below ground surface (Elevation 83.8 m to 78.4 m) and is 0.3 m to 6.5 m thick.

The measured SPT 'N' values within the clayey silt fill range from 6 to 30 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency.

The results of five grain size distribution tests carried out on samples of the clayey silt fill from the current investigation are shown on Figure B3.

Atterberg limits testing carried out on three samples of the clayey silt fill from the current investigation measured liquid limits ranging from 30 to 34 percent, plastic limits ranging from 16 to 18 percent and plasticity indices ranging from 15 to 17 percent. The results of the Atterberg limits testing are shown on Figure B4 and indicate that the material is a clayey silt of low plasticity.

The measured water contents of eight samples of the clayey silt fill from the current investigation range from 14 to 20 percent and are typically near the plastic limit of the material.

4.2.2.5 Silty Sand

A layer of silty sand was encountered at the ground surface (Elevation 78.6 m) in Borehole 3 advanced during the previous investigation and was 1.5 m thick. A layer of silty sand with gravel was also encountered in Borehole 3 at a depth of 13.1 m below ground surface (Elevation 65.5 m) and was penetrated 2.2 m before the borehole was terminated at a depth of 15.3 m below ground surface (Elevation 63.3 m) upon effective refusal on inferred bedrock. A layer of silty sand was also encountered within the clayey silt till deposit in Borehole M8 at a depth of 3.0 m below ground surface (Elevation 76.5 m) and is 0.5 m thick.

The measured SPT 'N' values within the silty sand layers were 15 blows per 0.3 m of penetration to 100 blows per 0.05 m of penetration, indicating a compact to very dense relative density.

The measured water contents of four samples of the silty sand from the previous and current investigations range from 8 to 18 percent.

4.2.2.6 Clayey Silt Till

A deposit of clayey silt till was encountered in all boreholes advanced in this area (M1 to M8, 1 to 4), however, the deposit was not classified as "Till" in the previous Record of Borehole sheets. The clayey silt to silty clay till



deposit typically contains trace to some sand and gravel. The surface of the clayey silt till deposit was encountered at depths ranging from ground surface (during the previous investigation) to 9.1 m below ground surface (at the Millen Road approach embankments) corresponding to Elevations ranging from 79.2 m to 77.1 m. The till deposit was 11.5 m to 18.3 m thick in the four deep boreholes (1 to 4) advanced during the previous investigation. Boreholes M1 to M8 penetrated 0.5 m to 5.2 m into the clayey silt till and were terminated at depths ranging from 6.6 m to 9.6 m below ground surface (Elevation 76.9 m to 72.8 m).

The measured SPT 'N' values within the clayey silt till range from 4 blows per 0.3 m of penetration to about 123 blows per 0.15 m of penetration, suggesting a firm to hard consistency. Dynamic Cone Penetration Tests (DCPT's) carried out below a depth of about 1 m below ground surface near Boreholes 1, 3 and 4 measured blow counts ranging from approximately 10 to 100 blows per 0.3 m of penetration. The DCPT values generally increased with depth and were terminated upon effective refusal (i.e. 100 blows per 0.3 m of penetration) at depths ranging from approximately 3 m to 6 m below ground surface (Elevation 75.9 m to 72.8 m). Field vane tests within the clayey silt till from the previous investigation indicate shear strengths ranging from approximately 55 kPa to greater than 100 kPa. Unconfined compression tests carried out on samples of the clayey silt till from the previous investigation indicate shear strengths ranging from approximately 40 kPa to greater than 170 kPa. A summary of the shear strength results from the unconfined compression tests and field vane tests (as interpreted from the previous Record of Borehole Sheets) are provided below:

Elevation (m)	Approximate Unconfined Compression Test Shear Strength (kPa)	Approximate Field Vane Test Shear Strength (kPa)
75 – 76	60	
74 – 75	40 - 70	70 - >100
73 – 74		55 - 75
72 – 73	60 - 85	75 - 100
71 – 72	60 - 70	75 - >100
70 – 71	50	>100
69 – 70	55 - >170	60
68 – 69	80	
67 – 68		>100
66 – 67	>160	>100

The results of the field vane and unconfined compression tests indicate the clayey till is firm to very stiff, and generally has a stiff consistency below Elevation 76 m.

The results of eight grain size distribution tests carried out on samples of the clayey silt till from the current investigation are shown on Figures B5A and B5B. The results of three grain size distribution tests carried out on samples of the clayey silt from the previous investigation are also provided in Appendix B.

Atterberg limits testing carried out on thirty-seven samples of the clayey silt till from the previous and current investigations measured liquid limits ranging from 22 to 40 percent, plastic limits ranging from 14 to 23 percent



and plasticity indices ranging from 6 to 19 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure B6 and the results from the previous investigation are also provided in Appendix B which indicate that the material is a clayey silt of low to medium plasticity.

The measured water contents of samples of the clayey silt till from the previous and current investigations range from 12 to 26 percent.

4.2.2.7 Shale Bedrock

Bedrock was inferred upon effective refusal to penetrate with the split-spoon sampler in Boreholes 1 to 4 at depths ranging from 14.8 m to 18.3 m below ground surface (Elevation 63.8 m to 61.0 m).

Shale Bedrock was sampled at a depth of 14.7 m below ground surface (Elevation 63.9 m) in Borehole 4 during the previous investigation. Bedrock was penetrated 0.1 m and the borehole was terminated at a depth of 14.8 m below ground surface (Elevation 63.8 m). No bedrock coring was performed.

Two measured SPT 'N' values within the shale bedrock were 113 blows per 0.15 m of penetration and 100 blows per 0.03 m of penetration.

4.2.2.8 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt fill (above the clayey silt till interface) in Borehole M4 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix B. The water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
M1	79.5	Dry	-	Dec. 22, 2009	Open Borehole
M2	79.5	Dry	-	Dec. 22, 2009	Open Borehole
M3	85.2	Dry	-	Dec. 23, 2009	Open Borehole
M4	86.5	Dry	-	Dec. 23, 2009	Open Borehole
		7.6	78.9	Mar. 17, 2010	Piezometer
M5	79.8	Dry	-	Jan. 29, 2010	Open Borehole
M6	79.8	Dry	-	Jan. 29, 2010	Open Borehole
M7	79.5	Dry	-	Feb. 1, 2010	Open Borehole
M8	79.5	Dry	-	Feb. 1, 2010	Open Borehole
1	79.2	0.9	78.3	Jan. 17, 1966	Open Borehole
2	78.9	0.9	78.0	Jan. 19, 1966	Open Borehole
3	78.6	0.7	77.9	Jan. 27, 1966	Open Borehole
4	78.6	-	-	-	-



It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within granular soils above the cohesive fill and till deposits.

4.2.3 Fruitland Road Underpass

The Fruitland Road Underpass carries northbound and southbound traffic over the QEW, S-W ramp and the N-E ramp. The Fruitland Road pavement surface at the north and south abutments is at approximately Elevation 86.5 m and Elevation 87.5 m, respectively. The QEW pavement surface is at approximately Elevation 80.5 m. The surface of the pavement where the S-E ramp and N-W ramp pass under the bridge is at about Elevation 80.5 m.

Boreholes F1 and F2 were advanced near the toe of the north abutment front slope on the east and west sides of the abutment and on the north shoulder of the S-W ramp. Boreholes F4 and F5 were advanced near the toe of the south abutment front slope on the east and west sides of the Fruitland Road Underpass and on the paved surface of the N-E ramp. Borehole F3 was advanced in the southbound lane of Fruitland Road through the north approach embankment near the north abutment. Borehole F6 was advanced in the northbound lane of Fruitland Road through the south approach embankment near the south abutment. Boreholes F7 and F8 were advanced at the west and east sides of the centre pier (Pier B) of the Fruitland Road Underpass on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from Boreholes 1 to 4 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-023). Boreholes 1 and 3 were advanced near the south and north abutment locations. Borehole 2 was drilled near the west side of Pier A and Borehole 4 was drilled near the west side of Pier C. The abutment and pier structures did not exist at the time of the previous investigation.

The borehole locations and stratigraphic profile through the Fruitland Road Underpass are shown on Drawing 7. The sections through each pier centreline are shown on Drawing 8 and the sections through each abutment are shown on Drawing 9.

The stratigraphy generally consists of surficial asphalt / concrete underlain by sand and gravel fill and clayey silt to silt clay fill which overlies clayey silt to silty clay till underlain by sandy silt to silty sand which is underlain by shale bedrock.

4.2.3.1 Asphalt / Concrete

A surficial layer of asphalt was encountered in Boreholes F1 and F3 to F8 and is 0.2 m to 0.3 m thick. A layer of concrete (about 0.2 m thick) was encountered directly below the asphalt in Boreholes F3 and F6 which were located within the Fruitland Road approach embankments.

4.2.3.2 Gravelly Sand to Sand and Gravel Fill

A layer of gravelly sand to sand and gravel fill was encountered in Boreholes F1 to F8. This layer typically contains trace to some silt and trace clay. The surface of the gravelly sand to sand and gravel fill layer was encountered at depths ranging from ground surface to 0.3 m below ground surface (Elevation 87.2 m to 80.2 m) and is 0.2 m to 1.9 m thick.

The measured SPT 'N' values within the gravelly sand to sand and gravel fill range from 11 blows per 0.3 m of penetration to 70 blows per 0.15 m of penetration, indicating a compact to very dense relative density.



The results of three grain size distribution tests carried out on samples of the gravelly sand to sand and gravel fill from the current investigation are shown on Figure C1.

The measured water contents of seven samples of the gravelly sand to sand and gravel fill from the current investigation range from 3 to 11 percent.

4.2.3.3 Clayey Silt to Silty Clay Fill

A layer of clayey silt to silty clay fill was encountered below the gravelly sand to sand and gravel fill in Boreholes F1 to F7. This layer typically contains trace to some sand and trace gravel. The surface of the clayey silt to silty clay fill was encountered at depths ranging from 0.2 m to 2.2 m below ground surface (Elevation 85.3 m to 79.0 m) and is 0.3 m to 6.5 m thick.

The measured SPT 'N' values within the clayey silt to silty clay fill range from 5 to 22 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency. Field vane tests carried out within the clayey silt fill indicated shear strengths greater than 50 kPa.

The results of four grain size distribution tests carried out on samples of the clayey silt to silty clay fill from the current investigation are shown on Figure C2.

Atterberg limits testing carried out on five samples of the clayey silt to silty clay fill from the current investigation measured liquid limits ranging from 27 to 37 percent, plastic limits ranging from 17 to 20 percent and plasticity indices ranging from 9 to 19 percent. The results of the Atterberg limits testing are shown on Figure C3 and indicate that the material is a clayey silt to silty clay of low to medium plasticity.

The measured water contents of ten samples of the clayey silt to silty clay fill from the current investigation range from 10 to 17 percent.

4.2.3.4 Clayey Silt to Silty Clay Till

A deposit of clayey silt to silty clay till was encountered below the fill soils in all of the current boreholes advanced in this area (F1 to F8). The clayey silt to silty clay till deposit was encountered at the ground surface in all of the previous boreholes (1 to 4); however, the deposit was not classified as "Till" in the previous Record of Boreholes sheets. The clayey silt to silty clay till typically contains trace to some sand and gravel. The surface of the clayey silt to silty clay till was encountered at depths ranging from ground surface to 8.7 m below ground surface (Elevation 79.9 m to 78.2 m) and is 12.6 m to 14.9 m thick based on the boreholes advanced during the previous investigation. Boreholes F1 to F8 penetrated 1.1 m to 4.9 m into the clayey silt to silty clay till and were terminated at depths ranging from 6.7 m to 9.8 m below ground surface (Elevation 77.8 m to 73.8 m).

The measured SPT 'N' values within the clayey silt to silty clay till range from 15 blows per 0.3 m of penetration to about 100 blows per 0.18 m of penetration, suggesting a stiff to hard consistency. Dynamic Cone Penetration tests (DCPT's) carried out within the till deposit below a depth of about 1 m below ground surface (near Boreholes 1 to 3) measured blow counts ranging from approximately 10 blows to 100 blows per 0.3 m of penetration. The DCPT values generally increased with depth and were terminated upon effective refusal (i.e. 100 blows per 0.3 m of penetration) at depths ranging from approximately 3 m to 4 m below ground surface (Elevation 77 m to 75 m). Field vane tests within the clayey silt to silty clay till in the previous investigation indicate shear strengths greater than 100 kPa. Unconfined compression tests carried out on two samples of the clayey silt till from the previous investigation indicate shear strengths of approximately 170 kPa and 200 kPa. A



summary of the shear strength results from the unconfined compression tests and field vane tests, as interpreted from the previous Record of Borehole sheets, is provided below:

Elevation (m)	Approximate Unconfined Compression Test Shear Strength (kPa)	Approximate Field Vane Test Shear Strength (kPa)
74 – 75	170	>100
73 – 74	200	
72 – 73		>100

The results of the field vane and unconfined compression tests indicate the clayey silt till is very stiff to hard between Elevation 75 to 72 m.

The results of six grain size distribution tests carried out on samples of the clayey silt to silty clay till from the current investigation are shown on Figure C4. The results of eight grain size distribution tests performed on samples of the clayey silt to silty clay till from the previous investigation are also provided in Appendix C.

Atterberg limits testing carried out on thirty-seven samples of the clayey silt to silty clay till from the current and previous investigations measured liquid limits ranging from 22 to 38 percent, plastic limits ranging from 13 to 21 percent and plasticity indices ranging from 8 to 19 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure C5 and the results from the previous investigation are provided in Appendix C. The results from the current and previous investigation indicate that the material is a clayey silt to silty clay of low to medium plasticity.

The measured water contents of samples of the clayey silt to silty clay till range from 7 to 16 percent and is typically near the plastic limit of the material.

4.2.3.5 Sandy Silt to Silty Sand

A layer of sandy silt to silty sand was encountered below the clayey silt to silty clay till in Boreholes 1 to 3 from the previous investigation. The sandy silt to silty sand layer contains some gravel. The surface of the sandy silt to silty sand layer was encountered at depths ranging from 12.6 m to 14.9 m below ground surface (Elevation 66.0 m to 64.6 m) and is 0.8 m to 1.6 m thick.

The measured SPT 'N' values within the sandy silt to silty sand range from 100 blows per 0.3 m of penetration to about 152 blows per 0.1 m of penetration, indicating a very dense relative density.

The results of three grain size distribution tests carried out on samples of the sandy silt to silty sand from the previous investigation are also shown in Appendix C.

Atterberg limits testing carried out on one sample of the sandy silt measured a liquid limit of 18 percent, a plastic limit of 15 percent and a plasticity index of 3 percent. The results of the Atterberg limits testing are also shown in Appendix C and indicate that the material is a sandy silt of low plasticity.

The measured water contents of three samples of the sandy silt to silty sand from the previous investigation range from approximately 9 to 11 percent.



4.2.3.6 Shale Bedrock

Bedrock was inferred upon effective refusal to penetrate the split-spoon sampler in Borehole 1 to 4 at depths ranging from 13.9 m to 16.6 m below ground surface (Elevation 65.8 m to 63.0 m).

Shale Bedrock was sampled in Boreholes 1 and 4 from the previous investigation and was described as weathered. The surface of the shale was encountered at depths of about 14.2 m and 13.9 m below ground surface (Elevation 64.5 m and 65.8 m), respectively. Boreholes 1 and 4 penetrated about 1.6 m into the shale; however, no bedrock coring was performed. Boreholes 1 to 4 were terminated at depths ranging from 15.5 m to 16.6 m below ground surface (Elevation 62.9 m and 64.2 m).

Two measured SPT 'N' values within the shale were 100 blows per 0.08 m of penetration and 100 blows per 0.05 m of penetration.

4.2.3.7 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt till in Borehole F2 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix C. The water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
F1	80.5	Dry	-	Feb. 2, 2010	Open Borehole
F2	80.8	Dry 3.3	- 77.5	Feb. 2, 2010 Mar. 19, 2010	Open Borehole Piezometer
F3	86.3	Dry	-	Feb. 2, 2010	Open Borehole
F4	80.5	Dry	-	Feb. 3, 2010	Open Borehole
F5	80.5	Dry	-	Feb. 3, 2010	Open Borehole
F6	87.5	Dry	-	Feb. 3, 2010	Open Borehole
F7	80.5	Dry	-	Feb. 12, 2010	Open Borehole
F8	80.5	Dry	-	Feb. 12, 2010	Open Borehole
1	78.6	3.3	75.3	Jan. 19, 1966	Open Borehole
2	79.6	1.3	78.3	Jan. 24, 1966	Open Borehole
3	79.6	1.3	78.3	Jan. 26, 1966	Open Borehole
4	79.9	2.9	77.0	Mar. 16, 1965	Open Borehole



It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within granular soils above the cohesive fill and till deposits.

4.2.4 Glover Road

The Glover Road Underpass carries northbound and southbound traffic over the QEW, North Service Road and South Service Road. The Glover Road pavement surface at the north and south abutments is at approximately Elevation 87.0 m and at Elevation 88.0 m, respectively. The QEW pavement surface is at approximately Elevation 81.5 m. The North Service Road and South Service Road pavement surface is at approximately Elevation 81.3 m and 81.5 m, respectively, near the bridge site.

Boreholes GL1 and GL2 were advanced near the toe of the north abutment front slope on the west and east sides of the Glover Road Underpass and on the north side of North Service Road. Boreholes GL5 and GL6 were advanced near the toe of the south abutment front slope on the east and west sides of the Glover Road Underpass and on the south side of South Service Road. Borehole GL3 was advanced in the northbound lane of Glover Road through the south approach embankment, near the south abutment. Borehole GL4 was advanced in the southbound lane of Glover Road through the north approach embankment near the north abutment. Boreholes GL7 and GL8 were advanced at the west and east sides of the centre pier (Pier B) on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from Boreholes 1 to 6 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-025). Boreholes 1 and 2 were drilled near the south and north abutment locations, respectively. Boreholes 3 and 5 were drilled near the east and west sides of Pier A, Borehole 4 was drilled near the east side of Pier C and Borehole 6 was drilled near the east side of the south abutment. The abutment and pier structures did not exist at the time of the previous investigation.

The borehole locations and stratigraphic profile through the Glover Road Underpass are shown on Drawing 10. The sections through each pier centreline are shown on Drawing 11 and the sections through each abutment are shown on Drawing 12.

The stratigraphy generally consists of surficial asphalt / concrete underlain by sand and gravel fill and clayey silt fill which overlies clayey silt till which is underlain by bedrock. A thin clayey silt layer (containing organics) was encountered in Boreholes GL1, GL2 and GL5 between the fill soils and the clayey silt till soils.

4.2.4.1 Asphalt / Concrete

A surficial layer of asphalt was encountered in all current Boreholes GL1 to GL8 and is 0.2 m to 0.3 m thick. A layer of concrete (about 0.2 m thick) was encountered directly below the asphalt in Borehole GL3 and GL4, which were located within the Glover Road approach embankments.

4.2.4.2 Gravelly Sand to Sand and Gravel Fill

A layer of gravelly sand to sand and gravel fill was encountered below the asphalt / concrete in Boreholes GL1 to GL8. This layer typically contains trace to some silt and trace clay. The surface of the gravelly sand to sand and gravel fill was encountered at depths ranging from 0.2 m to 0.4 m below ground surface (Elevation 87.7 to 81.0 m) and is 1.2 m to 2.1 m thick.



The measured SPT 'N' values within the gravelly sand to sand and gravel fill range from 7 blows per 0.3 m of penetration to 54 blows per 0.15 m of penetration, indicating a loose to very dense (generally dense) relative density.

The results of four grain size distribution tests carried out on samples of the gravelly sand to sand and gravel fill from the current investigation are shown on Figure D1.

The measured water contents of eight samples of the gravelly sand to sand and gravel fill from the current investigation range from 2 to 6 percent.

4.2.4.3 Clayey Silt Fill

A layer of clayey silt fill was encountered below the gravelly sand to sand and gravel fill in Boreholes GL3 and GL4 which were located within the approach embankments. The clayey silt fill typically contains some sand, trace gravel and organics. The surface of the clayey silt fill was encountered at a depth of 2.3 m below ground surface (Elevation 85.7 m and 84.6 m in Boreholes GL3 and GL4, respectively) and is 5.3 m thick. A 0.2 m thick layer of sand and gravel fill was encountered within the clayey silt fill in Borehole GL4 at a depth of 2.7 m below ground surface (Elevation 84.2 m).

The measured SPT 'N' values within the clayey silt fill range from 4 to 10 blows per 0.3 m of penetration, suggesting a firm to stiff consistency. Three field vane tests carried out within the clayey silt fill measured shear strengths greater than 50 kPa, indicating a stiff consistency.

The results of three grain size distribution tests carried out on samples of the clayey silt fill from the current investigation are shown on Figure D2.

Atterberg limits testing carried out on three samples of the clayey silt fill from the current investigation measured liquid limits ranging from 29 to 30 percent, plastic limits ranging from 16 to 18 percent and plasticity indices ranging from 11 to 14 percent. The results of the Atterberg limits testing are shown on Figure D3 and indicate that the material is a clayey silt of low plasticity.

The measured water contents of five samples of the clayey silt fill from the current investigation range from 14 to 19 percent.

4.2.4.4 Clayey Silt with Organics

A layer of clayey silt with organics was encountered below the sand and gravel fill in Boreholes GL1, GL2 and GL5. The clayey silt typically contains some sand and trace gravel. The surface of the clayey silt layer was encountered at depths of 1.5 m to 2.3 m below ground surface (Elevation 80.0 m to 79.0 m) and is 0.5 m to 0.8 m thick.

The measured SPT 'N' values within the clayey silt with organics layer range from 14 to 24 blows per 0.3 m of penetration, suggesting a stiff to very stiff consistency.

The results of two grain size distribution tests carried out on samples of the clayey silt with organics layer from the current investigation are shown on Figure D4.

Atterberg limits testing carried out on two samples of the clayey silt with organics layer from the current investigation measured liquid limits of 31 and 34 percent, plastic limits of 14 and 19 percent and plasticity indices



of 17 and 15 percent. The results of the Atterberg limits testing are shown on Figure D5 and indicate that the material is a clayey silt of low plasticity.

A laboratory organic content test carried out on a sample of the clayey silt from Borehole GL5 shows 4.1 percent organic content.

The measured water contents of three samples of the clayey silt with organics layer from the current investigation range from 11 to 19 percent.

4.2.4.5 Clayey Silt Till

A deposit of clayey silt till was encountered in all boreholes advanced in this area (GL1 to GL8, 1 to 6), however, the deposit was not classified as "Till" in the previous Record of Borehole sheets. The clayey silt till typically contains trace to some sand and trace gravel. Cobbles / boulders were inferred within this layer in Borehole GL8. The surface of the clayey silt till was encountered at depths ranging from ground surface (during the previous investigation) to 8.2 m below ground surface (at the Glover Road approach embankments) corresponding to Elevations ranging from 80.8 m to 78.4 m. The till deposit was 11.1 m thick in one borehole (Borehole 3), which was terminated within inferred bedrock. Boreholes GL1 to GL8, 1, 2, 4, 5 and 6 penetrated 1.6 m to 12.2 m into the clayey silt till deposit and were terminated at depths ranging from 3.1 m to 12.2 m below ground surface (Elevation 78.5 m to 68.3 m). Boreholes GL8 and 5 were terminated at a depth of 3.1 m and 11.6 m below ground surface (Elevation 78.5 m and 69.1 m) upon auger refusal on an inferred cobble / boulder within the clayey silt till.

The measured SPT 'N' values within the clayey silt till range from 15 blows to 89 blows per 0.3 m of penetration suggesting a very stiff to hard consistency. A Dynamic Cone Penetration Test (DCPT) carried out in Borehole 1 measured blow counts ranging from about 10 blows per 0.3 m of penetration to greater than 100 blows per 0.3 m of penetration. The DCPT values generally increased with depth and the test was terminated upon effective refusal (i.e. greater than 100 blows per 0.3 m of penetration) at a depth of about 3 m below ground surface (Elevation 77.8 m).

The results of three grain size distribution tests carried out on samples of the clayey silt till from the current investigation are shown on Figure D6. The results of four grain size distribution tests performed on samples of the clayey silt from the previous investigation are also provided in Appendix D.

Atterberg limits testing carried out on twenty-nine samples of the clayey silt till from the previous and current investigations measured liquid limits ranging from 25 to 34 percent, plastic limits ranging from 13 to 20 percent and plasticity indices ranging from 9 to 17 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure D7 and the results from the previous investigation are shown on the Record of Borehole sheets in Appendix D. The Atterberg limits testing results from the current and previous investigation indicate that the material is a clayey silt of low plasticity.

The measured water contents of samples of the clayey silt till range from 11 to 15 percent and is typically near the plastic limit of the material.

4.2.4.6 Shale Bedrock

Shale Bedrock was inferred in Borehole 3 during the previous investigation. The bedrock surface is shown to be encountered at a depth of 11.1 m below ground surface (Elevation 69.3 m). Borehole 3 penetrated 0.9 m into



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the shale and the borehole was terminated at a depth of 12.0 m below ground surface (Elevation 68.4 m). No bedrock coring was performed.

The shale is described as highly weathered in the previous Record of Borehole sheet.

4.2.4.7 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt fill and clayey silt till in Borehole GL3 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix D. The water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
GL1	81.3	Dry	-	Jan. 27, 2010	Open Borehole
GL2	81.3	Dry	-	Jan. 27, 2010	Open Borehole
GL3	88.0	Dry 7.9	- 80.1	Jan. 27, 2010 Mar. 17, 2010	Open Borehole Piezometer
GL4	86.9	Dry	-	Jan. 29, 2010	Open Borehole
GL5	81.5	Dry	-	Feb. 1, 2010	Open Borehole
GL6	81.5	Dry	-	Feb. 1, 2010	Open Borehole
GL7	81.5	Dry	-	Feb. 11, 2010	Open Borehole
GL8	81.5	Dry	-	Feb. 11, 2010	Open Borehole
1	80.8	2.6	78.2	Jan. 10, 1966	Open Borehole
2	80.5	1.3	79.2	Jan. 11, 1966	Open Borehole
3	80.5	1.3	79.2	Jan. 13, 1966	Open Borehole
4	80.5	1.3	79.2	Jan. 13, 1966	Open Borehole
5	80.8	4.0	76.8	Mar. 18, 1965	Open Borehole
6	80.5	1.3	79.2	Jan. 14, 1966	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within granular soils above the cohesive fill and till deposits.

4.2.5 Winona Road

The Winona Road Underpass carries northbound and southbound traffic over the QEW, North Service Road and South Service Road. The Winona Road pavement surface at the north and south abutments is at approximately Elevation 89.0 m and 89.5 m, respectively. The QEW pavement surface is at approximately Elevation 83.0 m and the North Service Road and South Service Road pavement surface is at approximately Elevation 83.5 m and 84.0 m, respectively.



Boreholes W1 and W2 were advanced near the toe of the south abutment front slope on the east and west sides of the abutment and on the south shoulder of South Service Road. Boreholes W3 and W4 were advanced near the toe of the north abutment front slope on the west and east sides of the abutment and on the north edge of North Service Road. Borehole W5 was advanced in the northbound lane of Winona Road through the south approach embankment near the south abutment. Borehole W6 was advanced in the northbound lane of Winona Road through the north approach embankment near the north abutment. Boreholes W7 and W8 were advanced at the west and east sides of the centre pier (Pier B) on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from Boreholes 1 to 7 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-026). Borehole 1 was drilled near the west side of Pier C. Boreholes 2 and 5 were drilled near the south and north abutments, respectively. Borehole 3 was drilled between the south abutment and Pier C and Borehole 6 was drilled between the north abutment and Pier A. Borehole 4 was drilled on the east side of Pier B and Borehole 7 was drilled near the west side of Pier A. The abutment and pier structures did not exist at the time of the previous investigation.

The borehole locations and stratigraphic profile through the Winona Road Underpass are shown on Drawing 13. The sections through each pier centreline are shown on Drawing 14 and the sections through each abutment are shown on Drawing 15.

The stratigraphy generally consists of surficial asphalt underlain by sand and gravel fill and clayey silt fill which is underlain by clayey silt to silty clay till.

4.2.5.1 *Asphalt*

A surficial layer of asphalt was encountered in Boreholes W3 to W8 and is 0.1 m to 0.2 m thick.

4.2.5.2 *Gravelly Sand to Sand and Gravel Fill*

A layer of gravelly sand to sand and gravel fill was encountered in Boreholes W1 to W8. This layer typically contains trace to some silt and trace clay. The surface of the gravelly sand to sand and gravel fill layer was encountered at depths ranging from ground surface to 0.2 m below ground surface (Elevation 89.5 m to 82.8 m) and is 0.7 m to 2.0 m thick.

The measured SPT 'N' values within the gravelly sand to sand and gravel fill layer range from 5 blows per 0.3 m of penetration to 100 blows per 0.25 m of penetration, indicating a loose to very dense relative density.

The results of three grain size distribution tests carried out on samples of the gravelly sand to sand and gravel fill layer from the current investigation are shown on Figure E1.

The measured water contents of eight samples of the gravelly sand to sand and gravel fill layer range from 4 to 8 percent.

4.2.5.3 *Clayey Silt Fill*

A layer of clayey silt fill was encountered below the gravelly sand to sand and gravel fill in Boreholes W1 to W6. The clayey silt fill typically contains some sand and trace gravel. Organics were present within the clayey silt fill in Borehole W4. The surface of the clayey silt fill was encountered at depths ranging from 0.8 m to 1.5 m below ground surface (Elevation 88.2 m to 82.0 m) and is 0.7 m to 6.2 m thick.



The measured SPT 'N' values within the clayey silt fill range from 4 to 14 blows per 0.3 m of penetration, suggesting a firm to stiff consistency.

The results of four grain size distribution tests carried out on samples of the clayey silt fill from the current investigation are shown on Figure E2.

Atterberg limits testing carried out on four samples of the clayey silt fill from the current investigation measured liquid limits ranging from 25 to 35 percent, plastic limits ranging from 13 to 17 percent and plasticity indices ranging from 10 to 20 percent. The results of the Atterberg limits testing are shown on Figure E3 and indicate that the material is a clayey silt of low plasticity.

The measured water contents of eight samples of the clayey silt fill from the current investigation range from 8 to 15 percent. A laboratory organic content test carried out on one sample of the clayey silt fill in Borehole W4 showed an organic content of 4.5 percent and the corresponding water content was 27 percent.

4.2.5.4 Clayey Silt with Organics

A layer of clayey silt with organics was encountered below the clayey silt fill in Boreholes W1 and W2. This layer contains trace sand and organics that typically consisted of wood fibres and rootlets. The surface of the clayey silt with organics layer was encountered at a depth of 1.5 m below ground surface (Elevation 82.5 m) and is 0.8 m thick.

Two measured SPT 'N' values within the clayey silt with organics were 10 and 11 blows per 0.3 m of penetration, suggesting a stiff consistency.

Atterberg limits testing carried out on one sample of the clayey silt with organics measured a liquid limit of 34 percent, a plastic limit of 18 percent and a plasticity index of 16 percent. The results of the Atterberg limits testing are shown on Figure E4 and indicate that the material is a clayey silt of low plasticity.

Laboratory organic content testing carried out on two samples of the clayey silt layer show organic contents of 2.9 and 4.4 percent.

The measured water content of one sample of the clayey silt with organics layer was 22 percent.

4.2.5.5 Clayey Silt to Silty Clay Till

A deposit of clayey silt to silty clay till was encountered in all boreholes (W1 to W8 and 1 to 7) advanced in this area; however, the deposit was not classified as "Till" in the previous Record of Borehole sheets. The clayey silt to silty clay till typically contains trace to some sand, trace gravel and seams of silt and sand. The surface of the clayey silt to silty clay till was encountered at depths ranging from ground surface (during the previous investigation) to 7.6 m below ground surface (at the Winona Road approach embankments) with corresponding Elevations ranging from 82.6 m to 80.8 m. The boreholes advanced in this area (W1 to W8 and 1 to 7) penetrated 2.2 m to 25.5 m into the clayey silt to silty clay deposit and were terminated at depths ranging from 6.7 m to 25.5 m below ground surface (Elevation 79.9 m to 56.4 m).

The measured SPT 'N' values within the clayey silt to silty clay till typically range from 16 blows per 0.3 m of penetration to 100 blows per 0.1 m of penetration, suggesting a very stiff to hard consistency. Two SPT 'N' values of 10 and 12 were measured within the upper metre of the till deposit in Boreholes W7 and W8.



Dynamic Cone Penetration Tests (DCPT's) carried out in Boreholes 1, 2, 3, 5 and 6 from the previous investigation measured blow counts ranging from about 10 blows per 0.3 m of penetration to greater than 100 blows per 0.3 m of penetration. The DCPT values generally increased with depth and the tests were terminated upon effective refusal (i.e. greater than 100 blows per 0.3 m of penetration) at a depth of about 2.9 m to 4.8 m below ground surface (Elevation 79.6 m to 77.4 m).

The results of five grain size distribution tests carried out on samples of the clayey silt to silty clay till from the current investigation are shown on Figure E5. The results of eleven grain size distribution tests performed on samples from the previous investigation are shown on the Record of Borehole sheets in Appendix E.

Atterberg limits testing carried out on forty-four samples of the clayey silt to silty clay till from the current and previous investigations measured liquid limits ranging from 23 to 36 percent, plastic limits ranging from 13 to 22 percent and plasticity indices ranging from 9 to 18 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure E6 and the results from the previous investigation are shown on the Record of Borehole sheets in Appendix E. The results from the current and previous investigation indicate that the material is a clayey silt to silty clay of low to medium plasticity. An Atterberg limit test carried out during the previous investigation on a sample of a silt seam in Borehole 4 measured a liquid limit of 19 percent, a plastic limit of 15 percent and a plasticity index of 4 percent indicating that the material is a clayey silt to silt of low plasticity.

The measured water contents of samples of the clayey silt to silty clay till from the previous and current investigations range from 7 to 23 percent and are typically near the plastic limit of the material.

4.2.5.6 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt fill and clayey silt till in Borehole W5 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix E. The water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
W1	84.0	Dry	-	Feb. 1, 2010	Open Borehole
W2	84.0	Dry	-	Feb. 1, 2010	Open Borehole
W3	83.4	Dry	-	Feb. 19, 2010	Open Borehole
W4	83.4	Dry	-	Feb. 19, 2010	Open Borehole
W5	89.6	7.6 6.9	82.0 82.7	Feb. 19, 2010 Mar. 17, 2010	Open Borehole Piezometer
W6	88.8	9.1	79.7	Feb. 19, 2010	Open Borehole
W7	83.0	6.1	76.9	Feb. 17, 2010	Open Borehole
W8	83.0	6.1	76.9	Feb. 17, 2010	Open Borehole



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Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
1	82.2	1.1	81.5	June 1, 1966	Open Borehole
2	82.6	1.1	81.5	June 7, 1966	Open Borehole
3	82.5	1.1	81.4	June 3, 1966	Open Borehole
4	82.4	1.1	81.3	June 8, 1966	Open Borehole
5	81.9	1.1	80.8	June 9, 1966	Open Borehole
6	82.0	1.1	80.9	June 10, 1966	Open Borehole
7	82.3	0.2	82.1	Apr. 1, 1965	Open Borehole

The water levels measured in the current boreholes during drilling were likely not stabilized. It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within granular soils above the cohesive fill and till deposits.

4.2.6 Fifty Road Underpass

The Fifty Road Underpass carries northbound and southbound traffic over the QEW, the S-W ramp and the N-E ramp. The Fifty Road pavement surface at the north and south abutments is at approximately Elevation 90.5 m and Elevation 91.0 m, respectively. The QEW pavement surface is at approximately Elevation 84.5 m and the S-W ramp and N-E ramp pavement surface is at about Elevation 85.0 m.

Boreholes FY2 and FY3 were advanced near the toe of the north abutment front slope on the west and east sides of the abutment and on the north shoulder of the S-W ramp. Boreholes FY5 and FY6 were advanced near the toe of the south abutment front slope on the west and east sides of the abutment and on the south shoulder of the N-E ramp. Borehole FY1 was advanced in the northbound lane of Fifty Road through the south approach embankment near the south abutment. Borehole FY4 was advanced in the southbound lane of Fifty Road through the north approach embankment near the north abutment. Boreholes FY7 and FY8 were advanced at the west and east sides of the centre pier (Pier B) on the north shoulder of the eastbound lanes of the QEW.

The current investigation was supplemented with information from Boreholes 1 to 6 that were drilled as part of the 1966 investigation (Geocres Report No. 30M04-036). Boreholes 1 and 3 were drilled on the west and east sides of the north abutment. Borehole 4 was drilled on the east side of the south abutment. Borehole 2 was drilled at the west side of Pier A and Borehole 5 was drilled at the east side of Pier C. Borehole 6 was drilled west of the Fifty Road Underpass between the south abutment and Pier C. The abutment and pier structures did not exist at the time of the previous investigation.

The borehole locations and stratigraphic profile through the Fifty Road Underpass are shown on Drawing 16. The sections through each pier centreline are shown on Drawing 17 and the sections through each abutment are shown on Drawing 18.

The stratigraphy generally consists of surficial asphalt / concrete underlain by sand and gravel fill and clayey silt fill which is underlain by clayey silt to silty clay till underlain by shale bedrock.



4.2.6.1 *Asphalt / Concrete*

A surficial layer of asphalt was encountered in Boreholes FY1 to FY8 and is 0.1 m to 0.3 m thick. A layer of concrete (0.2 m thick) was encountered directly below the asphalt in Boreholes FY1 and FY4 which were drilled at the south and north approach embankments, respectively.

4.2.6.2 *Sand and Gravel Fill*

A layer of sand and gravel fill was encountered below the asphalt / concrete in Boreholes FY1 to FY8. This layer typically contains trace to some silt and trace gravel. The surface of the sand and gravel fill layer was encountered at depths ranging from 0.1 m to 0.3 m below ground surface (Elevation 90.7 m to 84.3 m) and is 0.6 m to 2.5 m thick. A 0.5 m thick layer of sand and gravel fill was also encountered at a depth of 8.2 m below ground surface (Elevation 82.4 m) in Borehole FY4. A 0.1 m thick layer of clayey silt fill was encountered within the sand and gravel fill in Borehole FY7 at a depth of 1.1 m below ground surface (Elevation 83.4 m). The clayey silt fill contains some sand and trace gravel.

The measured SPT 'N' values within the sand and gravel fill layer range from 11 to 43 blows per 0.3 m of penetration, indicating a compact to dense relative density.

The results of three grain size distribution tests carried out on samples of the sand and gravel fill layer from the current investigation are shown on Figure F1.

The measured water contents of nine samples of the sand and gravel fill layer range from 3 to 8 percent

4.2.6.3 *Clayey Silt Fill*

A layer of clayey silt fill was encountered below the sand and gravel fill in Boreholes FY1 to FY4 and FY8. This layer typically contains some sand and trace gravel. Organics were present within the clayey silt fill in Borehole FY8. The surface of the clayey silt fill was encountered at depths ranging from 0.8 m to 2.7 m below ground surface (Elevation 89.6 m to 82.1 m) and is 0.3 m to 6.7 m thick.

The measured SPT 'N' values within the clayey silt fill range from 6 to 15 blows per 0.3 m of penetration, suggesting a firm to stiff consistency. Three field vane tests carried out within the clayey silt fill indicate shear strengths greater than 50 kPa.

The results of two grain size distribution tests carried out on samples of the clayey silt fill from the current investigation are shown on Figure F2.

Atterberg limits testing carried out on three samples of the clayey silt fill from the current investigation measured liquid limits ranging from 25 to 33 percent, plastic limits ranging from 14 to 20 percent and plasticity indices ranging from 12 to 15 percent. The results of the Atterberg limits testing are shown on Figure F3 and indicate that the material is a clayey silt of low plasticity.

A laboratory organic content test carried out on a sample of the clayey silt fill from Borehole FY8 shows an organic content of 2.6 percent.

The measured water content of eight samples of the clayey silt fill range from 8 to 19 percent and is typically near the plastic limit of the material.



4.2.6.4 Clayey Silt to Silty Clay Till

A deposit of clayey silt to silty clay till was encountered in all boreholes (FY1 to FY8 and 1 to 6) advanced in this area, however, the deposit was not classified as “Till” in the previous Record of Borehole sheets. The clayey silt to silty clay till typically contains some sand and trace gravel. Organics were also present within the upper metre of the clayey silt to silty clay till in Borehole FY1. The surface of the clayey silt to silty clay till was encountered at depths ranging from ground surface (during the previous investigation) to 8.7 m below ground surface (at the Fifty Road approach embankment) corresponding to Elevations ranging from 83.4 m to 81.8 m. The clayey silt to silty clay till was 8.5 m to 10.2 m thick in Boreholes 1 to 5. Boreholes FY1 to FY8 and 6 penetrated 1.1 m to 9.3 m into the clayey silt to silty clay till and were terminated at depths ranging from 6.7 m to 9.8 m below ground surface (Elevation 81.3 m to 73.8 m).

The measured SPT ‘N’ values within the clayey silt to silty clay till generally range from 13 blows to 74 blows per 0.3 m of penetration suggesting a stiff to hard consistency. One lower SPT ‘N’ value of 8 was measured in Borehole FY2. Two Dynamic Cone Penetration Tests (DCPT’s) carried out in Boreholes 1 and 4 from the previous investigation measured blow counts ranging from about 20 blows to 100 blows per 0.3 m of penetration below a depth of about 1 m below ground surface. The DCPT values generally increased with depth and the tests were terminated upon effective refusal (i.e. greater than 100 blows per 0.3 m of penetration) at a depth of 3.4 m (Elevation 79.2 m) and 4 m (Elevation 79.0 m) below ground surface in Boreholes 1 and 4, respectively.

The results of eight grain size distribution tests carried out on samples of the clayey silt to silty clay till from the current investigation are shown on Figures F4A and F4B. The results of five grain size distribution tests performed on samples of the clayey silt to silty clay till from the previous investigation are provided in Appendix F.

Atterberg limits testing carried out on thirty-six samples of the clayey silt to silty clay till from the previous and current investigations measured liquid limits ranging from 21 to 36 percent, plastic limits ranging from 12 to 20 percent and plasticity indices ranging from 7 to 20 percent. The results of the Atterberg limits testing from the current investigation are shown on Figure F5 and the results from the previous investigation are provided in Appendix F. The results from the current and previous investigation indicate that the material is predominantly a clayey silt of low plasticity.

A laboratory organic content test carried out on a sample of the upper metre of the clayey silt till from Borehole FY1 from the current investigation shows an organic content of 3.6 percent.

The measured water contents of samples of the clayey silt to silty clay till from the previous and current investigations range from 8 to 20 percent.

4.2.6.5 Shale Bedrock

Shale Bedrock was encountered and confirmed by coring in Boreholes 1, 2, 4 and 5 from the previous investigation. Inferred bedrock (i.e. refusal to advance the split-spoon sampler) was encountered in Boreholes 3 and 6. The surface of the bedrock (inferred or confirmed) was encountered at depths ranging from 8.5 m to 10.2 m below ground surface (Elevation 74.9 m to 72.5 m). Boreholes 1, 2, 4 and 5 were cored to 0.5 m to 2.3 m into the shale (using A-size and/or B-size core barrels) and were terminated within the shale at depths ranging from 10.2 m to 11.6 m below ground surface (Elevation 73.2 m to 71.3 m). Boreholes 3 and 6 were terminated on inferred shale bedrock at depths of 10 m and 9.3 m below ground surface (Elevation 72.6 m



FOUNDATION REPORT

QEW BRIDGE REHABILITATIONS, G.W.P. 2088-08-00

and 73.2 m), respectively. The shale bedrock was described as “weathered” becoming “sound” below about 1 m depth from the bedrock surface.

The measured SPT ‘N’ values within the inferred shale bedrock ranged from 108 blows per 0.3 m of penetration to about 50 blows per 0.05 m of penetration. The Total Core Recovery ranged from 30 percent to 100 percent in the cored Boreholes 1, 2, 4 and 5.

4.2.6.6 Groundwater Conditions

Water levels were noted within the boreholes during and upon completion of drilling operations. A piezometer was installed (sealed) within the clayey silt to silty clay till in Borehole FY6 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix F. The water levels recorded in the boreholes and piezometer from the current and previous investigations are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
FY1	91.0	Dry	-	Feb. 4, 2010	Open Borehole
FY2	84.8	Dry	-	Feb. 4, 2010	Open Borehole
FY3	84.8	Dry	-	Feb. 4, 2010	Open Borehole
FY4	90.5	8.2	82.3	Feb. 5, 2010	Open Borehole
FY5	84.8	Dry	-	Feb. 5, 2010	Open Borehole
FY6	84.8	5.5 1.1	79.3 83.7	Feb. 5, 2010 Mar. 17, 2010	Inside Augers Piezometer
FY7	84.5	Dry	-	Feb. 17, 2010	Open Borehole
FY8	84.5	Dry	-	Feb. 17, 2010	Open Borehole
1	82.7	0.6	82.1	June 7, 1966	Open Borehole
2	82.9	0.5	82.4	June 8, 1966	Open Borehole
3	82.7	0.6	82.1	June 8, 1966	Open Borehole
4	83.4	0.9	82.5	June 9, 1966	Open Borehole
5	83.3	0.3	83.0	June 13, 1966	Open Borehole
6	83.1	0.2	82.9	Mar. 22, 1965	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year. Localized perched water is expected to be present within granular soils above the cohesive fill and till deposits.



5.0 CLOSURE

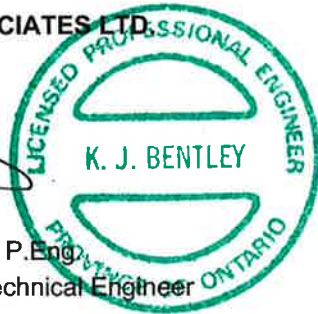
The field drilling program was supervised by Mr. Garry McEnhill and Mr. Ted Beadle. This Foundation Investigation Report was prepared by Mr. Ted Beadle and reviewed by Mr. Kevin Bentley, P.Eng., an Associate and Senior Geotechnical Engineer with Golder. Mr. Fintan J. Heffernan, P.Eng., a Designated MTO Contact for Foundations carried out a quality control review of this report.



Report Signature Page

GOLDER ASSOCIATES LTD.

Kevin J. Bentley, P.Eng.
Associate, Geotechnical Engineer



Fintan J. Heffernan, P.Eng.
Designated MTO Contact



TB/KJB/FJH/sm

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REFERENCES

Chapman, L.J., and Putnam, D.F. 1984. The Physiography of Southern, 3rd Edition. Ontario Geological Survey, Special Volume 2. Ontario Ministry of Natural Resources.

STANDARDS:

ASTM International:

ASTM D1586-08a Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

Ontario Water Resources Act:

Ontario Regulation 372/97 Amendment to Ontario Regulation 903.



LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$,	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ϵ	linear strain
ϵ_v	volumetric strain
η	coefficient of viscosity
ν	poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - \mu$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
μ	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

T_p, T_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 + \sigma_3)/2$ or $(\sigma'_1 + \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 + \sigma_3)$
S_t	sensitivity

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2



LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index	N
Relative Density	Blows/300 mm or Blows/ft
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

(b) Cohesive Soils Consistency

	Cu, Su	psf
	kPa	
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

Dynamic Cone Penetration Resistance; N_d :

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH:	Sampler advanced by hydraulic pressure
PM:	Sampler advanced by manual pressure
WH:	Sampler advanced by static weight of hammer
WR:	Sampler advanced by weight of sampler and rod

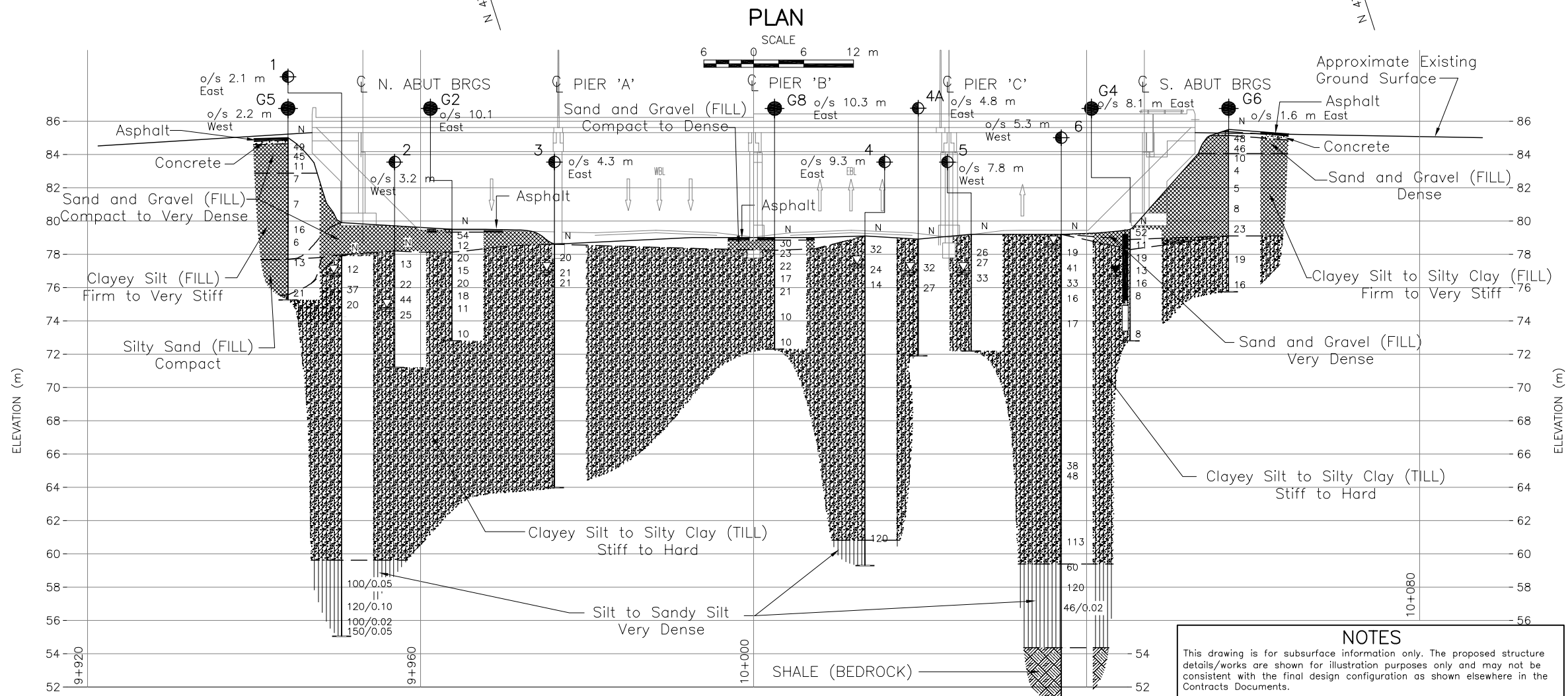
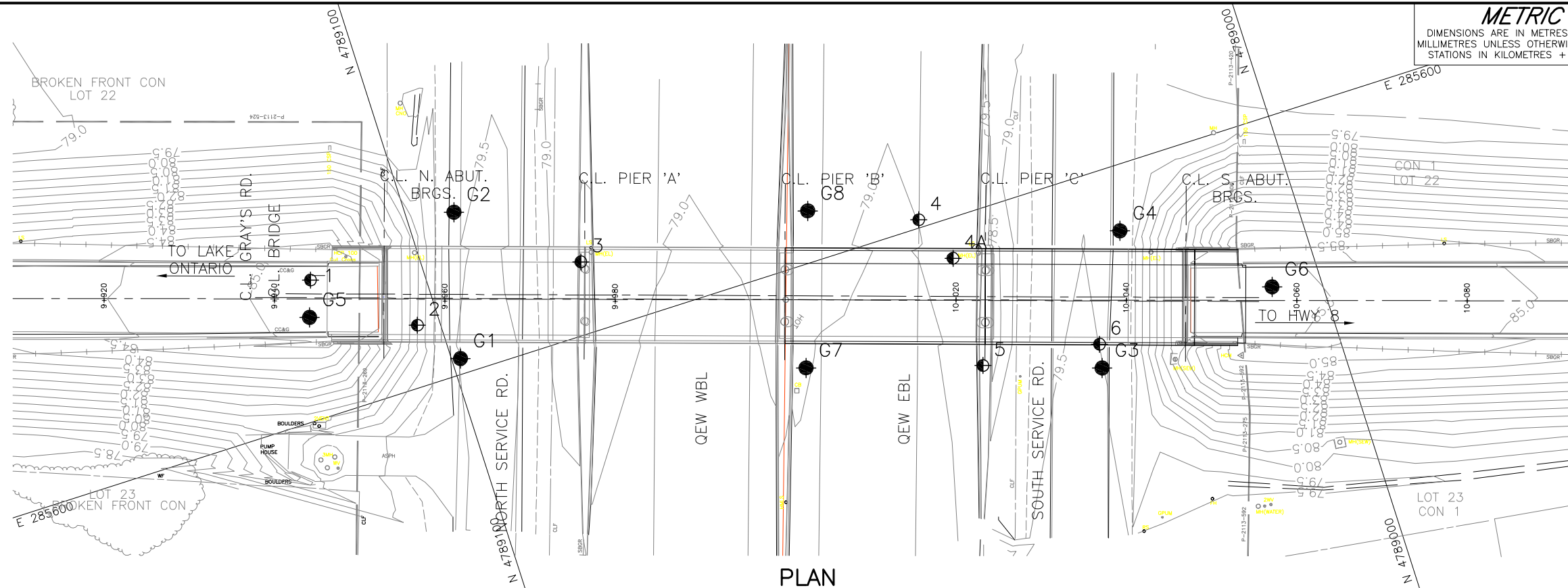
Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

IV. SOIL TESTS

w	water content
w _p	plastic limit
w _l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G _s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.



NOTES

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The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

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METRIC

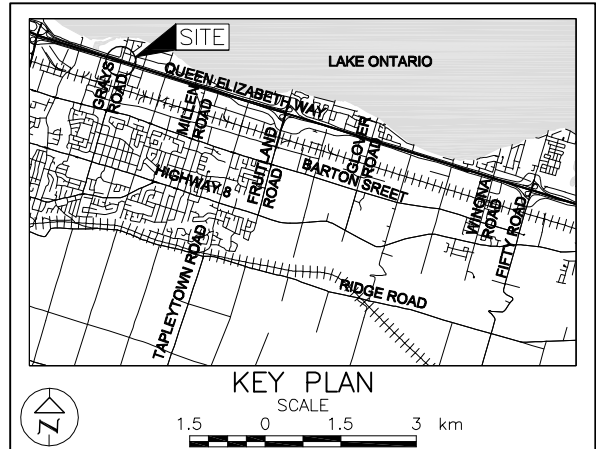
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MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2088-08-00







QUEEN ELIZABETH WAY	
GRAY'S ROAD UNDERPASS	
BOREHOLE LOCATIONS AND SOIL STRATA	



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MISSISSAUGA, ONTARIO, CANADA



LEGEND

- | | |
|---|--|
|  | Borehole – Current Investigation |
|  | Borehole – Previous Investigation (DHO, 1966) |
|  | Seal |
|  | Piezometer |
| N | Standard Penetration Test Value |
| 16 | Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow) |
|  | WL in piezometer, measured on March 19, 2010 |
|  | WL upon completion of drilling |

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
1	77.9	4789113.0	285615.9
2	78.2	4789102.6	285607.1
3	78.6	4789082.1	285608.3
4	79.1	4789042.8	285600.9
4A	78.9	4789040.3	285595.4
5	79.2	4789040.8	285582.3
6	79.2	4789027.0	285580.5
G1	79.5	4789099.0	285601.8
G2	79.5	4789094.5	285618.4
G3	79.5	4789027.6	285577.8
G4	79.5	4789020.7	285592.5
G5	85.0	4789114.4	285611.8
G6	85.5	4789005.7	285580.8
G7	79.0	4789060.7	285588.4
G8	79.0	4789054.9	285605.9

REFERENCE

Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010, and drawing file no. 36-203S-01.dwg, received February 11, 2010.

NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
Hwy. QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-203
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 1

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MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

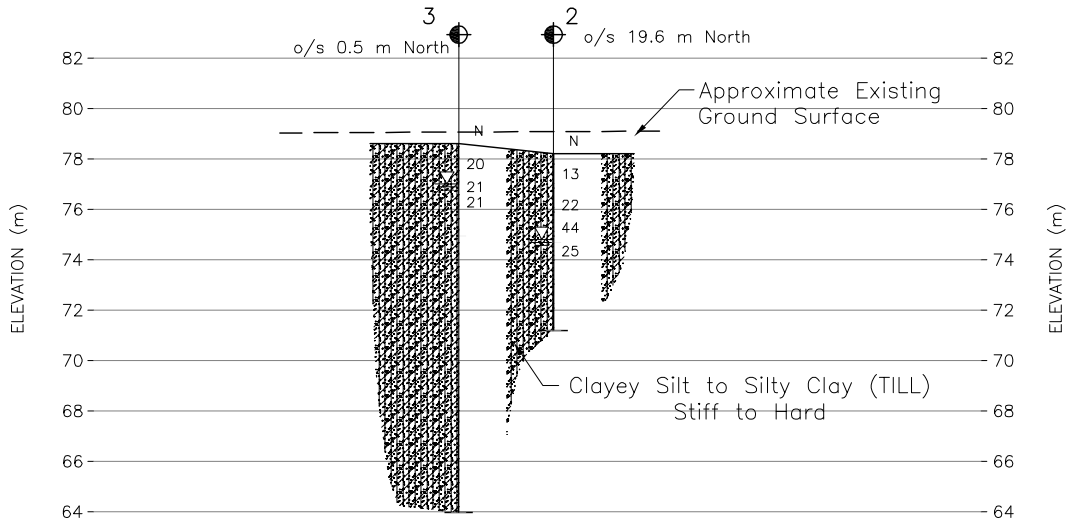
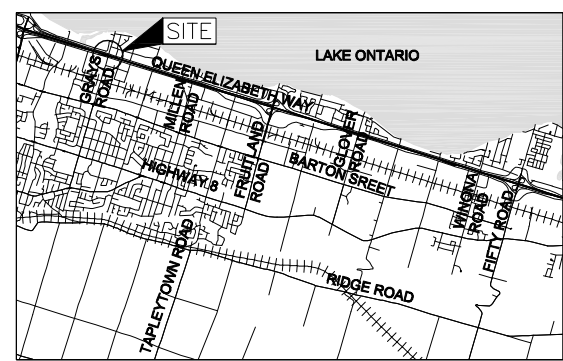
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
GRAY'S ROAD UNDERPASS
SOIL STRATA

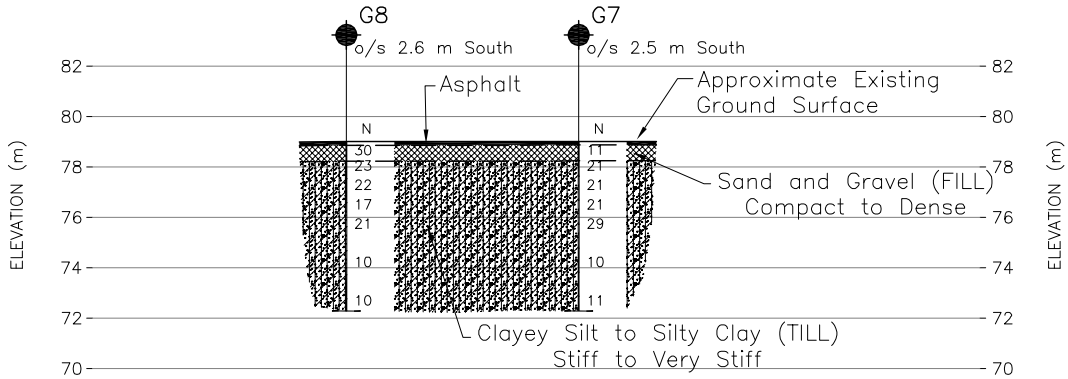
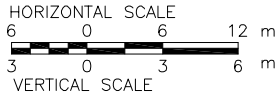
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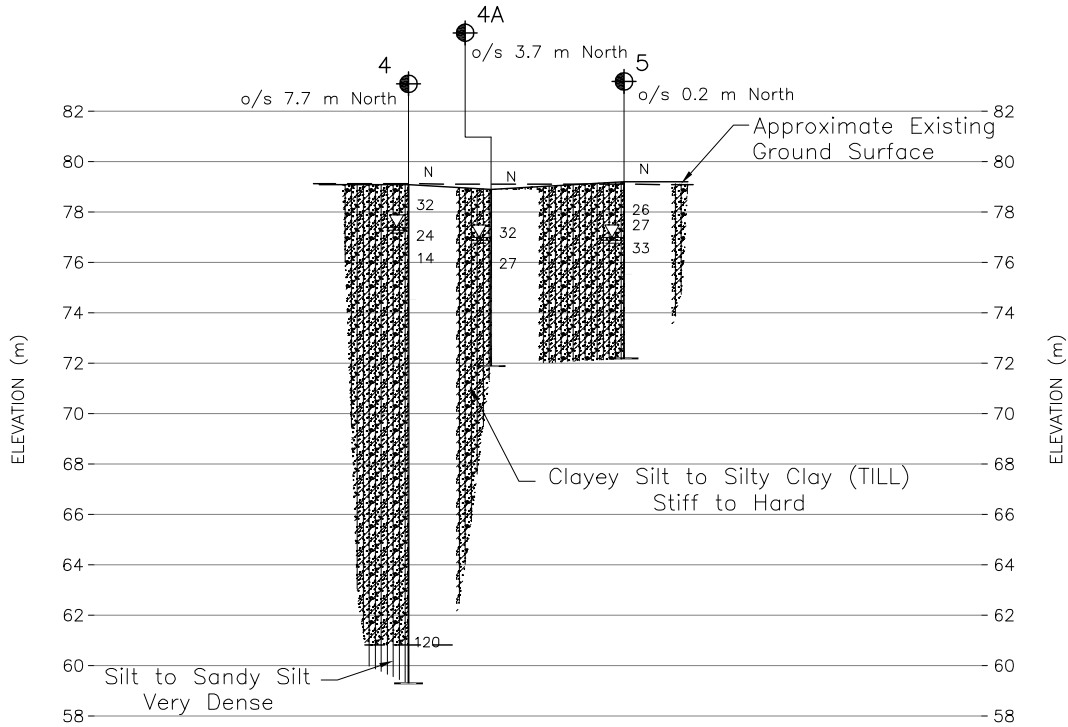
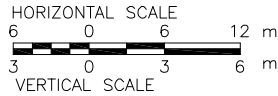
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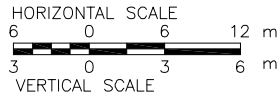
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SECTION ALONG C/L PIER 'B'



SECTION ALONG C/L PIER 'C'



LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
2	78.2	4789102.6	285607.1
3	78.6	4789082.1	285608.3
4	79.1	4789042.8	285600.9
4A	78.9	4789040.3	285595.4
5	79.2	4789040.8	285582.3
G7	79.0	4789060.7	285588.4
G8	79.0	4789054.9	285605.9

NOTES

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NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-203
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 2

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MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

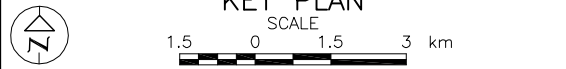
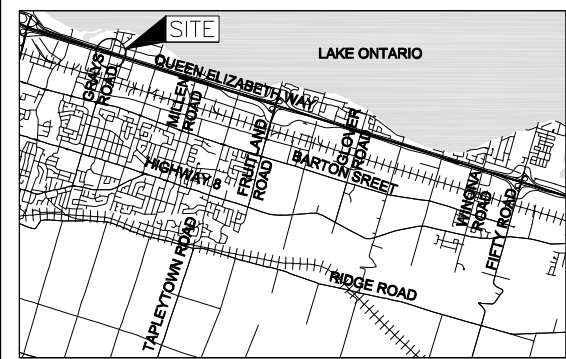
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
GRAY'S ROAD UNDERPASS
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on March 19, 2010
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
6	79.2	4789027.0	285580.5
G1	79.5	4789099.0	285601.8
G2	79.5	4789094.5	285618.4
G3	79.5	4789027.6	285577.8
G4	79.5	4789020.7	285592.5

NOTES

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The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

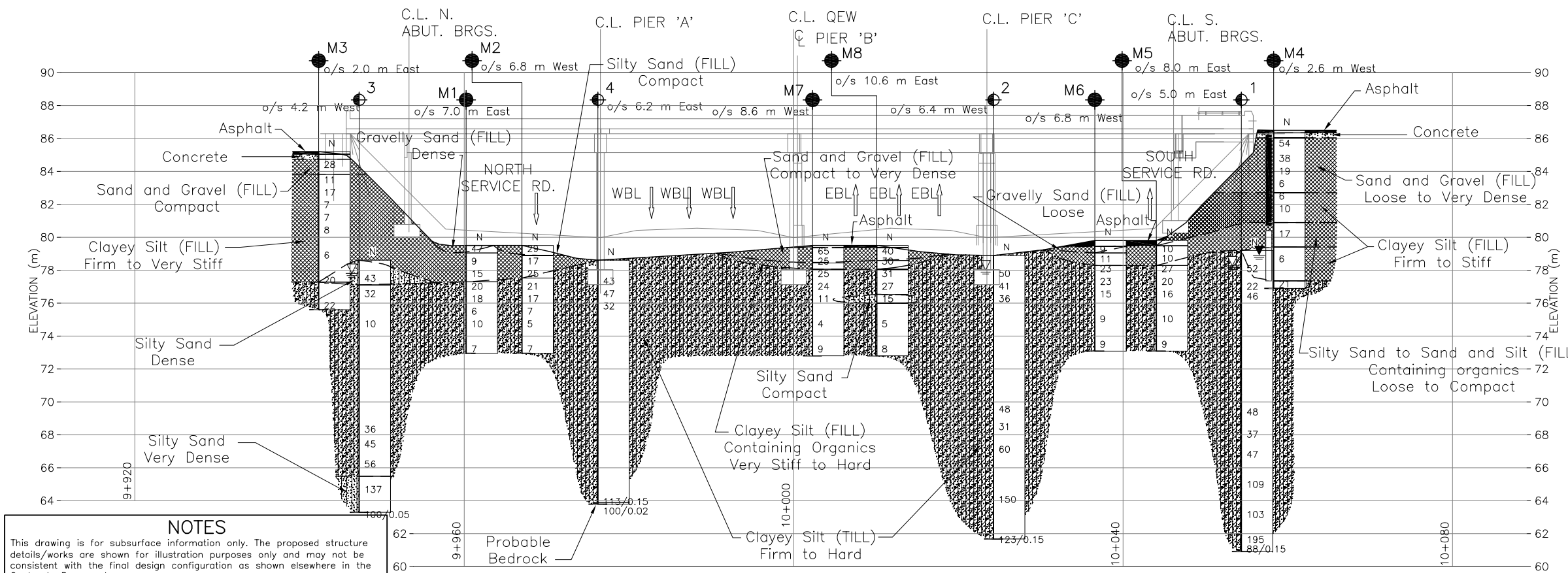
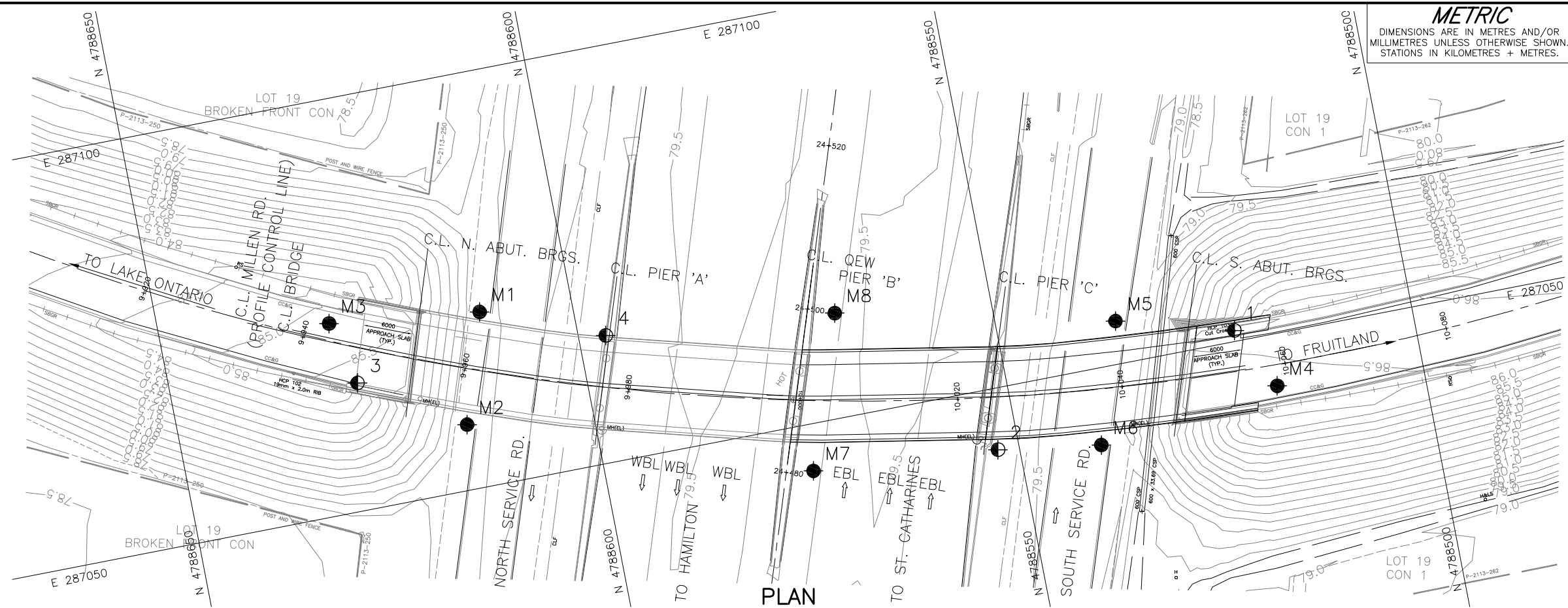
The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

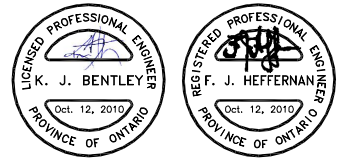
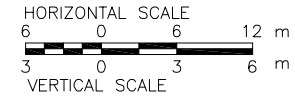
Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010. and drawing file no. 36-203S-01.dwg, received February 11, 2010.



NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-203
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 3



MILLEN RD. CENTRELINE PROFILE

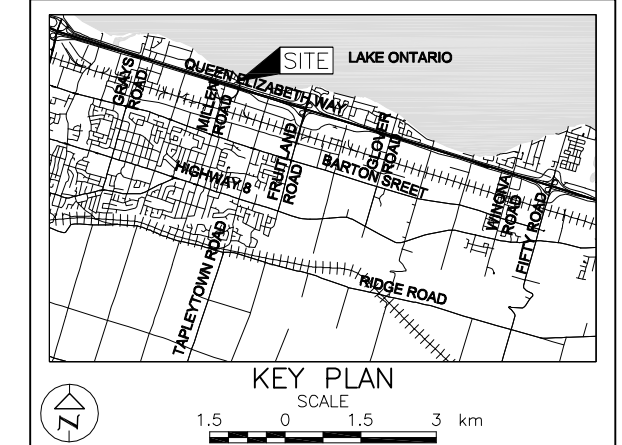


CONT No. GWP No. 2088-08-00

QUEEN ELIZABETH WAY
MILLEN ROAD UNDERPASS
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

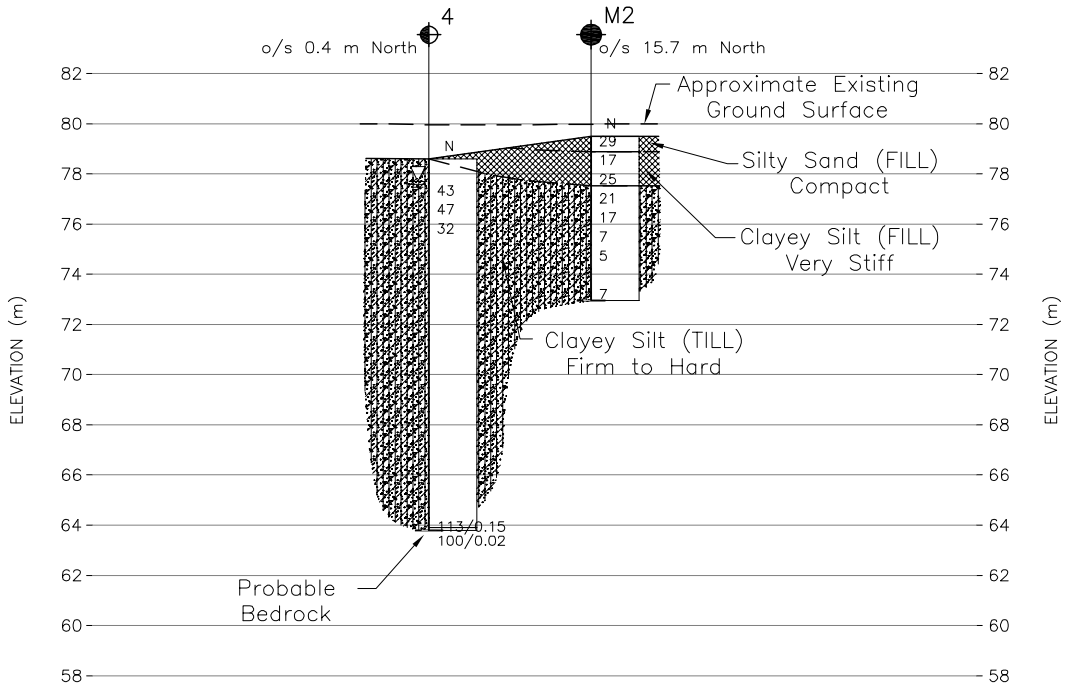


LEGEND

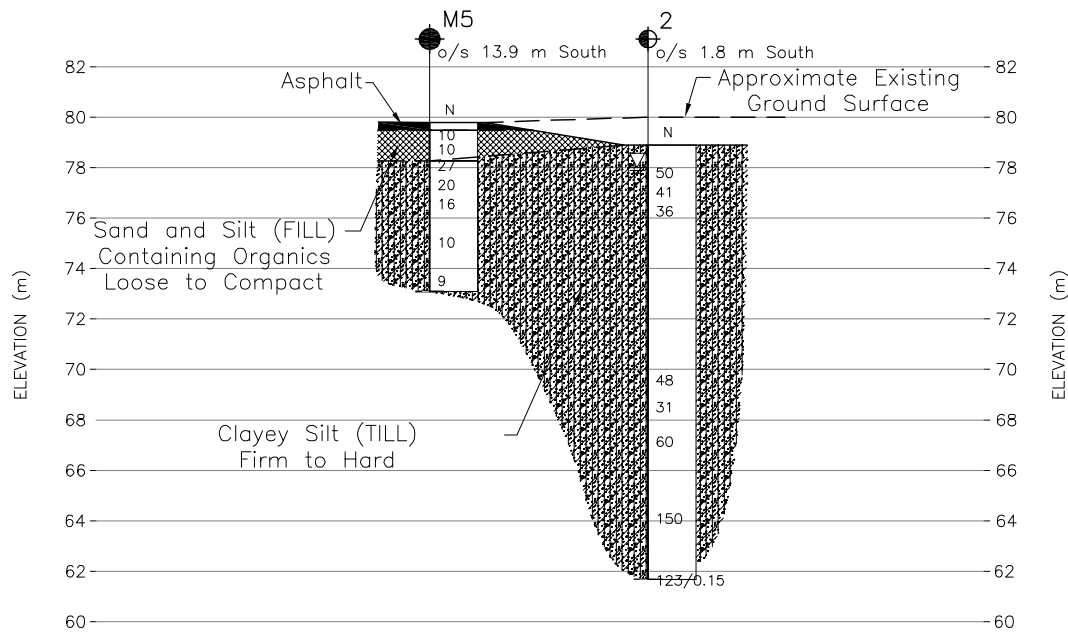
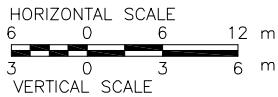
- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on March 17, 2010
- WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
1	79.2	4788521.7	287051.3
2	78.9	4788552.6	287042.6
3	78.6	4788627.4	287065.4
4	78.6	4788596.7	287065.3
M1	79.5	4788611.2	287071.0
M2	79.5	4788615.3	287057.9
M3	85.2	4788629.4	287073.1
M4	86.5	4788517.8	287043.7
M5	79.8	4788535.6	287055.2
M6	79.8	4788540.2	287040.8
M7	79.5	4788575.1	287044.3
M8	79.5	4788568.9	287062.7

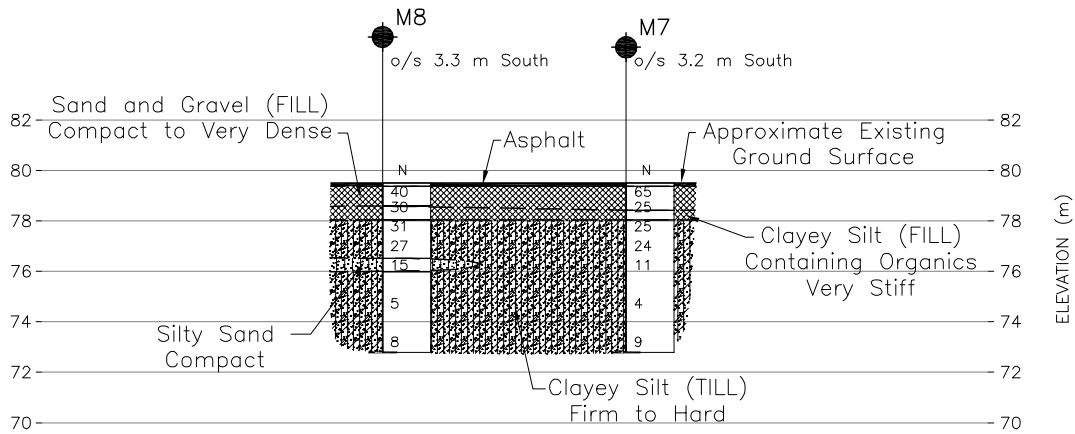
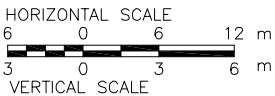
REFERENCE			
Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010, and drawing file no. 36-204S-01.dwg, received February 11, 2010.			
Geocres No. 30M4-114			
NO.	DATE	BY	REVISION
HWY: QEW PROJECT NO. 09-1111-6066 DIST.			
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-204
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 4



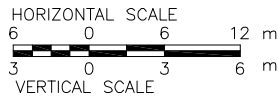
SECTION ALONG C/L PIER 'A'



SECTION ALONG C/L PIER 'C'



SECTION ALONG C/L PIER 'B'



METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

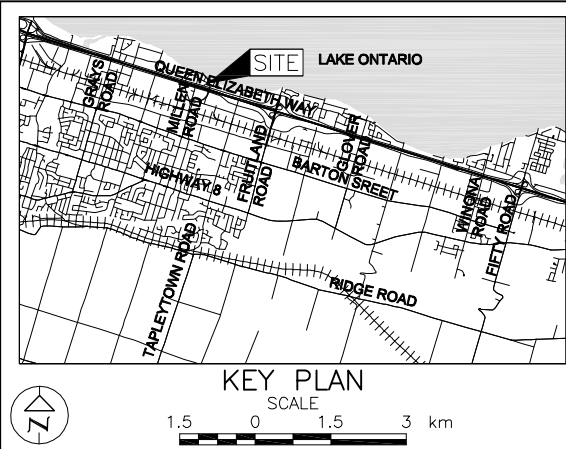
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
MILLEN ROAD UNDERPASS
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
2	78.9	4788552.6	287042.6
4	78.6	4788596.7	287065.3
M2	79.5	4788615.3	287057.9
M5	79.8	4788535.6	287055.2
M7	79.5	4788575.1	287044.3
M8	79.5	4788568.9	287062.7

NOTES

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REFERENCE

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NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-204
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 5

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

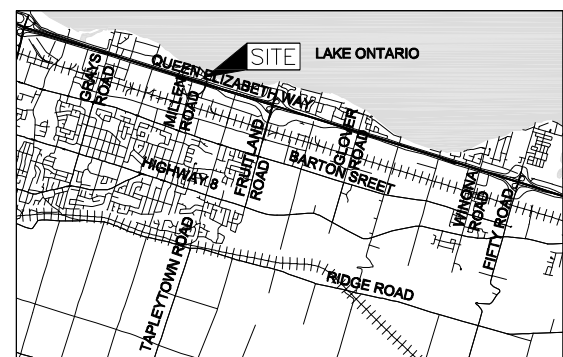
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
MILLEN ROAD UNDERPASS
SOIL STRATA

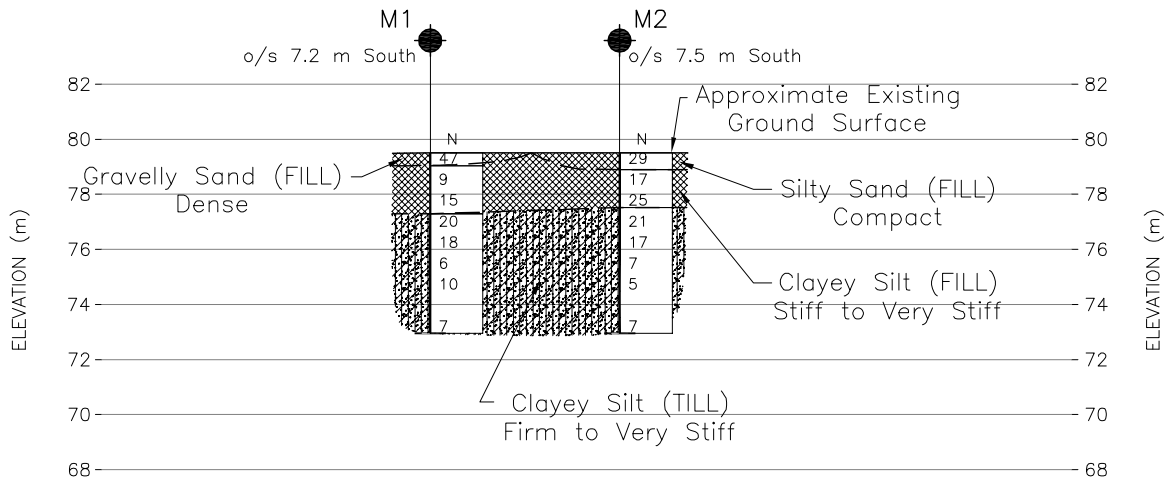
SHEET



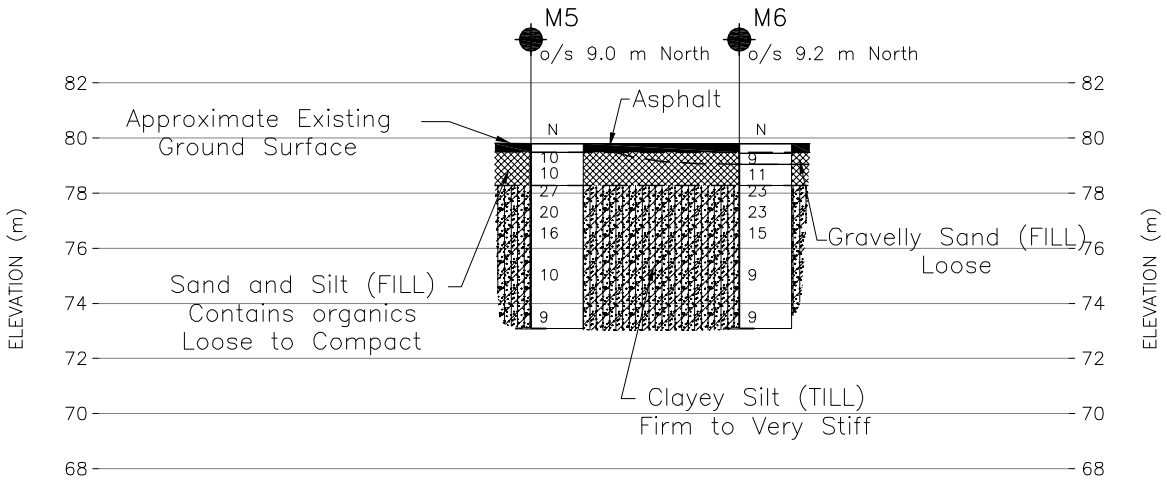
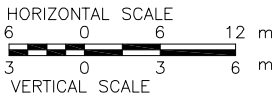
Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



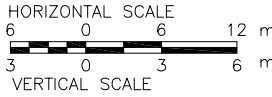
KEY PLAN
SCALE
1.5 0 1.5 3 km



SECTION ALONG C/L NORTH ABUTMENT



SECTION ALONG C/L SOUTH ABUTMENT



LEGEND	
	Borehole - Current Investigation
	Borehole - Previous Investigation (DH0, 1966)
	Seal
	Piezometer
	N Standard Penetration Test Value
	16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
	WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
M1	79.5	4788611.2	287071.0
M2	79.5	4788615.3	287057.9
M5	79.8	4788535.6	287055.2
M6	79.8	4788540.2	287040.8

NOTES

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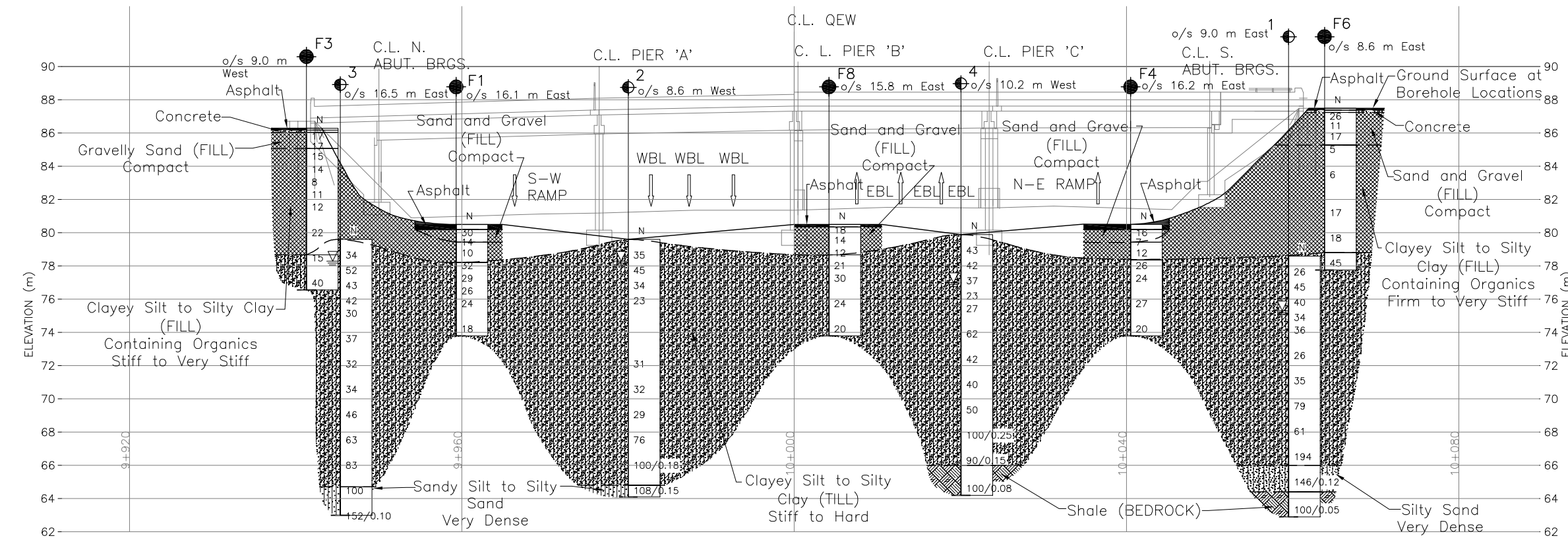
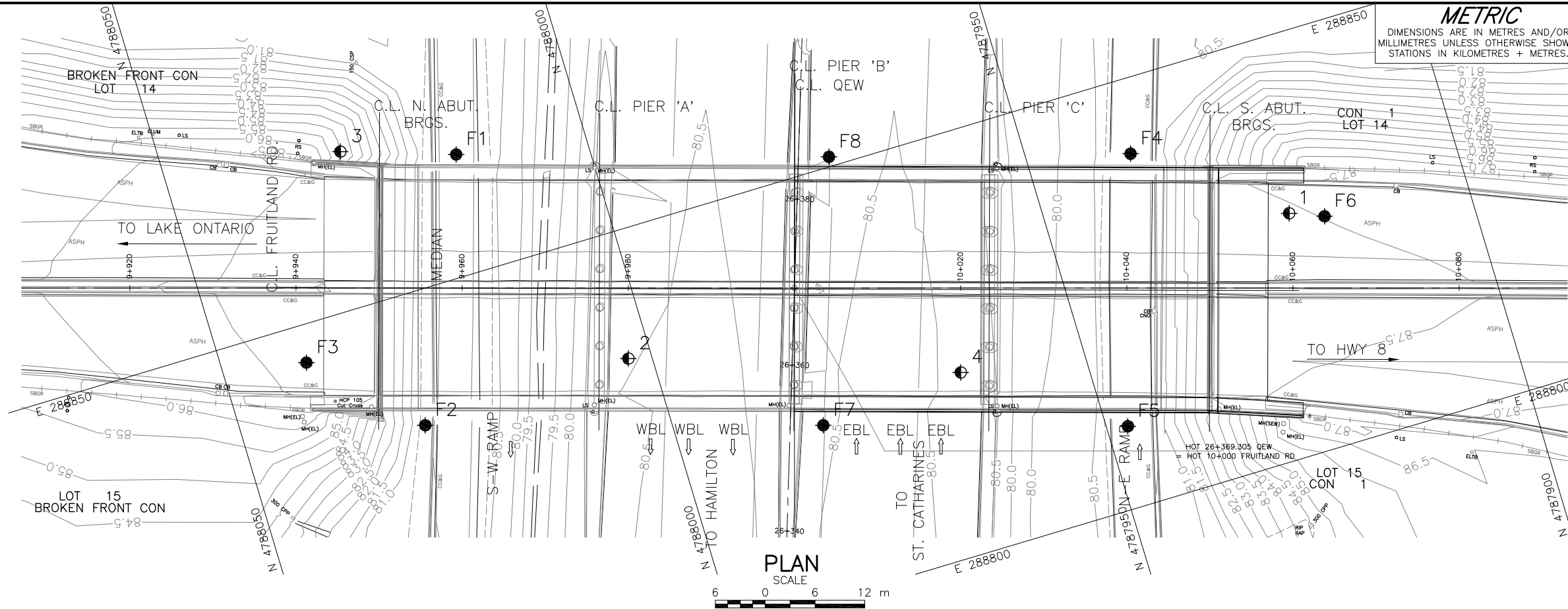
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REFERENCE

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NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-204
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 6



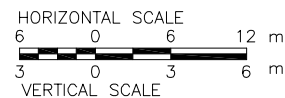
NOTES

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FRUITLAND ROAD CENTRELINE PROFILE



CONT No.
GWP No. 2088-08-00

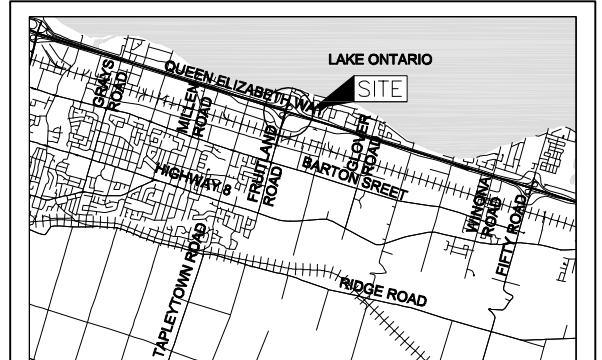
QUEEN ELIZABETH WAY
FRUITLAND ROAD UNDERPASS
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

SCALE 1.5 0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling

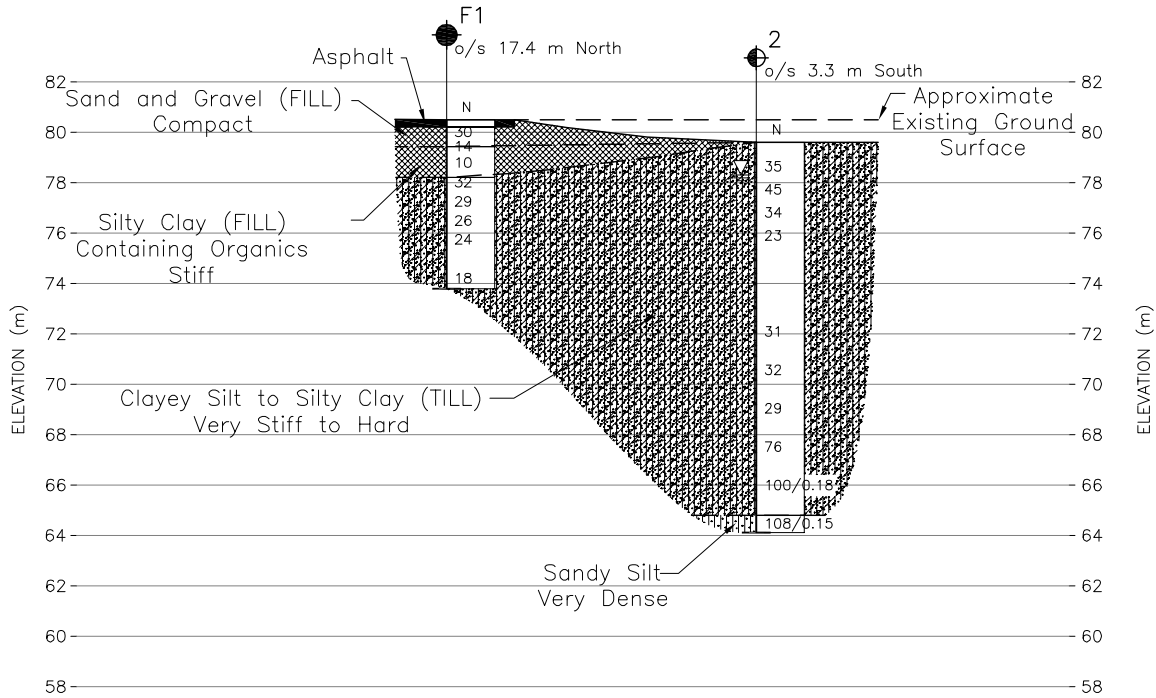
BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
1	78.6	4787921.6	288828.8
2	79.6	4788002.8	288834.8
3	79.6	4788028.8	288868.7
4	79.9	4787964.9	288821.7
F1	80.5	4788015.6	288864.3
F2	80.8	4788028.5	288834.2
F3	86.3	4788040.0	288845.5
F4	80.5	4787937.8	288841.1
F5	80.5	4787947.5	288809.8
F6	87.5	4787917.6	288827.2
F7	80.5	4787982.6	288820.4
F8	80.5	4787972.7	288851.2

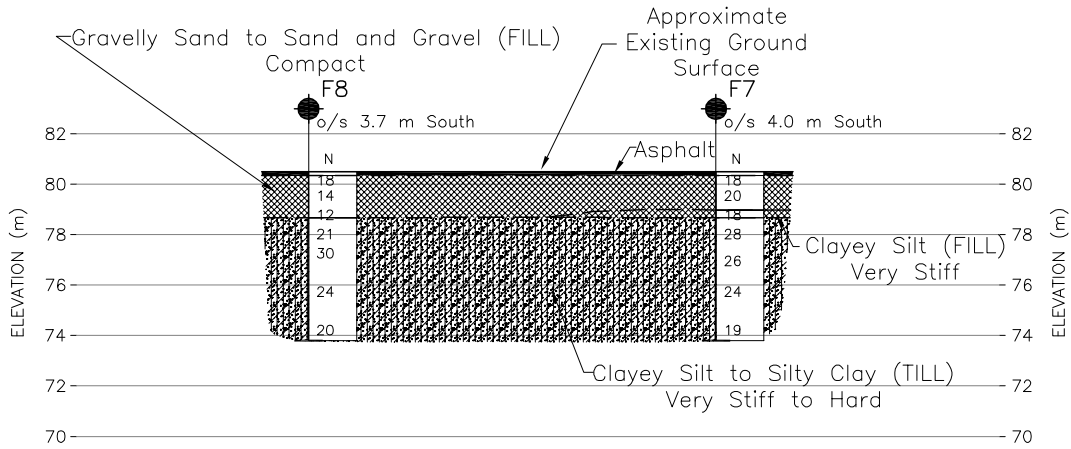
REFERENCE

Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010, and drawing file no. 36-208S-01.dwg, received February 11, 2010.

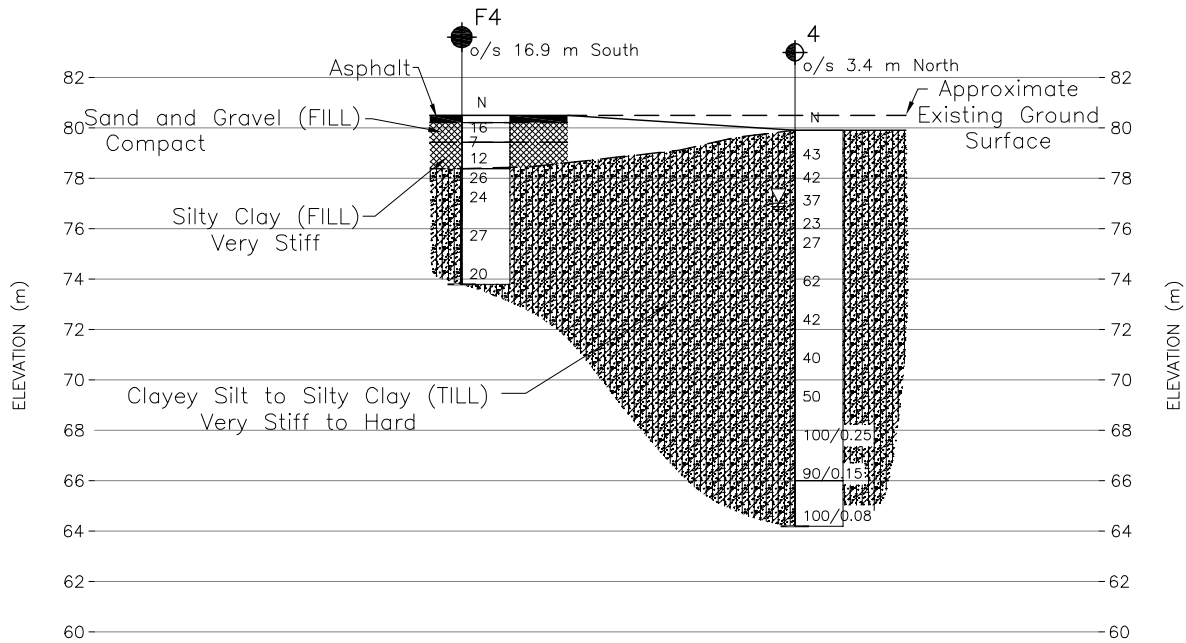
NO.	DATE	BY	REVISION
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SECTION ALONG C/L PIER 'A'



SECTION ALONG C/L PIER 'B'



SECTION ALONG C/L PIER 'C'

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

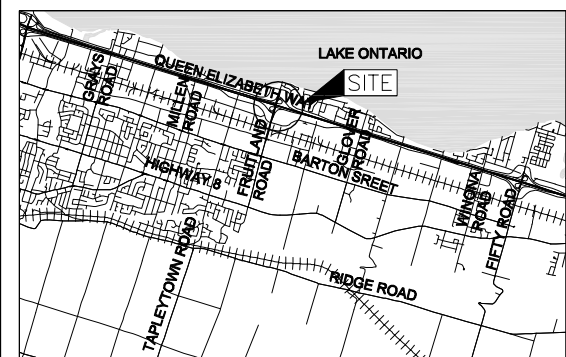
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
FRUITLAND ROAD UNDERPASS
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - Previous Investigation (DHO, 1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
2	79.6	4788002.8	288834.8
4	79.9	4787964.9	288821.7
F1	80.5	4788015.6	288864.3
F4	80.5	4787937.8	288841.1
F7	80.5	4787982.6	288820.4
F8	80.5	4787972.7	288851.2

NOTES

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REFERENCE

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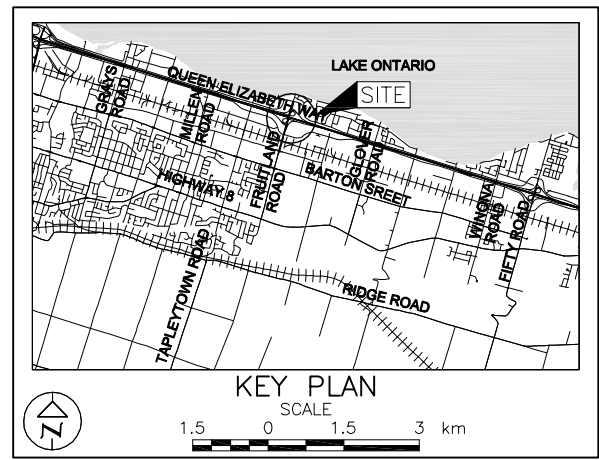


NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-205
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 8


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. GWP No. 2088-08-00		
QUEEN ELIZABETH WAY FRUITLAND ROAD UNDERPASS SOIL STRATA		SHEET


**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA




LEGEND




Borehole – Current Investigation




Borehole – Previous Investigation (DHO, 1966)




Seal




Piezometer




Standard Penetration Test Value



Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)



WL in piezometer, measured on March 19, 2010



WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
F1	80.5	4788015.6	288864.3
F2	80.8	4788028.5	288834.2
F4	80.5	4787937.8	288841.1
F5	80.5	4787947.5	288809.8

NOTES

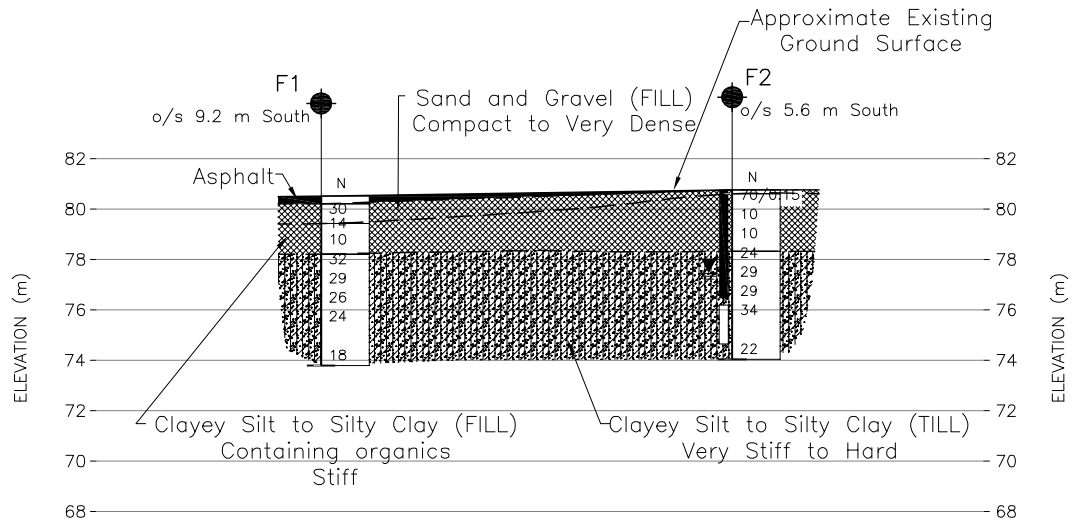
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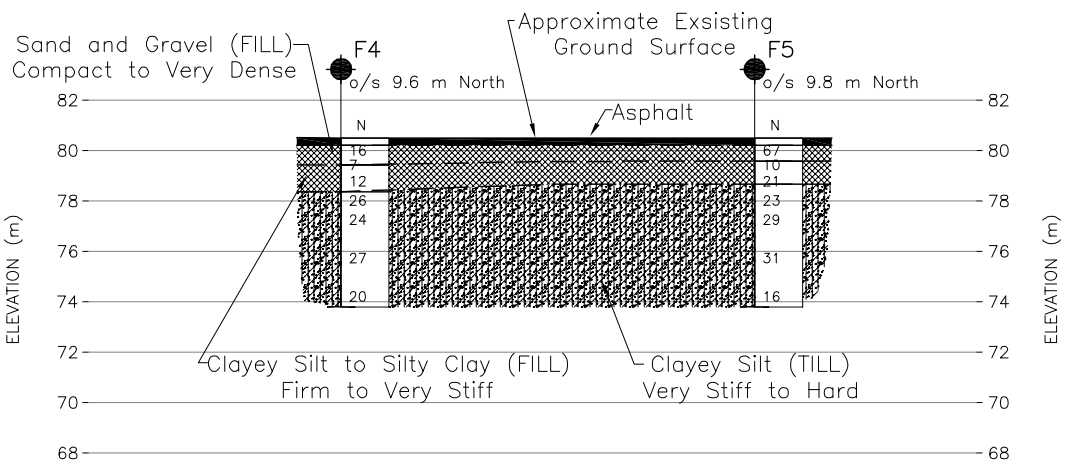
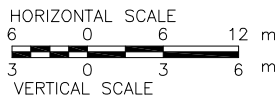
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REFERENCE

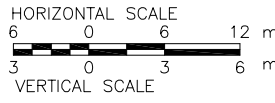
Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010. and drawing file no. 36-208S-01.dwg, received February 11, 2010.



SECTION ALONG C/L NORTH ABUTMENT



SECTION ALONG C/L SOUTH ABUTMENT



NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-205
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 9

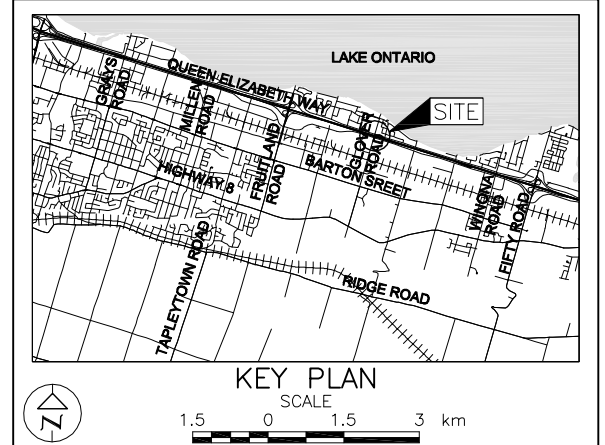
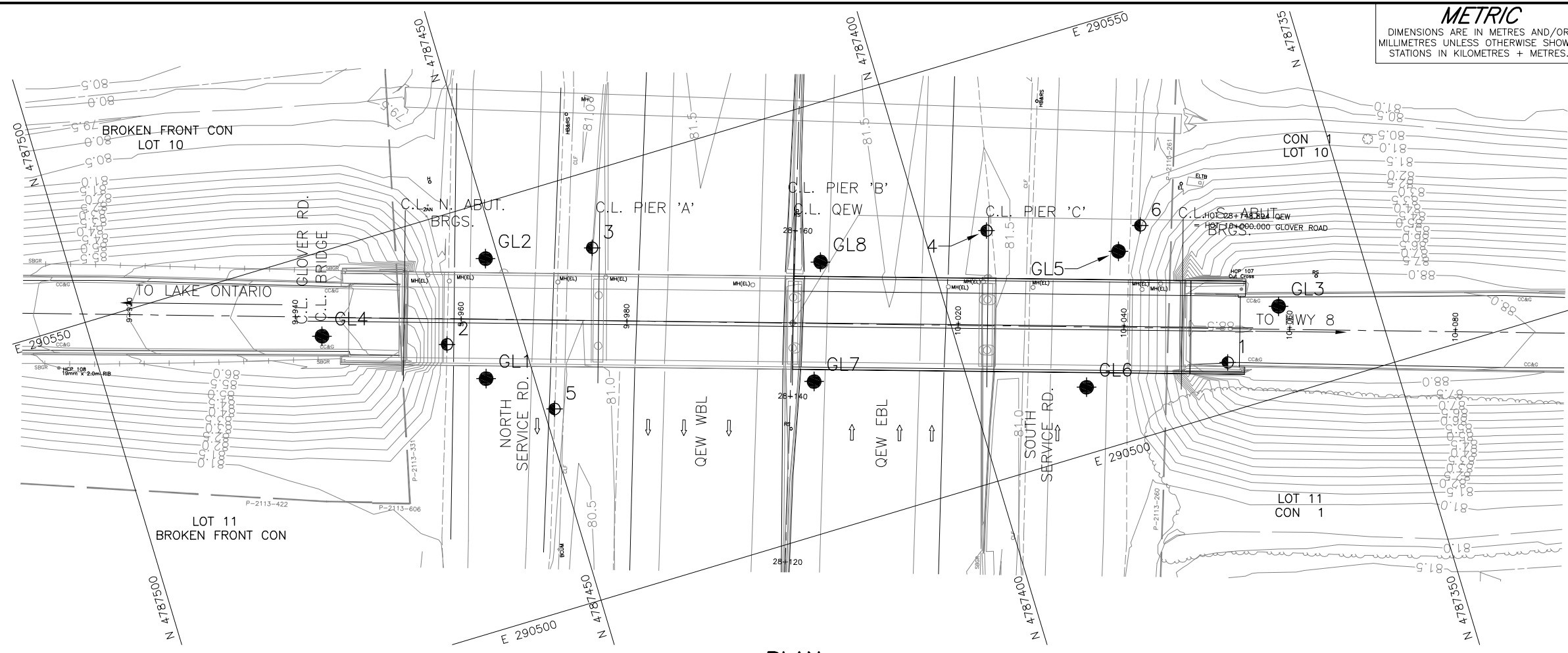
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
GLOVER ROAD UNDERPASS
BOREHOLE LOCATIONS AND SOIL STRATA

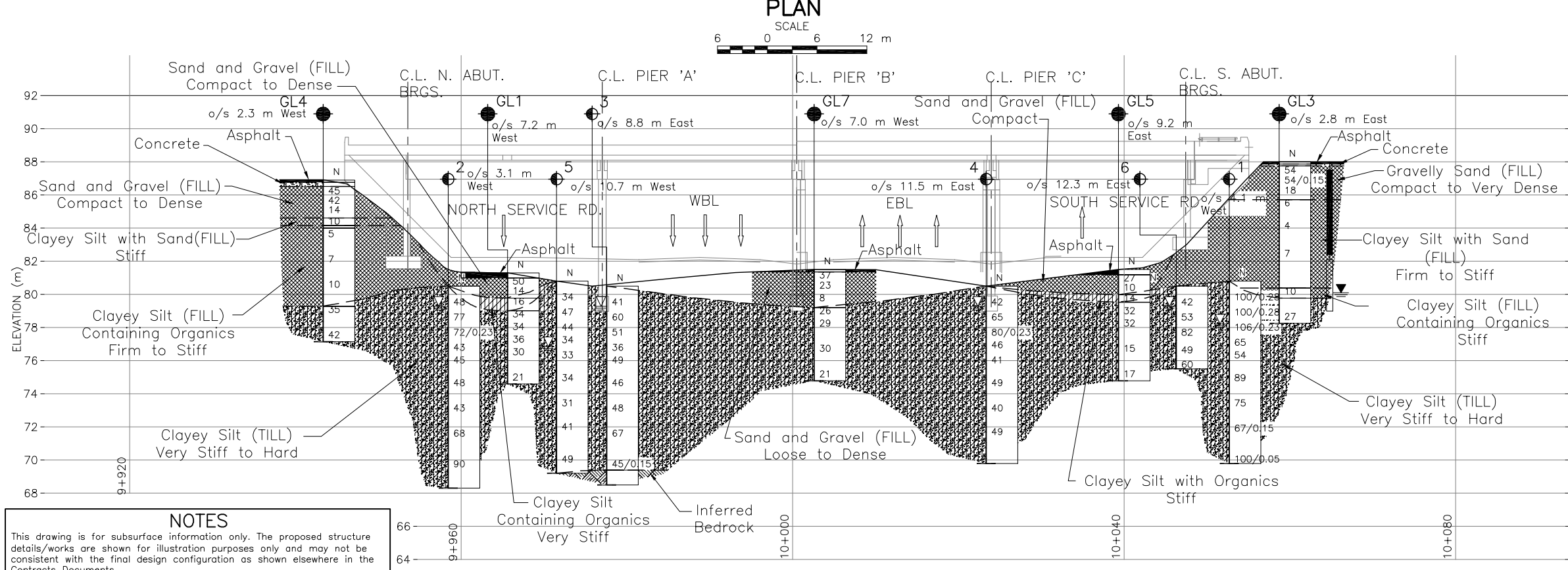
SHEET

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation (DHO, 1966)
- Seal
- Piezometer
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on March 17, 2010
- WL upon completion of drilling



BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
1	80.8	4787369.3	290505.8
2	80.5	4787458.9	290534.9
3	80.5	4787438.8	290541.1
4	80.5	4787392.6	290529.4
5	80.8	4787448.7	290523.7
6	80.5	4787374.7	290524.6
GL1	81.3	4787455.6	290529.6
GL2	81.3	4787451.5	290543.5
GL3	88.0	4787361.5	290510.5
GL4	86.9	4787473.1	290540.2
GL5	81.5	4787378.1	290522.4
GL6	81.5	4787386.5	290507.8
GL7	81.5	4787417.8	290517.9
GL8	81.5	4787412.9	290531.5

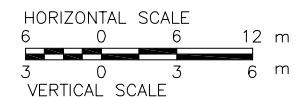
NOTES



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GLOVER ROAD CENTRELINE PROFILE





REFERENCE

Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010, and drawing file no. 36-206S-01.dwg, received February 11, 2010.

NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-206
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 10

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

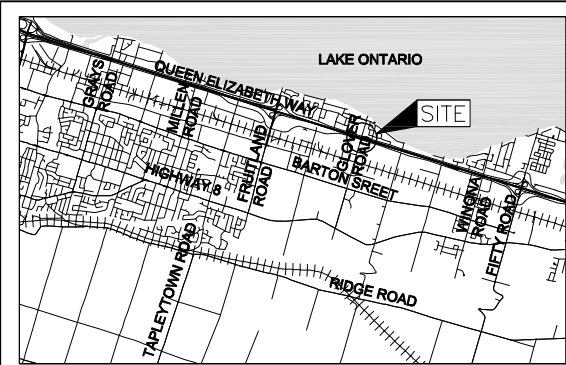
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
GLOVER ROAD UNDERPASS
SOIL STRATA

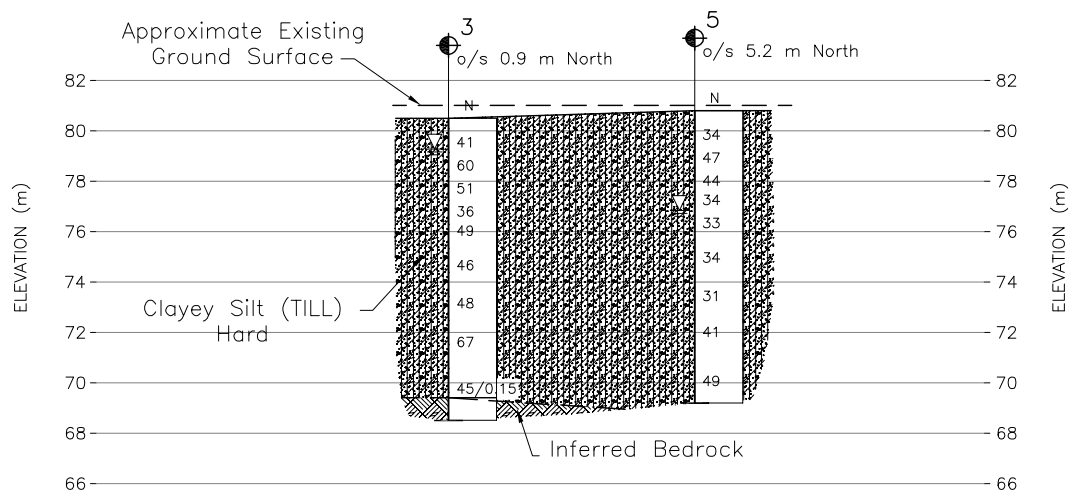
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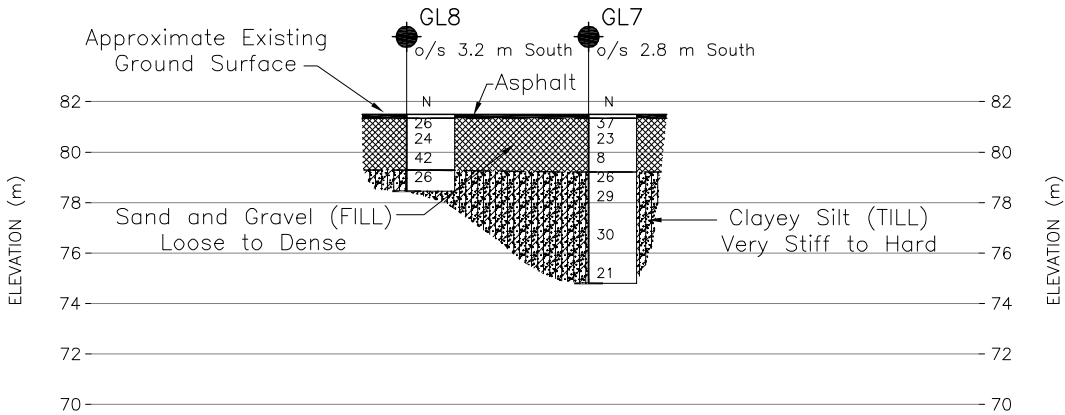
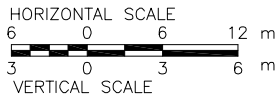
Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



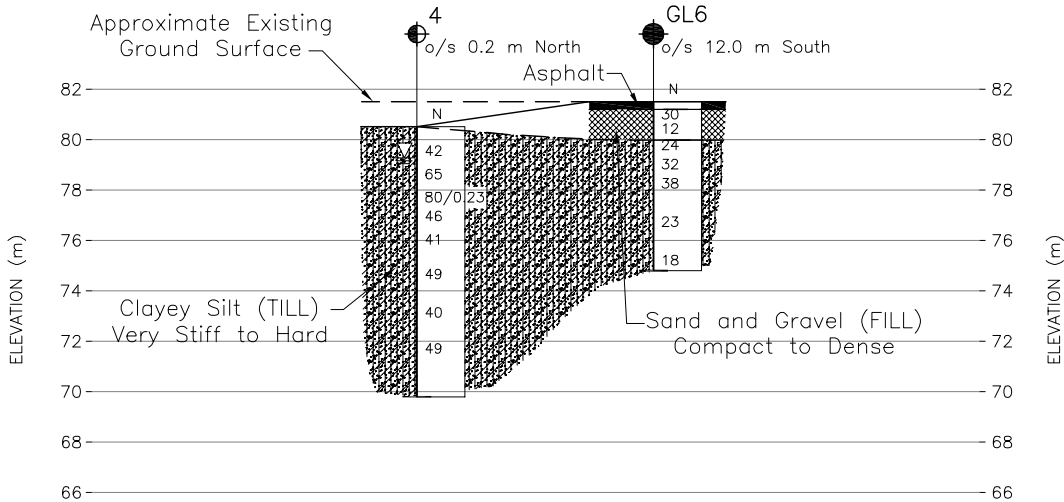
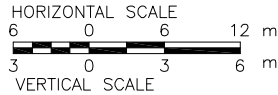
KEY PLAN
SCALE
1.5 0 1.5 3 km



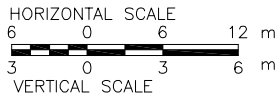
SECTION ALONG C/L PIER 'A'



SECTION ALONG C/L PIER 'B'



SECTION ALONG C/L PIER 'C'



LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - Previous Investigation (DHO, 1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
3	80.5	4787438.8	290541.1
4	80.5	4787392.6	290529.4
5	80.8	4787448.7	290523.7
GL6	81.5	4787386.5	290507.8
GL7	81.5	4787417.8	290517.9
GL8	81.5	4787412.9	290531.5

NOTES

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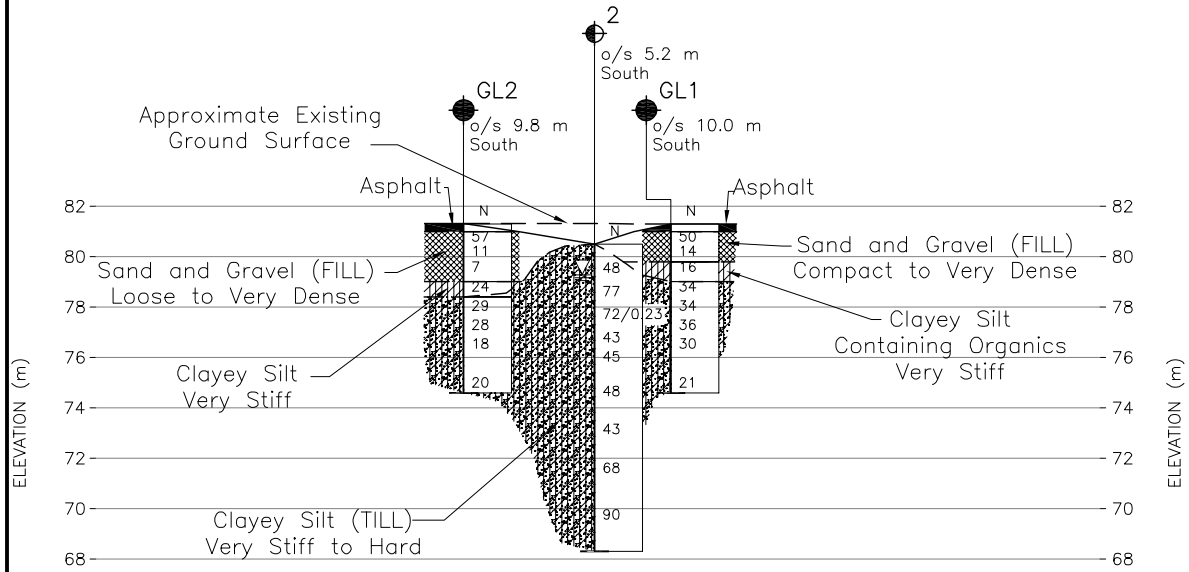
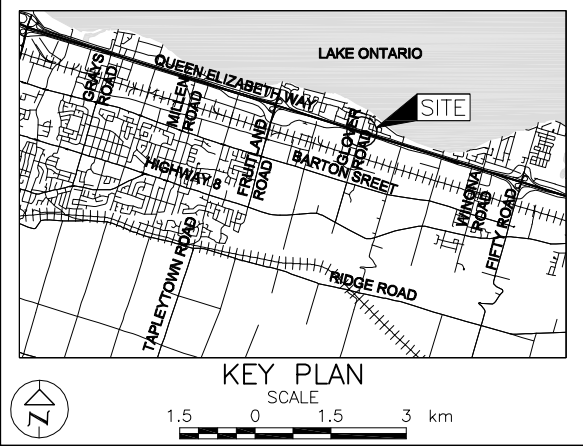
NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-206
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 11

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

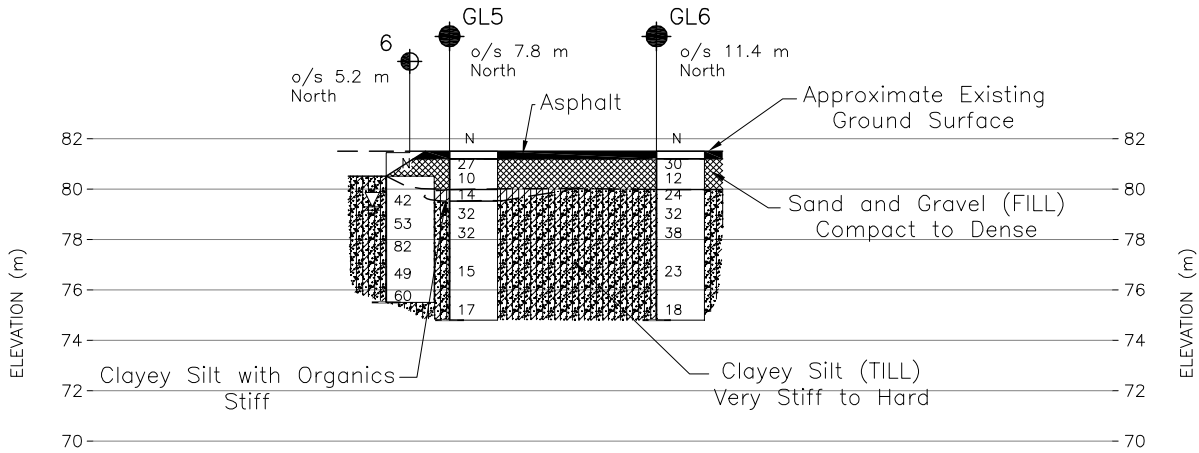
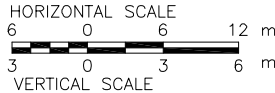
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
GLOVER ROAD UNDERPASS
SOIL STRATA

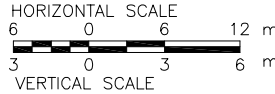
**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA




SECTION ALONG C/L NORTH ABUTMENT




SECTION ALONG C/L SOUTH ABUTMENT



LEGEND



Borehole – Current Investigation




Borehole – Previous Investigation (DHO, 1966)

N

Standard Penetration Test Value

16

Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)



WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
2	80.5	4787458.9	290534.9
6	80.5	4787374.7	290524.6
GL1	81.3	4787455.6	290529.6
GL2	81.3	4787451.5	290543.5
GL5	81.5	4787378.1	290522.4
GL6	81.5	4787386.5	290507.8

NOTES

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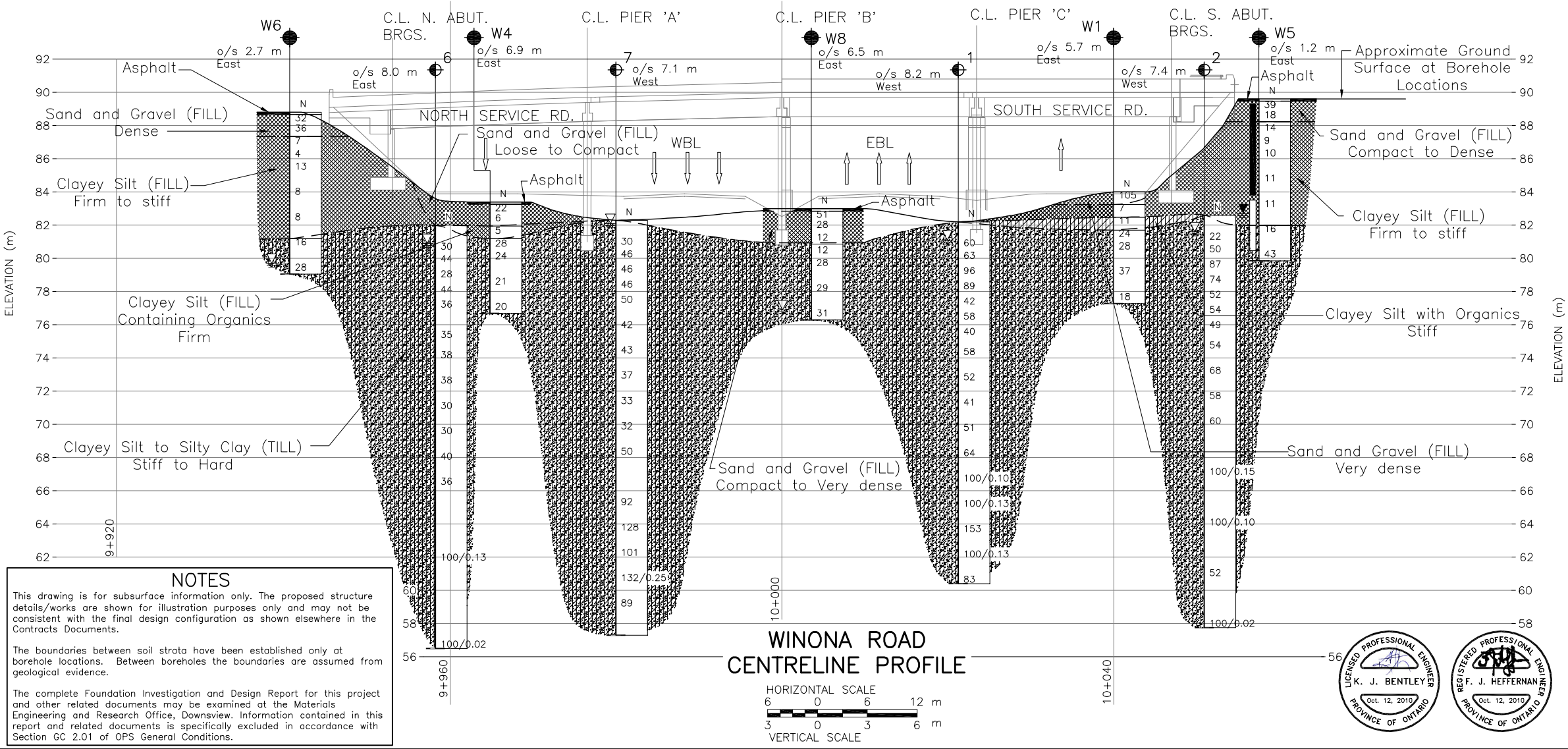
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REFERENCE

Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010. and drawing file no. 36-206S-01.dwg, received February 11, 2010.

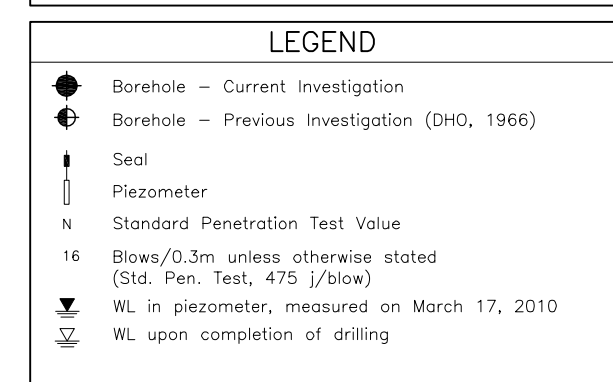


NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-206
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 12



 **Golder Associates**

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MISSISSAUGA, ONTARIO, CANADA



<h2 style="text-align: center;">REFERENCE</h2> <p>Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010. and drawing file no. 36-207S-01.dwg, received February 11, 2010.</p>			
NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY. QEW		PROJECT NO. 09-1111-6066	DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-207
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 13

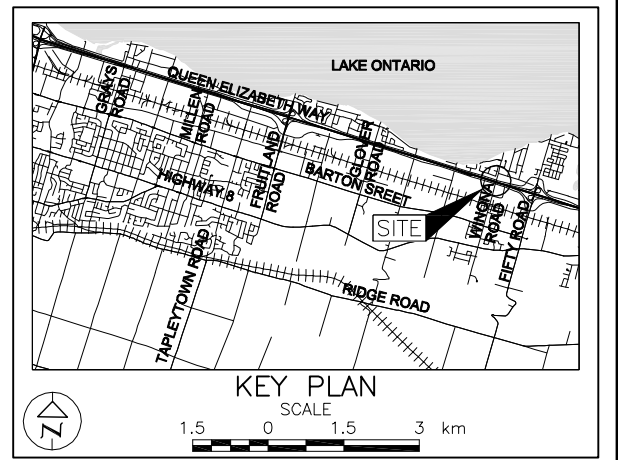
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
WINONA ROAD UNDERPASS
SOIL STRATA

SHEET

**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA



LEGEND

Borehole – Current Investigation

Borehole – Previous Investigation (1966)

Standard Penetration Test Value

Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)

WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
1	82.2	4786601.8	292908.5
4	82.4	4786614.3	292934.2
6	82.0	4786658.0	292941.5
7	82.3	4786641.2	292921.0
W1	84.0	4786580.0	292916.8
W4	83.4	4786653.8	292939.1
W7	83.0	4786619.7	292914.2
W8	83.0	4786614.8	292927.6

NOTES

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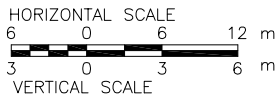
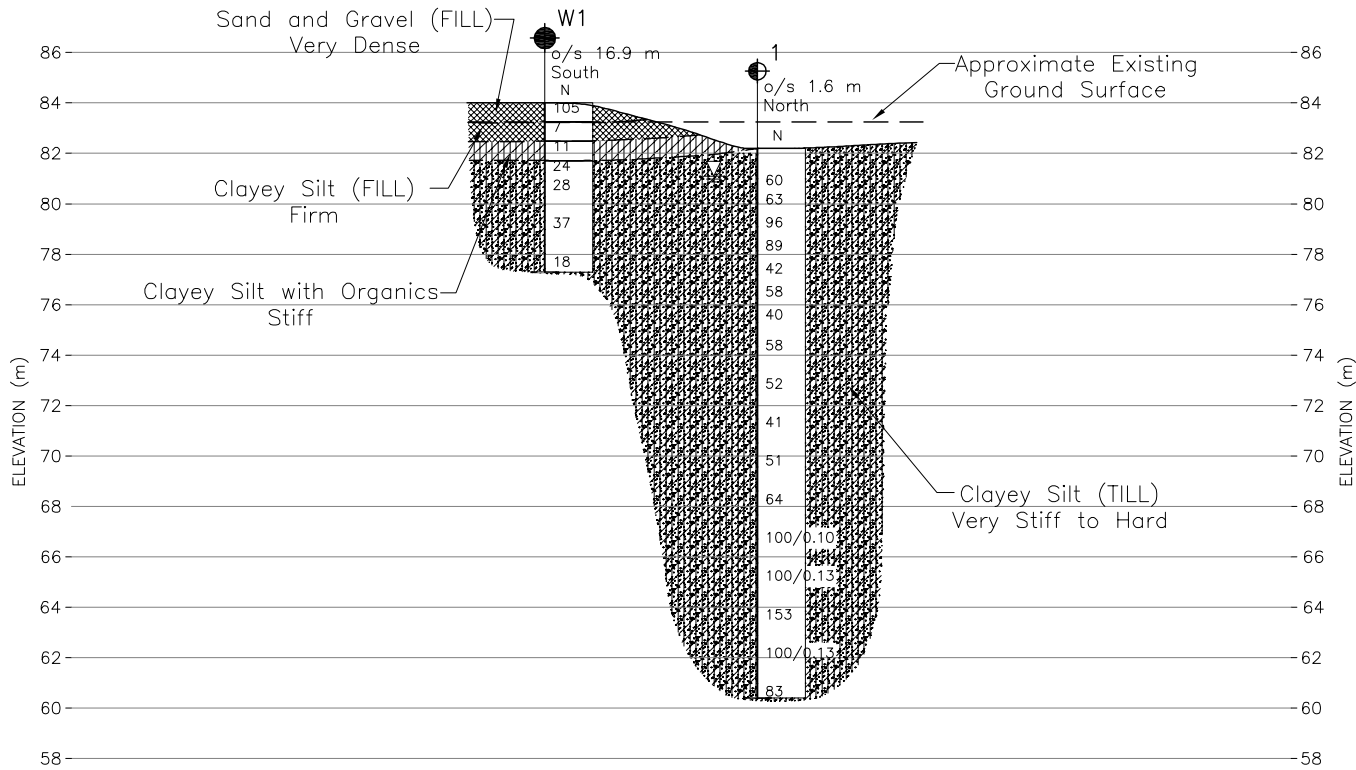
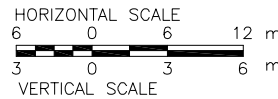
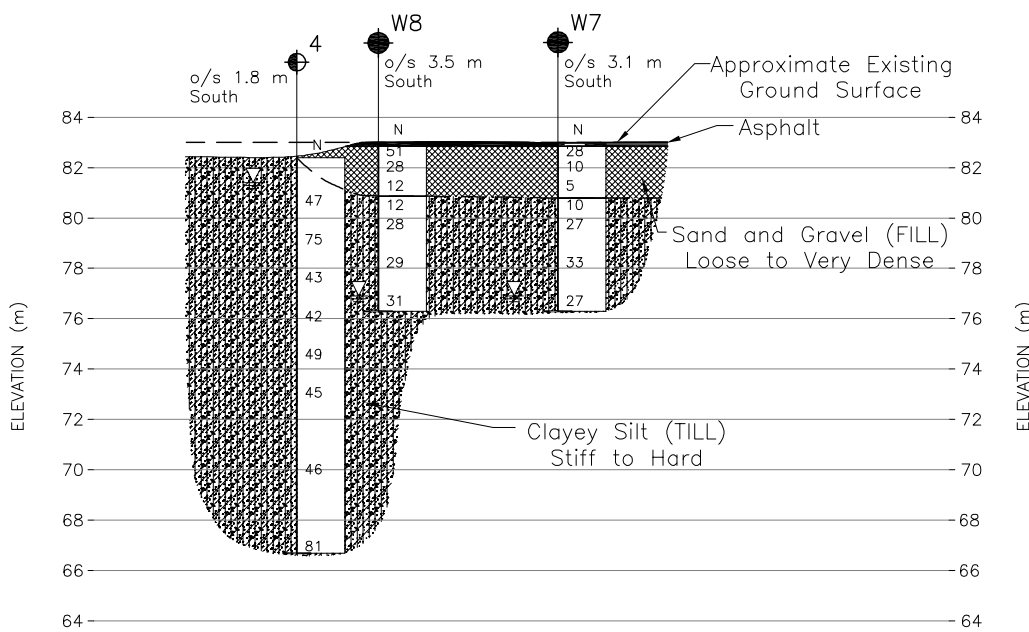
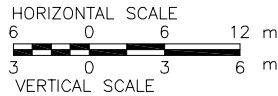
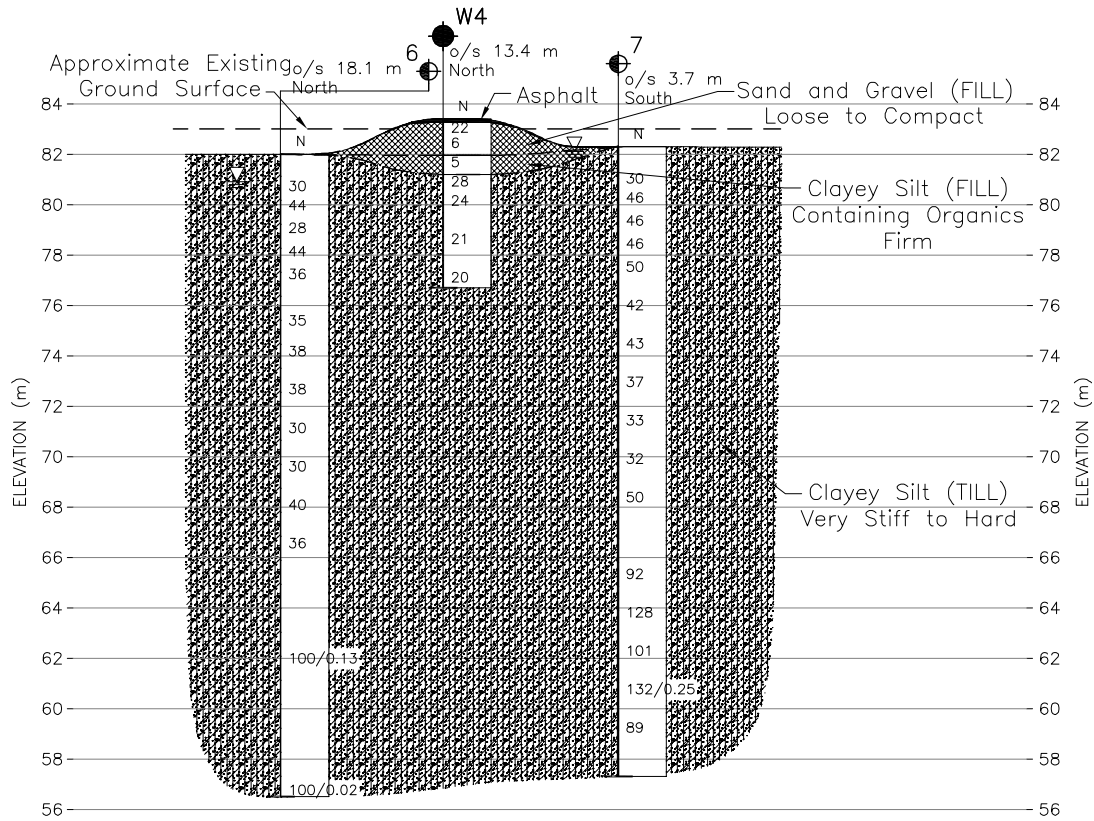
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NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D.TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-207
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 14



METRIC
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MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

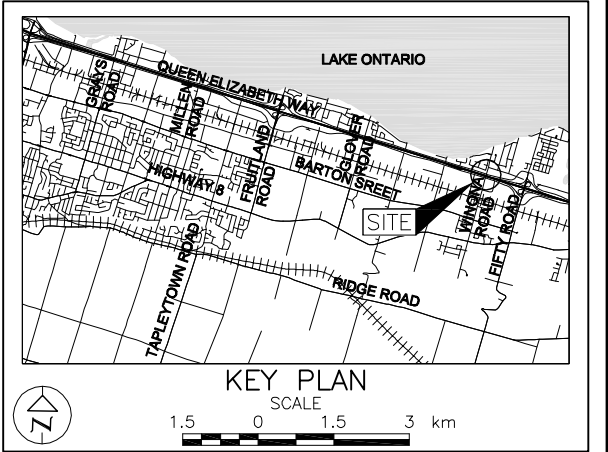
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
WINONA ROAD UNDERPASS
SOIL STRATA

SHEET

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- Borehole - Previous Investigation 1 (1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling

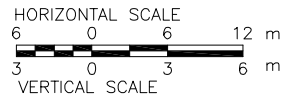
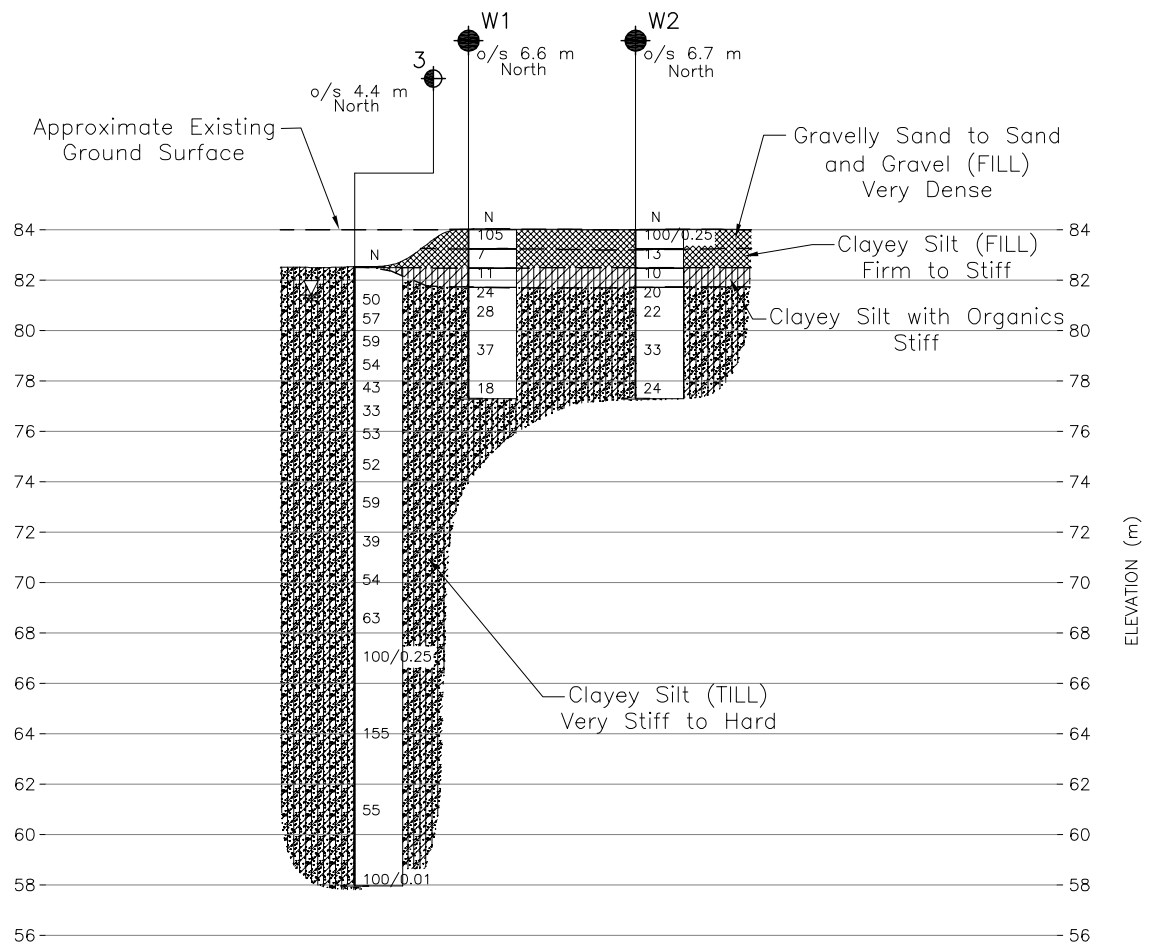
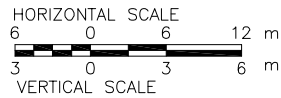
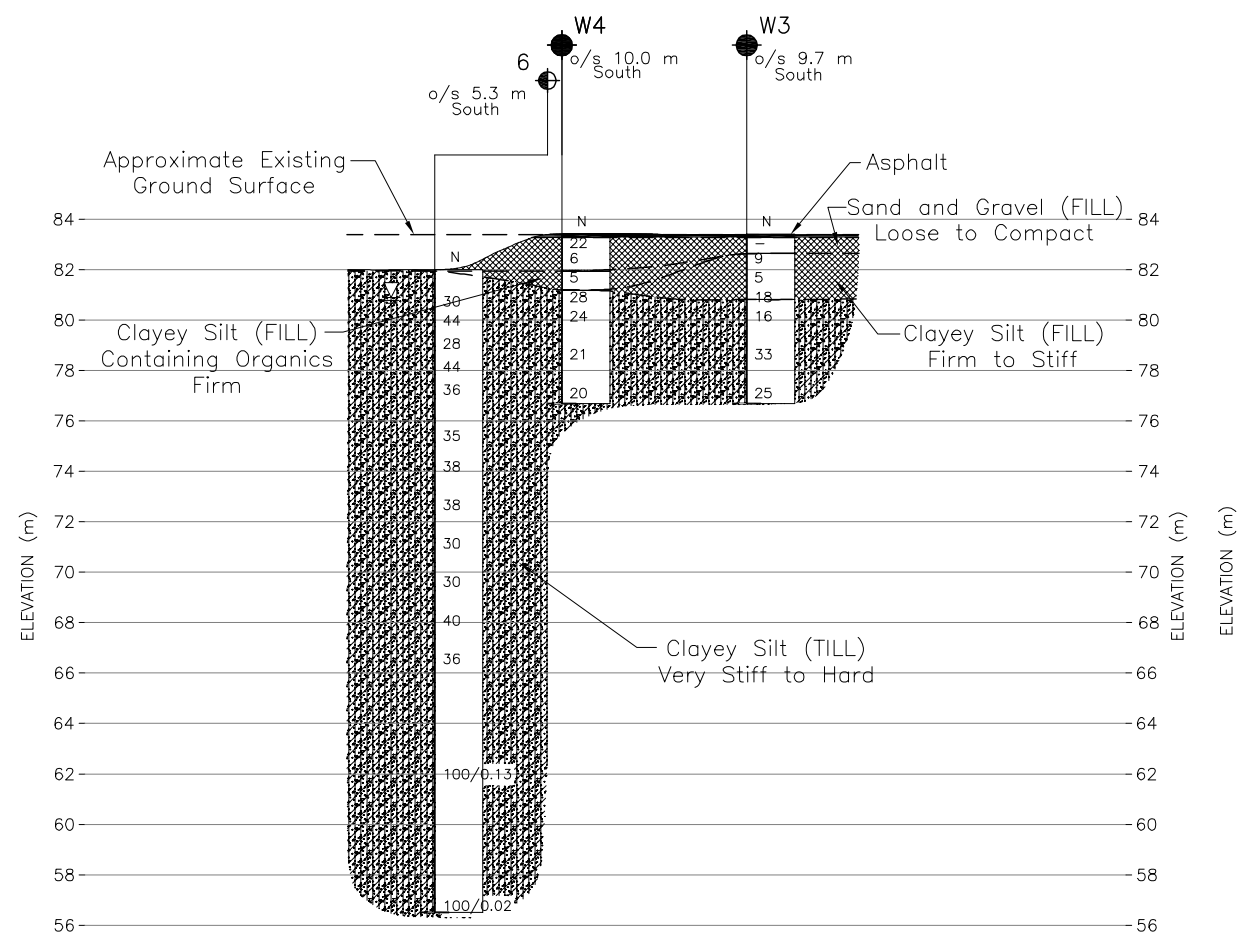
BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
3	82.5	4786577.2	292918.9
6	82.0	4786658.0	292941.5
W1	84.0	4786580.0	292916.8
W2	84.0	4786583.8	292904.1
W3	83.4	4786658.2	292925.1
W4	83.4	4786653.8	292939.1

NOTES

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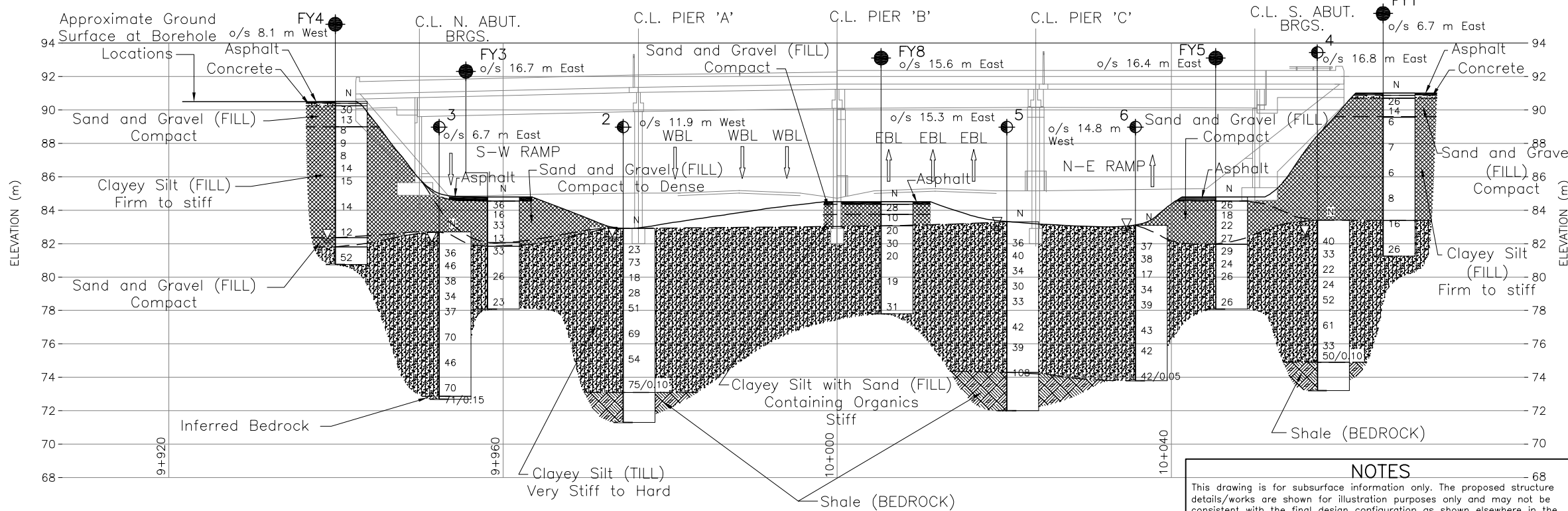
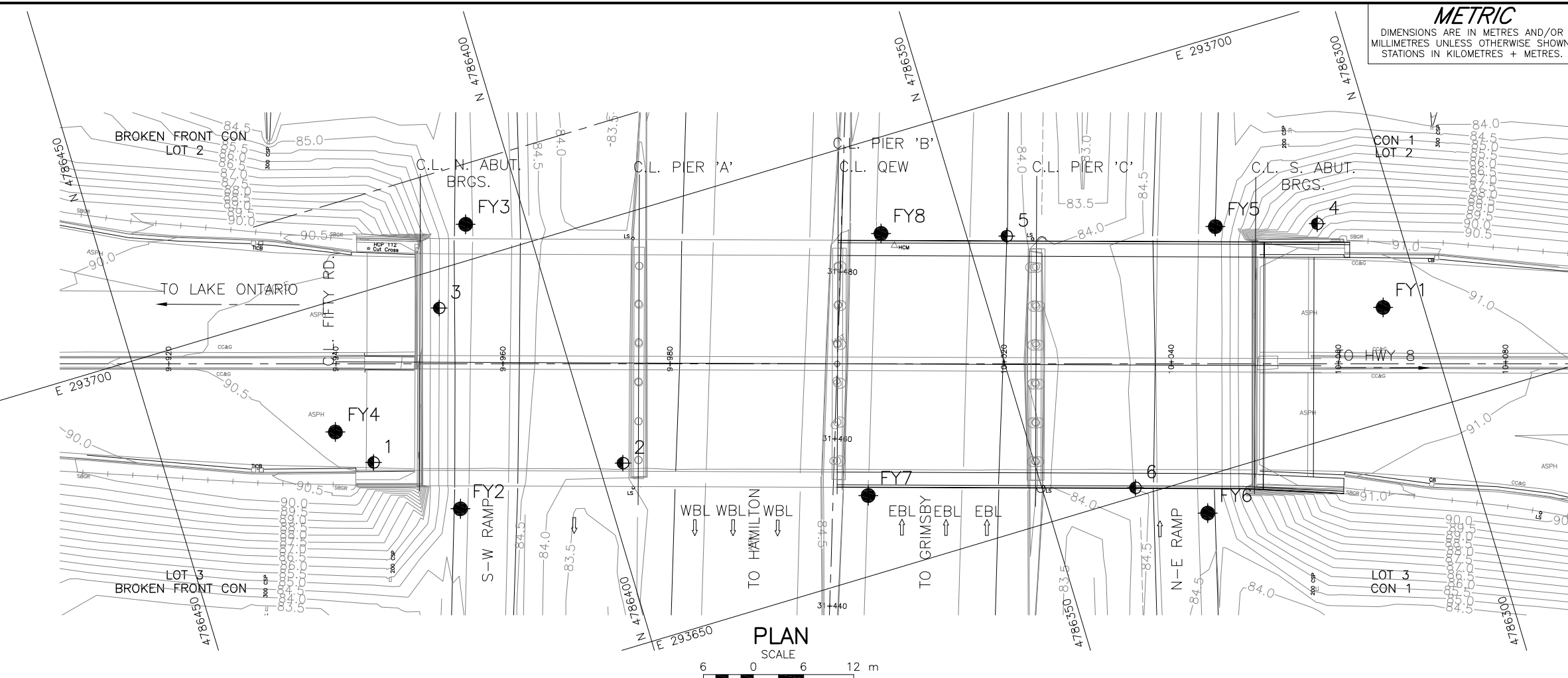
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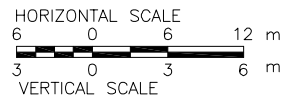
K. J. BENTLEY
Oct. 12, 2010
PROVINCE OF ONTARIO

F. J. HEFFERNAN
Oct. 12, 2010
PROVINCE OF ONTARIO

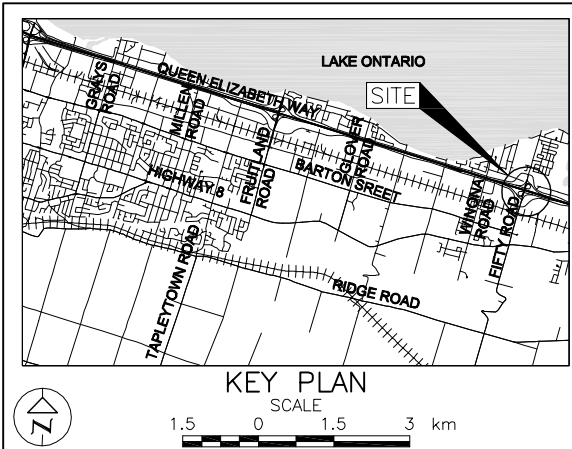
NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY: QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-207
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 15



FIFTY ROAD CENTRELINE PROFILE

CONT No.
GWP No. 2088-08-00QUEEN ELIZABETH WAY
FIFTY ROAD UNDERPASS
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - Previous Investigation (DHO, 1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
1	82.7	4786425.7	293680.1
2	82.9	4786397.2	293671.4
3	82.7	4786412.9	293695.5
4	83.4	4786309.4	293675.1
5	83.3	4786345.4	293684.3
6	83.1	4786339.3	293651.0
FY1	91.0	4786304.7	293663.2
FY2	84.8	4786417.4	293671.8
FY3	84.8	4786407.0	293704.2
FY4	90.5	4786429.1	293684.9
FY5	84.8	4786321.1	293678.2
FY6	84.8	4786331.9	293645.7
FY7	84.5	4786370.2	293659.3
FY8	84.5	4786359.7	293688.9

NOTES

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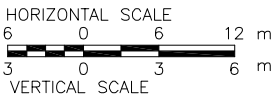
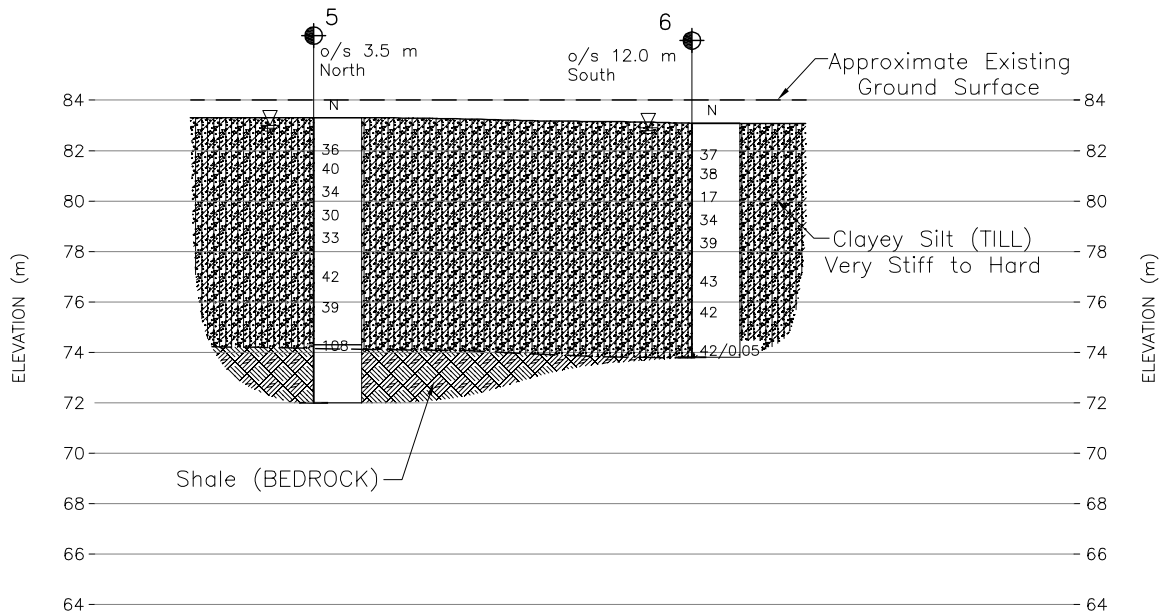
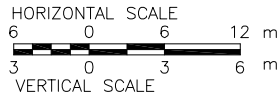
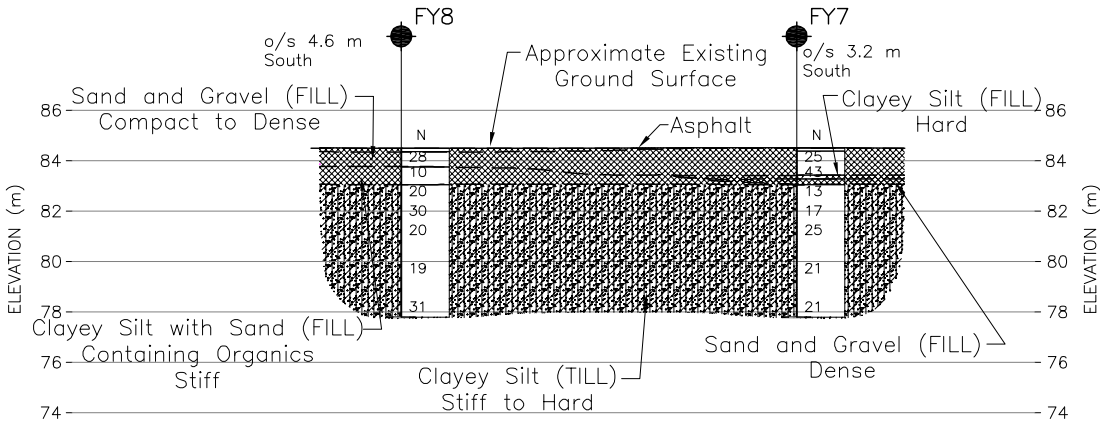
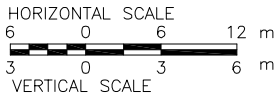
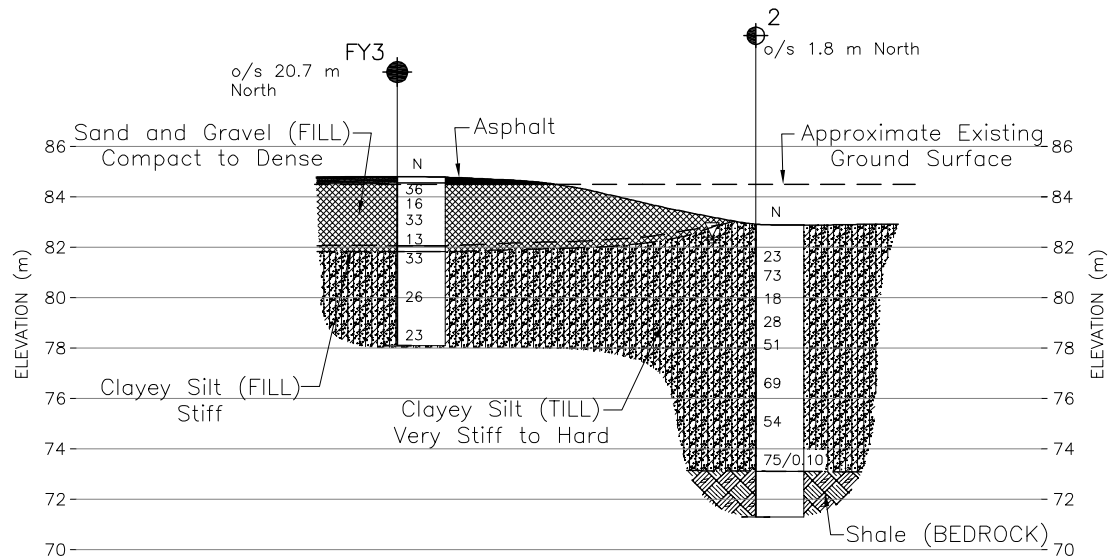
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METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

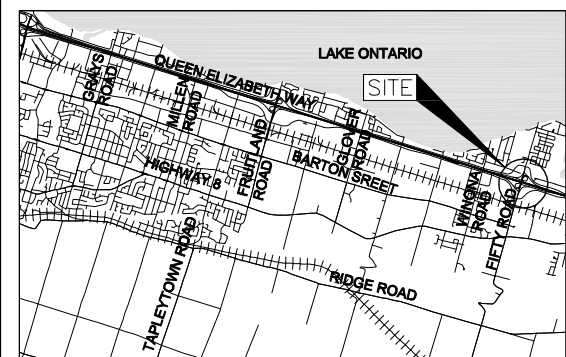
CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
FIFTY ROAD UNDERPASS
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
SCALE: 1.5 0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - Previous Investigation (DHO, 1966)
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ▽ WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
2	82.9	4786397.2	293671.4
5	83.3	4786345.4	293684.3
6	83.1	4786339.3	293651.0
FY3	84.8	4786407.0	293704.2
FY7	84.5	4786370.2	293659.3
FY8	84.5	4786359.7	293688.9

NOTES

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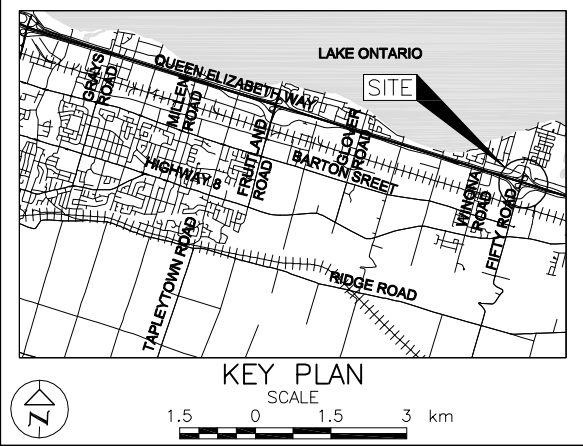
NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY. QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-208
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 17

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.


CONT No.
GWP No. 2088-08-00

QUEEN ELIZABETH WAY
FIFTY ROAD UNDERPASS
SOIL STRATA


**Golder Associates Ltd.**
MISSISSAUGA, ONTARIO, CANADA




LEGEND




Borehole – Current Investigation




Borehole – Previous Investigation (DHO, 1966)




Seal




Piezometer




Standard Penetration Test Value



Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)



WL in piezometer, measured on March 17, 2010



WL upon completion of drilling

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
1	82.7	4786425.7	293680.1
3	82.7	4786412.9	293695.5
FY2	84.8	4786417.4	293671.8
FY3	84.8	4786407.0	293704.2
FY5	84.8	4786321.1	293678.2
FY6	84.8	4786331.9	293645.7

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

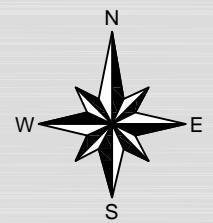
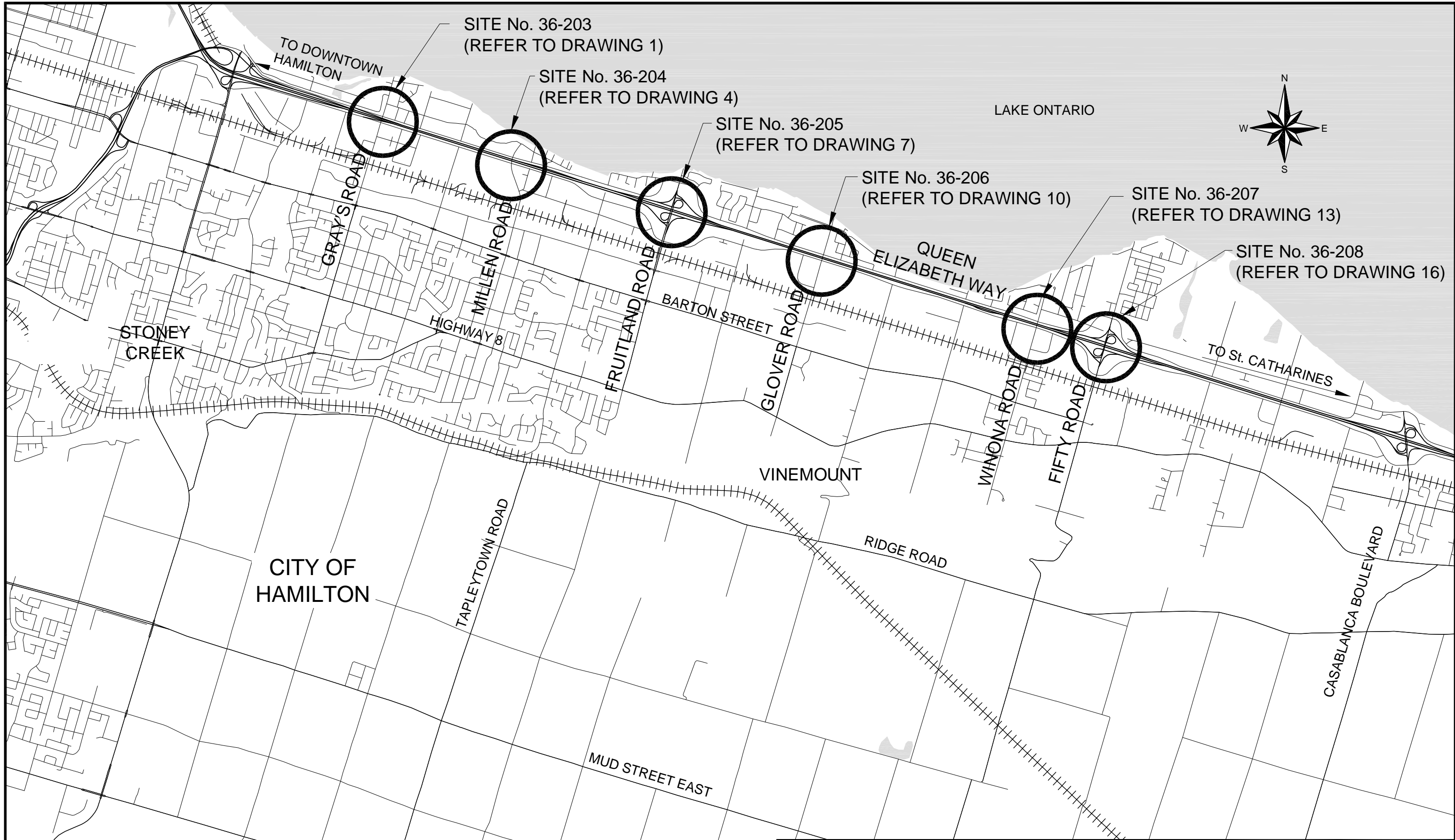
REFERENCE

Base plans and profile provided in digital format by Morrison Hershfield, drawing file no. E-135-QEW-1.dwg, received January 21, 2010. and drawing file no. 36-205S-01.dwg, received February 11, 2010.



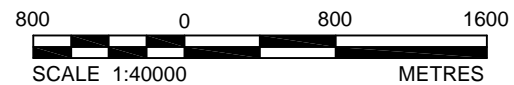
NO.	DATE	BY	REVISION
Geocres No. 30M4-114			
HWY. QEW	PROJECT NO. 09-1111-6066		DIST.
SUBM'D. TB	CHKD. TB	DATE: 11/8/2010	SITE: 36-208
DRAWN: JFC	CHKD. KJB	APPD. FJH	DWG. 18

PLOT DATE: November 5, 2010
FILENAME: T:\Projects\2009\09-1111-6066 (MH, Hamilton)\-AB-091116066AB0.dwg



REFERENCES:

BASE DATA - MNR NRVIS, OBTAINED 2004, CANMAP V2008
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, ©QUEENS PRINTER 2008
DATUM : NAD 83 PROJECTION : MTM ZONE 10



FILE No. 0911116066AB0.dwg
PROJECT No. 09-1111-6066 REV.

SCALE	AS SHOWN
DATE	May. 27, 2010
DESIGN	KJB
CAD	JFC
CHECK	KJB
REVIEW	FJH

TITLE	
INDEX PLAN	
QUEEN ELIZABETH WAY BRIDGE REHABILITATIONS CITY OF HAMILTON, ONTARIO	FIGURE 1



APPENDIX A

Gray's Road Underpass Record of Boreholes and Laboratory Test Results

PROJECT		09-1111-6066		RECORD OF BOREHOLE No G1		1 OF 1 METRIC											
G.W.P.		2088-08-00		LOCATION		N 4789099.0 ; E 285601.8											
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger											
DATUM		Geodetic		DATE		January 21, 2010											
						ORIGINATED BY GM											
						COMPILED BY SAC											
						CHECKED BY TB/KJB											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
79.5	GROUND SURFACE																
0.0	ASPHALT																
0.2	Sand and gravel, trace to some silt, trace clay (FILL) Compact to very dense Grey Moist		1	SS	56												
			2	SS	10												
78.1																	
1.5	Clayey silt with sand, some gravel, containing wood fibres (FILL) Stiff Brown Moist		3	SS	9												
			4	CS	-												
76.8																	
2.7	CLAYEY SILT, trace sand and gravel (TILL) Stiff to very stiff Brown Moist		5	SS	19												
			6	SS	16												
			7	SS	15												
			8	SS	14												
			9	SS	14												
72.8																	
6.7	END OF BOREHOLE																
NOTES:																	
1. Borehole dry upon completion of drilling.																	
2. Sample 4 taken from field vane.																	

PROJECT 09-1111-6066		RECORD OF BOREHOLE No G2				1 OF 1 METRIC								
G.W.P. 2088-08-00		LOCATION N 4789094.5 ; E 285618.4				ORIGINATED BY GM								
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC								
DATUM Geodetic		DATE January 21, 2010				CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
79.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	ASPHALT													
0.2	Sand and gravel, trace silt (FILL) Compact to very dense Grey Moist		1	SS	54		79							
			2	SS	12									
78.1							78							
1.4	CLAYEY SILT, trace to some sand, trace gravel (TILL) Stiff to very stiff Brown Moist		3	SS	20									
			4	SS	15		77							0 12 45 43
			5	SS	20		76							
			6	SS	18		75							
			7	SS	11		74							
			8	SS	10		73							
72.8	END OF BOREHOLE													
6.7	NOTES: 1. Borehole dry upon completion of drilling.													

PROJECT 09-1111-6066			RECORD OF BOREHOLE No G3			1 OF 1 METRIC								
G.W.P. 2088-08-00			LOCATION N 4789027.6 ; E 285577.8			ORIGINATED BY GM								
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC								
DATUM Geodetic			DATE January 21, 2010			CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
79.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100					
0.0	ASPHALT													
0.2	Sand and gravel, trace to some silt, trace clay (FILL)		1	SS	37									31 50 [19]
78.7	Dense Grey Moist		2	SS	16									
0.8	CLAYEY SILT, trace to some sand, trace gravel, containing sandy silt seams (TILL)		3	SS	28									
	Stiff to very stiff Brown Moist		4	SS	19									1 7 61 31
			5	SS	18									
			6	SS	11									
			7	SS	11									
			8	SS	9									
72.8	END OF BOREHOLE													
6.7	NOTES: 1. Borehole dry upon completion of drilling.													

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

PROJECT		09-1111-6066		RECORD OF BOREHOLE No G5		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4789114.4 ; E 285611.8								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		January 22, 2010								
						ORIGINATED BY GM								
						COMPILED BY SAC								
						CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W	W _L		
85.0	GROUND SURFACE													
0.0	ASPHALT													
	CONCRETE													
0.4	Sand and gravel, trace silt (FILL) Compact to dense Grey / brown Moist		1	SS	49									
			2	SS	45									
			3	SS	11									
82.9	Clayey silt, some sand, trace gravel, containing shale fragments, (FILL) Firm to very stiff Brown / grey Moist		4	SS	7									
2.1														
			5	SS	7									
			6	SS	16									
			7	SS	6									
77.7	Silty sand, some gravel (FILL) Compact Reddish / brown Moist		8	SS	13									
7.3														
75.9	Clayey silt, trace sand and gravel (FILL) Very stiff Brown Moist		9	SS	21									
75.6														
75.3	CLAYEY SILT, trace sand and gravel (TILL) Very stiff Brown Moist													
9.8	END OF BOREHOLE													
NOTES: 1. Borehole dry upon completion of drilling.														

PROJECT		09-1111-6066		RECORD OF BOREHOLE No G6		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4789005.7 ; E 285580.8								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		January 22, 2010								
				ORIGINATED BY		GM								
				COMPILED BY		SAC								
				CHECKED BY		TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W	W _L		
85.5	GROUND SURFACE													
0.0	ASPHALT													
	CONCRETE													
0.4	Sand and gravel, trace silt (FILL) Dense Grey Moist		1	SS	48									
			2	SS	46									
84.1														
1.5	Clayey silt, some sand, trace gravel (FILL) Firm to very stiff Brown Moist		3	SS	10									
			4	SS	4									
			5	SS	5									
			6	SS	8									
79.1	Organic silt seam at 6.4 m		7	SS	23									
6.4	CLAYEY SILT to SILTY CLAY, trace to some sand, trace gravel (TILL) Very stiff Brown becoming grey below 7.6 m Moist													
			8	SS	19									
			9	SS	16									
75.8														
9.8	END OF BOREHOLE													
NOTES:														
1. Borehole dry upon completion of drilling.														

PROJECT 09-1111-6066		RECORD OF BOREHOLE No G7				1 OF 1 METRIC										
G.W.P. 2088-08-00		LOCATION N 4789060.7 ; E 285588.4				ORIGINATED BY GM										
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC										
DATUM Geodetic		DATE February 1, 2010				CHECKED BY TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
79.0	GROUND SURFACE															
0.0	ASPHALT															
0.1	Sand and gravel, trace silt (FILL)		1	SS	11											
78.2	Compact Grey Moist															
0.8	CLAYEY SILT to SILTY CLAY, trace to some sand, trace gravel (TILL)		2	SS	21											
	Stiff to very stiff															
	Brown becoming grey at 4.1 m		3	SS	21											
	Moist															
			4	SS	21											
			5	SS	29											
			6	SS	10											
			7	SS	11											
72.3	END OF BOREHOLE															
6.7	NOTES: 1. Borehole dry upon completion of drilling.															

PROJECT 09-1111-6066			RECORD OF BOREHOLE No G8			1 OF 1 METRIC								
G.W.P. 2088-08-00			LOCATION N 4789054.9 ; E 285605.9			ORIGINATED BY GM								
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC								
DATUM Geodetic			DATE February 1, 2010			CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
79.0	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100					
0.0	ASPHALT													
0.2	Sand and gravel, some silt, trace clay (FILL)		1	SS	30									38 47 13 2
78.2	Compact to dense Grey Moist		2	SS	23									0 4 53 43
0.8	CLAYEY SILT to SILTY CLAY, trace sand and gravel (TILL)													
	Stiff to very stiff		3	SS	22									
	Brown becoming grey at 4.1 m Moist		4	SS	17									
			5	SS	21									
			6	SS	10									
			7	SS	10									
72.3	END OF BOREHOLE													
6.7	Note: 1. Borehole dry upon completion of drilling.													

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-P-1

LOCATION E.W. & Gray's Rd Sta. 28+15 10' Lt.

ORIGINATED BY P.L.W.

W.P. 207-63

BORING DATE Jan. 4 - 9, 1966.

COMPILED BY P.L.W.

DATUM Geodetic

BOREHOLE TYPE Penn Auger.

CHECKED BY M.D. *MD*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	WP	W	WL		
						SHEAR STRENGTH P.S.F. + Field Vane Test • Unconfined Compression					WATER CONTENT %				
						1000 2000 3000					10 20 30				
255.5	Groundlevel														
243.5 12	Brown (Grey) Grey clayey silt with traces of sand and gravel. Firm to very stiff.		1	SS	12	250									
			2	SS	37										
			3	SS	20										
			4	TW	PH	240									
			5	TW	PH										
			6	TW	PH										
			7	TW	PH	230									
			8	TW	PH										
			9	TW	PH	220									
			10	TW	PH										
			11	TW	PH	210									
			12	TW	PH										
			13	TW	PH	200									
			195.5 60	Reddish brown silt to sandy silt with traces of gravel. Very dense.		14	TW	PH	190						
15	SS		100/2"												
16	SS		120/4"												
180.5 75	End of borehole.			17	SS	100/1"									
			18	SS	150/2"	180									
						Percent strain at failure					S= Sensitivity				

WL
251.6

133

133

128

133

132

136

138

127

134

134

Gr2%Sa5%
Si&Cl 93%

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-1 LOCATION C.E.W. & Gray's Rd Sta. 28+62 17' Rt. ORIGINATED BY P.L.W.
W.P. 207-63 BORING DATE Jan. 9, 1966. COMPILED BY P.L.W.
DATUM Geodetic BOREHOLE TYPE Penn Auger CHECKED BY M.D. *W.D.*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 — SHEAR STRENGTH P.S.F. + Field Vane Test • Unconfined Compression Test 1000 2000 3000	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W Wp — W — WL WATER CONTENT % 15 30 45	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
256.5	Groundlevel									
0	Brown (Gray) Clayey silt with traces of sand and gravel. Firm to very stiff.		1	SS	13					
2			SS	22	250					
3			SS	44						
4			SS	25						
5			PH		240					
6			PH							
233.5										
23.0	End of borehole.					230				

20
15+5 Percent strain at failure.
S=Sensitivity

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-1

LOCATION S.E.W. & Gray's Rd. Sta. 29+23 12' Lt.

ORIGINATED BY P.L.W.

W.P. 207-63

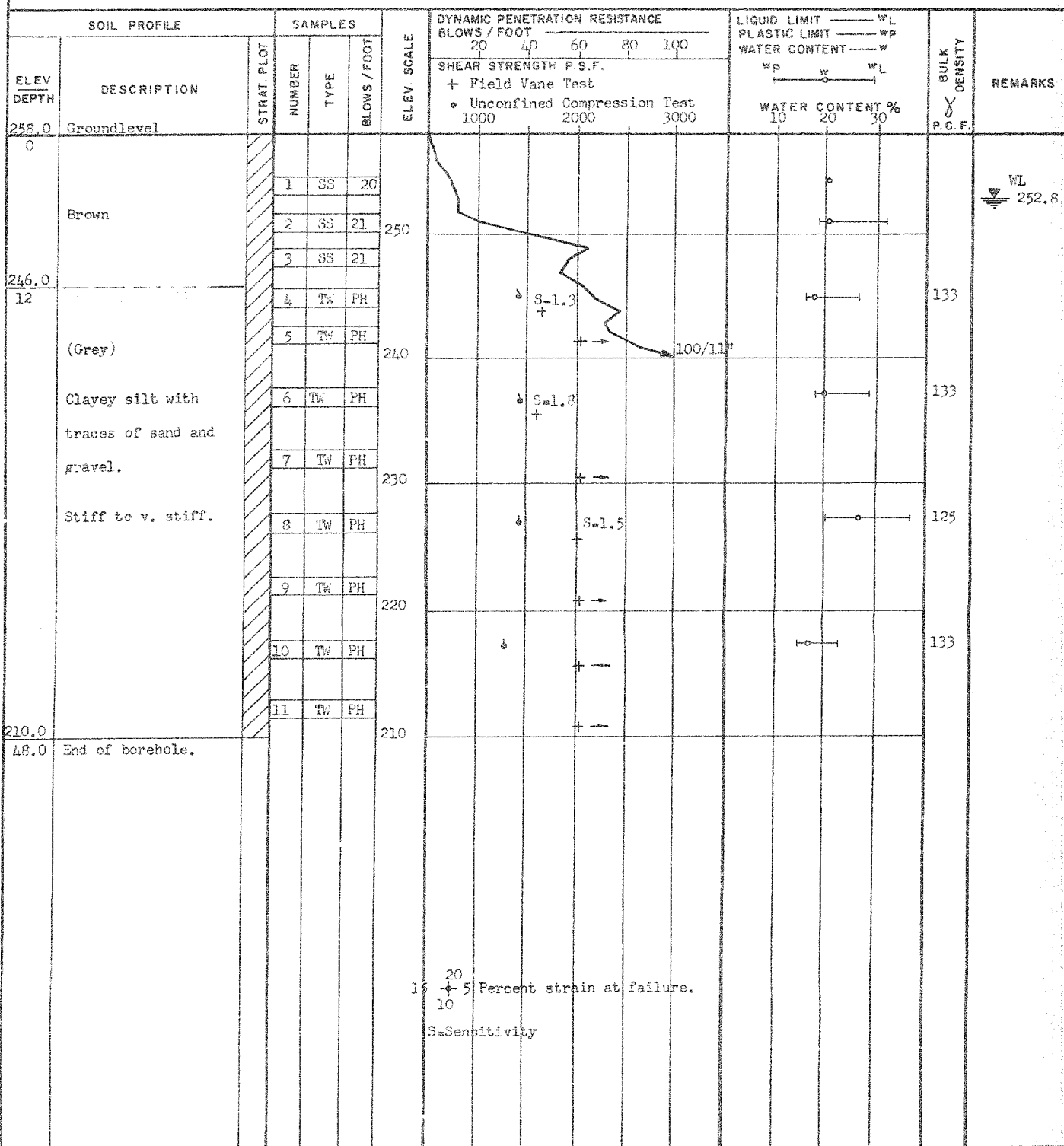
BORING DATE Jan. 11 - 12, 1966.

COMPILED BY P.L.W.

DATUM Geodetic

BOREHOLE TYPE Penn Auger

CHECKED BY M.D. 152



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 66-F-1 LOCATION E.B.W. & Gray's Rd. Sta. 30467 16' Lt. ORIGINATED BY P.L.W.
 W.P. 207-63 BORING DATE Jan. 12 to 14, 1966 COMPILED BY P.L.W.
 DATUM Geodetic BOREHOLE TYPE Penn Auger CHECKED BY M.D. *MD*

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4A

FOUNDATION SECTION

JOB 66-F-1 LOCATION C.B.W. & Gray's Rd, Sta. 30452 30' Lt. ORIGINATED BY P.L.W.
 W.P. 207-63 BORING DATE Jan. 17, 1966 COMPILED BY P.L.W.
 DATUM Geodetic BOREHOLE TYPE Penn Auger CHECKED BY M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. + Field Vane Test • Unconfined Compression Test			WATER CONTENT %					
259.0	Groundlevel					1000	2000	3000	10	20	30			
0	Brown		1	SS	32								W.L. 252.8	
			2	SS	27									
			3	TW	PH									
	(Grey) Clayey silt with traces of sand & gravel Stiff to very stiff.		4	TW	PH									
236.0														
23.0	End of borehole.													

20

15

10

5

Percent strain at failure.

S=Sensitivity

20
 15 + 5 Percent strain at failure.
 10

S = Sensitivity

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 66-F-1

LOCATION Q.E.W. & Gray's Rd Sta. 30+76.28' Rt.

ORIGINATED BY P.L.W.

W.P. 207-63

BORING DATE Jan. 17, 1966.

COMPILED BY P.L.W.

DATUM Geodetic

BOREHOLE TYPE Penn Auger

CHECKED BY M.D. *l.d.*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80			100
260.0	Groundlevel											
0	Brown		1	SS	26							
			2	SS	27							
			3	SS	33							
			4	TW	PH							
248.0			5	TW	PH							
12.0	(Grey) Clayey silt with traces of sand and gravel. Stiff to very stiff.		6	TW	PH							
			7	TW	PH							
237.0												
23.0	End of borehole.											

250
240
230

100/9" = 9050

+ >2000
+ >2000

+ S=1.4

+ S=1.7

WL 252.5

GrO%Sa3%
Si56%Cl 41%

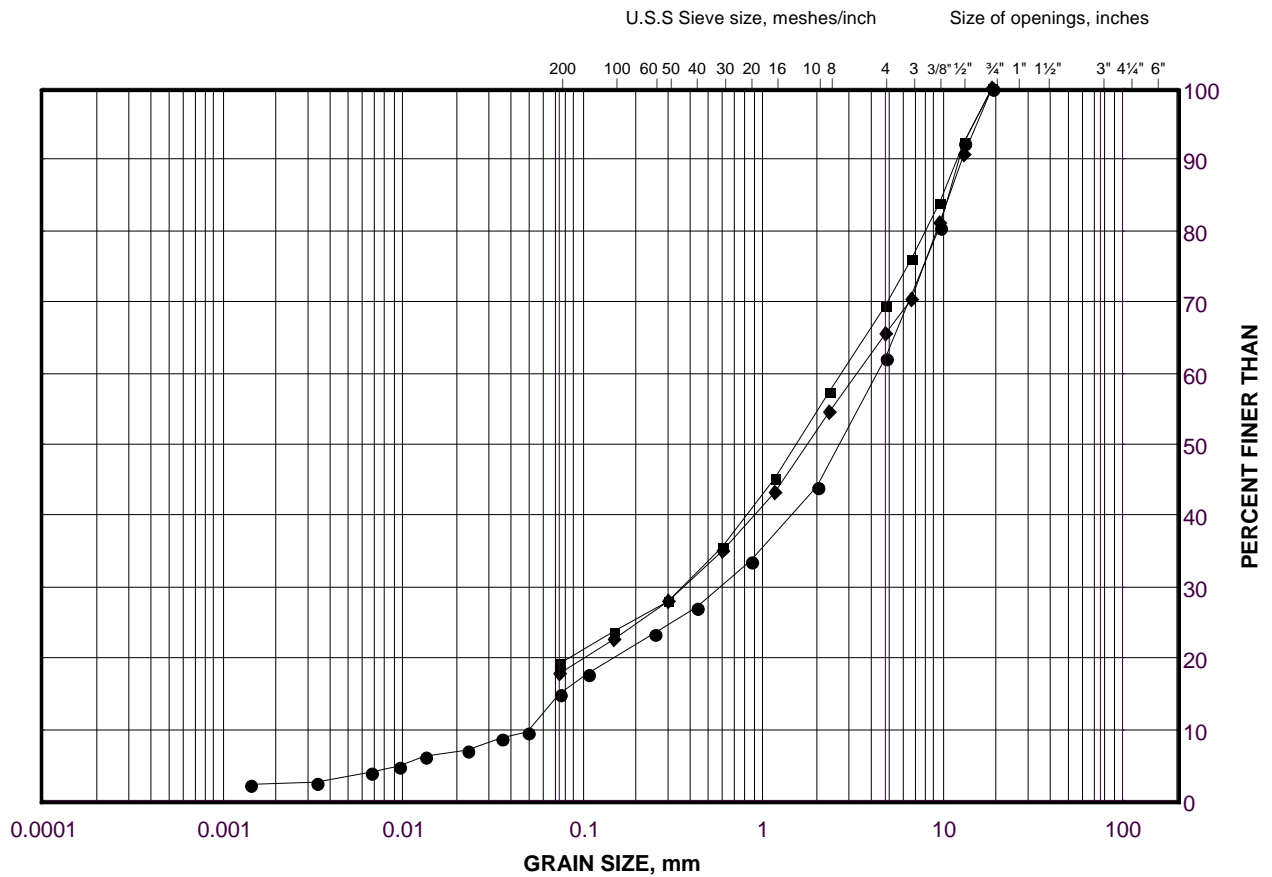
136
132
132
135

20
15 + 5 Percent strain at failure
10
S= Sensitivity

GRAIN SIZE DISTRIBUTION

Sand and Gravel Fill

FIGURE A1



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	G8	1	78.2
■	G3	1	79.0
◆	G1	2	78.4

Project Number: 09-1111-6066

Checked By: KJB

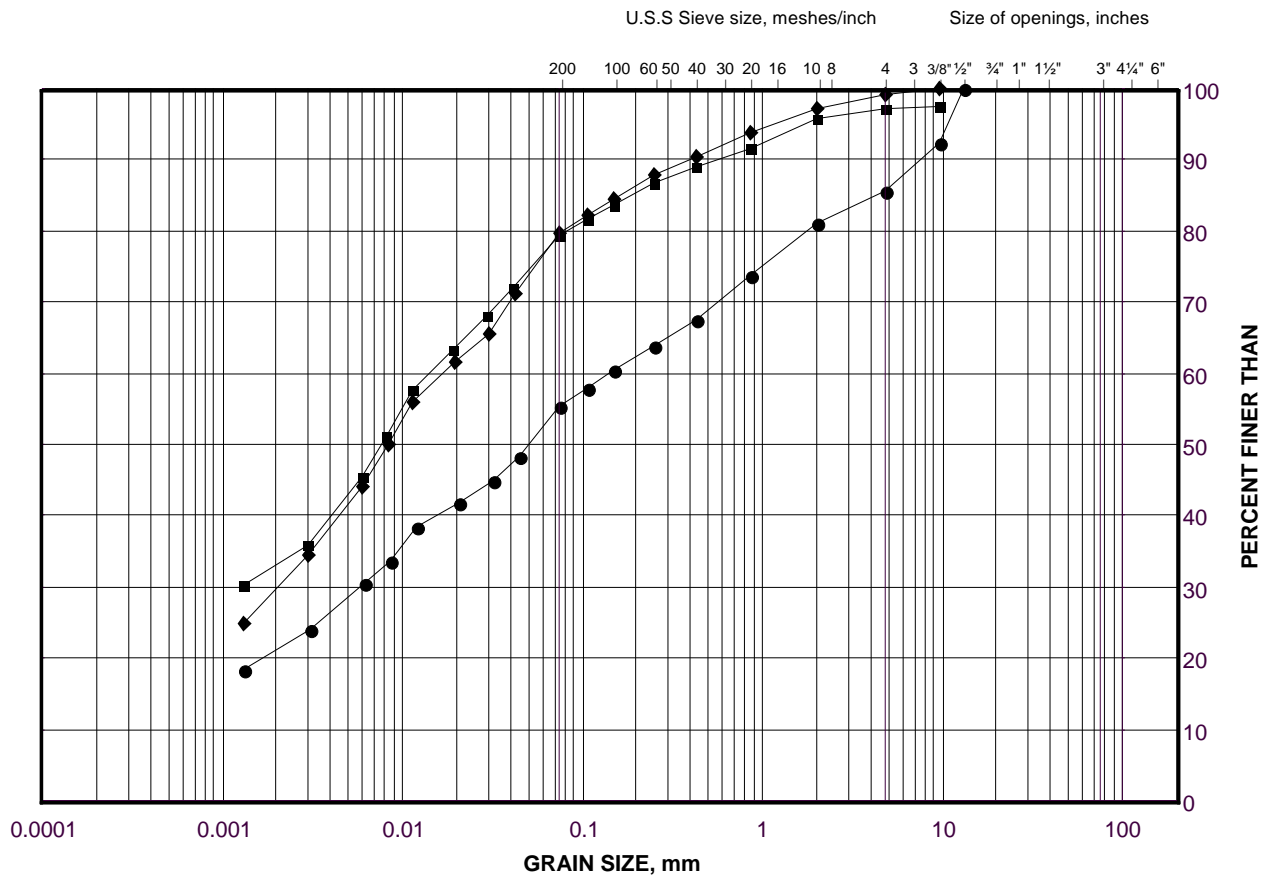
Golder Associates

Date: 13-Apr-10

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Fill

FIGURE A2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

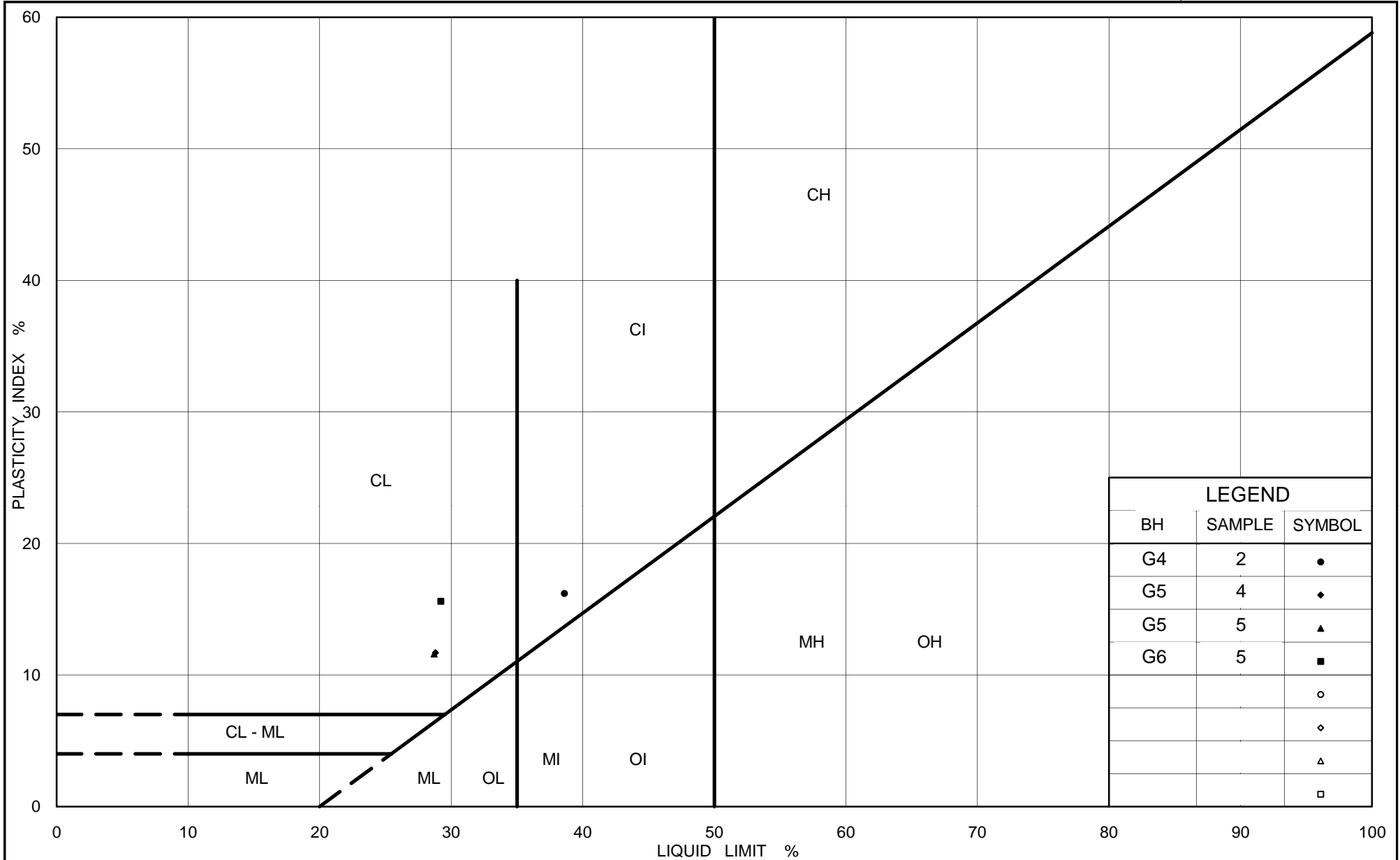
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	G1	3	78.4
■	G5	4	82.4
◆	G6	5	81.8

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 13-Apr-10



Ministry of Transportation

PLASTICITY CHART

Clayey Silt to Silty Clay Fill

Ontario

Figure No. A3

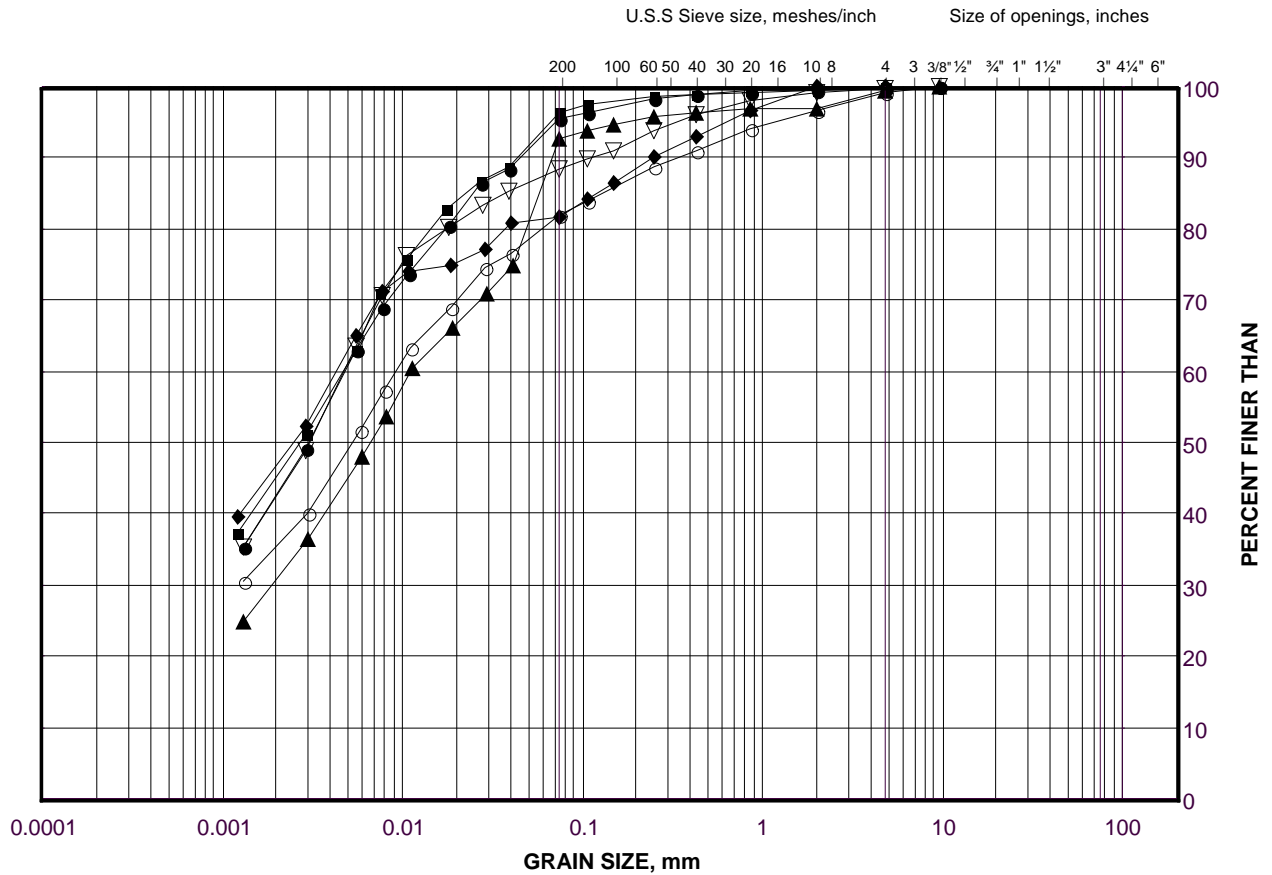
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Till

FIGURE A4



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

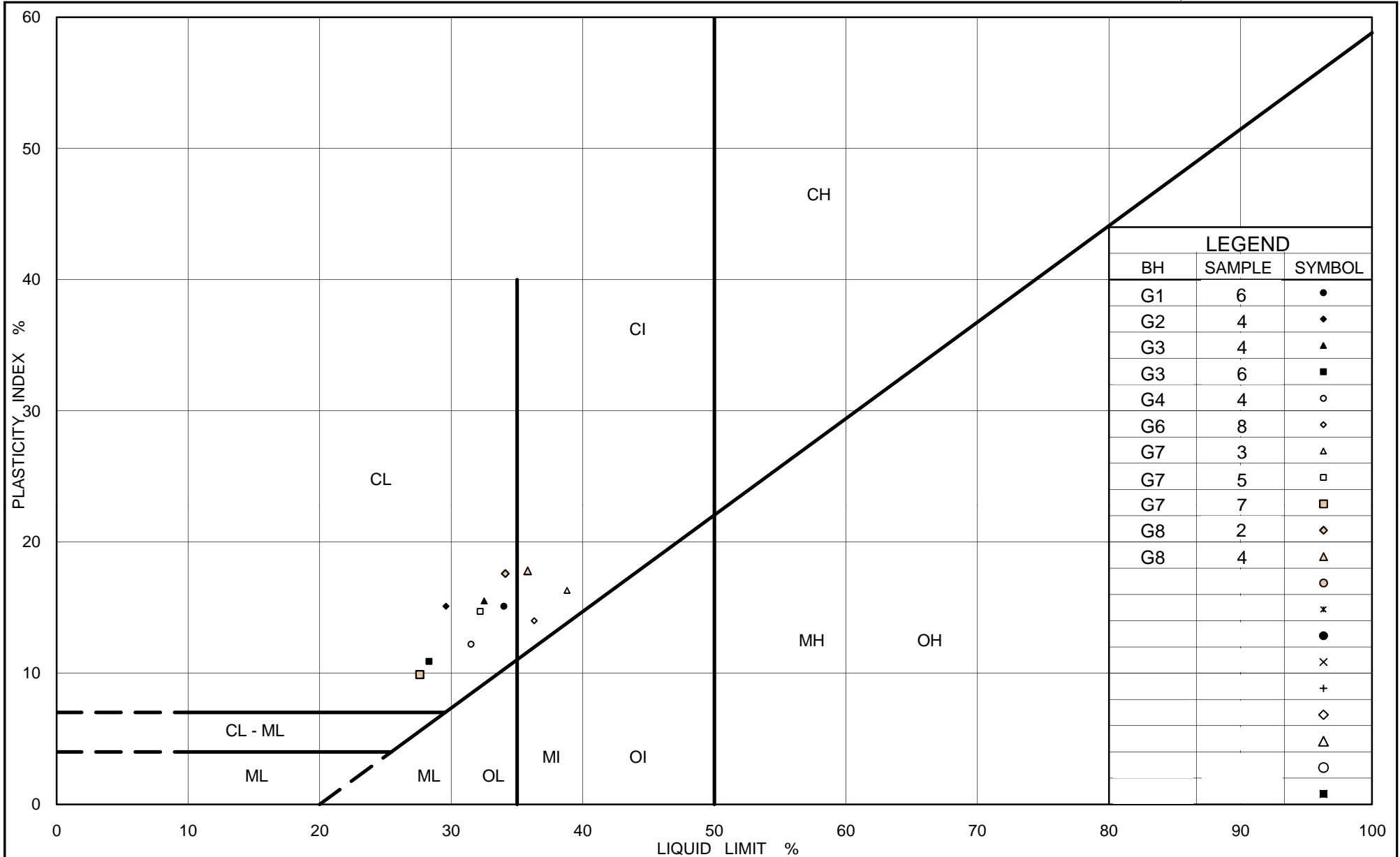
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	G8	2	77.9
■	G7	3	77.2
◆	G4	4	76.9
▲	G3	4	76.9
▽	G2	4	76.9
○	G7	7	72.6

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 13-Apr-10



Ontario

Ministry of
Transportation

PLASTICITY CHART

Clayey Silt to Silty Clay Till

Figure No. A5

Project No. 09-1111-6066



Checked By: KJB



APPENDIX B

Millen Road Underpass Record of Boreholes and Laboratory Test Results

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

PROJECT		09-1111-6066		RECORD OF BOREHOLE No M2		1 OF 1 METRIC											
G.W.P.		2088-08-00		LOCATION		N 4788615.3 ; E 287057.9											
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger											
DATUM		Geodetic		DATE		December 22, 2009											
				ORIGINATED BY		GM											
				COMPILED BY		SAC											
				CHECKED BY		TB/KJB											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W _p	W	W _L			
79.5	GROUND SURFACE																
0.0	Silty sand, trace gravel (FILL) Compact Grey/brown Moist		1	SS	29												
78.9			2	SS	17												
0.6	Clayey silt, some sand, trace gravel (FILL) Very stiff Brown Moist		3	SS	25												
77.5																	
2.0	CLAYEY SILT, some sand, trace to some gravel (TILL) Firm to very stiff Brown becoming grey below 3.8 m Moist		4	SS	21												
			5	SS	17												
			6	SS	7												
			7	SS	5												
73.0			8	SS	7												
6.6	END OF BOREHOLE																
NOTE: 1. Borehole dry upon completion of drilling.																	

PROJECT		09-1111-6066		RECORD OF BOREHOLE No M3		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4788629.4 ; E 287073.1								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		December 23, 2009								
				ORIGINATED BY		GM								
				COMPILED BY		SAC								
				CHECKED BY		TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W	W _L		
85.2	GROUND SURFACE													
0.0	ASPHALT													
84.7	CONCRETE													
0.5	Sand and gravel, some silt, trace clay (FILL) Compact Brown Moist		1	SS	28									31 53 14 2
83.8														
1.4	Clayey silt, some sand, trace gravel (FILL) Firm to very stiff Brown Moist		2	SS	11									
			3	SS	17									4 18 48 30
			4	SS	7									
			5	SS	7									
			6	SS	8									
			7	SS	6									
77.3			8A	SS	20									
7.9	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Brown Moist		8B											
75.6			9	SS	22									
9.6	END OF BOREHOLE													
	NOTE: 1. Borehole dry upon completion of drilling.													

MIS-MTO 001 09-1111-6066.GPJ GAL-MISS.GDT 8/11/10 DD/SAC

PROJECT		09-1111-6066		RECORD OF BOREHOLE No M4		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4788517.8 ; E 287043.7								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		December 23, 2009								
				ORIGINATED BY		GM								
				COMPILED BY		SAC								
				CHECKED BY		TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
86.5	GROUND SURFACE													
0.0	ASPHALT													
86.0	CONCRETE													
0.5	Sand and gravel, some silt, trace clay (FILL) Loose to very dense Brown Moist		1	SS	54									
			2	SS	38									
			3	SS	19									
			4	SS	6									
82.7														
3.8	Clayey silt, some sand, trace gravel (FILL) Firm to stiff Brown Moist		5	SS	6									
			6	SS	10									
80.9														
5.6	Silty sand, trace gravel, trace clay (FILL) Compact Brown Moist		7	SS	17									
79.4														
7.1	Clayey silt, some sand, trace gravel, containing organics (FILL) Firm Brown Moist		8	SS	6									
77.4														
9.1	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Brown Moist		9	SS	21									
76.9														
9.6	END OF BOREHOLE													
NOTE: 1. Borehole dry upon completion of drilling. 2. Water level in piezometer at a depth of 7.6 m below ground surface (Elev. 78.9 m) on March 17, 2010.														

MIS-MTO 001 09-1111-6066.GPJ GAL-MISS.GDT 8/11/10 DD/SAC

PROJECT		09-1111-6066		RECORD OF BOREHOLE No M5		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4788535.6 ; E 287055.2								
DIST		HWY QEWS		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		January 29, 2010								
				ORIGINATED BY		GM								
				COMPILED BY		SAC								
				CHECKED BY		TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
79.8	GROUND SURFACE													
0.0 79.5	ASPHALT													
0.3	Sand and silt, trace to some clay, trace gravel, containing organics (FILL) Loose to compact Brown Moist		1	SS	10								OC=2.7%	
			2	SS	10									5 36 50 9
78.3														
1.5	CLAYEY SILT, trace to some sand, trace gravel, containing silty sand seams (TILL) Stiff to very stiff Brown becoming grey below 4.6 m Moist		3	SS	27									0 11 53 36
			4	SS	20									
			5	SS	16									
			6	SS	10									
			7	SS	9									
73.1	END OF BOREHOLE													
6.7	NOTE: 1. Borehole dry upon completion of drilling.													

PROJECT		2088-08-00		LOCATION		N 4788540.2 ; E 287040.8		ORIGINATED BY		GM			
DIST		HWY		QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger		COMPILED BY			
SAC		DATE		January 29, 2010		CHECKED BY		TB/KJB					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)		
79.8	GROUND SURFACE												
0.0	ASPHALT												
79.4													
79.0	Gravelly sand, trace to some silt, trace clay (FILL)		1	SS	9								23 52 [25]
0.8	Loose Brown Moist		2	SS	11								1 33 49 17
78.3	Sand and silt, some clay, trace gravel (FILL)												
1.5	Compact Brown Moist		3	SS	23								
	CLAYEY SILT, some sand, trace gravel, containing silty sand seams (TILL)												
	Stiff to very stiff		4	SS	23								
	Brown becoming grey below 3.0 m												
	Moist		5	SS	15								
			6	SS	9								
			7	SS	9								2 20 50 28
73.1	END OF BOREHOLE												
6.7	NOTE: 1. Borehole dry upon completion of drilling.												

PROJECT 09-1111-6066			RECORD OF BOREHOLE No M7			1 OF 1 METRIC										
G.W.P. 2088-08-00			LOCATION N 4788575.1 ; E 287044.3			ORIGINATED BY GM										
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC										
DATUM Geodetic			DATE February 1, 2010			CHECKED BY TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
79.5	GROUND SURFACE															
0.0	ASPHALT															
0.1	Sand and gravel, trace silt (FILL) Compact to very dense Brown Moist		1	SS	65											
78.4			2	SS	25											
78.1	Clayey silt, trace to some sand, trace gravel, containing organics (FILL) Very stiff Brown Moist		3	SS	25											
1.5			4	SS	24											
	CLAYEY SILT, trace to some sand, trace gravel (TILL) Firm to very stiff Brown becoming grey at 3.0 m Moist		5	SS	11											
			6	SS	4											
			7	SS	9											
72.8	END OF BOREHOLE															
6.7	NOTES: 1. Borehole dry upon completion of drilling.															

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

RECORD OF BOREHOLE NO. 1

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-7

LOCATION C.E.W. & Millen Rd. Rev'n Sta. 31/73 17' Lt.

ORIGINATED BY L.P.

W. P. 208-63

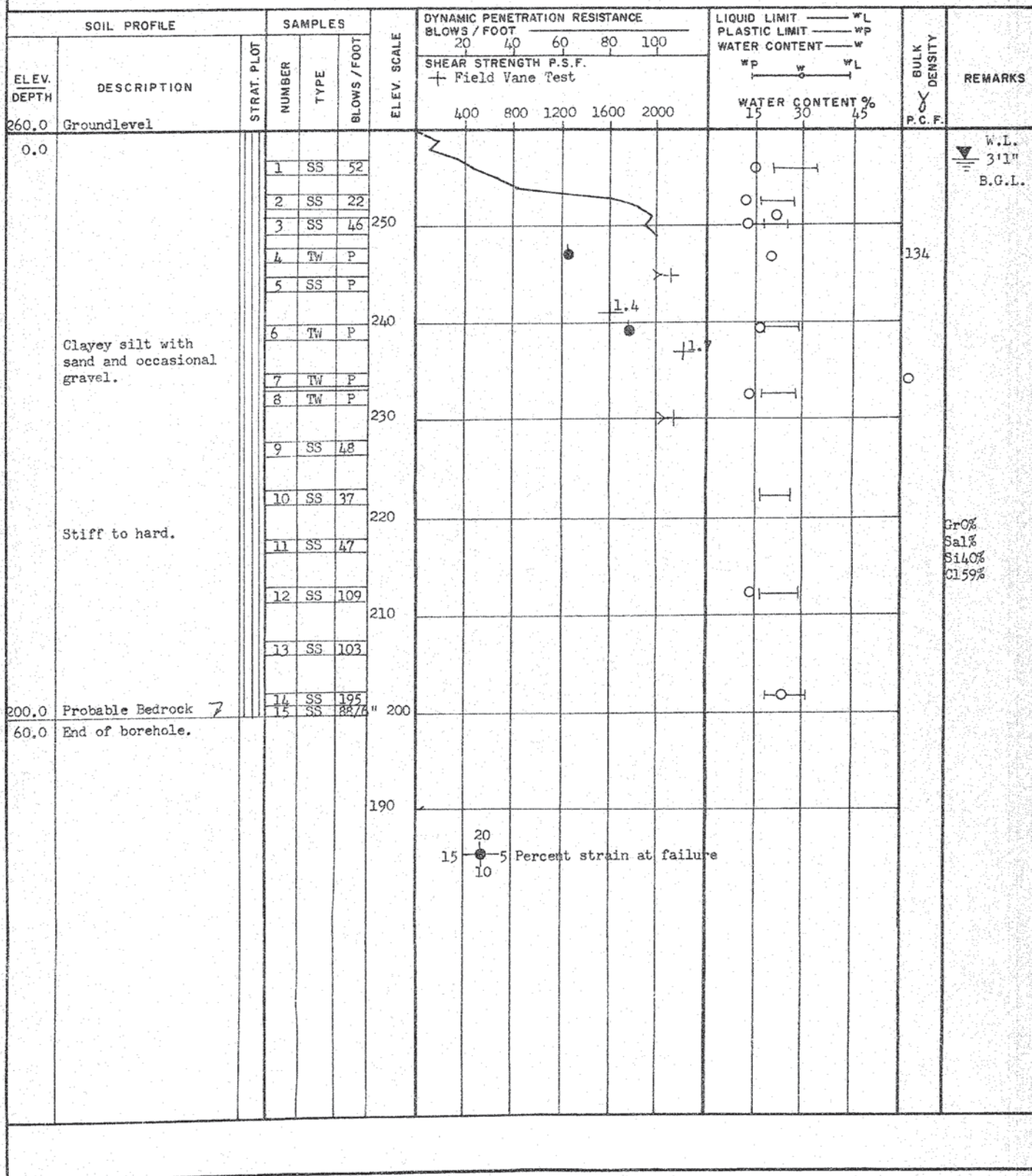
BORING DATE Jan. 17, 1966.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Dynamic Cone & Penn Auger

CHECKED BY



FOUNDATION SECTION

ORIGINATED BY H.S.

COMPILED BY

CHECKED BY

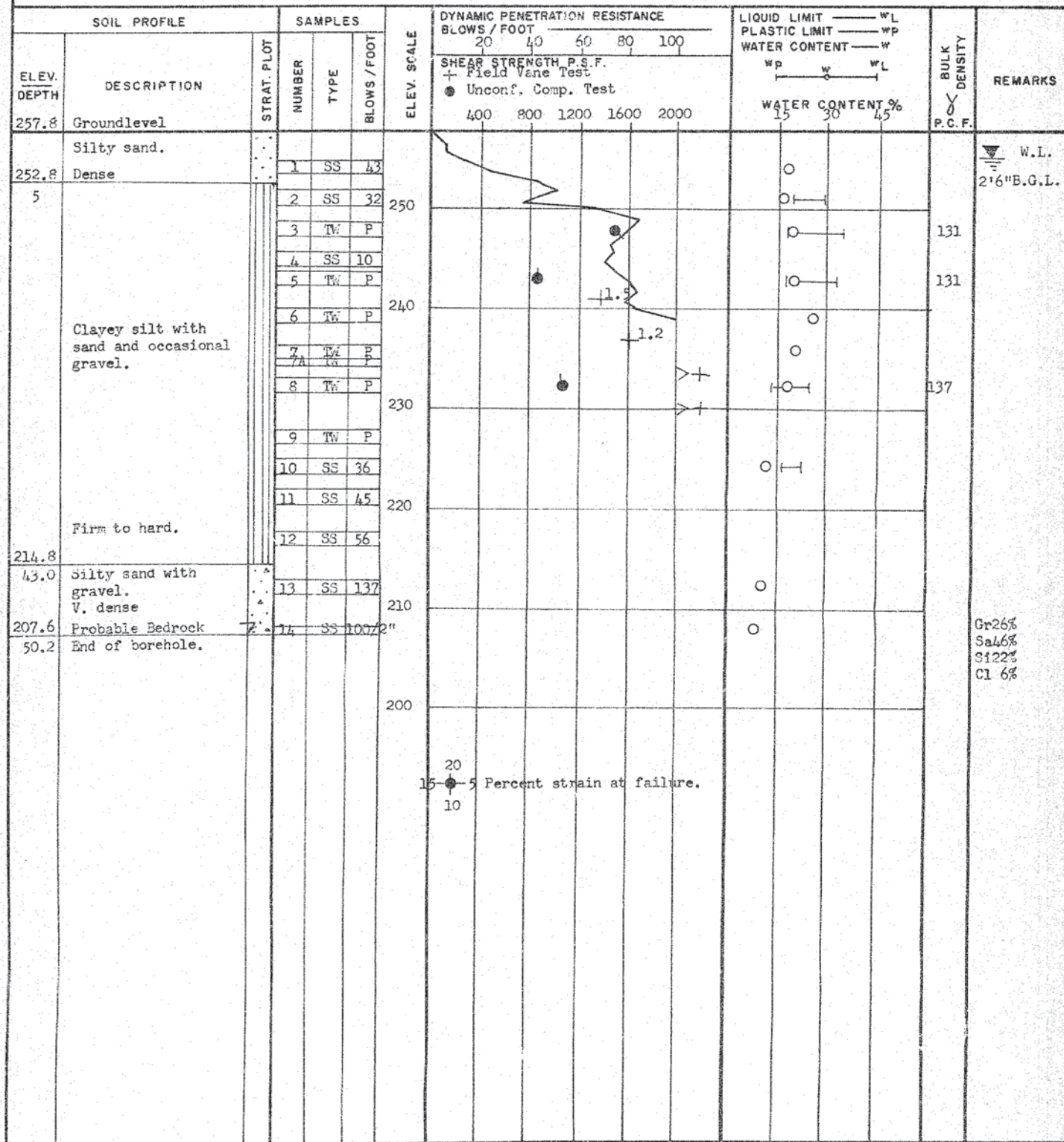
15 — 20 — 5 Percent strain at failure
10

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-7 LOCATION G.E.W. & Millen Rd. Rev'n Sta. 28+26 15' Rt. ORIGINATED BY P.L.W.
W.P. 208-63 BORING DATE Jan. 27, 1966. COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Dynamic Cone & Penn Auger CHECKED BY HL



FOUNDATION SECTION

ORIGINATED BY H.S.

COMPILED BY

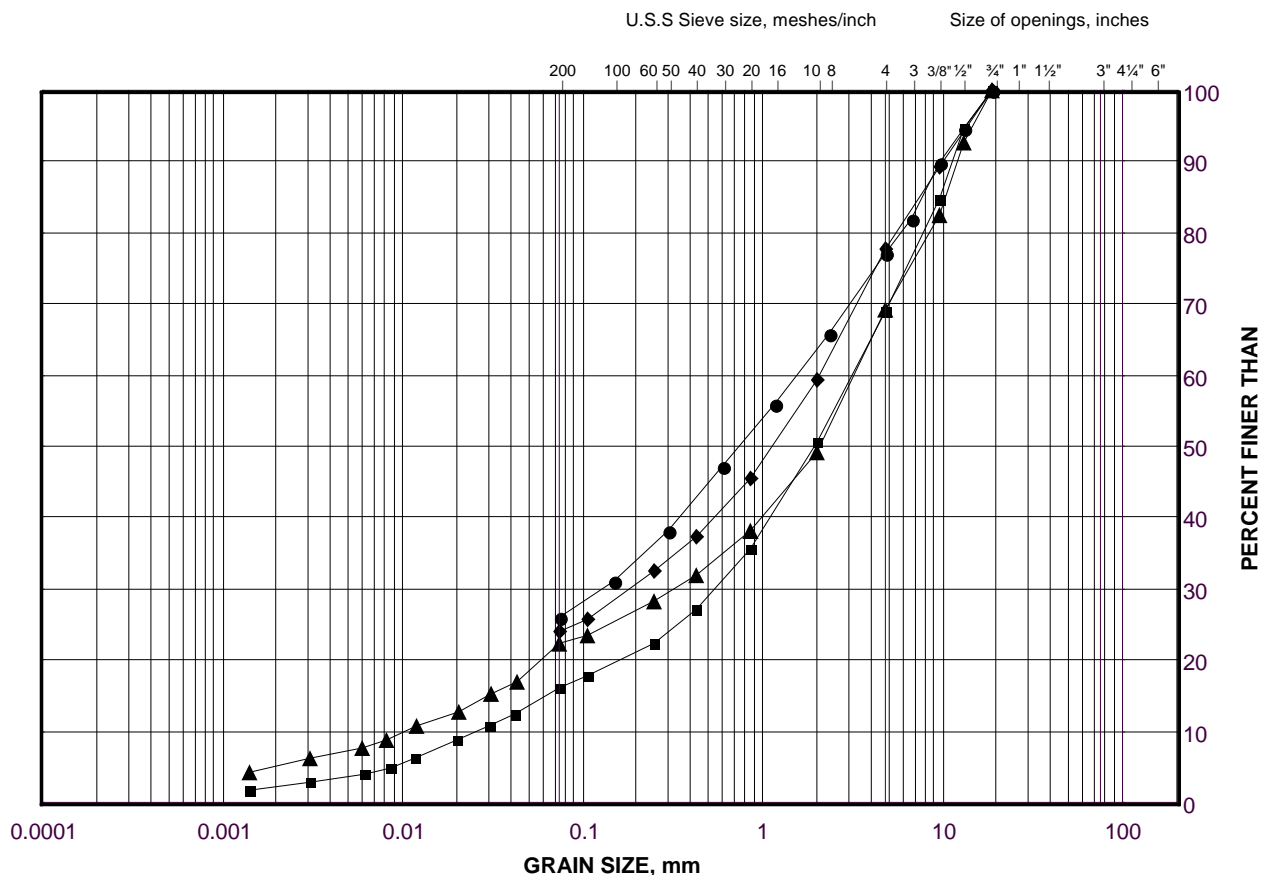
CHECKED BY _____

[illegible]

GRAIN SIZE DISTRIBUTION

Gravelly Sand to Sand and Gravel Fill

FIGURE B1



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	M6	1	79.2
■	M3	1	84.3
◆	M1	1	79.2
▲	M4	3	84.0

Project Number: 09-1111-6066

Checked By: KJB

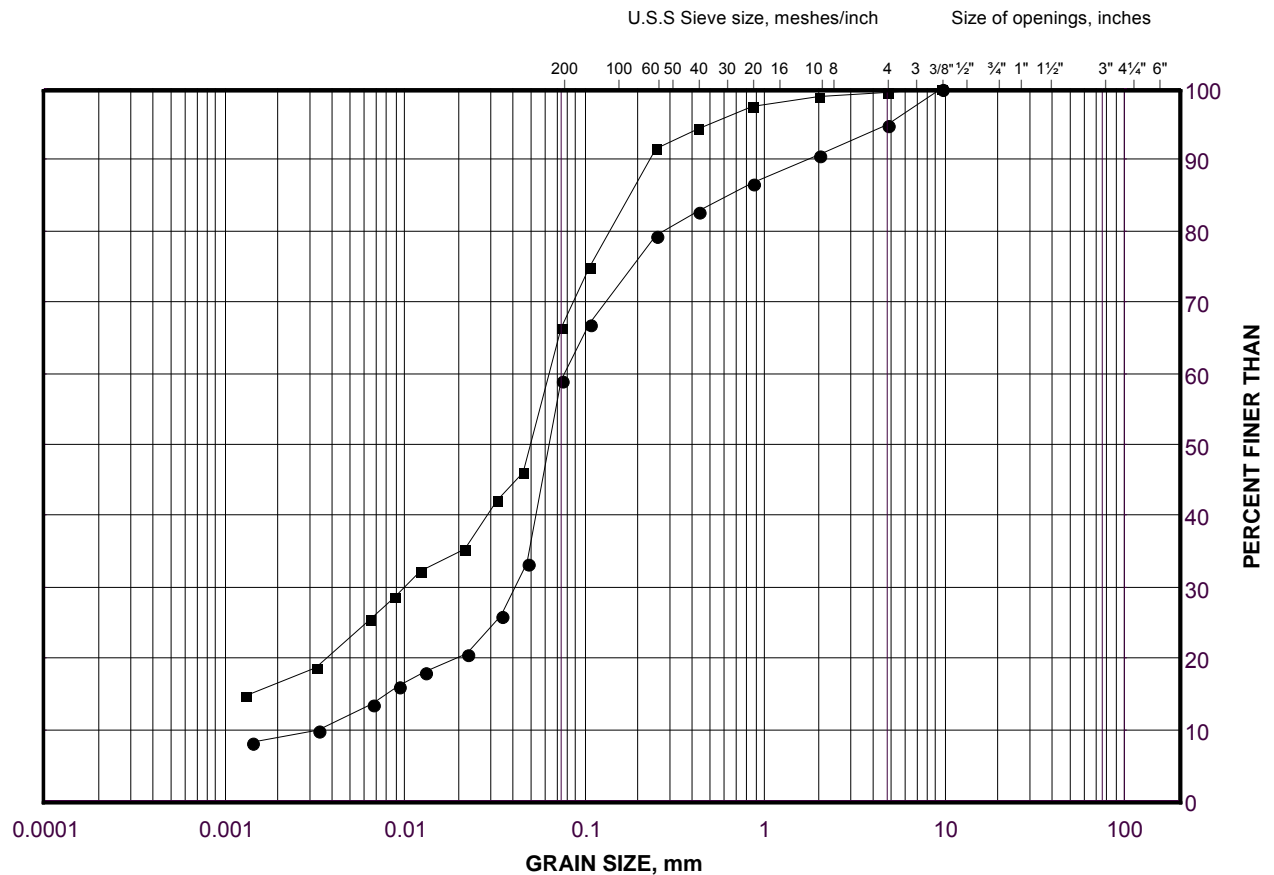
Golder Associates

Date: 22-Apr-10

GRAIN SIZE DISTRIBUTION

Sand and Silt Fill

FIGURE B2



SILT AND CLAY SIZES				FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED				SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	M5	2	78.7
■	M6	2	78.7

Project Number: 09-1111-6066

Checked By: KJB

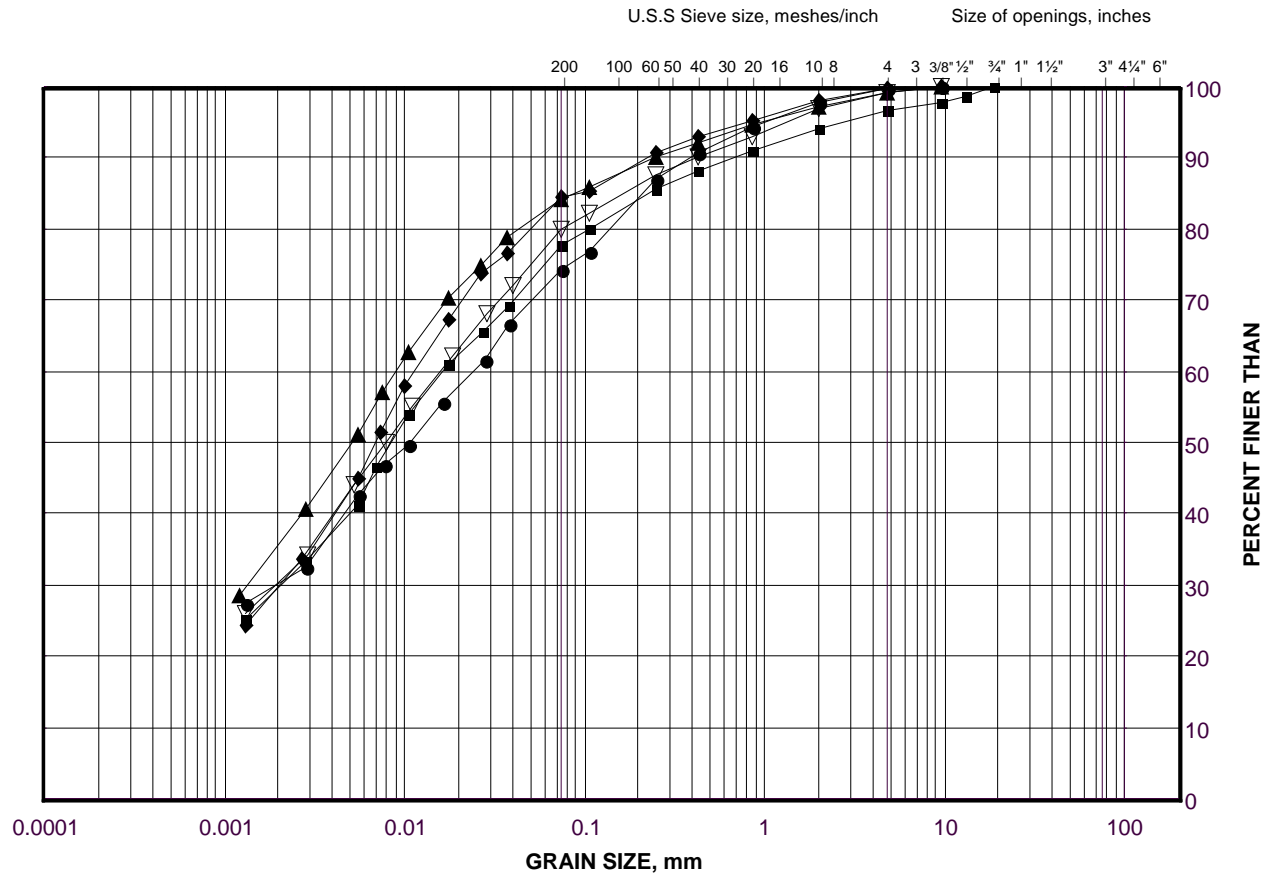
Golder Associates

Date: 04-JUN-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Fill

FIGURE B3



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

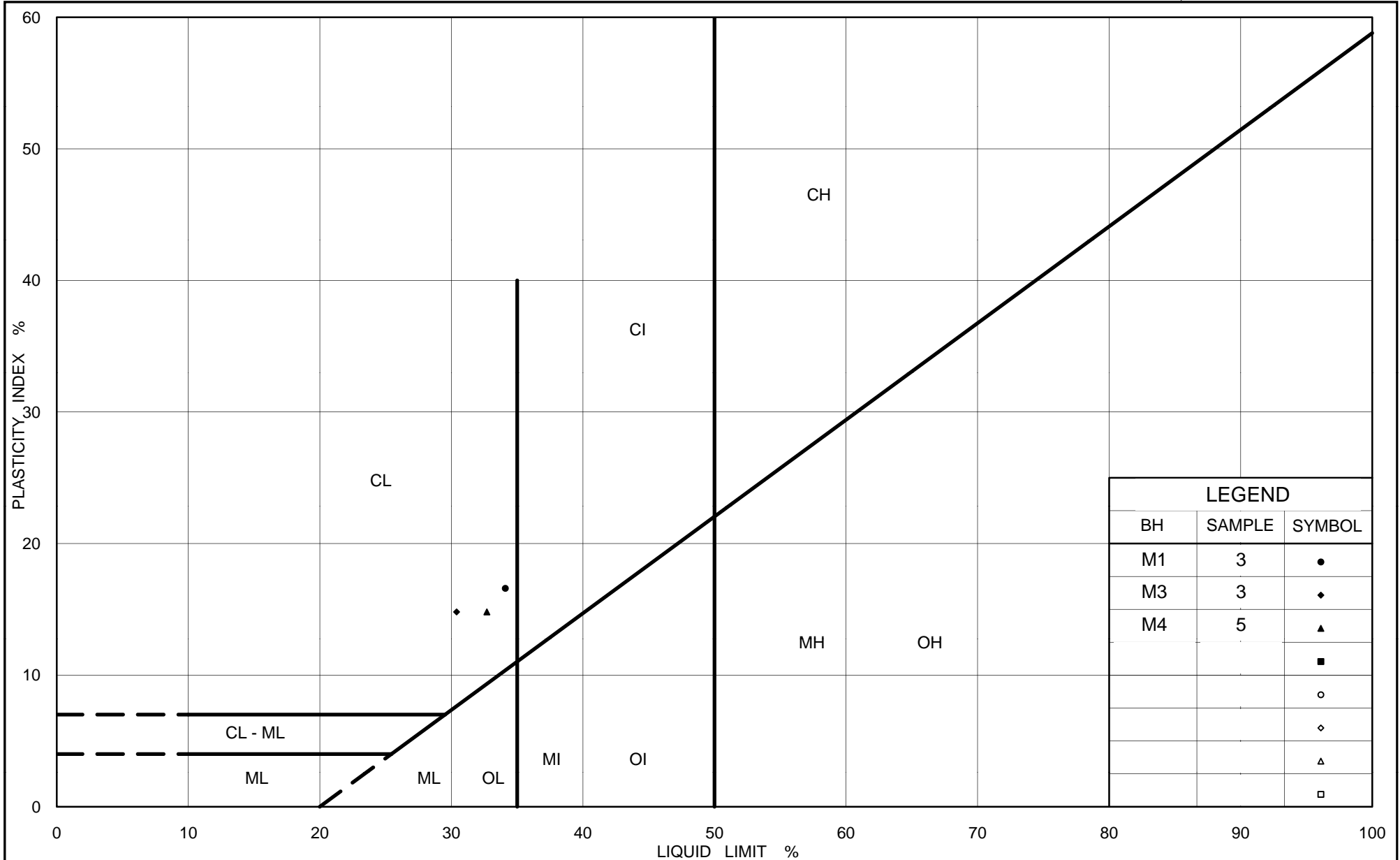
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	M1	2	78.5
■	M3	3	82.7
◆	M2	3	77.7
▲	M1	3	77.7
▽	M4	5	82.4

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Fill

Figure No. B4

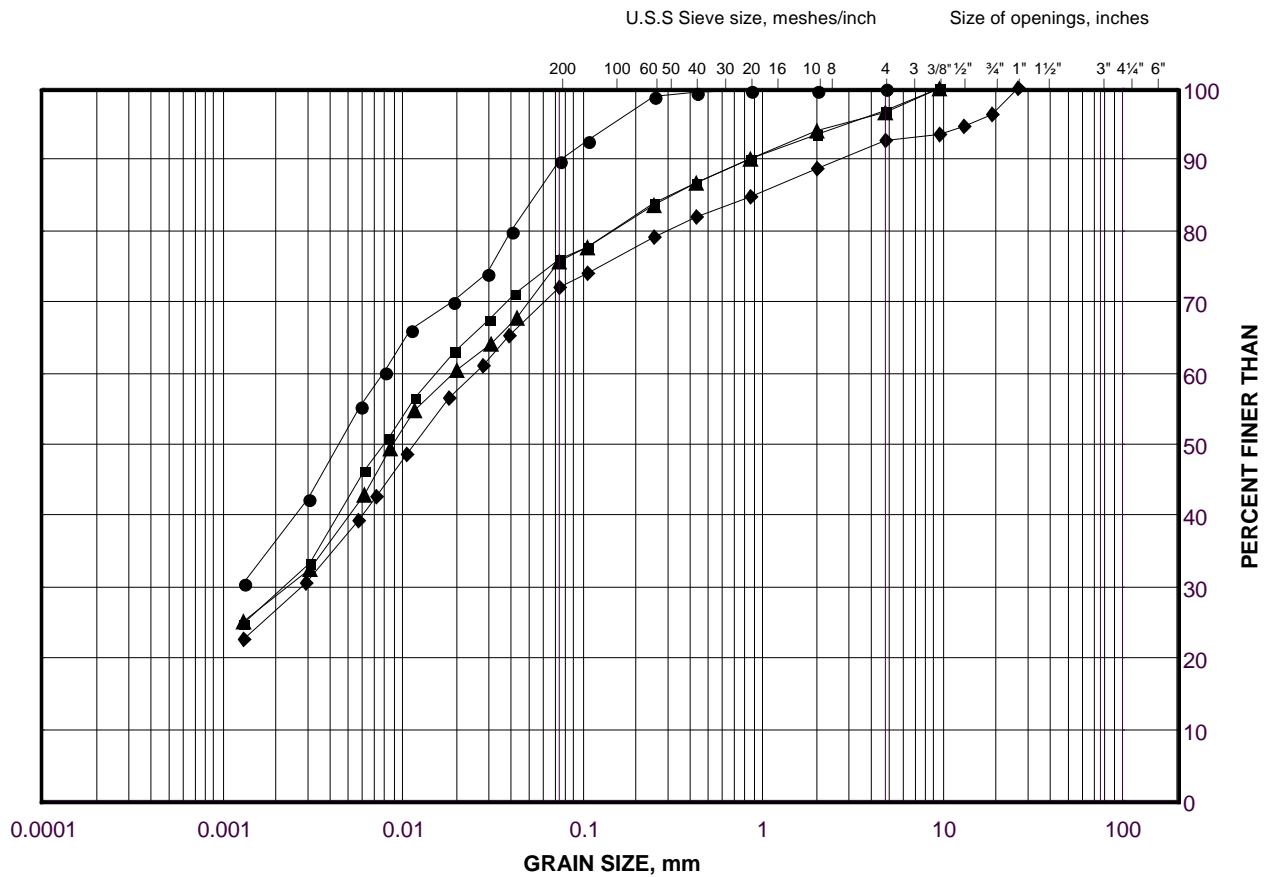
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B5A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	M5	3	78.0
■	M8	3	77.7
◆	M2	4	77.0
▲	M8	6	74.6

Project Number: 09-1111-6066

Checked By: KJB

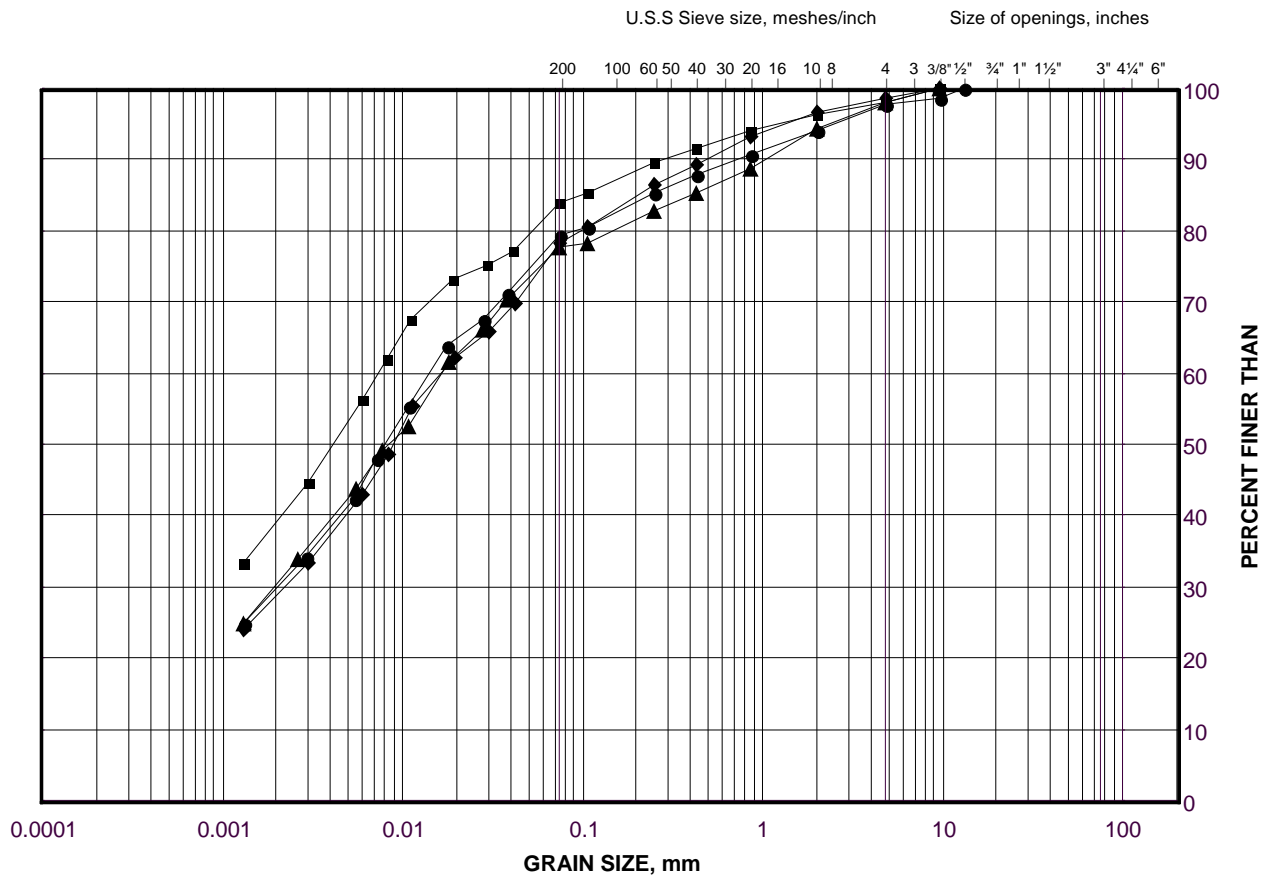
Golder Associates

Date: 04-Jun-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B5B



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

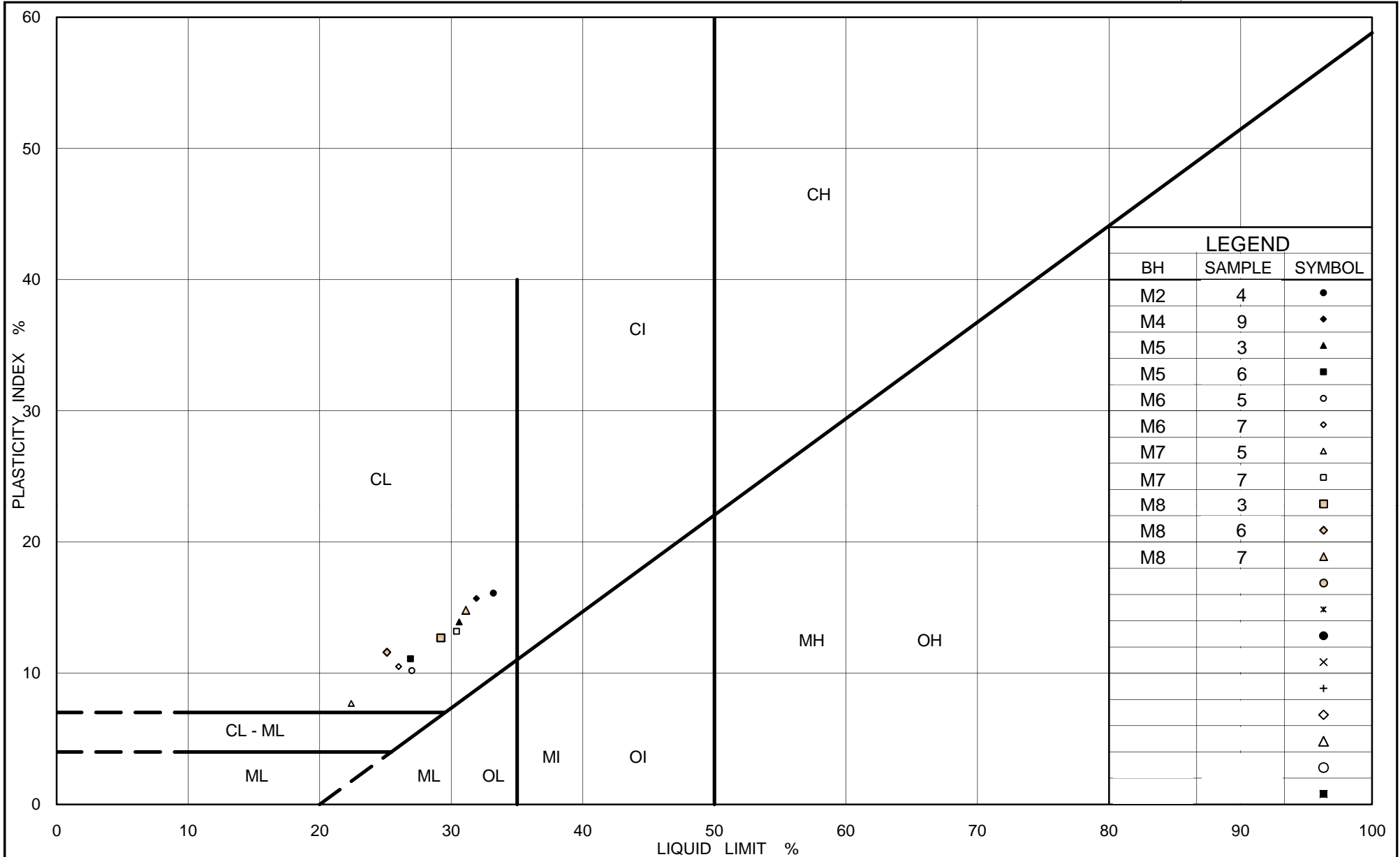
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	M1	6	75.4
■	M7	7	73.1
◆	M6	7	73.4
▲	M4	9	77.1

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 04-Jun-10



Ontario

Ministry of
Transportation

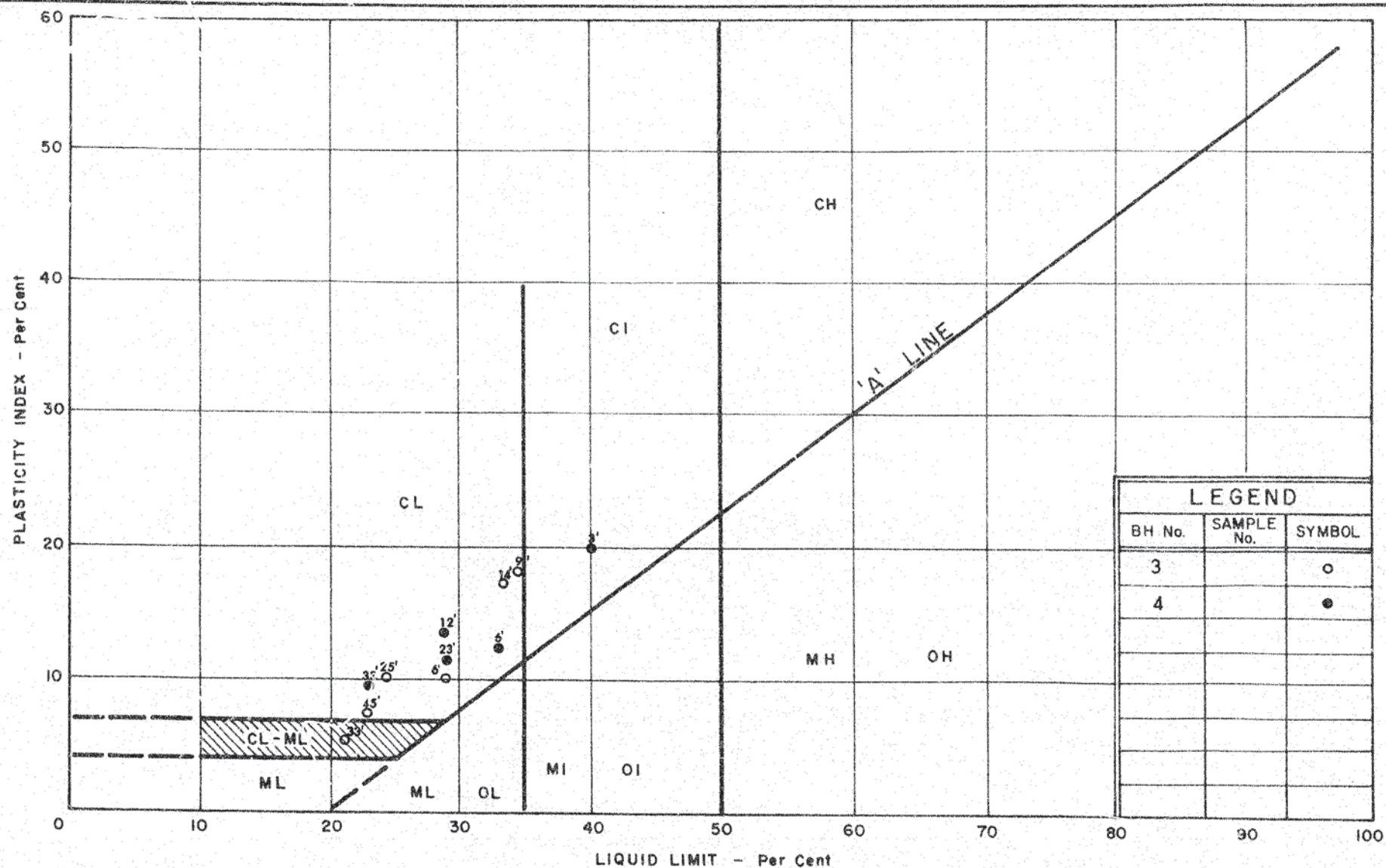
PLASTICITY CHART

Clayey Silt Till

Figure No. B6

Project No. 09-1111-6066

Checked By: KJB

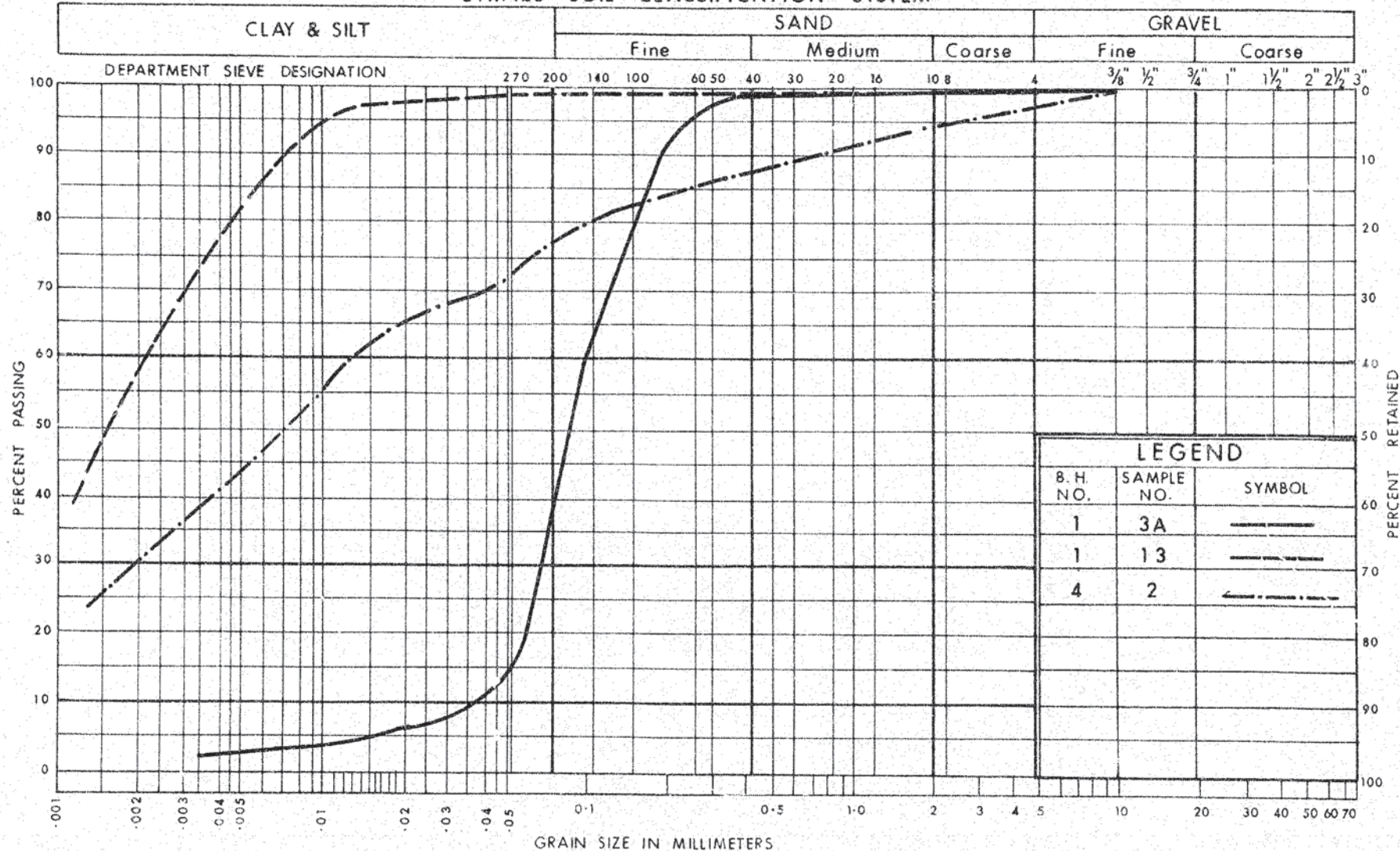


DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART Q.E.W. & MILLEN RD.

W.P. No. 208 - 63
JOB No. 66 - F - 7

UNIFIED SOIL CLASSIFICATION SYSTEM



ONTARIO

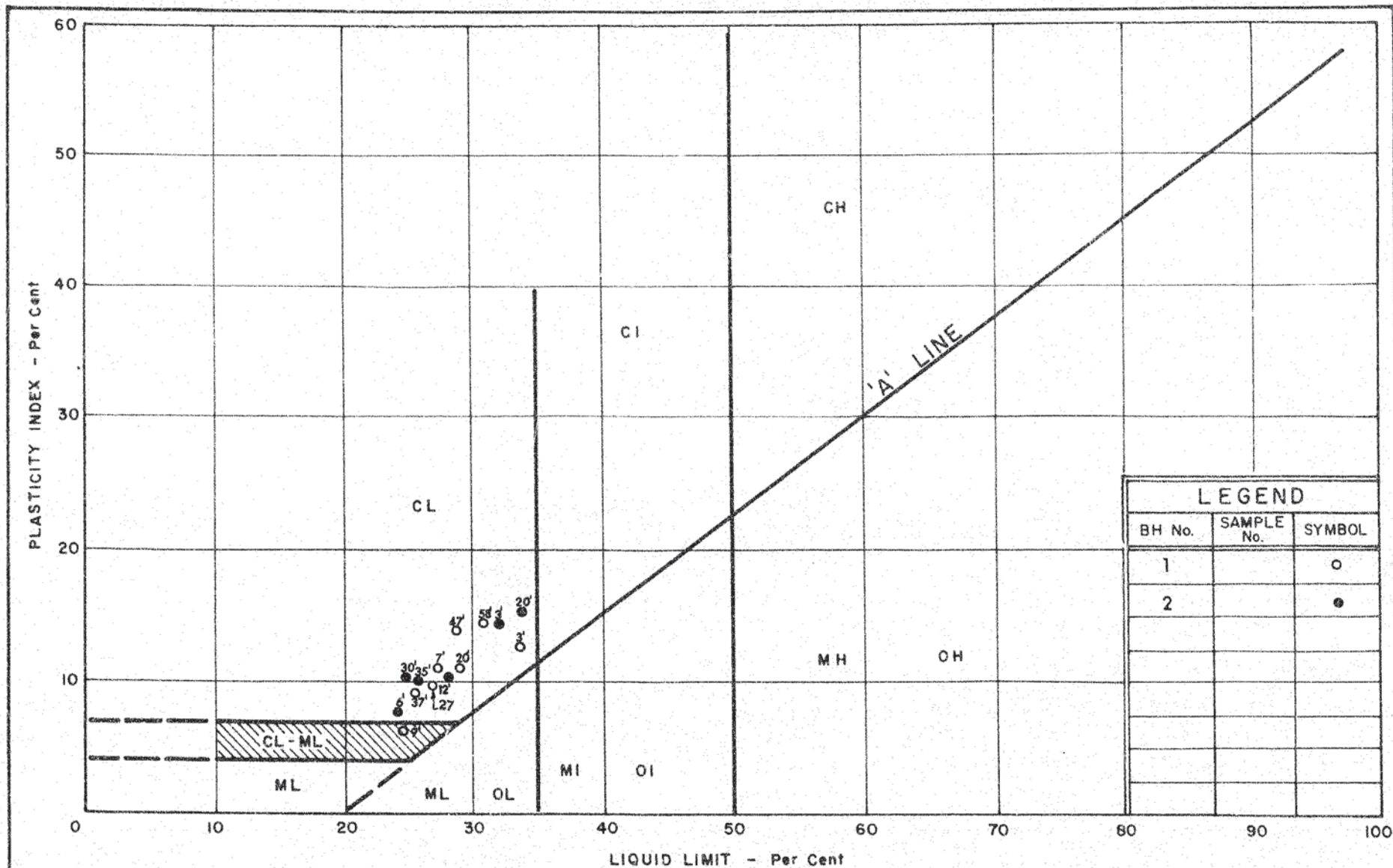
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION

CLAYEY SILT WITH SAND AND OCCASIONAL GRAVEL

W.P. No. 208-63

JOB No. 66-F-7



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

Q.E.W. & MILLEN RD.

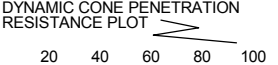
W.P. No. 208 - 63




JOB No. 66 - F-7



APPENDIX C

Fruitland Road Underpass Record of Boreholes and Laboratory Test Results

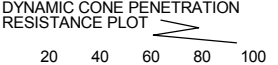
PROJECT 09-1111-6066			RECORD OF BOREHOLE No F1			1 OF 1 METRIC					
G.W.P. 2088-08-00			LOCATION N 4788015.6 ; E 288864.3			ORIGINATED BY GM					
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC					
DATUM Geodetic			DATE February 2, 2010			CHECKED BY TB/KJB					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT  SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p — W — W _L WATER CONTENT (%)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
80.5	GROUND SURFACE										
80.0	ASPHALT										
0.3	Sand and gravel, trace silt (FILL) Compact Brown Moist		1	SS	30		80				
79.4			2A	SS	14						
1.1	Silty clay, some sand, trace gravel, containing organics (FILL) Stiff Brown/grey Moist		2B				79				
			3	SS	10						
78.2											
2.3	SILTY CLAY, trace sand and gravel (TILL) Very stiff to hard Brown becoming grey below 5.6 m Moist		4	SS	32		78				
			5	SS	29		77				
			6	SS	26		76				
			7	SS	24		75				
			8	SS	18		74				
73.8											
6.7	END OF BOREHOLE										
	NOTES: 1. Open borehole dry upon completion of drilling.										

PROJECT 09-1111-6066				RECORD OF BOREHOLE No F2				1 OF 1 METRIC						
G.W.P. 2088-08-00				LOCATION N 4788028.5 ; E 288834.2				ORIGINATED BY GM						
DIST _____ HWY QEW				BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC						
DATUM Geodetic				DATE February 2, 2010				CHECKED BY TB/KJB						
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		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 (%)				
80.8	GROUND SURFACE						20 40 60 80 100							
0.0	Sand and gravel, trace silt (FILL) Very dense Brown Moist Clayey silt, some sand, trace gravel, containing organics and rootlets (FILL) Stiff Brown/grey Moist		1A	SS	70/0.15									
0.2			1B											
			2	SS	10									
			3A	SS	10									
			3B											
78.3	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff to hard Brown becoming grey below 6.1 m Moist		4	SS	24									
2.4														
			5	SS	29									
			6	SS	29									
			7	SS	34									
			8	SS	22									
74.0	END OF BOREHOLE													
6.7														
NOTES: 1. Open borehole dry upon completion of drilling. 2. Water level in piezometer at a depth of 3.3 m below ground surface (Elev. 77.5 m) on March 19, 2010.														

PROJECT 09-1111-6066			RECORD OF BOREHOLE No F3			1 OF 1 METRIC											
G.W.P. 2088-08-00			LOCATION N 4788040.0 ; E 288845.5			ORIGINATED BY GM											
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC											
DATUM Geodetic			DATE February 2, 2010			CHECKED BY TB/KJB											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					W _p — W — W _L			γ	GR SA SI CL
							20 40 60 80 100	○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED	WATER CONTENT (%)							
86.3	GROUND SURFACE																
0.0	ASPHALT																
0.3	CONCRETE																
85.1	Gravelly sand, trace to some silt, trace clay (FILL) Compact Brown Moist		1	SS	17		86										26 54 [20]
1.2	Clayey silt, trace sand and gravel (FILL) Stiff to very stiff Grey / brown Moist		2A	SS	17		85										
			2B	SS	17												
			3	SS	15		84										
			4	SS	14												
			5	SS	8		83										
			6	SS	11		82										
			7	SS	12		81										
			8	SS	22		80										
							79										
78.7	SILTY CLAY, some sand, trace gravel, containing rootlets and organics to 7.7 m (TILL) Stiff to hard Brown Moist		9	SS	15		78										0 18 49 33
76.6			10	SS	40		77										
9.8	END OF BOREHOLE																
NOTES: 1. Open borehole dry upon completion of drilling.																	

PROJECT		09-1111-6066		RECORD OF BOREHOLE No F4		1 OF 1 METRIC										
G.W.P.		2088-08-00		LOCATION		N 4787937.8 ; E 288841.1										
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger										
DATUM		Geodetic		DATE		February 3, 2010										
						ORIGINATED BY GM										
						COMPILED BY SAC										
						CHECKED BY TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
80.5	GROUND SURFACE															
80.0	ASPHALT															
80.2																
0.3	Sand and gravel, trace to some silt, trace clay (FILL)		1	SS	16											
79.4	Compact Grey Moist		2A	SS	7											
1.1	Silty clay, some sand, trace gravel, containing shale fragments (FILL)		2B													
	Firm to stiff Brown Moist		3	SS	12											
78.4																
2.1	CLAYEY SILT, trace sand and gravel (TILL)		4	SS	26											
	Very stiff Brown Moist		5	SS	24											
			6	SS	27											
			7	SS	20											
73.8	END OF BOREHOLE															
6.7	NOTES: 1. Borehole dry upon completion of drilling.															

PROJECT		09-1111-6066		RECORD OF BOREHOLE No F5		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4787947.5 ; E 288809.8								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger								
DATUM		Geodetic		DATE		February 3, 2010								
						ORIGINATED BY GM								
						COMPILED BY SAC								
						CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
80.5	GROUND SURFACE													
80.0	ASPHALT													
80.2														
0.3	Sand and gravel, trace silt (FILL) Very dense Grey Moist		1	SS	67		80							
79.6														
0.9	Clayey silt, trace sand and gravel (FILL) Stiff to very stiff Brown Moist		2	SS	10									
							79							
78.7			3A	SS	21									
1.8	CLAYEY SILT, some sand, trace gravel, contains silty sand seams (TILL) Very stiff to hard Brown Moist		3B											
							78							
			4	SS	23									
			5	SS	29		77							
							76							
			6	SS	31									
							75							
			7	SS	16		74							
73.8														
6.7	END OF BOREHOLE													
NOTES: 1. Borehole dry upon completion of drilling.														

PROJECT 09-1111-6066			RECORD OF BOREHOLE No F6			1 OF 1 METRIC					
G.W.P. 2088-08-00			LOCATION N 4787917.6 ; E 288827.2			ORIGINATED BY GM					
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC					
DATUM Geodetic			DATE February 3, 2010			CHECKED BY TB/KJB					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT  SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
87.5	GROUND SURFACE										
0.0	ASPHALT										
0.3	CONCRETE										
	Sand and gravel, trace to some silt, trace clay (FILL) Compact Grey Moist		1	SS	26		87		○		
			2	SS	11						
			3	SS	17		86		○		
85.3											
2.2	Clayey silt with sand, some gravel, containing organics from 7.9 m to 8.7 m (FILL) Firm to very stiff Brown Moist		4	SS	5		85		○	10	13 26 40 21
							84				
			5	SS	6		83				
							82				
			6	SS	17		81		○		
							80				
			7	SS	18		79				
78.8											
8.7	CLAYEY SILT, some sand, trace to some gravel (TILL) Hard Brown Moist		8	SS	45		78		○	10	7 16 45 32
77.8											
9.8	END OF BOREHOLE										
NOTES: 1. Borehole dry upon completion of drilling.											

PROJECT 09-1111-6066				RECORD OF BOREHOLE No F7				1 OF 1 METRIC									
G.W.P. 2088-08-00				LOCATION N 4787982.6 ; E 288820.4				ORIGINATED BY GM									
DIST _____ HWY QEW				BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC									
DATUM Geodetic				DATE February 12, 2010				CHECKED BY TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
80.5	GROUND SURFACE							20	40	60	80	100					
0.0	ASPHALT																
0.2	Gravelly sand, some silt, trace to some clay, containing asphalt pieces (FILL) Compact Grey/black Moist		1	SS	18		80										25 50 18 7
79.0			2	SS	20		79										
78.7	Clayey silt, trace to some sand, trace gravel (FILL) Very stiff Brown Moist		3A	SS	18		79										
1.8			3B														
	CLAYEY SILT, some sand, trace gravel, containing sandy silt seams, cobbles and boulders (TILL) Very stiff Brown Moist		4	SS	28		78										
			5	SS	26		77										
			6	SS	24		76										
			7	SS	19		74										3 22 46 29
73.8	END OF BOREHOLE																
6.7	NOTES: 1. Borehole dry upon completion of drilling.																

PROJECT 09-1111-6066		RECORD OF BOREHOLE No F8				1 OF 1 METRIC								
G.W.P. 2088-08-00		LOCATION N 4787972.7 ; E 288851.2				ORIGINATED BY GM								
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC								
DATUM Geodetic		DATE February 12, 2010				CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
80.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	ASPHALT													
0.2	Sand and gravel, trace silt, trace clay, containing asphalt pieces (FILL) Compact Grey to brown Moist		1	SS	18		80							
			2	SS	14									
78.7			3A	SS	12		79							
1.8	CLAYEY SILT with sand, trace gravel (TILL) Very stiff to hard Brown Moist		3B											
			4	SS	21		78							
			5	SS	30		77							
			6	SS	24		76							
							75							
			7	SS	20		74							
73.8	END OF BOREHOLE													
6.7	NOTES: 1. Borehole dry upon completion of drilling.													

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-F-10

LOCATION W.E.W. & Fruitland Rd. Sta. 31/78 18' Lt.

ORIGINATED BY P.L.W.

W. P. 209-63

BORING DATE Jan. 18 - 19, 1966.

COMPILED BY _____ P.L.W.

DATUM Geodetic

BOREHOLE TYPE Augering

CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F.	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W WP ——— W ——— WL WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT					
258.0	Groundlevel									
0.0	Clayey silt with sand and occasional gravel.		1	SS	26	250				Gr1%Sa16% Si50%Cl 33%
			2	SS	45					
			3	SS	40					
			4	SS	34					
			5	SS	36					
			6	SS	26					
			7	SS	35					
			8	SS	79					
			9	SS	61					
216.5	Hard.		10	SS	194	240				Gr7%Sa22% Si45%Cl 26%
41.5	Silty sand with some gravel.									
211.5	Very dense.		11	SS	146/5"	230				
46.5	Weathered shale.					220				Gr5%Sa20% Si45%Cl 30%
206.5			12	SS	100/2"					
51.5	End of borehole.					210				Gr8%Sa84% Si5%Cl 3%

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-10

LOCATION W.E.W. & Fruitland Rd., Sta. 29+23 33' Rt.

ORIGINATED BY P.L.W.

W. P. 209-63

BORING DATE Jan. 20 - 24, 1966.

COMPILED BY P.L.W.

DATUM Geodetic

BOREHOLE TYPE Penn Auger

CHECKED BY

[illegible]

MATERIALS & TESTING DIVISION

JOB 66-F-10

LOCATION G.E.W. & Fruitland Rd., Sta. 28/22 40' Lt.

ORIGINATED BY P.L.W.

W.P. 209-63

BORING DATE Jan. 24 - 26, 1966.

COMPILED BY S.O.

DATUM Geodetic

BOREHOLE TYPE Penn Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WP	W	WL		
261.0	Groundlevel															
0						260										Gr3%Sa18% Si149%Cl 30%
			1	SS	34											
			2	SS	52											
			3	SS	43											
			4	SS	42	250										
			5	SS	30											
	Clayey silt with sand and occasional gravel.		6	SS	37	240										
			7	SS	32											
	Very stiff to hard.		8	SS	34	230										
			9	SS	46											
			10	SS	63	220										
			11	SS	83											
212.0																Gr2%Sa14% Si141%Cl 43%
49.0	Silty sand with some gravel.	0.0	12	SS	100	210										
206.7	V. dense.	0.0	13	SS	152	1/4"										
54.3	End of borehole. Probable Bedrock	0.0														Gr13%Sa45% Si130%Cl 4%

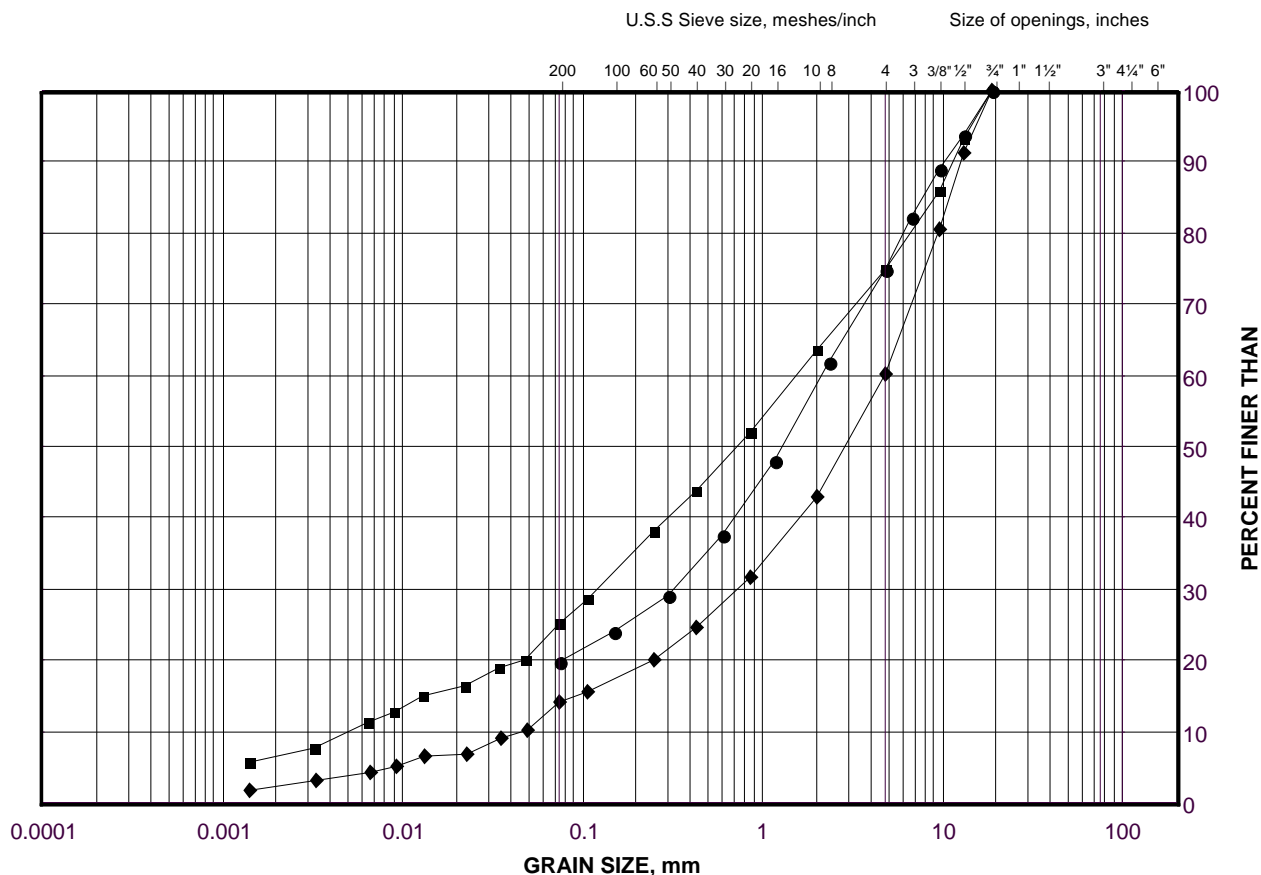
DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 4 (66F2)		FOUNDATION SECTION
MATERIALS & TESTING DIVISION				
JOB <u>66/F-10 (65-F-28)</u>	LOCATION <u>Q.E.W. & Fruitland Rd., Sta. 30+70 39' Rt.</u>	ORIGINATED BY <u>T.C.</u>		
W.P. <u>209-63</u>	BORING DATE <u>March 16, 1965.</u>	COMPILED BY <u>T.C.</u>		
DATUM <u>G.S.C.</u>	BOREHOLE TYPE <u>Penndrill</u>	CHECKED BY <u>M.D.</u>		

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W Wp — W — WL WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT						
262.0	Groundlevel					260					Gr 5% Sal 8% Si 47% Cl 30% El 252.5 Observed in borehole.
0	(Brown)		1	SS	43						
			2	SS	42						
251.0			3	SS	37						
11.0	(Grey)		4	SS	23	250					
	Clayey silt with sand and occasional gravel. Very stiff to hard.		5	SS	27						
			6	SS	62	240					
			7	SS	42						
			8	SS	40	230					
			9	SS	50						
			10	SS	100	10"	220				
			11	SS	90	5"					
216.0											
45.5	Shale, (weathered) reddish brown refusal.		12	SS	100	3"	210				
210.5											
51.5	End of borehole.										
						200					

GRAIN SIZE DISTRIBUTION

Gravelly Sand to Sand and Gravel Fill

FIGURE C1



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	F3	1	85.7
■	F7	2	79.4
◆	F4	2A	79.5

Project Number: 09-1111-6066

Checked By: KJB

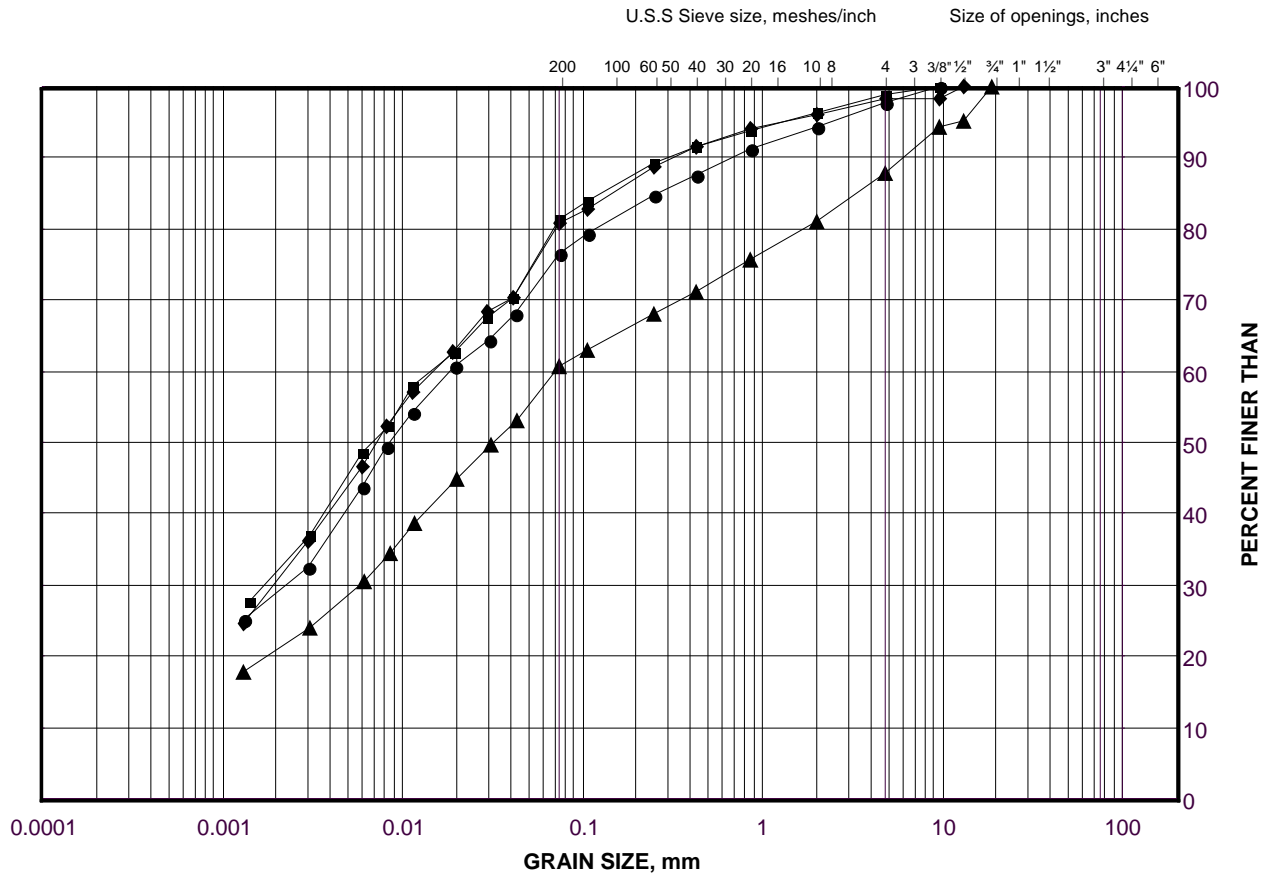
Golder Associates

Date: 26-Apr-10

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Fill

FIGURE C2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

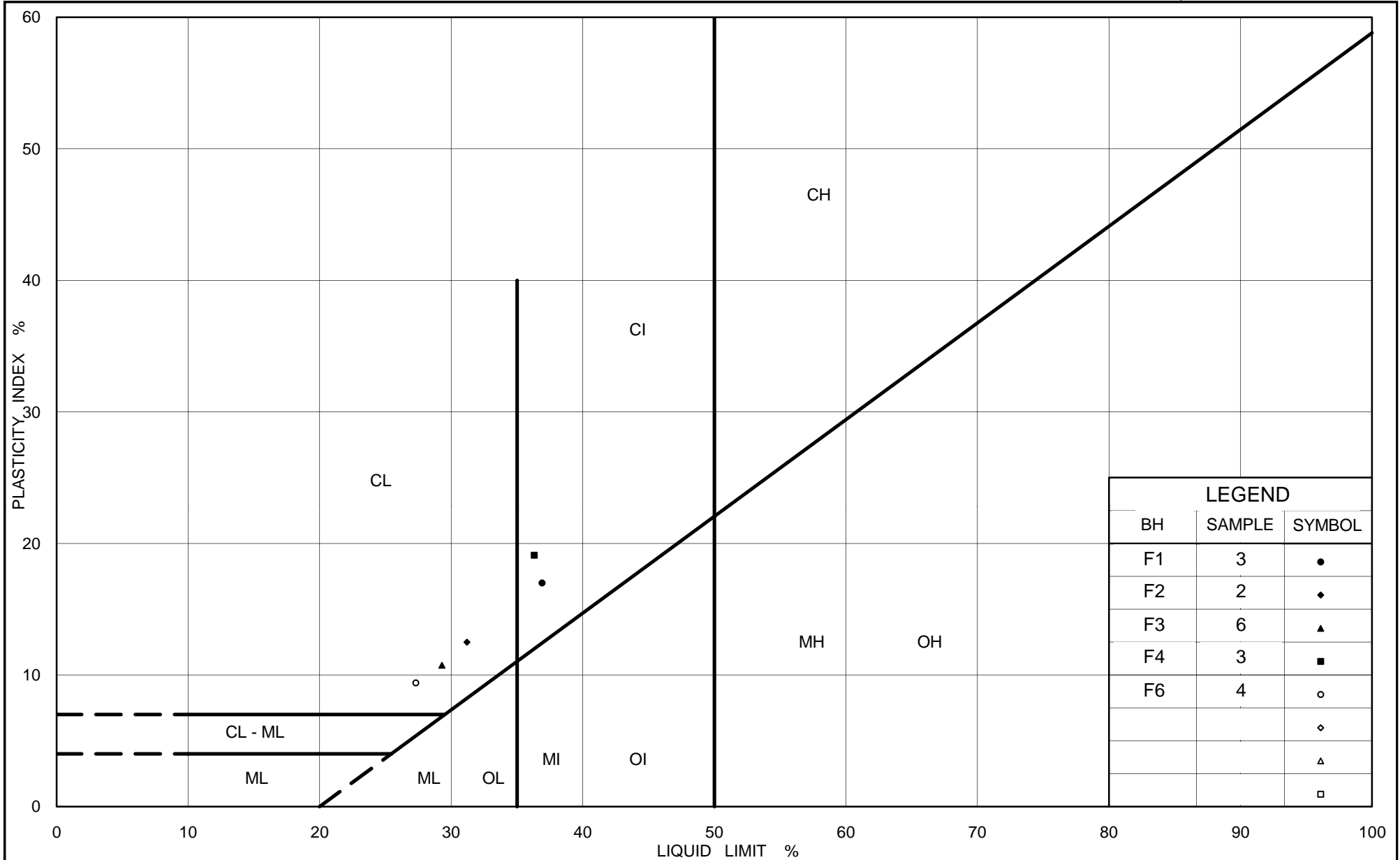
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	F2	2	79.7
■	F1	3	78.7
◆	F4	3	78.7
▲	F6	4	84.9

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of Transportation

PLASTICITY CHART Clayey Silt to Silty Clay Fill

Ontario

Figure No. C3

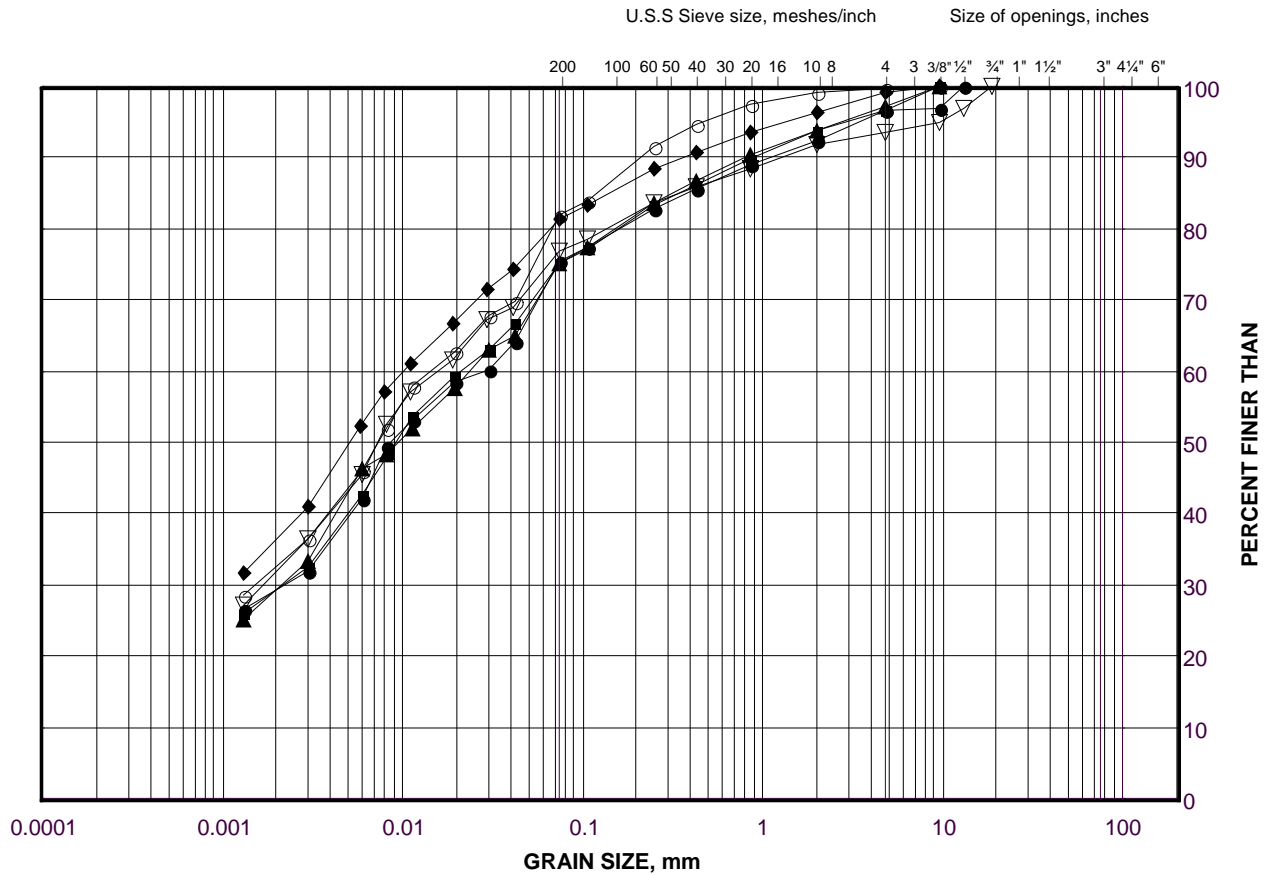
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Till

FIGURE C4



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

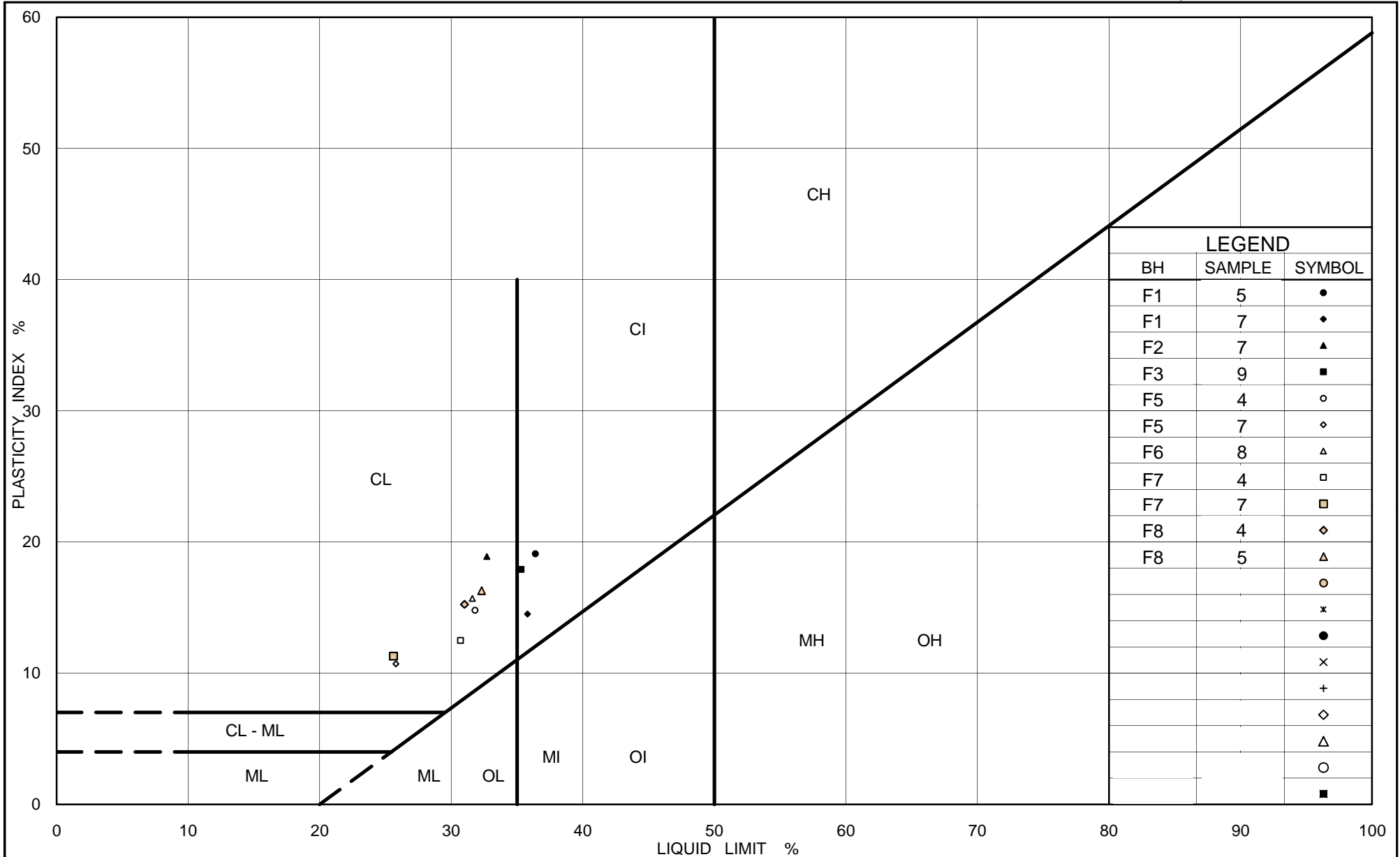
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	F8	3B	78.5
■	F5	4	77.9
◆	F2	7	75.9
▲	F7	7	74.1
▽	F6	8	78.0
○	F3	9	78.4

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ontario

Ministry of
Transportation

PLASTICITY CHART

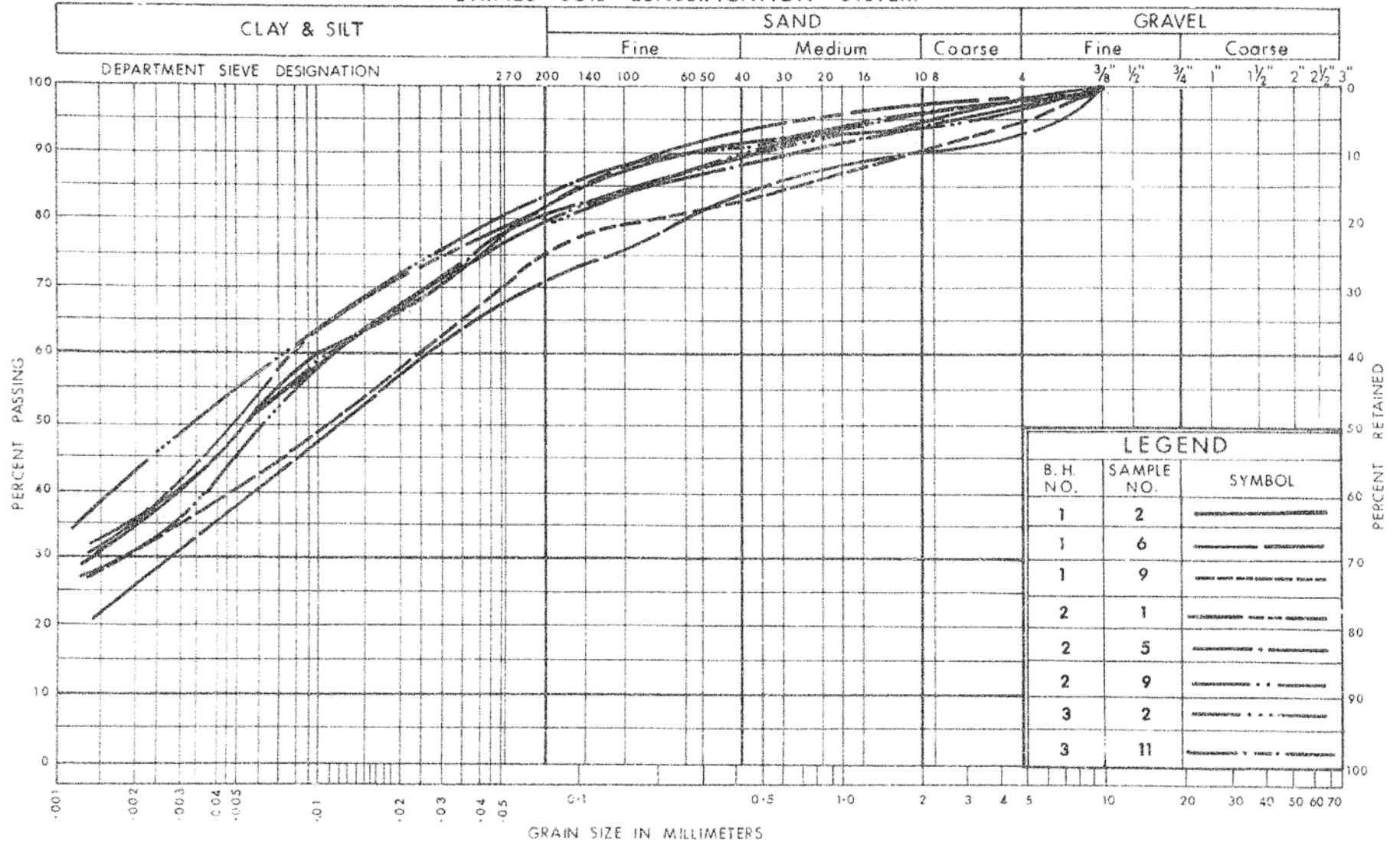
Clayey Silt to Silty Clay Till

Figure No. C5

Project No. 09-1111-6066

Checked By: KJB

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

ONTARIO

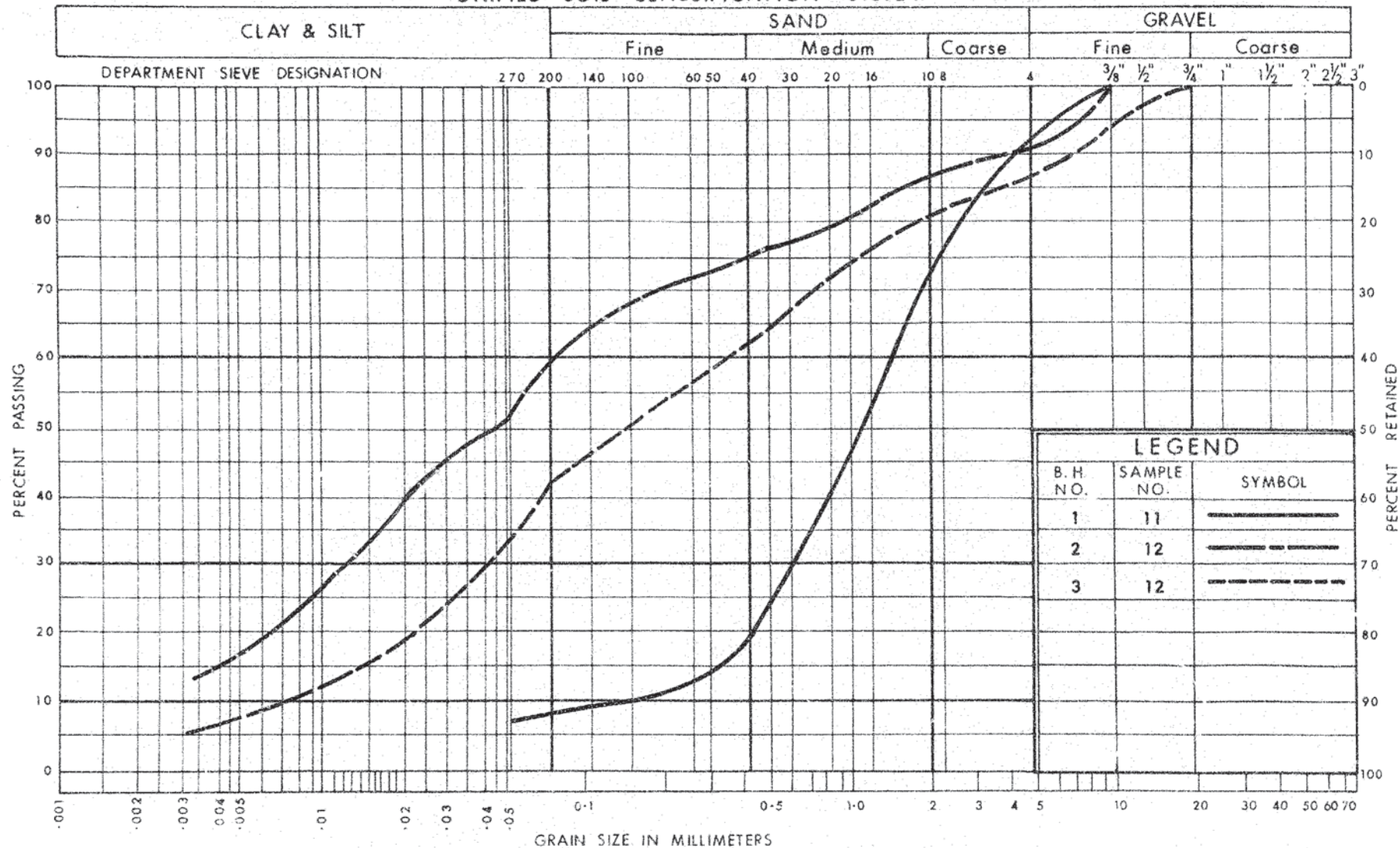
GRAIN SIZE DISTRIBUTION

CLAYEY SILT WITH SAND & OCCASIONAL GRAVEL

W.P. No. 209-63

JOB No. 66-F-10

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
B. H. NO.	SAMPLE NO.	SYMBOL
1	11	SOLID LINE
2	12	DASHED LINE
3	12	DOTTED LINE



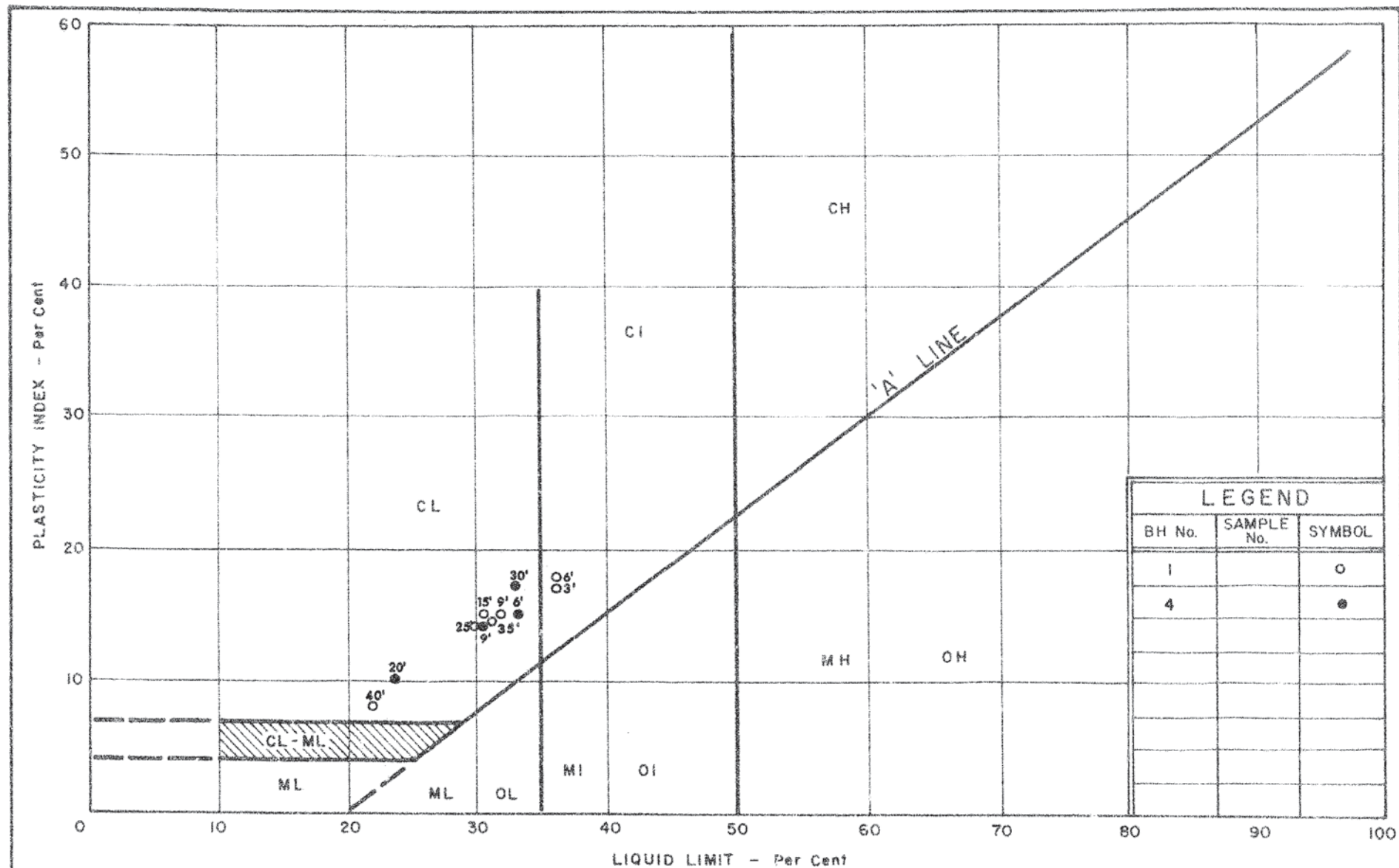
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION

SILTY SAND TO SANDY SILT WITH SOME GRAVEL

W.P. No. 209 - 63

JOB No. 66-F-10



LEGEND		
BH No.	SAMPLE No.	SYMBOL
1		○
4		●

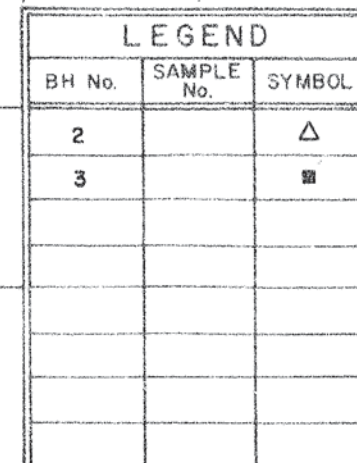


DEPARTMENT OF HIGHWAYS
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PLASTICITY CHART

W.P. No. 209-63

JOB No. 66-F-10



ONTARIO

DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 209-63

JOB No. 66 - F - 10



APPENDIX D

Glover Road Underpass Record of Boreholes and Laboratory Test Results

PROJECT <u>09-1111-6066</u>		RECORD OF BOREHOLE No GL1		1 OF 1 METRIC	
G.W.P. <u>2088-08-00</u>		LOCATION <u>N 4787455.6 ; E 290529.6</u>		ORIGINATED BY <u>GM</u>	
DIST <u> </u> HWY <u>QEW</u>		BOREHOLE TYPE <u>150 mm O.D. Hollow Stem Auger</u>		COMPILED BY <u>SAC</u>	
DATUM <u>Geodetic</u>		DATE <u>January 27, 2010</u>		CHECKED BY <u>TB/KJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × REMOULDED							
81.3	GROUND SURFACE															
0.0	ASPHALT															
0.3	Sand and gravel, trace silt (FILL) Compact to dense Grey Moist		1	SS	50					○						
			2	SS	14											
79.8																
1.5	CLAYEY SILT with organics, some sand, trace gravel, containing rootlets Very stiff Brown Moist		3	SS	16					○				3 17 47 33		
79.0																
2.3	CLAYEY SILT, trace sand and gravel, containing shale fragments (TILL) Very stiff to hard Brown to reddish grey Moist		4	SS	34											
			5	SS	34											
			6	SS	36					○						
			7	SS	30											
			8	SS	21					○						
74.6	END OF BOREHOLE															
6.7	NOTE: 1. Borehole dry upon completion of drilling.															

PROJECT		09-1111-6066		RECORD OF BOREHOLE No GL2		1 OF 1 METRIC							
G.W.P.		2088-08-00		LOCATION		N 4787451.5 ; E 290543.5							
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger							
DATUM		Geodetic		DATE		January 27, 2010							
						ORIGINATED BY GM							
						COMPILED BY SAC							
						CHECKED BY TB/KJB							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W		
81.3	GROUND SURFACE												
0.0	ASPHALT												
0.3	Sand and gravel, trace to some silt, trace clay (FILL) Loose to very dense Grey Moist becoming wet below 1.4 m		1	SS	57								
			2	SS	11								
			3	SS	7								
79.0													
2.3	CLAYEY SILT, some sand, trace gravel, containing shale fragments, trace organics Very stiff Brown Moist		4	SS	24								
78.4													
2.9	CLAYEY SILT, trace sand and gravel, containing shale fragments (TILL) Very stiff Brown to reddish grey Moist		5	SS	29								
			6	SS	28								
			7	SS	18								
			8	SS	20								
74.6													
6.7	END OF BOREHOLE												
	Note: 1. Borehole dry upon completion of drilling.												

PROJECT 09-1111-6066		RECORD OF BOREHOLE No GL3				1 OF 1 METRIC								
G.W.P. 2088-08-00		LOCATION N 4787361.5 ; E 290510.5				ORIGINATED BY GM								
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC								
DATUM Geodetic		DATE January 27, 2010				CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
88.0	GROUND SURFACE													
0.0	ASPHALT													
0.3	CONCRETE													
	Gravelly sand, trace to some silt, trace clay (FILL) Compact to very dense Grey Moist		1	SS	54									25 58 [17]
			2	SS	54/0.15									
			3	SS	18									
85.7														
2.3	Clayey silt with sand, trace to some gravel, containing shale fragments (FILL) Firm to stiff Brown Moist		4	SS	6									9 24 42 25
			5	SS	4									
			6	SS	7									1 20 49 30
80.4														
7.6	Clayey silt, trace sand and gravel, containing organics and rootlets (FILL) Stiff Brown Moist		7	SS	10									
79.8														
8.2	CLAYEY SILT, trace sand and gravel (TILL) Very stiff Brown / grey Moist		8	SS	27									
78.3														
9.8	END OF BOREHOLE													
NOTE: 1. Borehole dry upon completion of drilling. 2. Water level in piezometer at a depth of 7.9 m below ground surface (Elev. 80.1 m) on March 17, 2010.														



PROJECT 09-1111-6066			RECORD OF BOREHOLE No GL4			1 OF 1 METRIC								
G.W.P. 2088-08-00			LOCATION N 4787473.1 ; E 290540.2			ORIGINATED BY GM								
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC								
DATUM Geodetic			DATE January 29, 2010			CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
86.9	GROUND SURFACE													
0.0	ASPHALT													
	CONCRETE													
0.4	Sand and gravel, trace silt (FILL) Dense to compact Grey / brown Moist		1	SS	45									
			2	SS	42									
			3	SS	14									
84.6														
2.3	Clayey silt with sand, trace gravel (FILL) Stiff Brown Moist		4	SS	10									
84.2														
2.9	Sand and gravel, trace silt (FILL) Compact Brown Moist		5	SS	5									
	Clayey silt, trace to some sand and gravel, containing organics below 4.6 m (FILL) Firm to stiff Brown Moist		6	SS	7									
			7	SS	10									
79.3														
7.6	CLAYEY SILT, trace sand and gravel, containing sandy silt seams (TILL) Hard Brown Moist		8	SS	35									
			9	SS	42									
77.2														
9.8	END OF BOREHOLE													
	Note: 1. Borehole dry upon completion of drilling.													

MIS-MTO-001 09-1111-6066.GPJ GAL-MISS.GDT 8/11/10 DD/SAC

PROJECT		09-1111-6066		RECORD OF BOREHOLE No GL5		1 OF 1 METRIC							
G.W.P.		2088-08-00		LOCATION		N 4787378.1 ; E 290522.4							
DIST		HWY QEWS		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger							
DATUM		Geodetic		DATE		February 1, 2010							
				ORIGINATED BY		GM							
				COMPILED BY		SAC							
				CHECKED BY		TB/KJB							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W		
81.5	GROUND SURFACE												
0.0	ASPHALT												
81.2													
0.3	Sand and gravel, trace to some silt, trace clay (FILL) Compact Grey Moist		1	SS	27								31 49 [20]
			2	SS	10								
80.0													
1.5	CLAYEY SILT with organics, trace sand and gravel Stiff Black / brown Moist		3A	SS	14								OC=4.1%
79.5			3B										
2.0	CLAYEY SILT, some sand, trace to some gravel (TILL) Very stiff to hard Brown becoming grey below 4.6 m Moist		4	SS	32								7 18 47 28
			5	SS	32								
			6	SS	15								
			7	SS	17								
74.8	END OF BOREHOLE												
6.7	NOTE: 1. Borehole dry upon completion of drilling.												

PROJECT 09-1111-6066		RECORD OF BOREHOLE No GL6				1 OF 1 METRIC								
G.W.P. 2088-08-00		LOCATION N 4787386.5 ; E 290507.8				ORIGINATED BY GM								
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC								
DATUM Geodetic		DATE February 1, 2010				CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
81.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100					
0.0	ASPHALT													
81.2														
0.3	Sand and gravel, trace silt (FILL) Compact to dense Grey Moist		1	SS	30		81							
			2	SS	12									
80.0							80							
1.5	CLAYEY SILT, trace to some sand, trace gravel, containing shale fragments (TILL) Very stiff to hard Brown becoming grey below 4.6 m Moist		3	SS	24									
			4	SS	32		79							
			5	SS	38		78							
			6	SS	23		77							
							76							
74.8			7	SS	18		75							
6.7	END OF BOREHOLE													
	NOTE: 1. Borehole dry upon completion of drilling.													

PROJECT 09-1111-6066		RECORD OF BOREHOLE No GL7				1 OF 1 METRIC										
G.W.P. 2088-08-00		LOCATION N 4787417.8 ; E 290517.9				ORIGINATED BY GM										
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC										
DATUM Geodetic		DATE February 11, 2010				CHECKED BY TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED				W _p	W	W _L		
81.5	GROUND SURFACE															
0.0	ASPHALT															
0.2	Sand and gravel, trace silt, containing clayey silt layers (FILL) Loose to dense Grey Moist		1	SS	37											
			2	SS	23											
			3	SS	8											
79.2	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff to hard Brown Moist		4	SS	26											
2.3			5	SS	29											
			6	SS	30											
			7	SS	21											
74.8	END OF BOREHOLE															
6.7	NOTES: 1. Borehole dry upon completion of drilling.															

PROJECT 09-1111-6066				RECORD OF BOREHOLE No GL8				1 OF 1 METRIC									
G.W.P. 2088-08-00				LOCATION N 4787412.9 ; E 290531.5				ORIGINATED BY GM									
DIST _____ HWY QEW				BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC									
DATUM Geodetic				DATE February 11, 2010				CHECKED BY TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
81.5	GROUND SURFACE						20	40	60	80	100						
0.0	ASPHALT																
0.2	Sand and gravel, trace to some silt, trace clay (FILL) Compact to dense Grey Moist		1	SS	26							o				44 44 10 2	
			2	SS	24												
			3	SS	42												
79.3	CLAYEY SILT, trace sand and gravel, containing cobbles and boulders (TILL) Very stiff Brown Moist		4	SS	26								o				
2.2																	
78.5	END OF BOREHOLE (Obstruction encountered)																
3.1																	
NOTES: 1. Borehole dry upon completion of drilling. 2. Borehole terminated on obstruction (inferred cobble/boulder) at 3.1 m below ground surface. (Elev. 78.5 m)																	

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-F-6

LOCATION W. & Glover Rd (Sta. 595/28, 171' Rt. of E)

ORIGINATED BY L.P.

W.P. 210-63

BORING DATE Jan. 10, 1966.

COMPILED BY L.P.

DATUM Contours

BOREHOLE TYPE Penndrill

CHECKED BY M.D. *dl*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	WATER CONTENT %			
265.0	Groundlevel										
0	Clayey silt - some sand occasional gravel, hard, brown.		1	SS	100	11"	260				
			2	SS	100	11"					
			3	SS	106	9"					
254.0	Grey		4	SS	65		250				
11.0			5	SS	54						
			6	SS	89						
			7	SS	75		240				
			8	SS	67	6"					
			9	SS	100	2"	230				
228.8	End of borehole.										
36.2											

Elev. 256.5
Gr 3% Sa 16%
Si 51% Cl 30%

RECORD OF BOREHOLE NO.

2

FOUNDATION SECTION

JOB 66-F-6

LOCATION QEW & Glover Rd. (Sta. 595+33, 151' Lt. of E)

ORIGINATED BY L.P.

W. P. 210-63

BORING DATE Jan. 11, 1966.

COMPILED BY L.P.

DATUM Contours

BOREHOLE TYPE Penndrill

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT % 10 20 30			
264.0	Groundlevel												
0	Clayey silt, some sand, occasional gravel. hard, brown.		1	SS	48	260							Ground waterlevel 260
			2	SS	77								
			3	SS	72/9"								
252.0	Grey		4	SS	43	250							Gr12%Sa13% Si45%Cl 30%
12.0			5	SS	45								
			6	SS	48								
			7	SS	43	240							
			8	SS	68								
			9	SS	90	230							
224.0	End of borehole.												
40.0													

FOUNDATION SECTION

CHECKED BY M.D. *α*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT						
264.0	Groundlevel										
0	Clayey silt, some sand, occasional gravel. hard. brown.		1	SS	41	260					Ground waterlevel 260 Gr2%Sa25% S147%Cl 28%
			2	SS	60						
			3	SS	51						
252.0			4	SS	36						
12.0	Grey		5	SS	49	250					
			6	SS	46						
			7	SS	48	240					
			8	SS	67						
227.5			9	SS	45/6"	230					
36.5	Highly weathered shale.										
224.5											
39.5	End of borehole.										
						220					

FOUNDATION SECTION

JOB 65-F-6

LOCATION LEW & Glover Rd (Sta. 595+78.5, 79' Rt. of C)

ORIGINATED BY L.P.

W. P. 210-63

BORING DATE Jan. 13, 1966

COMPILED BY L.P.

DATUM Contours

BOREHOLE TYPE Pennadrill

CHECKED BY _____ M.D. *GR*

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT % 10 20 30			
264.0	Groundlevel												
0	Clayey silt, some sand, occasional gravel, hard. brown.		1	SS	42	260							Ground waterlevel 260
			2	SS	65								
			3	SS	80/9"								
252.0	Grey.		4	SS	46	250							Gr3%Sa22% Si47%Cl 28%
12.0			5	SS	41								
			6	SS	49								
			7	SS	40	240							
			8	SS	49								
228.9	End of borehole.					230							
35.1													
						220							

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 66-F-6 (65-F-28)

LOCATION Q.E.W. Sta. 595+07. 100' Lt. Glover Rd.

ORIGINATED BY T.C.

W.P.

BORING DATE March 18, 1965.

COMPILED BY T.C.

DATUM G.S.C.

BOREHOLE TYPE Penndrill

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WP	W	WL		
265.0	Groundlevel												
0.0													
	(Brown)		1	SS	34	260							Gr2%Sa18% Si50%Cl 30%
			2	SS	47								
			3	SS	44								
253.0			4	SS	34	250							El. 252
12.0	(Grey)		5	SS	33								WL Observed in B.H.
	Clayey silt with sand and occasional gravel.		6	SS	34	240							
			7	SS	31								
	Hard.		8	SS	41								
			9	SS	49	230							
226.8	Refusal												
38.2	End of borehole.												
						220							

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 66-F-6

LOCATION QEW & Glover Rd (Sta. 595+78, 134' Rt. of E)

ORIGINATED BY L.P.

W.P. 210-63

BORING DATE Jan. 14, 1966

COMPILED BY L.P.

DATUM Contours

BOREHOLE TYPE Penndrill

CHECKED BY M.D. *HL*

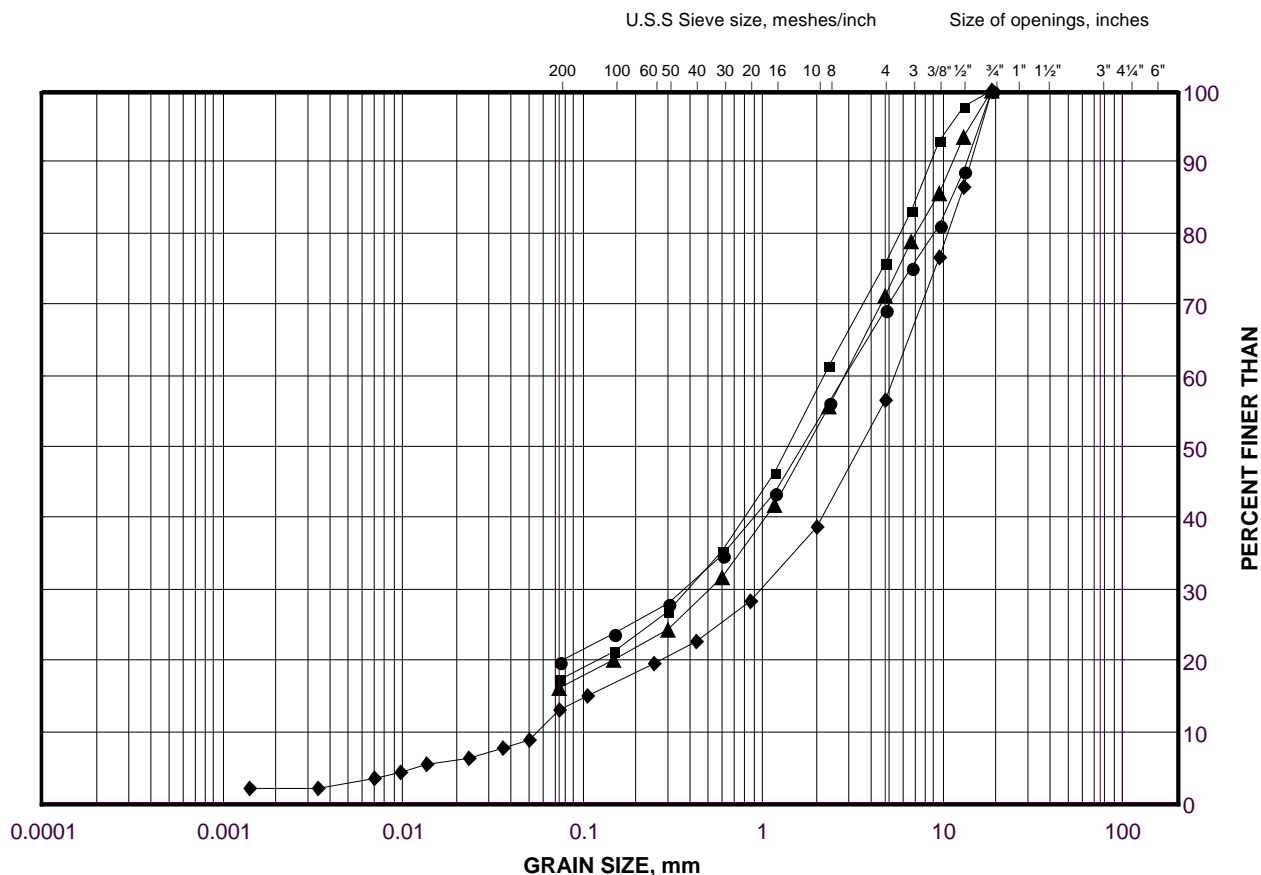
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WP	WL	W		
264.0	Groundlevel														
0	Clayey silt, some sand, occasional gravel, hard. brown.		1	SS	42	260									
			2	SS	53										
252.5			3	SS	82										
11.5	Grey		4	SS	49	250									
247.5			5	SS	60										
16.5	End of borehole.														
						240									

Ground waterlevel
260

GRAIN SIZE DISTRIBUTION

Gravelly Sand to Sand and Gravel Fill

FIGURE D1



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	GL5	1	80.9
■	GL3	1	87.4
◆	GL8	1	81.1
▲	GL2	2	80.2

Project Number: 09-1111-6066

Checked By: KJB

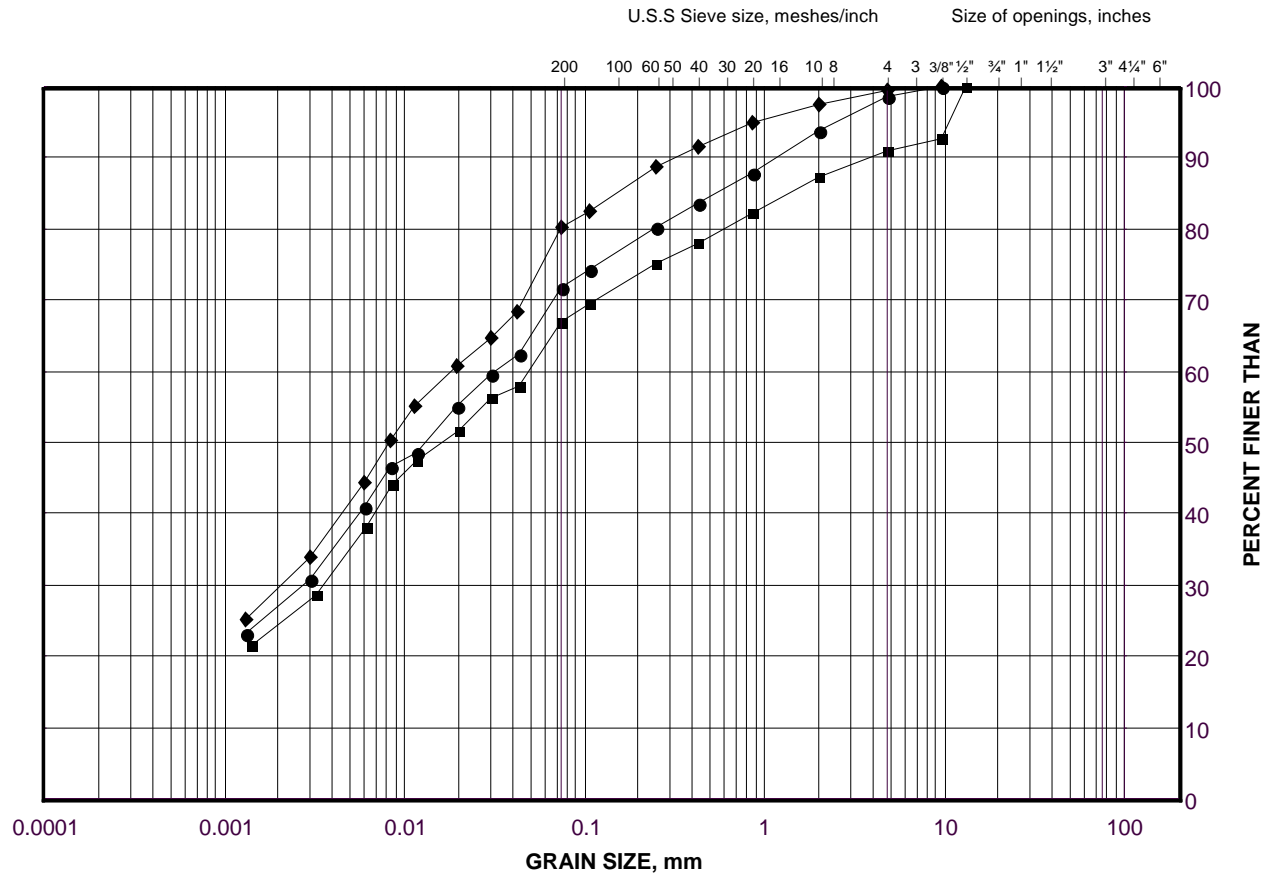
Golder Associates

Date: 22-Apr-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Fill

FIGURE D2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

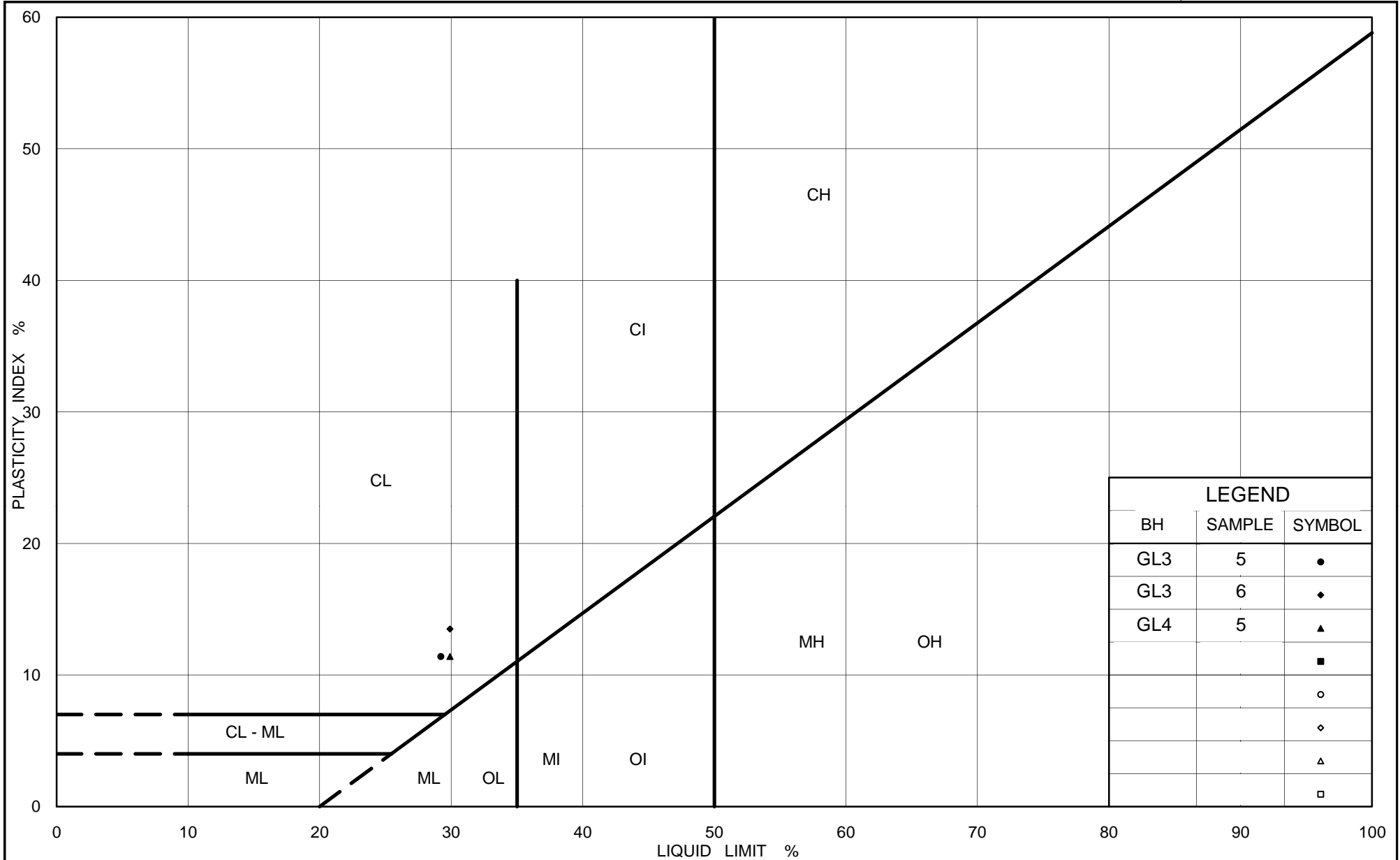
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	GL4	4	84.3
■	GL3	4	85.4
◆	GL3	6	82.4

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Fill

Figure No. D3

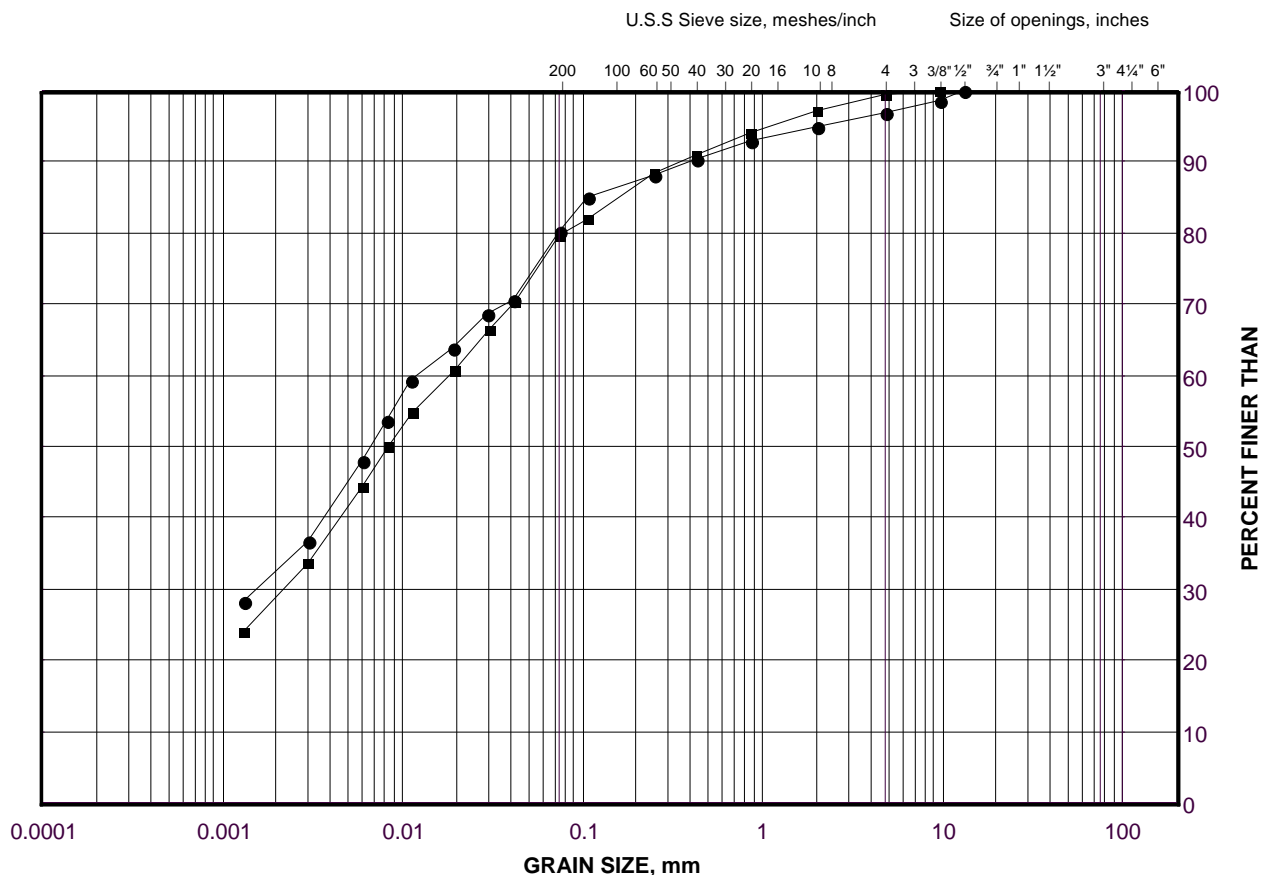
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt with Organics

FIGURE D4



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

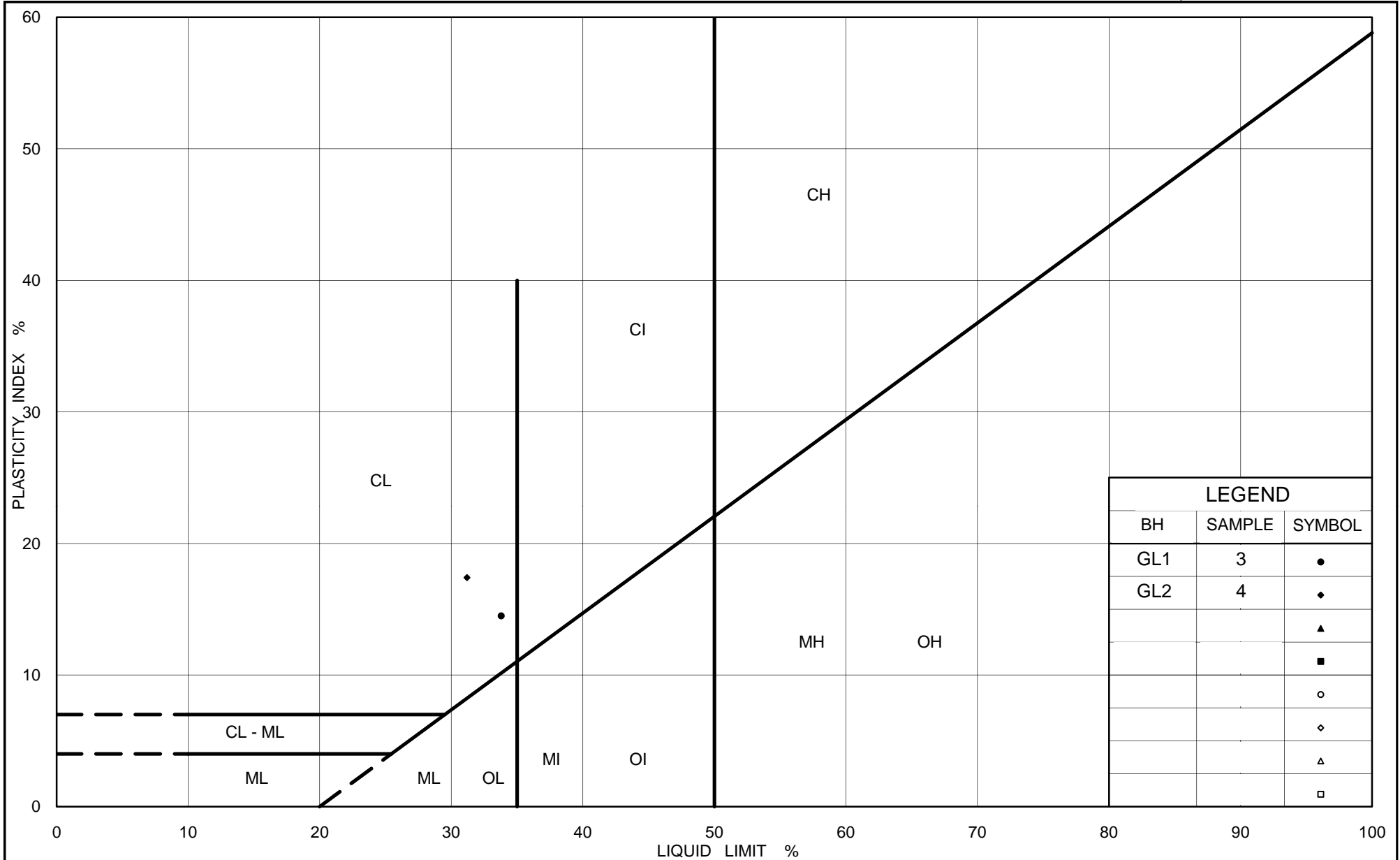
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	GL1	3	79.5
■	GL2	4	78.7

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 02-Jun-10



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt with Organics

Figure No. D5

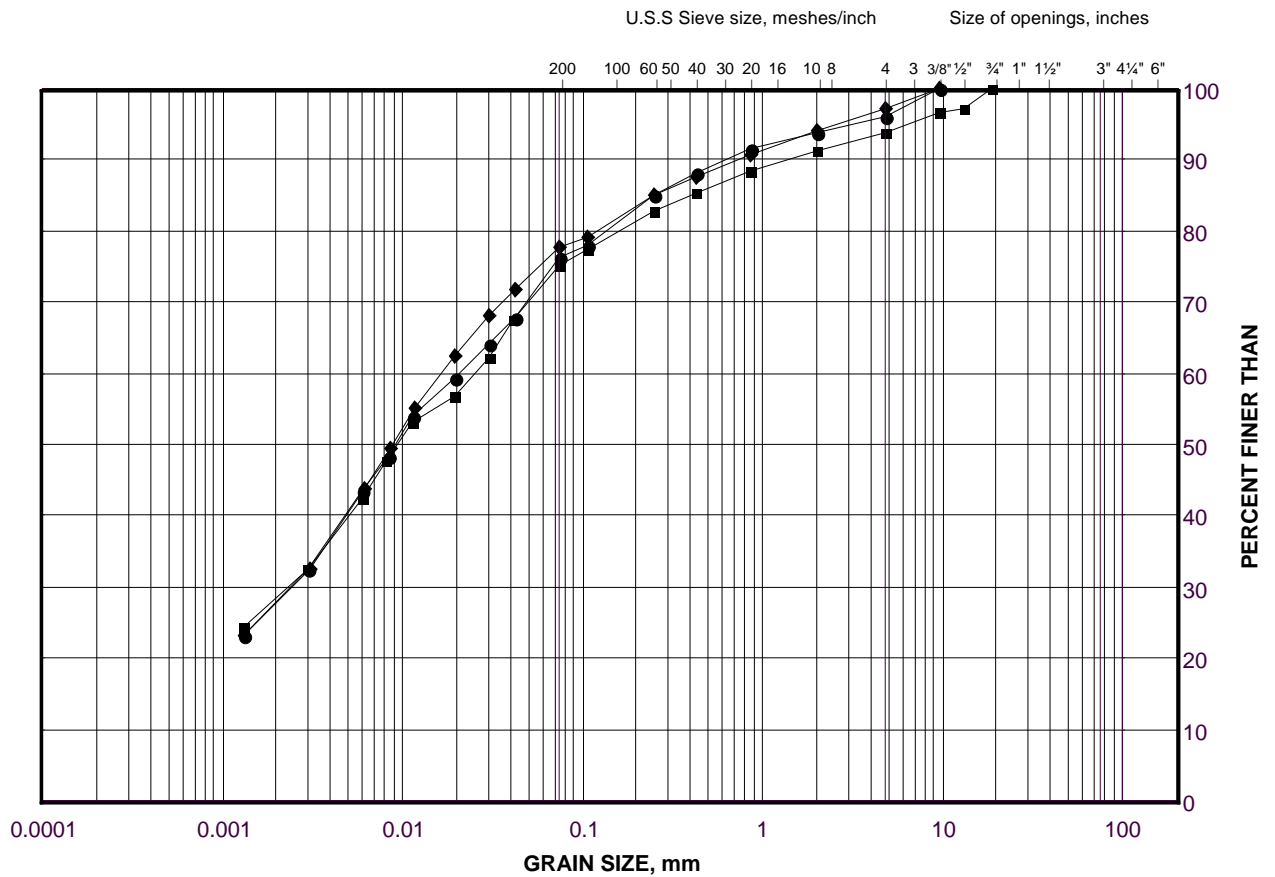
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D6



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

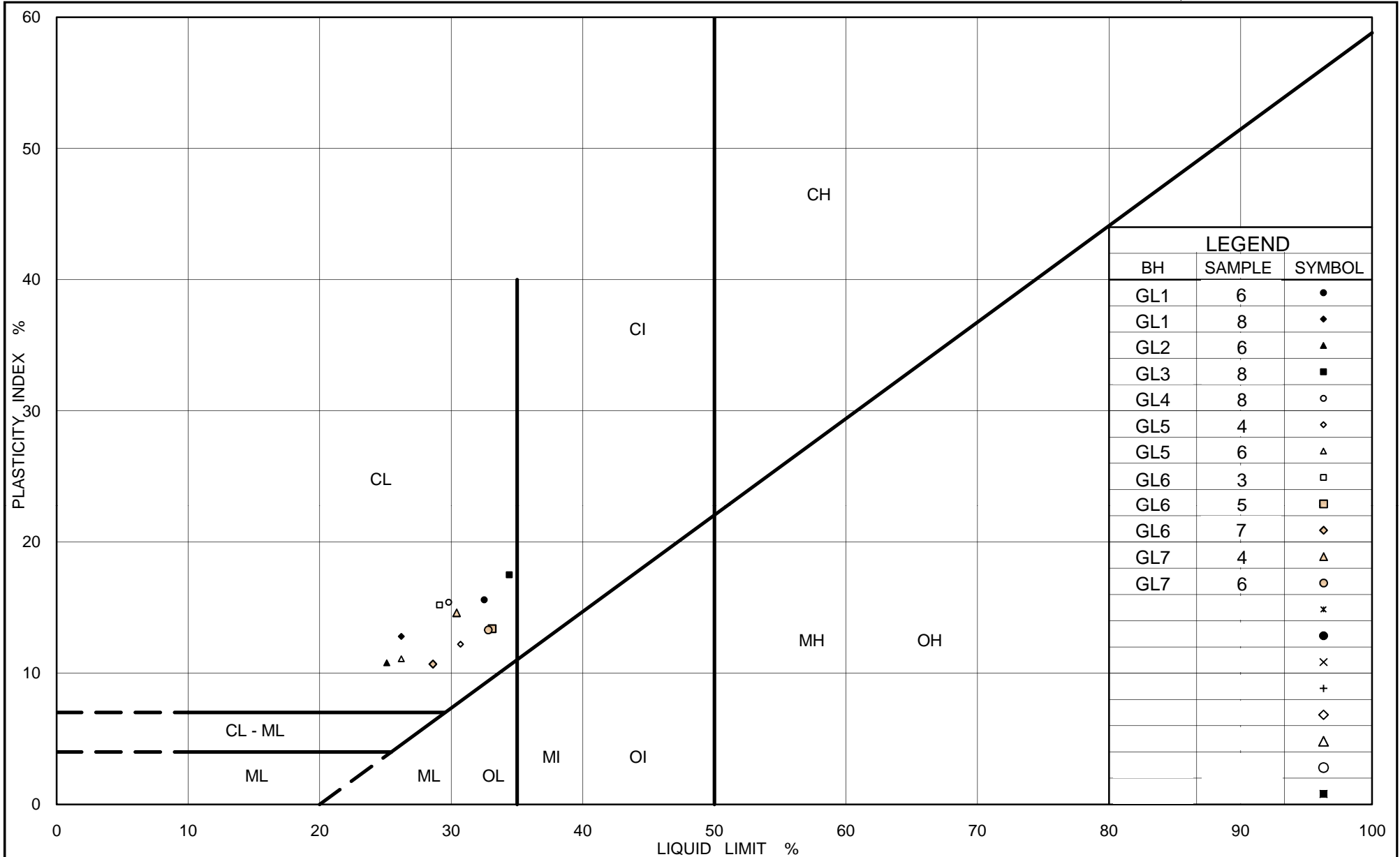
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	GL6	3	79.7
■	GL5	4	78.9
◆	GL7	4	78.9

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of
Transportation

Ontario

PLASTICITY CHART Clayey Silt Till

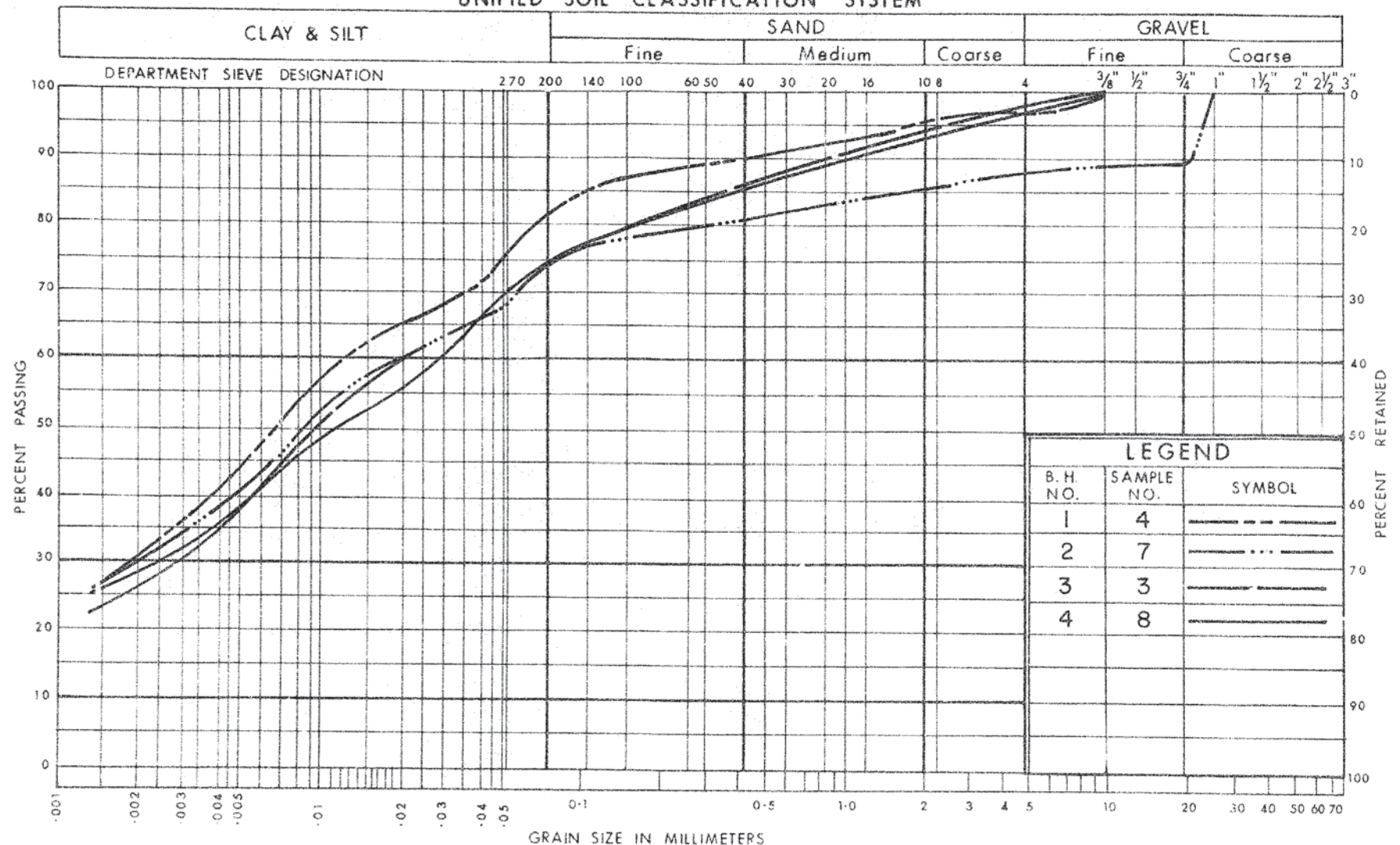
Figure No. D7

Project No. 09-1111-6066

Checked By: KJB

KJB

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION


W.P. No. 210-63


JOB No. 66-F-6



APPENDIX E

Winona Road Underpass Record of Boreholes and Laboratory Test Results

PROJECT 09-1111-6066			RECORD OF BOREHOLE No W1			1 OF 1 METRIC									
G.W.P. 2088-08-00			LOCATION N 4786580.0 ; E 292916.8			ORIGINATED BY GM									
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC									
DATUM Geodetic			DATE February 1, 2010			CHECKED BY TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
84.0	GROUND SURFACE							20 40 60 80 100							
0.0	Sand and gravel, trace silt (FILL) Very dense Grey Moist		1	SS	105										
83.2			2	SS	7										
0.8	Clayey silt with sand, trace to some gravel (FILL) Firm Brown Moist														
82.5			3	SS	11										
1.5	CLAYEY SILT with organics, trace sand, containing rootlets and wood fibres Stiff Brown/black Moist														
81.7			4	SS	24										
2.3	CLAYEY SILT, trace sand and gravel (TILL) Very stiff to hard Brown to reddish grey below 6.1 m Moist														
			5	SS	28										
			6	SS	37										
			7	SS	18										
77.3	END OF BOREHOLE														
6.7	NOTE: 1. Borehole dry upon completion of drilling.														

PROJECT		09-1111-6066		RECORD OF BOREHOLE No W2				1 OF 1		METRIC							
G.W.P.		2088-08-00		LOCATION		N 4786583.8 ; E 292904.1		ORIGINATED BY		GM							
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger		COMPILED BY		SAC							
DATUM		Geodetic		DATE		February 1, 2010		CHECKED BY		TB/KJB							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
84.0	GROUND SURFACE																
0.0	Gravelly sand, trace to some silt, trace clay (FILL) Very dense Grey Moist		1	SS	100/0.25											22 54 [24]	
83.2	Clayey silt, trace sand and gravel (FILL) Stiff Brown Moist		2	SS	13												
82.5	CLAYEY SILT with organics, trace sand, containing rootlets Stiff Brown/black Moist		3	SS	10												
81.7	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff to hard Brown Moist		4	SS	20												
81.7			5	SS	22												3 18 49 30
80.0			6	SS	33												
77.3			7	SS	24												
6.7	END OF BOREHOLE NOTE: 1. Borehole dry upon completion of drilling.																

PROJECT		09-1111-6066		RECORD OF BOREHOLE No W3		1 OF 1 METRIC									
G.W.P.		2088-08-00		LOCATION		N 4786658.2 ; E 292925.1									
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger									
DATUM		Geodetic		DATE		February 19, 2010									
				ORIGINATED BY		GM									
				COMPILED BY		SAC									
				CHECKED BY		TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			W _p
83.4	GROUND SURFACE														
0.0	ASPHALT														
0.1	Sand and gravel, trace silt (FILL)		1	SS	-										
82.6	Brown Moist														
0.8	Clayey silt, some sand, trace gravel (FILL)		2	SS	9										
	Firm to stiff														
	Brown Moist		3	SS	5										
80.8			4A	SS	18										
2.6	CLAYEY SILT, some sand, trace gravel (TILL)		4B												
	Very stiff to hard														
	Brown Moist		5	SS	16										
			6	SS	33										
76.7			7	SS	25										
6.7	END OF BOREHOLE														
	NOTE:														
	1. Borehole dry upon completion of drilling.														

PROJECT		09-1111-6066		RECORD OF BOREHOLE No W4				1 OF 1 METRIC						
G.W.P.		2088-08-00		LOCATION		N 4786653.8 ; E 292939.1		ORIGINATED BY		GM				
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger		COMPILED BY		SAC				
DATUM		Geodetic		DATE		February 19, 2010		CHECKED BY		TB/KJB				
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			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 (%)				
83.4	GROUND SURFACE													
0.0	ASPHALT													
0.1	Sand and gravel, some silt, trace clay (FILL) Loose to compact Brown Moist		1	SS	22		83							38 40 18 4
			2	SS	6									
82.0							82							
1.5	Clayey silt, trace sand and gravel, containing organics (FILL) Firm Brown Moist		3	SS	5								OC=4.5%	
81.2														
2.2	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Brown Moist		4	SS	28		81							
			5	SS	24		80							
			6	SS	21		79							4 19 50 27
							78							
76.7			7	SS	20		77							
6.7	END OF BOREHOLE													
NOTE: 1. Borehole dry upon completion of drilling.														

PROJECT 09-1111-6066				RECORD OF BOREHOLE No W5				1 OF 1 METRIC					
G.W.P. 2088-08-00				LOCATION N 4786564.4 ; E 292907.6				ORIGINATED BY GM					
DIST _____ HWY QEW				BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC					
DATUM Geodetic				DATE February 19, 2010				CHECKED BY TB/KJB					
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT		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		W _p W W _L			
89.6	GROUND SURFACE												
0.0	ASPHALT												
0.1	Sand and gravel, trace silt (FILL) Compact to dense Brown Moist		1	SS	39								
			2	SS	18								
88.2													
1.4	Clayey silt, some sand, trace gravel, contains Silty Sand pockets (FILL) Stiff Brown Moist		3	SS	14								
			4	SS	9								
			5	SS	10								
			6	SS	11								
			7	SS	11								
82.0													
7.6	CLAYEY SILT, trace to some sand, trace gravel (TILL) Very stiff to hard Brown Moist		8	SS	16								
			9	SS	43								
79.9													
9.8	END OF BOREHOLE												
NOTES: 1. Water level in open borehole at a depth of 7.6 m below ground surface (Elev. 82 m) upon completion of drilling. 2. Water level in piezometer at a depth of 6.9 m below ground surface (Elev. 82.7 m) on March 17, 2010.													

PROJECT		09-1111-6066		RECORD OF BOREHOLE No W6		1 OF 1 METRIC									
G.W.P.		2088-08-00		LOCATION		N 4786676.3 ; E 292941.2									
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger									
DATUM		Geodetic		DATE		February 19, 2010									
				ORIGINATED BY		GM									
				COMPILED BY		SAC									
				CHECKED BY		TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			W _p
88.8	GROUND SURFACE														
0.0	ASPHALT														
0.1	Sand and gravel, trace silt (FILL) Dense Brown Moist		1	SS	32										
			2	SS	36										
87.4															
1.5	Clayey silt with sand, trace gravel (FILL) Firm to stiff Brown Moist		3	SS	7										
			4	SS	4										
			5	SS	13										
			6	SS	8										
			7	SS	8										
81.2															
7.6	SILTY CLAY, trace sand and gravel (TILL) Very stiff Brown Moist		8	SS	16										
			9	SS	28										
79.1															
9.8	END OF BOREHOLE														
	Note: 1. Water level in open borehole at a depth of 9.1 m below ground surface (Elev. 79.7 m) upon completion of drilling.														

PROJECT 09-1111-6066		RECORD OF BOREHOLE No W7				1 OF 1 METRIC							
G.W.P. 2088-08-00		LOCATION N 4786619.7 ; E 292914.2				ORIGINATED BY GM							
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC							
DATUM Geodetic		DATE February 17, 2010				CHECKED BY TB/KJB							
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
83.0	GROUND SURFACE						20 40 60 80 100						
0.0	ASPHALT						20 40 60 80 100						
0.2	Sand and gravel, trace silt, trace clay (FILL) Loose to compact Brown Moist		1	SS	28								
			2	SS	10								
			3	SS	5								
80.8													
2.2	CLAYEY SILT, some sand, trace to some gravel (TILL) Stiff to hard Brown Moist		4	SS	10								
			5	SS	27								
			6	SS	33								
			7	SS	27								
76.3	END OF BOREHOLE												
6.7	Note: 1. Water level in open borhole at a depth of 6.1 m below ground surface (Elev. 76.9 m) upon completion of drilling.												

PROJECT		09-1111-6066		RECORD OF BOREHOLE No W8		1 OF 1 METRIC										
G.W.P.		2088-08-00		LOCATION		N 4786614.8 ; E 292927.6										
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger										
DATUM		Geodetic		DATE		February 17, 2010										
				ORIGINATED BY		GM										
				COMPILED BY		SAC										
				CHECKED BY		TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
83.0	GROUND SURFACE															
0.0	ASPHALT															
0.2	Sand and gravel, some silt, trace clay (FILL) Compact to very dense Brown Moist to wet below 1.5 m		1	SS	51											
			2	SS	28											42 43 13 2
			3	SS	12											
80.9																
2.1	CLAYEY SILT with sand, trace to some gravel (TILL) Stiff to hard Brown Moist		4	SS	12											
			5	SS	28											
			6	SS	29											
			7	SS	31											
76.3																
6.7	END OF BOREHOLE															
Note: 1. Water level in open borehole at a depth of 6.1 m below ground surface (Elev. 76.9 m) upon completion of drilling.																

FOUNDATION SECTION

CHECKED BY M.D.

SOIL PROFILE		STRAT. PLT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20 40 60 80 100	SHEAR STRENGTH P.S.F.	10 20 30			
269.7	Groundlevel											
0.0			1	SS	60							WL266.2 3.5
			2	SS	63							
			3	SS	96	250		100/10"				Gr3%Sa19% Si53%Cl 25%
255.7	(Brown)		4	SS	89							
14.0	(Grey)		5	SS	42							
			6	SS	58	250						
			7	SS	40							
	Clayey silt with sand and traces of gravel- Hard.		8	SS	58							
	(With occasional seams of silt and sand).		9	SS	52	240						
			10	SS	41							
			11	SS	51	230						
			12	SS	64							
			13	SS	100	220						
			14	SS	100	210						
			15	SS	153							
			16	SS	100	200						Gr5%Sa23% Si49%Cl 23%
198.2			17	SS	83							
71.5	End of borehole.					190						

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-49

W. P. 216-63

DATUM Geodetic

LOCATION QCN & Winona Rd. Sta. 31/71 O/S 23.5' Rt.

BORING DATE June 3 & 7, 1966.

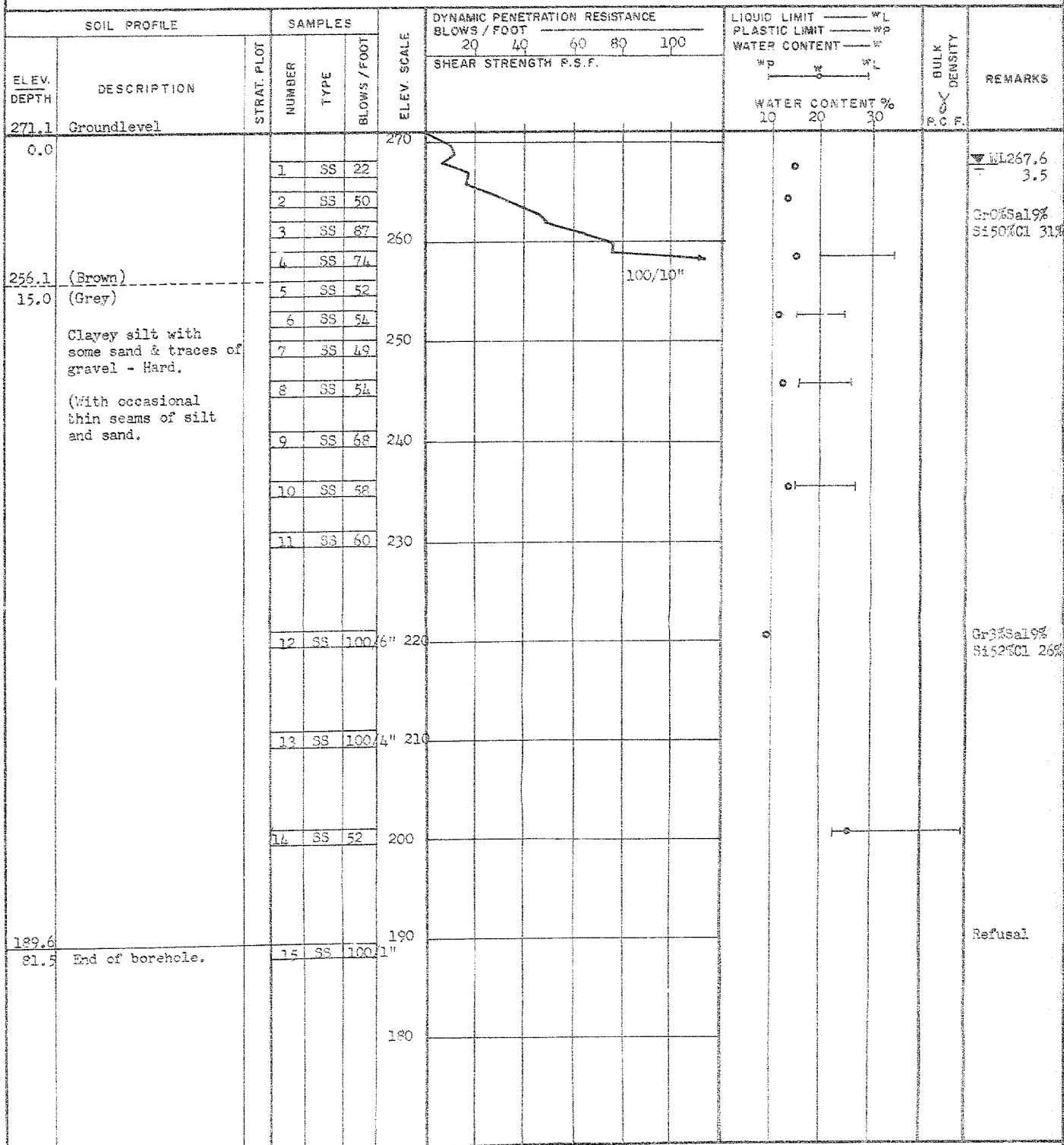
BOREHOLE TYPE Penn Drill.

FOUNDATION SECTION

ORIGINATED BY V.K.

COMPILED BY W.T.E.

CHECKED BY M.D.

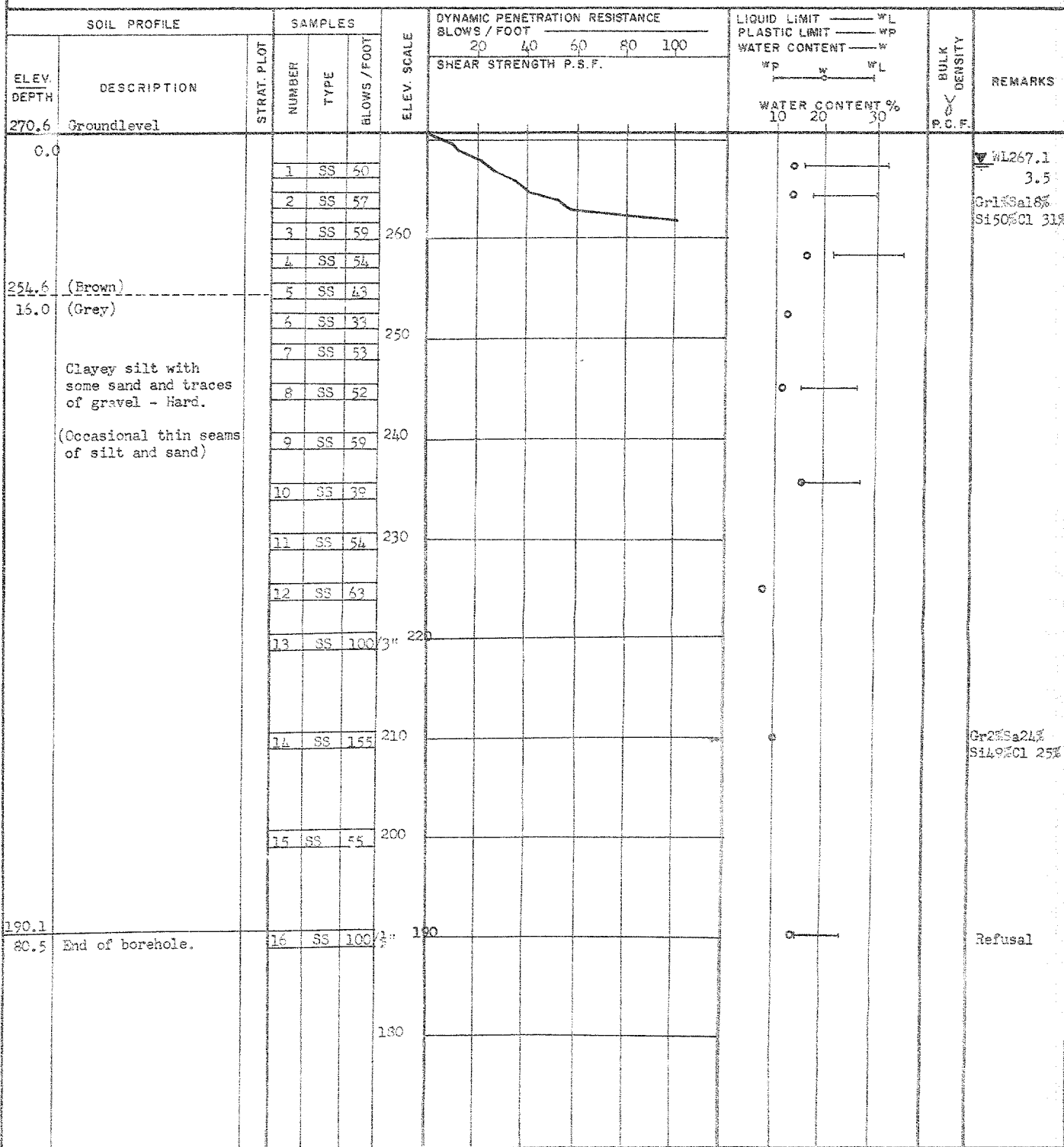


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-49 LOCATION Q&W & Winona Rd. Sta. 31+35 O/S 30' Lt. ORIGINATED BY V.K.
W.P. 216-63 BORING DATE June 3, 1966 COMPILED BY W.T.E.
DATUM Geodetic BOREHOLE TYPE Cone; Penn Drill CHECKED BY M.D.



FOUNDATION SECTION

CHECKED BY M.D.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — WL			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT			PLASTIC LIMIT — WP				
							SHEAR STRENGTH P.S.F.			WATER CONTENT — W				
										WP — W — WL				
									WATER CONTENT %					
									10 20 30					
270.5	Groundlevel													
0.0														
			1	SS	47									
			2	SS	75	260								
255.5	(Brown)		3	SS	43									
15.0	(Grey)		4	SS	42	250								
	Clayey silt with some sand and traces of gravel - Hard.		5	SS	49									
	(Occasional thin seams of silt and sand)		6	SS	45	240								
			7	SS	46	230								
219.0			8	SS	81	220								
51.5	End of borehole.					210								

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 66-F-49 LOCATION QEW & Winona Rd. Sta. 28+62.5 O/S 29.51t. ORIGINATED BY V.K.
W.P. 216-63 BORING DATE June 10/66 COMPILED BY N.T.E.
DATUM Geodetic BOREHOLE TYPE Penn Drill CHECKED BY N.E.

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS					
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	20	40			60	80	100	WL	WP
268.9	Groundlevel														
0.0															
			1	SS	30										
			2	SS	44										
			3	SS	28										
			4	SS	44										
253.4	(Brown)		5	SS	36										
15.5	(Grey)		6	SS	35										
	Clayey silt with some sand and traces of gravel - Hard.		7	SS	38										
			8	SS	38										
			9	SS	30										
			10	SS	30										
			11	SS	40										
			12	SS	36										
212.9	(Grey)														
56.0	(Reddish Brown)														
			13	SS	100	5"									
185.1															
83.8	End of borehole.		14	SS	100	1"									

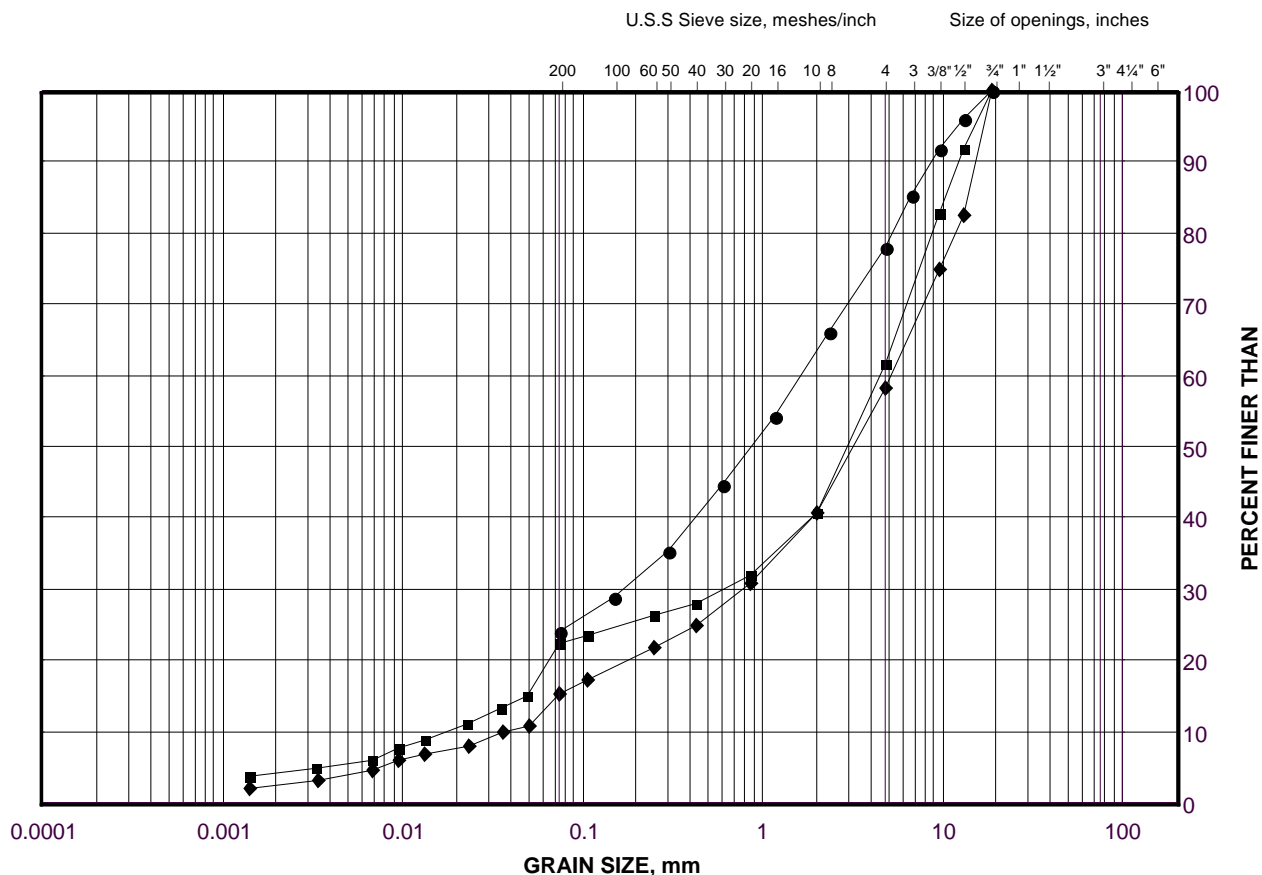
Gr 0%, Sal 0%
S 153%
Cl 37%

Refusal

GRAIN SIZE DISTRIBUTION

Gravelly Sand to Sand and Gravel Fill

FIGURE E1



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	W2	1	83.8
■	W4	1	82.9
◆	W8	2	81.9

Project Number: 09-1111-6066

Checked By: KJB

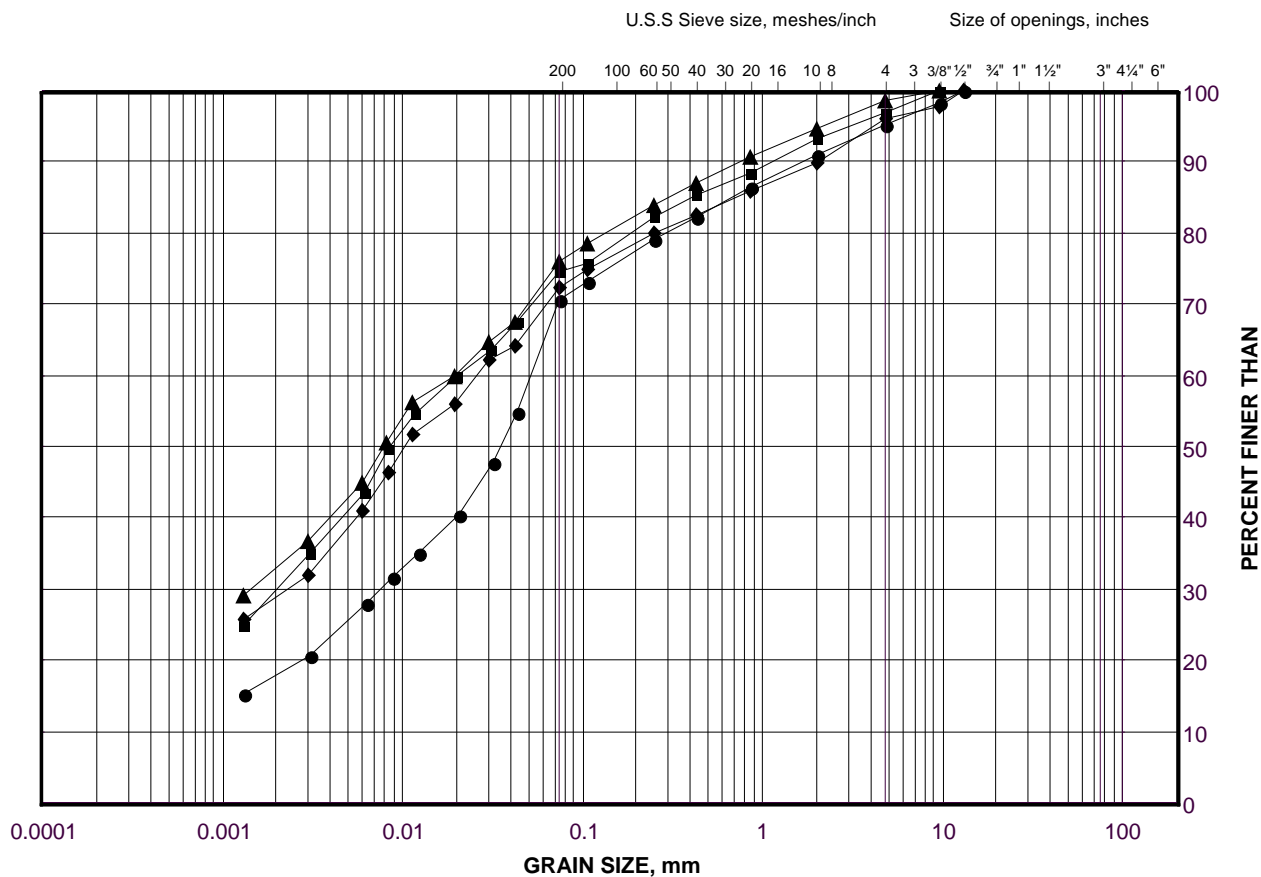
Golder Associates

Date: 22-Apr-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Fill

FIGURE E2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

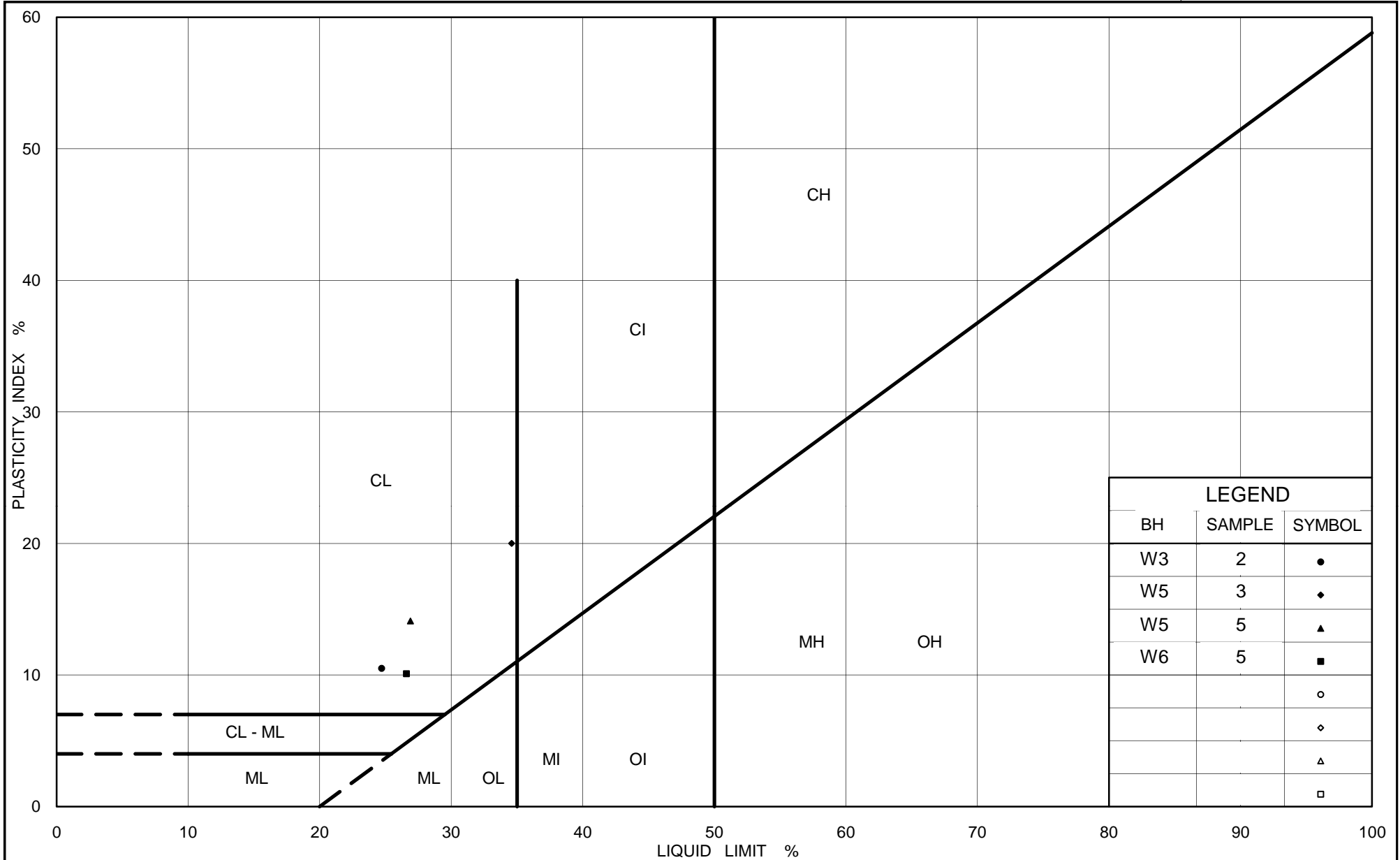
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	W1	2	82.9
■	W3	2	82.3
◆	W5	3	87.8
▲	W6	6	83.9

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of Transportation

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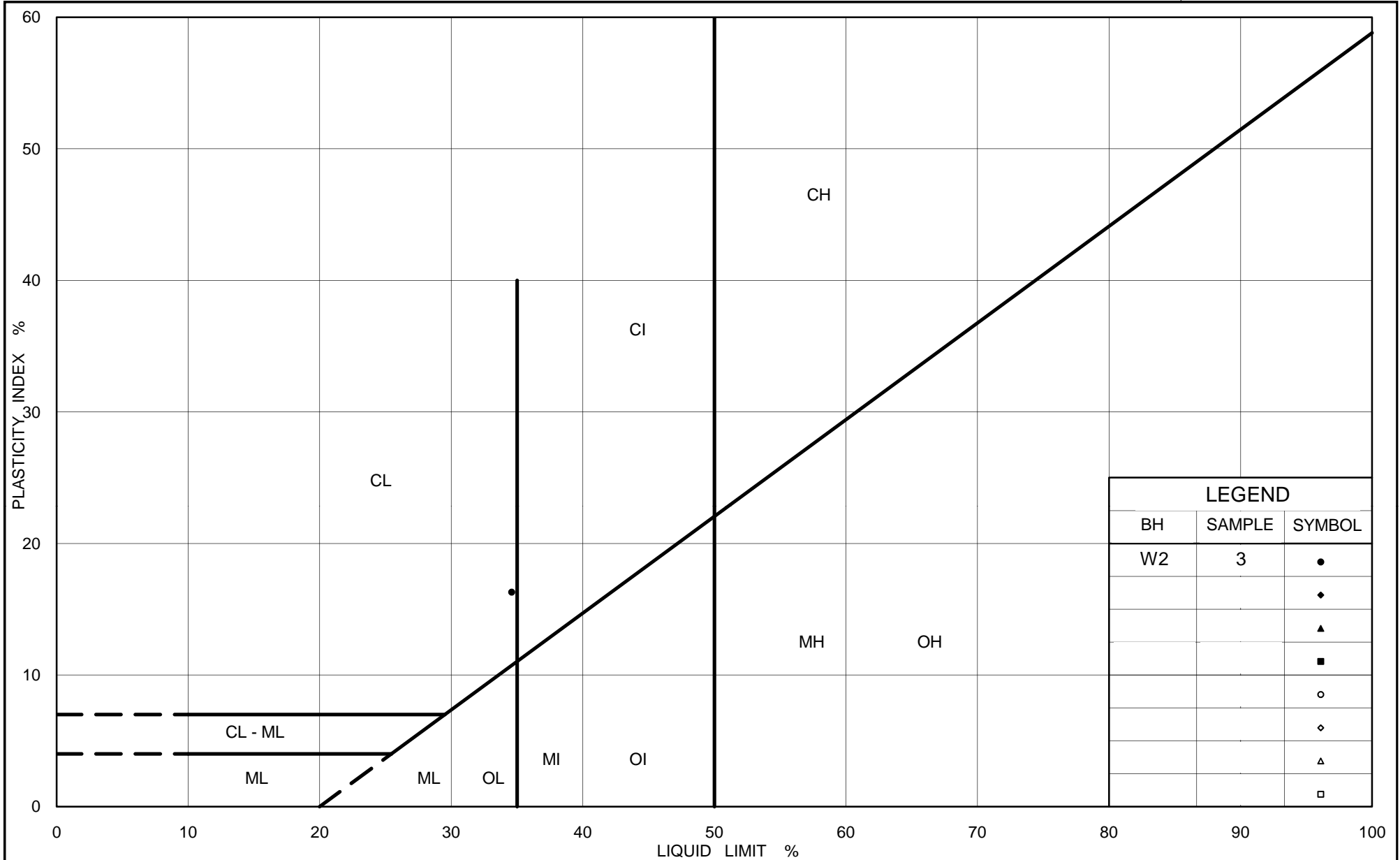
PLASTICITY CHART

Clayey Silt Fill

Figure No. E3

Project No. 09-1111-6066

Checked By: KJB



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt with Organics

Figure No. E4

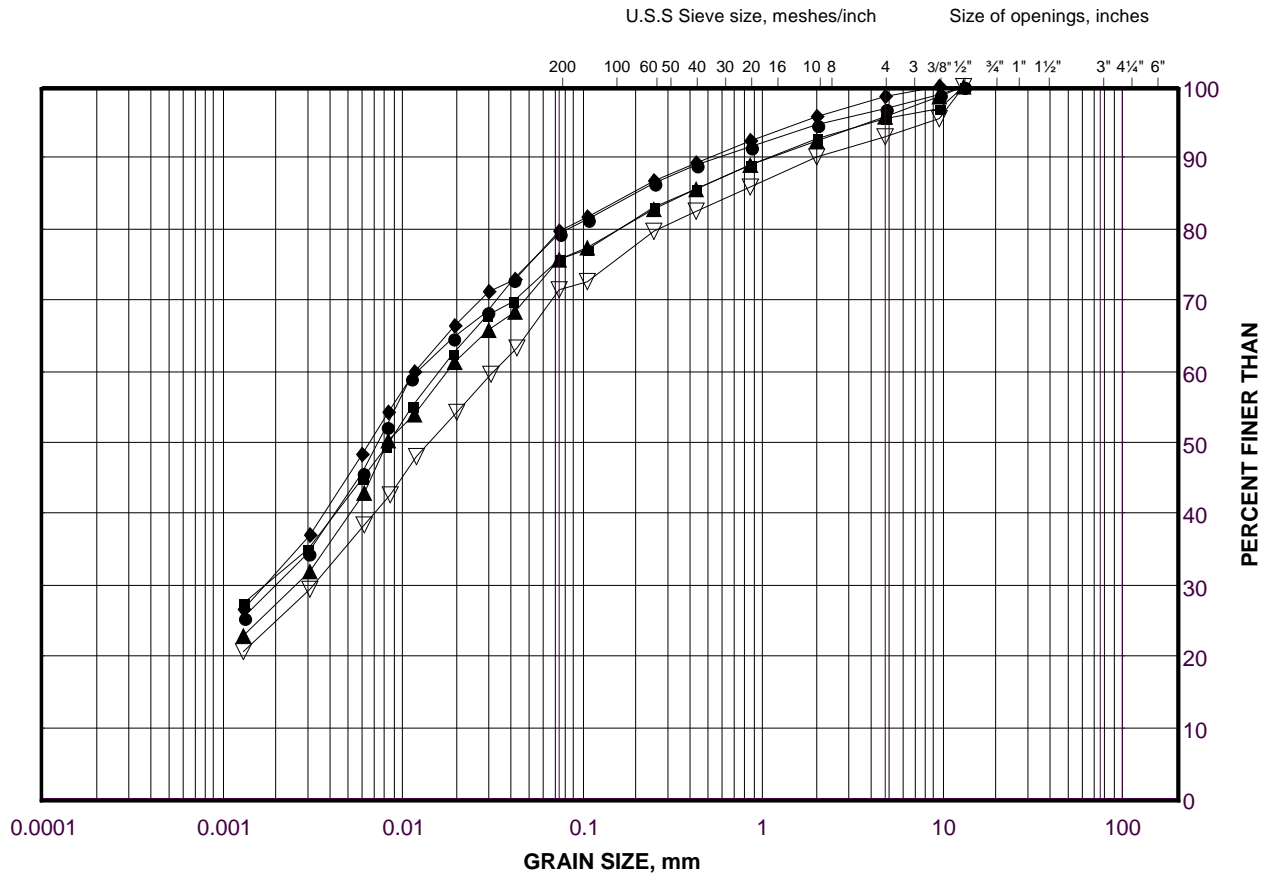
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Till

FIGURE E5



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

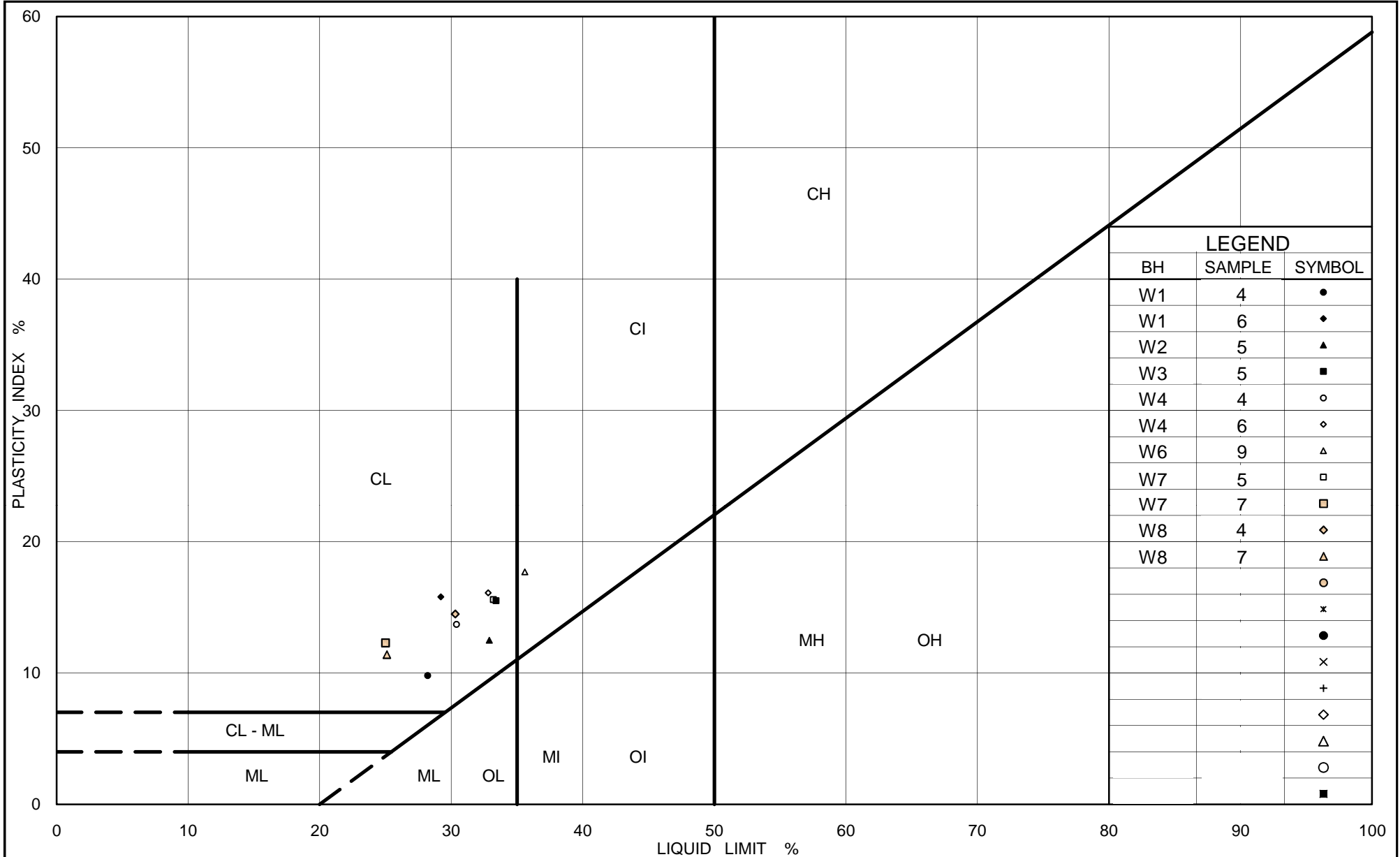
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	W2	5	80.6
■	W7	5	79.6
◆	W3	5	80.1
▲	W4	6	78.5
▽	W8	7	76.6

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 02-Jun-10



Ontario

Ministry of
Transportation

PLASTICITY CHART Clayey Silt to Silty Clay Till

Figure No. E6

Project No. 09-1111-6066



Checked By: KJB





APPENDIX F

Fifty Road Underpass Record of Boreholes and Laboratory Test Results

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



PROJECT		09-1111-6066		RECORD OF BOREHOLE No FY2		1 OF 1 METRIC									
G.W.P.		2088-08-00		LOCATION		N 4786417.4 ; E 293671.8									
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Auger									
DATUM		Geodetic		DATE		February 4, 2010									
						ORIGINATED BY GM									
						COMPILED BY SAC									
						CHECKED BY TB/KJB									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W	W _L			WATER CONTENT (%)
84.8	GROUND SURFACE														
0.0	ASPHALT														
0.3	Sand and gravel, trace to some silt (FILL) Compact to dense Grey Moist		1	SS	27										
			2	SS	29										
			3	SS	33										
82.2			4	SS	11										
81.8	Clayey silt, some sand, trace gravel (FILL) Stiff Brown Moist		5	SS	30										
3.0	CLAYEY SILT, some sand, trace gravel (TILL) Stiff to hard Brown becoming grey below 5.2 m Moist		6	SS	18										
			7	SS	8										
78.1	END OF BOREHOLE														
6.7	Note: 1. Borehole dry upon completion of drilling.														

PROJECT 09-1111-6066		RECORD OF BOREHOLE No FY3				1 OF 1 METRIC											
G.W.P. 2088-08-00		LOCATION N 4786407.0 ; E 293704.2				ORIGINATED BY GM											
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger				COMPILED BY SAC											
DATUM Geodetic		DATE February 4, 2010				CHECKED BY TB/KJB											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
84.8	GROUND SURFACE																
0.0	ASPHALT																
0.3	Sand and gravel, some silt, trace clay (FILL) Compact to dense Grey Moist		1	SS	36												
			2	SS	16												
			3	SS	33												
			4A	SS	13												
82.1			4B														
3.0	Clayey silt, some sand, trace gravel (FILL) Stiff Brown Moist CLAYEY SILT with sand, trace gravel (TILL) Very stiff to hard Brown Moist		5	SS	33												
			6	SS	26												
			7	SS	23												
78.1																	
6.7	END OF BOREHOLE																
	Note: 1. Borehole dry upon completion of drilling.																

MIS-MTO.001 09-1111-6066.GPJ GAL-MASS.GDT 8/11/10 DD/SAC

PROJECT		09-1111-6066		RECORD OF BOREHOLE No FY4		1 OF 1 METRIC								
G.W.P.		2088-08-00		LOCATION		N 4786429.1 ; E 293684.9								
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Augers								
DATUM		Geodetic		DATE		February 5, 2010								
						ORIGINATED BY TB								
						COMPILED BY SAC								
						CHECKED BY TB/KJB								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			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		
90.5	GROUND SURFACE													
0.0	ASPHALT													
0.3	CONCRETE													
	Sand and gravel, trace silt (FILL) Compact Brown Moist		1	SS	30									
			2	SS	13									
89.0														
1.5	Clayey silt, some sand, trace gravel (FILL) Firm to stiff Brown Moist		3	SS	8									
			4	SS	9									
			5	SS	8									
			6	SS	14									
			7	SS	15									
			8	SS	14									
			9A	SS	12									
82.4			9B											
8.2	Sand and gravel, trace silt, trace clay (FILL) Compact Grey Wet													
81.8														
8.7	CLAYEY SILT with sand, trace gravel (TILL) Hard Brown Moist		10	SS	52									
80.8														
9.8	END OF BOREHOLE													
NOTE:														
1. Water level in open borehole at a depth of 8.2 m below ground surface (Elev. 82.3 m) upon completion of drilling.														

MIS-MTO 001 09-1111-6066.GPJ GAL-MISS.GDT 8/11/10 DD/SAC

PROJECT		09-1111-6066		RECORD OF BOREHOLE No FY5				1 OF 1 METRIC							
G.W.P.		2088-08-00		LOCATION		N 4786321.1 ; E 293678.2		ORIGINATED BY TB							
DIST		HWY QEW		BOREHOLE TYPE		150 mm O.D. Hollow Stem Augers		COMPILED BY SAC							
DATUM		Geodetic		DATE		February 5, 2010		CHECKED BY TB/KJB							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
84.8	GROUND SURFACE														
0.0	ASPHALT														
0.3	Sand and gravel, some silt, trace clay (FILL) Compact Grey Moist becoming wet below 1.5 m		1	SS	26										
			2	SS	18										
			3	SS	22										
			4A	SS	27										
82.0	CLAYEY SILT, some sand, trace to some gravel (TILL) Very stiff Brown Moist		4B												
2.8			5	SS	29										
			6	SS	24										
			7	SS	26										
78.1	END OF BOREHOLE		8	SS	26										
6.7															
Note: 1. Borehole dry upon completion of drilling.															

PROJECT		09-1111-6066		RECORD OF BOREHOLE No FY6		1 OF 1 METRIC							
G.W.P.		2088-08-00		LOCATION		N 4786331.9 ; E 293645.7							
DIST		HWY QEW		BOREHOLE TYPE		210 mm O.D. Hollow Stem Augers							
DATUM		Geodetic		DATE		February 5, 2010							
				ORIGINATED BY		TB							
				COMPILED BY		SAC							
				CHECKED BY		TB/KJB							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)		
84.8	GROUND SURFACE												
0.0	ASPHALT												
0.3	Sand and gravel, some silt, trace clay (FILL) Compact Brown/grey Moist becoming wet below 1.5 m		1	SS	22								
			2	SS	16								
			3	SS	21								
82.0			4A	SS	12								
2.8	CLAYEY SILT TO SILTY CLAY, some sand, trace to some gravel (TILL) Very stiff to hard Brown Moist		4B										
			5	SS	24								
			6	SS	18								
			7	SS	19								
78.1			8	SS	33								
6.7	END OF BOREHOLE												
NOTES: 1. Water level inside augers at a depth of 5.5 m below ground surface (Elev. 79.3 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.1 m below ground surface (Elev. 83.7 m) on March 17, 2010.													

PROJECT 09-1111-6066			RECORD OF BOREHOLE No FY7			1 OF 1 METRIC		
G.W.P. 2088-08-00			LOCATION N 4786370.2 ; E 293659.3			ORIGINATED BY GM		
DIST _____ HWY QEW			BOREHOLE TYPE 150 mm O.D. Hollow Stem Auger			COMPILED BY SAC		
DATUM Geodetic			DATE February 17, 2010			CHECKED BY TB/KJB		
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100
84.5	GROUND SURFACE							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p — W — W _L WATER CONTENT (%)
0.0	ASPHALT							
0.1	Sand and gravel, trace to some silt, trace clay (FILL) Compact to dense Grey Moist		1	SS	25		84	○ 10 20 30 46 45 7 2
83.4	Clayey silt, some sand, trace gravel (FILL) Hard Brown Moist		2	SS	43		83	○ 10 20 30 5 37 40 18
1.5	Sand and gravel, trace to some silt, trace clay (FILL) Dense Grey Moist		3	SS	13		82	
	CLAYEY SILT with sand to CLAYEY SILT, some sand, trace to some gravel (TILL) Stiff to very stiff Brown Moist		4	SS	17		81	
			5	SS	25		80	
			6	SS	21		79	
			7	SS	21		78	○ 10 20 30
77.8	END OF BOREHOLE							
6.7	NOTE: 1. Borehole dry upon completion of drilling.							

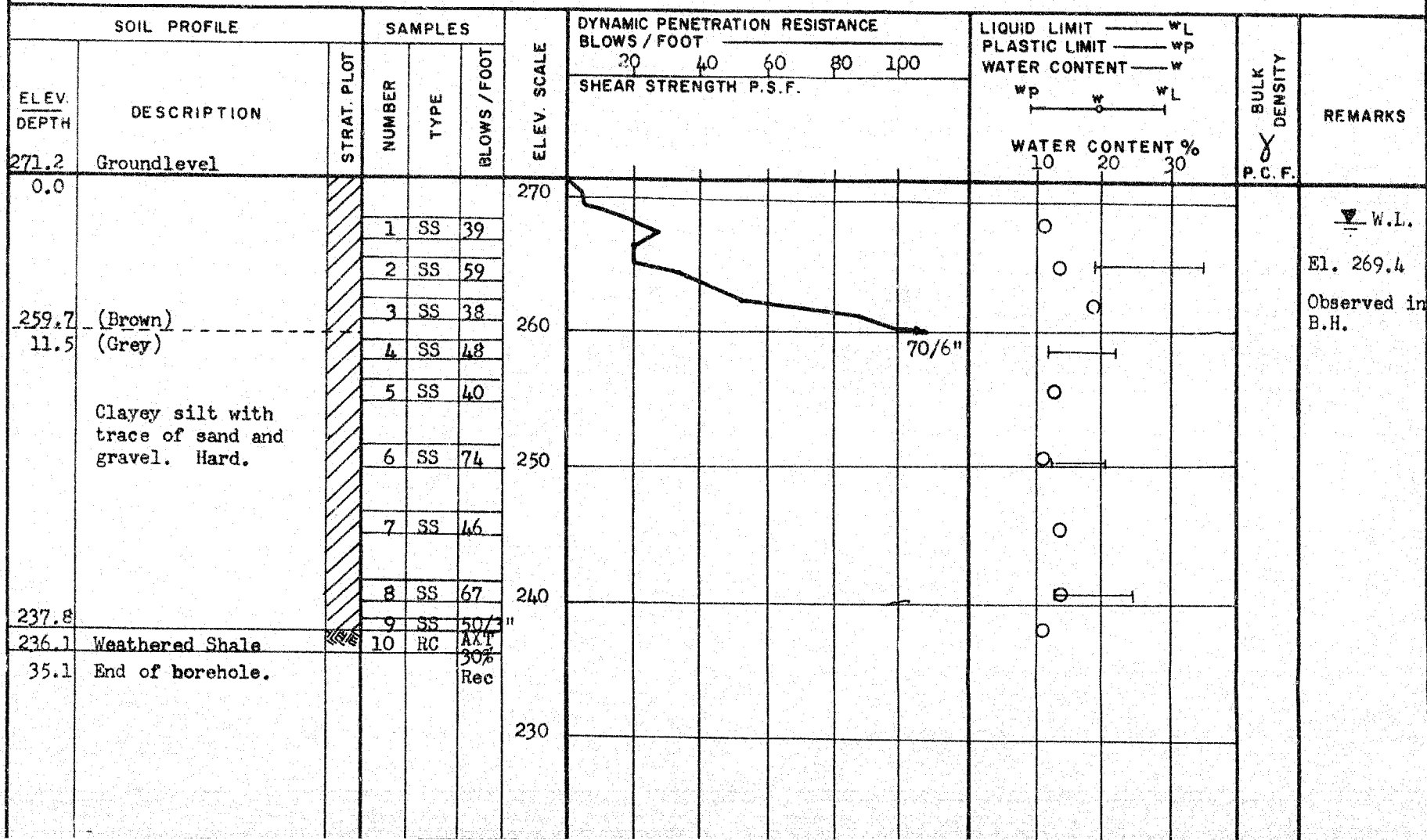
PROJECT 09-1111-6066		RECORD OF BOREHOLE No FY8				1 OF 1 METRIC										
G.W.P. 2088-08-00		LOCATION N 4786359.7 ; E 293688.9				ORIGINATED BY GM										
DIST _____ HWY QEW		BOREHOLE TYPE 150 mm Solid Stem Auger				COMPILED BY SAC										
DATUM Geodetic		DATE February 17, 2010				CHECKED BY TB/KJB										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
84.5	GROUND SURFACE															
0.0	ASPHALT															
0.2	Sand and gravel, trace silt (FILL)		1	SS	28											
83.7	Compact Grey Moist															
0.8	Clayey silt with sand, trace gravel, containing organics (FILL)		2	SS	10											
83.1	Stiff Brown Moist															
1.5	CLAYEY SILT with sand, trace gravel (TILL)		3	SS	20											
	Very stiff to hard Brown Moist		4	SS	30											
			5	SS	20											
			6	SS	19											
			7	SS	31											
77.8	END OF BOREHOLE															
6.7	NOTE: 1. Borehole dry upon completion of drilling.															

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-F-55LOCATION QEW & Fifty Rd.; Sta. 28/19, O/S 38' Rt.ORIGINATED BY L.P.W.P. 217-63BORING DATE June 6 & 7, 1966.COMPILED BY W.T.E.DATUM GeodeticBOREHOLE TYPE Cone; Washboring BX; AXTCHECKED BY W.T.E.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-55

LOCATION Gen & Fifty Rd.; Sta. 29/21, O/S 40' Rt.

ORIGINATED BY L.P.

W. P. 217-63

BORING DATE June 7 & 8, 1966.

COMPILED BY _____ W.T.E.



DATUM Geodetic

BOREHOLE TYPE Washboring NX-BX; BXL

CHECKED BY JK

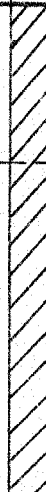


SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W			
272.1	Groundlevel												
262.6 9.5	Clayey silt with traces of sand and gravel. Very stiff to hard. (Brown) ----- (Grey)		1	SS	23	270						<div style="text-align: center;">W.L. El. 270.3</div>	
			2	SS	73								
			3	SS	18								
			4	SS	28	260							
			5	SS	51								
			6	SS	69	250							
			7	SS	54								
			8	SS	75/4"	240							
32.0	Bedrock		9	RC	BXL								
234.0			10	RC	BXL 75%								
38.1	End of borehole.				Rec	230							

CHECKED BY AK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.		WATER CONTENT % 10 20 30			
271.2	Groundlevel											
261.7 9.5	Clayey silt with traces of sand and (Brown)		1	SS	36	270						WL El. 269.4 Observed in B.H.
	2		SS	46								
	3		SS	38	260							
	4		SS	34								
	5		SS	37								
	6		SS	70	250							
	7		SS	46								
238.3	Weathered Shale		8	SS	70	240					No Recovery	
32.9	End of borehole.		9	SS	71 1/2"							
						230						

FOUNDATION SECTION

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w		BULK DENSITY P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT		WATER CONTENT %					
							20	40	60	80			100	w _p
273.7	Groundlevel													
264.7 9.0	Clayey silt with traces of sand and (Grey Brown) (Grey) gravel - pockets of silt - Very stiff to hard.		1	SS	40	270							WL  El. 270.6 Observed in B.H. No recovery	
			2	SS	33									
			3	SS	22									
			4	SS	24	260								
			5	SS	52									
			6	SS	61									
			7	SS	33	250								
245.7			8	SS	50/3"									
28.0	Dedrock				BXL									
240.3	Sound Shale		9	RC	97% Rec	240								
33.4	End of borehole.													
						230								

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-55

LOCATION QEW & Fifty Rd.: Sta. 30+66.5 O/S 49' Lt.

ORIGINATED BY L.P.

W.P. 217-63

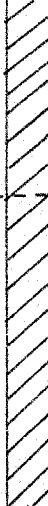

BORING DATE June 10 & 13, 1966.

COMPILED BY W.T.E.

DATUM Geodetic

BOREHOLE TYPE Washboring NX-BX; BXL

CHECKED BY AK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT ——— WL PLASTIC LIMIT ——— wp WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT % 10 20 30					
273.3	Groundlevel														
	Hard clayey silt with some sand and traces of gravel.		1	SS	36	270								<div>WL</div> <div>El. 272.3</div> <div>Observed in B.H.</div>	
			2	SS	40										
262.3			3	SS	34										
11.0			4	SS	30	260									
			5	SS	33										
			6	SS	42	250									
			7	SS	39										
243.8	Weathered Shale		8	SS	108										
29.5															
241.3	Sound Shale (Red)					240									
32.0															
236.1	End of borehole.		9	RC	100%	Rec									
37.2															
						230									

PREVIOUSLY USED AS
BH. NO. 6 OF
JOB NO. 65-F-28.

CHECKED BY M.D. [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT % 10 20 30			
272.5 0.0	Groundlevel					270						El. 272 Observed in B.H. Gr 3% S 18% Si 48% Cl 31%
			1	SS	37							
			2	SS	38							
263.0 9.5	(Brown)		3	SS	17							
	(Grey)		4	SS	34	260						
	Clayey silt with sand and occasional gravel.		5	SS	39							
	V. stiff to hard.		6	SS	43	250						
			7	SS	42							
242.0 30.5	Refusal (Probably Shale) End of borehole.		8	SS	42 1/2"	240						

Sand and Gravel Fill

U.S.S Sieve size, meshes/inch

Size of openings, inches

PERCENT FINER THAN

GRAIN SIZE, mm

SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

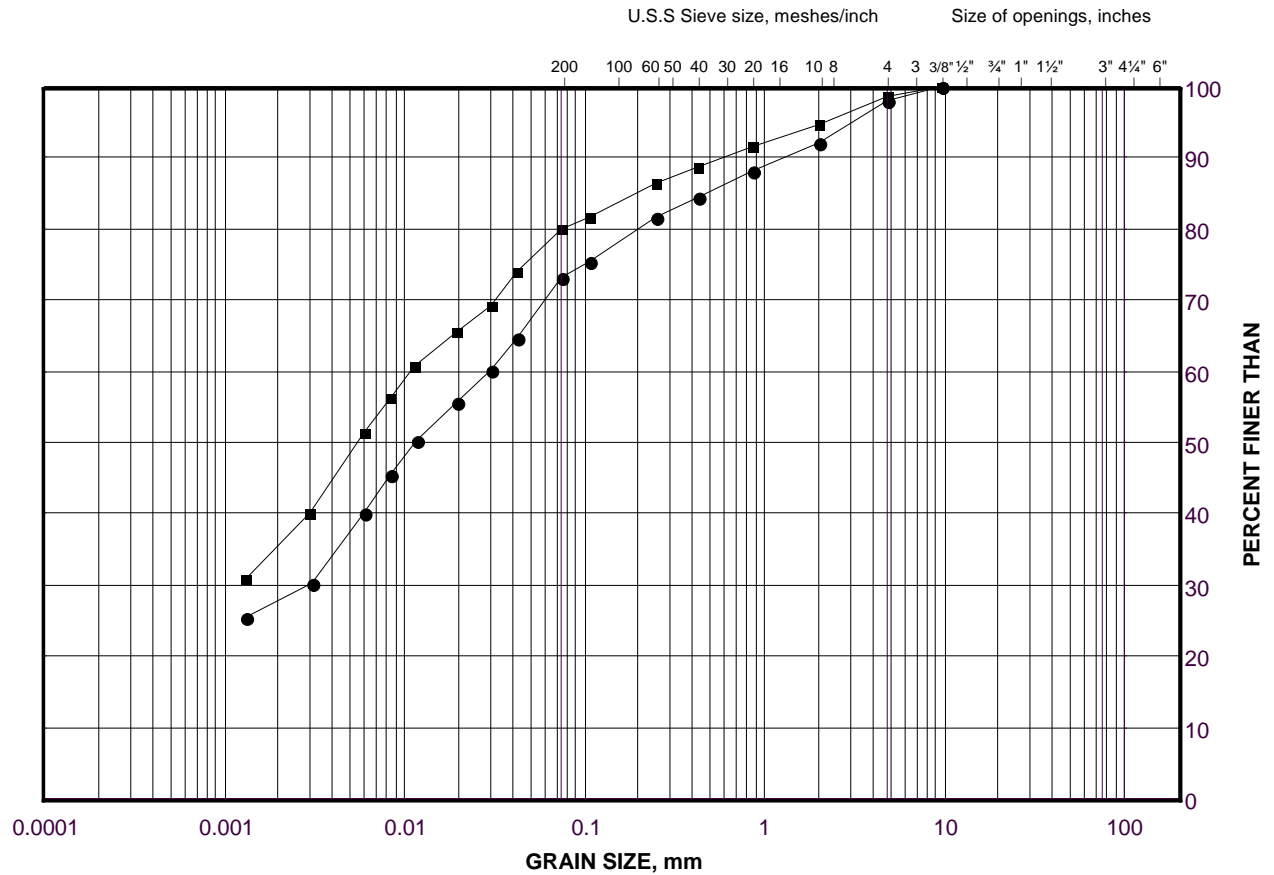
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	FY7	1	84.0
■	FY6	2	83.6
◆	FY3	2	83.7

Date: 22-Apr-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Fill

FIGURE F2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

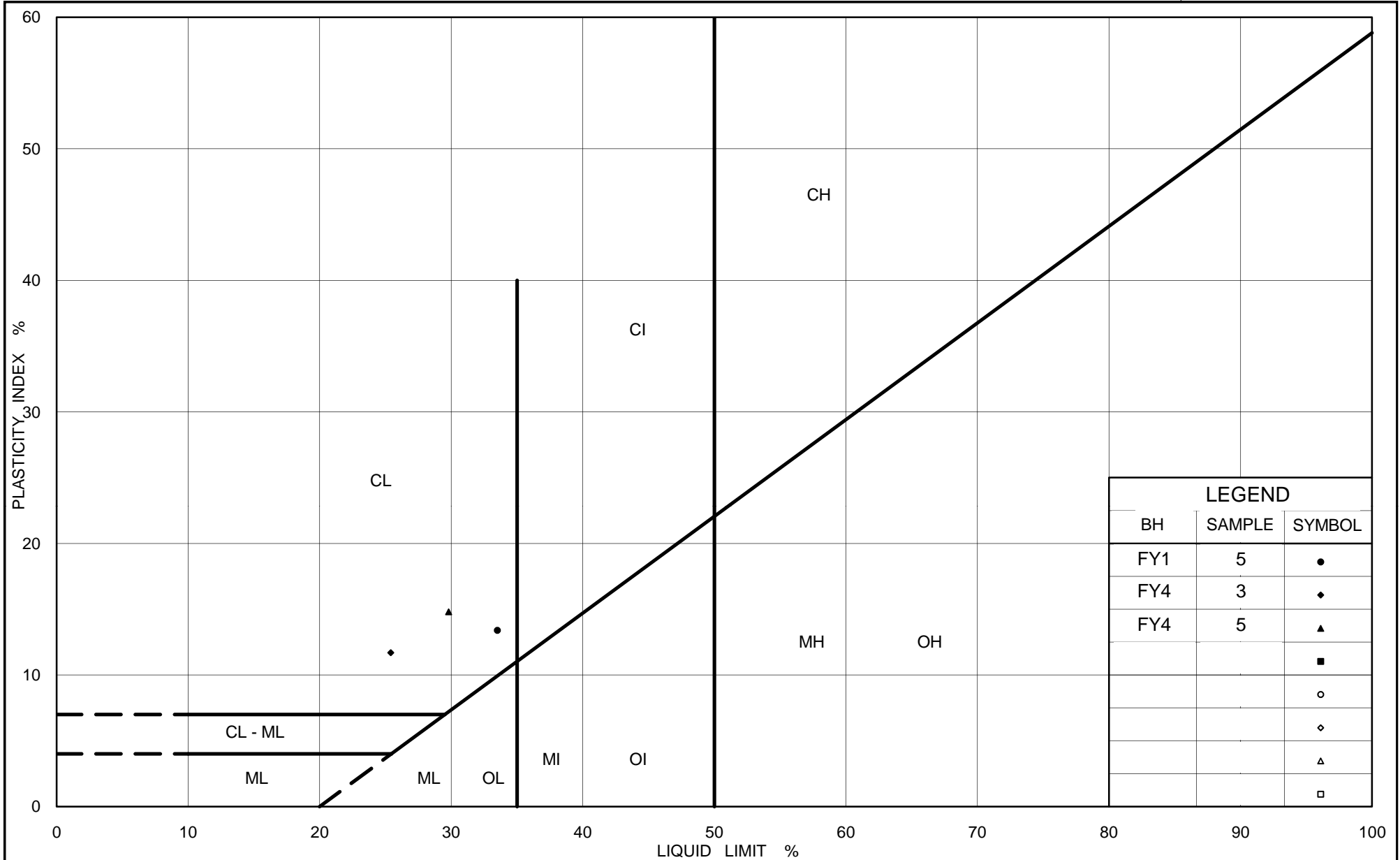
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	FY1	4	87.6
■	FY4	5	87.1

Project Number: 09-1111-6066

Checked By: KJB

Golder Associates

Date: 22-Apr-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Fill

Figure No. F3

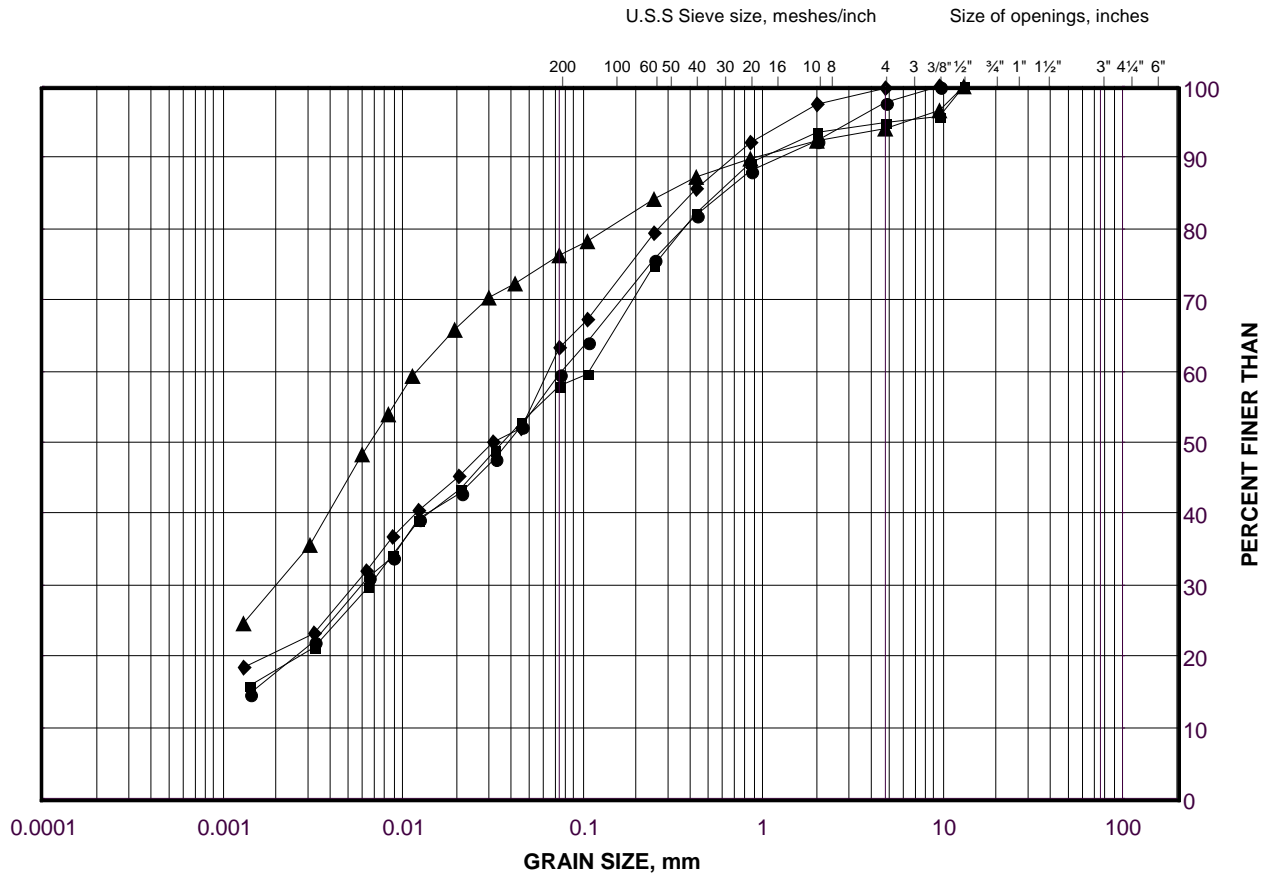
Project No. 09-1111-6066

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Till

FIGURE F4A



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	FY4	10	81.0
■	FY7	3	82.7
◆	FY3	5	81.4
▲	FY5	5	81.4

Project Number: 09-1111-6066

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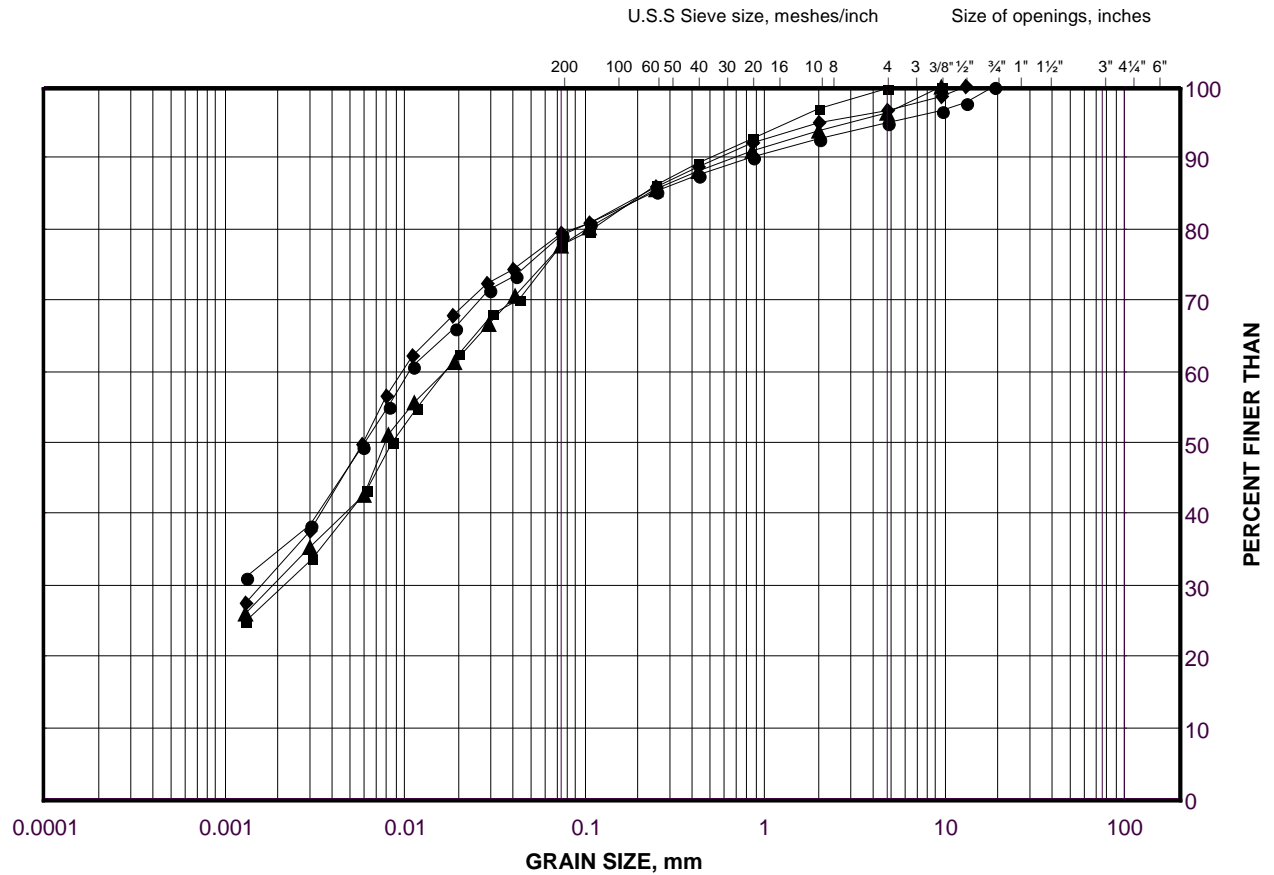
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GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay Till

FIGURE F4B



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

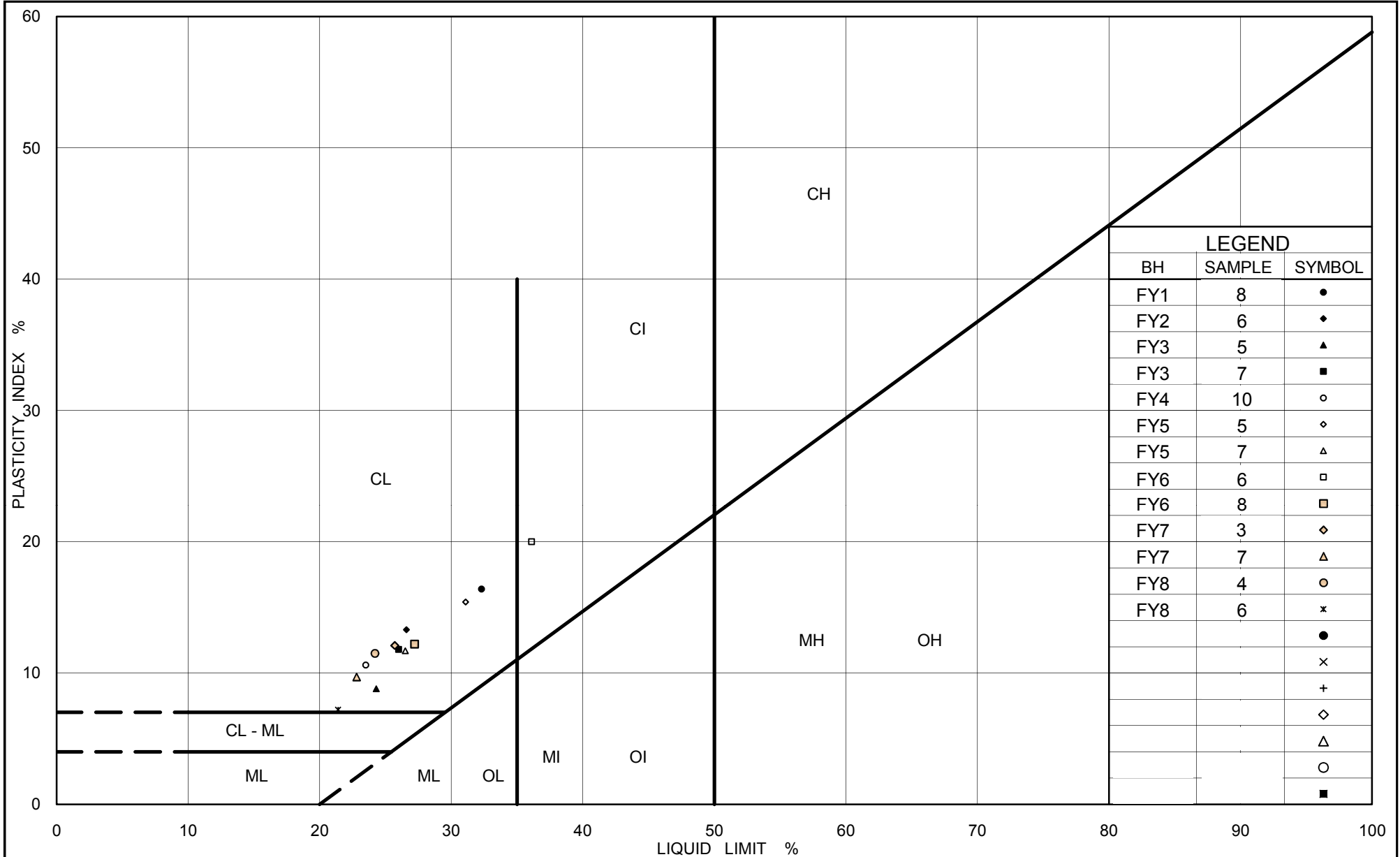
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	FY6	6	80.7
■	FY8	6	79.6
◆	FY2	6	79.9
▲	FY6	8	78.4

Project Number: 09-1111-6066

Checked By: KJB

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Date: 22-Apr-10



Ontario

Ministry of
Transportation

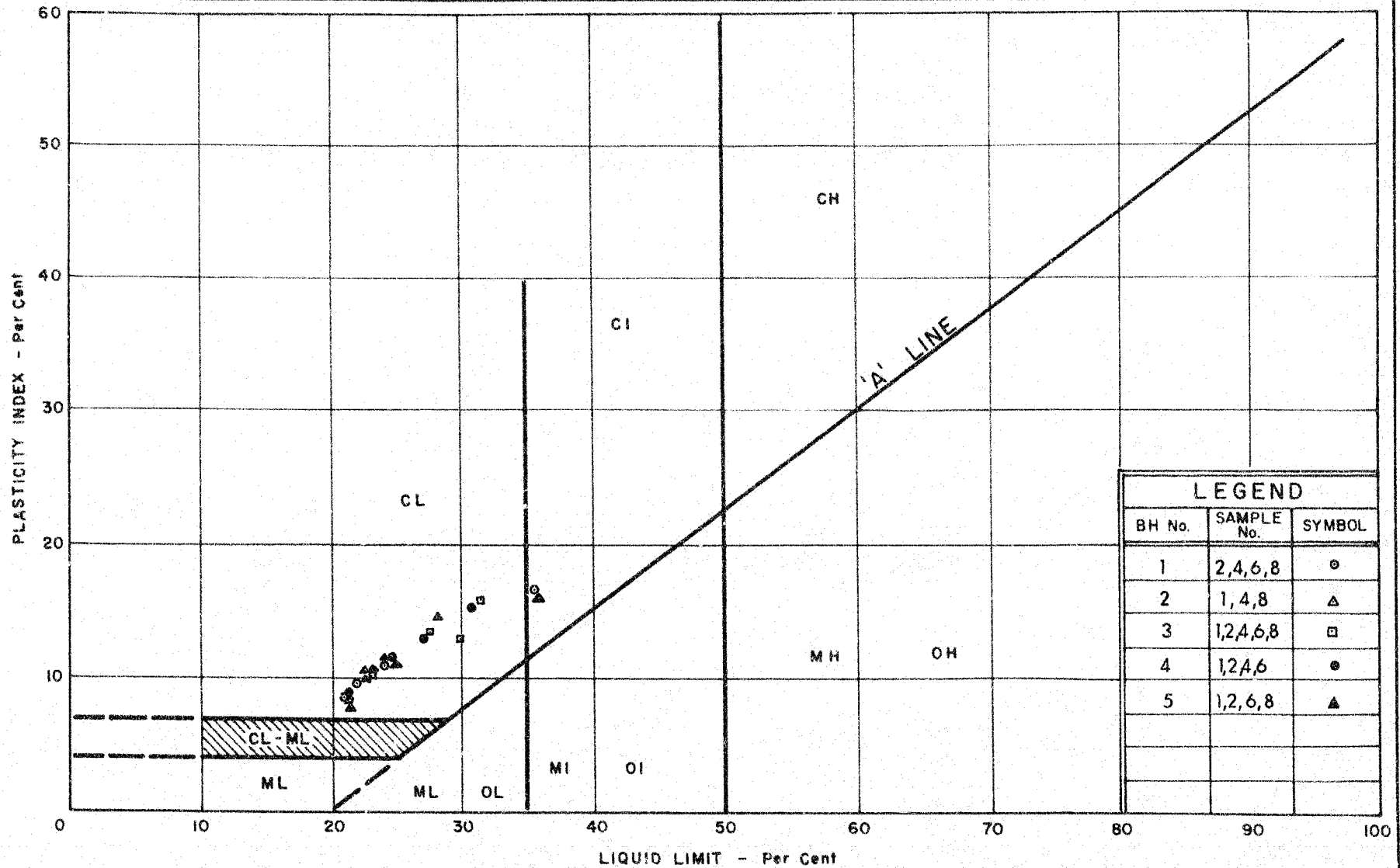
PLASTICITY CHART

Clayey Silt to Silty Clay Till

Figure No. F5

Project No. 09-1111-6066

Checked By: KJB



DEPARTMENT OF HIGHWAYS
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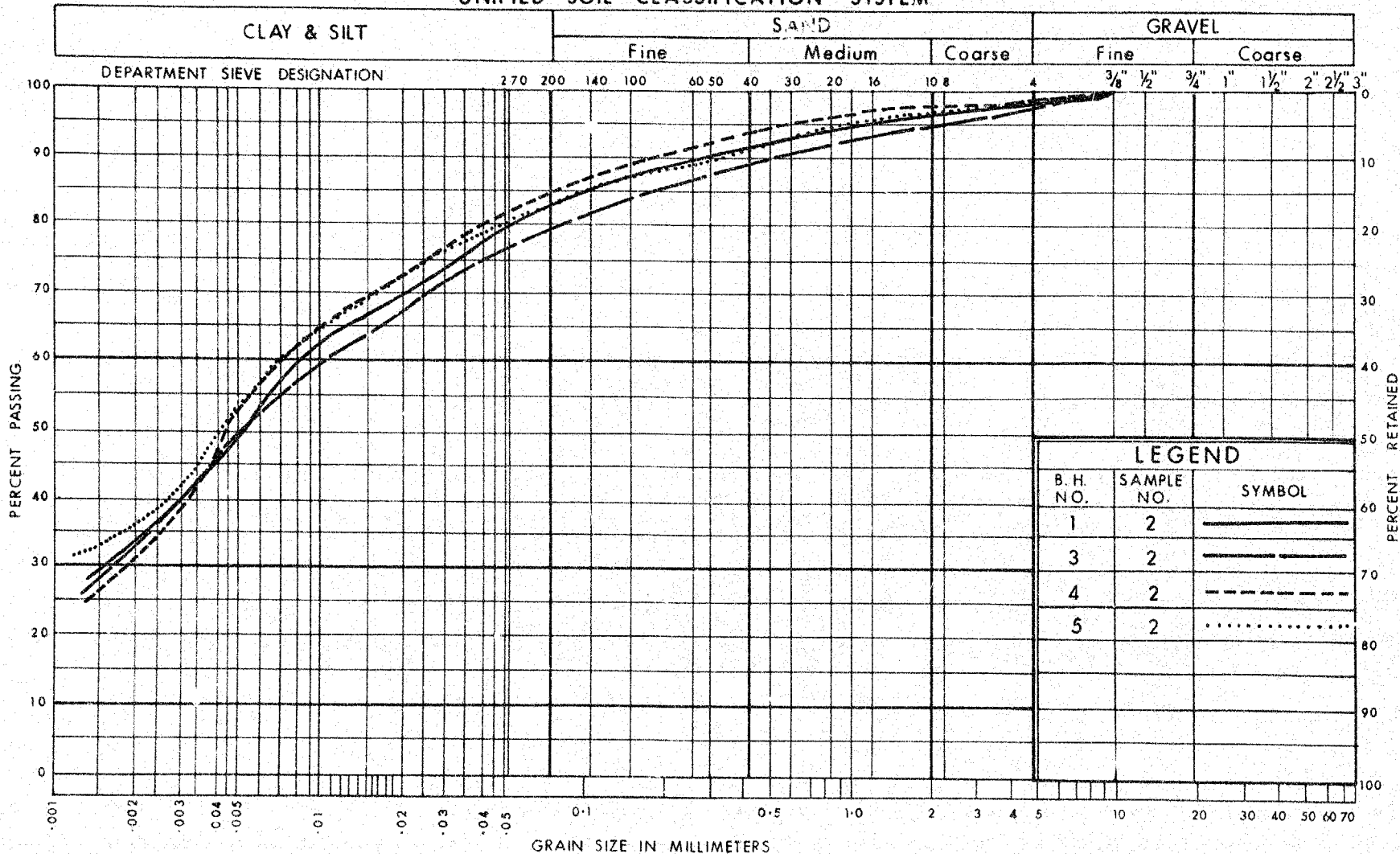
PLASTICITY CHART

W.P. No. 217 - 63

JOB No. 6 KJB - 55

Q.E.W. & FIFTY ROAD

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION



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JOB No. 66 - F - 55

KJB

Q.E.W. & FIFTY ROAD

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