



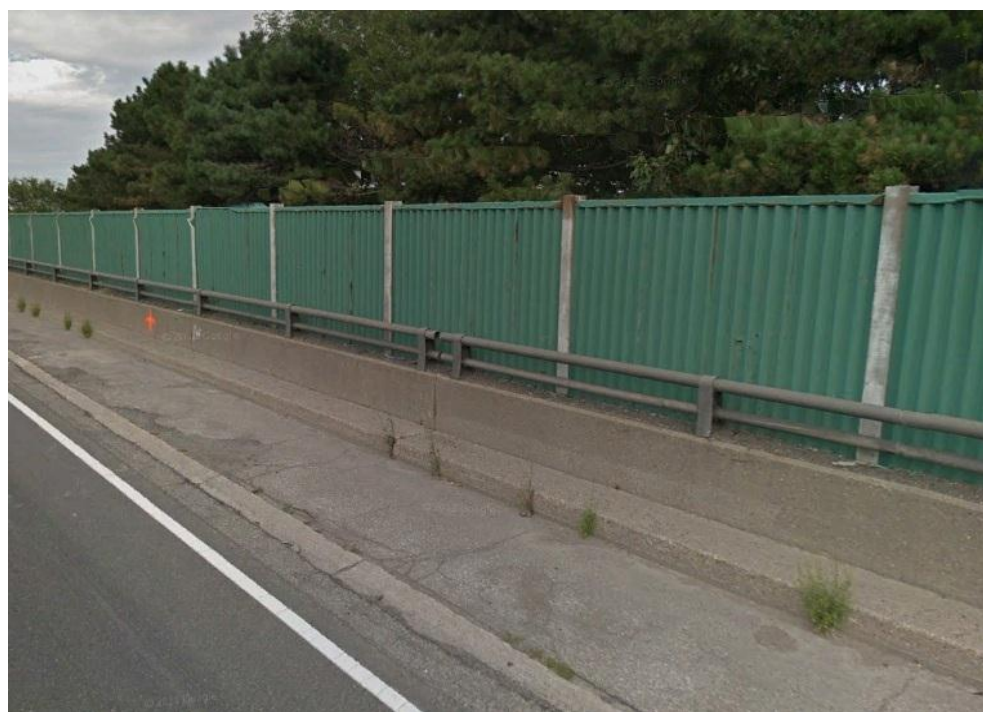
May 31, 2013

FOUNDATION INVESTIGATION REPORT

Noise Barrier Walls Highway 401 Eastbound Collector Rehabilitation from Jane Street to Avenue Road Toronto, Ontario G.W.P. 2131-01-00

Submitted to:

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GEOCRES NO.: 30M11-248

Report Number: 09-1111-6007 (10000)

Distribution:

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REPORT





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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by URS Canada Inc. on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services in support of the rehabilitation of the Highway 401 eastbound collector (EBC) between Jane Street and Avenue Road in Toronto, Ontario.

This report addresses the Foundation Investigation for four proposed Noise Barrier Walls to be replaced along Highway 401 extending for lengths between about 270 m and 1,280 m, approximately at the locations shown on Drawings 1 to 4.

The Terms of Reference for the foundation investigation are outlined in MTO's Request for Proposal (RFP) for Agreement No. 2009-E-0011, issued on December 16, 2009 and MTO's revised Terms of Reference in the Addendum for Noise Barrier Walls sent electronically to URS on May 23, 2012. The Scope of Work for the foundation engineering services is presented in Golder's revised scope change letter, dated June 20, 2012.

This Foundation Investigation report is based on a desktop study of existing geotechnical information supplemented with a total of six (6) new boreholes in accordance with the revised Scope of Work.

2.0 SITE DESCRIPTION

Based on information provided by URS, a description of each site of proposed Noise Barrier Wall replacement is summarized below and shown on Drawings 1 to 4.

Noise Barrier Wall Number	Noise Barrier Wall Location		Site Description
	Original Highway 401 EBC Stationing	New Highway 401 EBC Stationing	
NBW1	Jane Street to Keele Street		The existing noise barrier wall extends along Highway 401 EBC behind an existing guide rail and will be replaced for a length of about 1,280 m. The right paved shoulder separates active lanes from the noise barrier wall.
	STA 27+830 to STA 29+110	STA 12+734 to STA 14+010	
NBW2	Keele Street to CNR Overhead		The existing noise barrier wall starts at the top of the on-ramp from Keele Street northbound and extends along Highway 401 EBC behind an existing guide rail and will be replaced for a length of about 500 m. The right paved shoulder separates active lanes from the noise barrier wall.
	STA 29+800 to STA 30+300	STA 14+717 to STA 15+219	
NBW3	Allen Road to Bathurst Street		The existing noise barrier wall starts at the on-ramps from Allen Road North and South and extends along Highway 401 EBC behind an existing rail and will be replaced for a length of about 780 m. The right paved shoulder separates active lanes from the noise barrier wall.
	STA 32+970 to STA 33+750	STA 17+874 to STA 18+650	
NBW4	Avenue Road Area		The existing noise barrier wall starts at the off-ramp from Highway 401 West to Avenue Road North/South and extends along the South side of the ramp behind an existing concrete guide rail and will be replaced for a length of about 270 m.
	STA 34+730 to STA 35+000	STA 19+624 to STA 19+897	



3.0 INVESTIGATION PROCEDURES

3.1 Previous Investigations

As part of the Highway 401 construction and widening from Jane Street to Avenue Road in the early 1960's, and subsequent rehabilitation/widening works, various subsurface investigations were carried out by or on behalf of MTO in these areas. The majority of subsurface information used in this report was obtained from the existing Foundation Investigation pertinent to this section of Highway 401 corridor, available from MTO Pavement and Foundations Section's GEOCRES database, as follows:

- **MTO GEOCRES No. 30M11-076:** Report titled "Avenue Road – Highway No. 401, Interchange – Leg "A", Retaining Wall (W.P. 85-59-2)", by Dominion Soil Investigation Limited, dated December 1962.
- **MTO GEOCRES No. 30M11-084:** Report titled "Foundation Investigation Report for Proposed New Structure at Keele Street and Hwy. 401, Toronto, W.J. 63-F-87, W.P. 231-60, District 6", by Department of Highways – Ontario, Materials and Research Section, dated August 1963.
- **MTO GEOCRES No. 30M11-134:** Report titled "Proposed Extension of Bridge at Black Creek and Hwy. No. 401, North York, County of York, District No.6, W.J. 61-F-113 - - W.P. 85-59-3," by Department of Highways – Ontario, Materials and Research Section, dated January 19, 1962.
- **MTO GEOCRES No. 30M11-136:** Report titled "Proposed Basket Weave Structure at Springview Ave. South & Hwy. # 401, Toronto, Ontario. District #6, W.J. 62-F-86 - - W.P. 104-62," by Department of Highways – Ontario, Materials and Research Section, dated August 10, 1962.

The available existing information at the noise barrier wall locations is as follows:

Noise Barrier Wall Number	Existing Information
NBW1	A total of ten (10) boreholes (designated as 134-1, 134-7, and 136-1 to 136-8) were drilled in the vicinity of the proposed noise barrier wall replacement in 1962 and 1963 by the Department of Highways, Ontario (GEOCRES No. 30M11-134 and 30M11-136).
NBW2	One (1) borehole (designated as 84-2) was drilled in the vicinity of the proposed noise barrier wall replacement in 1963 by the Department of Highways, Ontario (GEOCRES No. 30M11-084).
NBW3	No existing subsurface information was found of GEOCRES for this extent of wall.
NBW4	A total of two (2) boreholes (designated as 76-1 and 76-2) were drilled in the vicinity of the proposed noise barrier wall replacement in 1962 by Dominion Soil Investigation Limited (GEOCRES No. 30M11-076).

The majority of subsurface information pertinent to the investigation of the subsurface conditions along the proposed noise barrier walls was collected from previous investigations performed at the site(s) in 1962 and 1963. A total of 13 boreholes were drilled near the proposed noise barrier wall replacement locations (GEOCRES No. 30M11-076, 30M11-084, 30M11-134 and 30M11-136). The available information in GEOCRES indicated that the previous boreholes were advanced through the overburden using either augering or wash boring methods/techniques. Soil samples were generally obtained at 0.75 m to 1.5 m intervals of depth, using 50 mm outer diameter split-spoon samplers. It is assumed that sampling was carried out by driving a manual



hammer as part of the Standard Penetration Test (SPT) procedure. Wash boring method was implemented to recover samples of the bedrock with an 'NX' size casing.

Groundwater levels recorded in the open boreholes are shown on the Record of Borehole sheets. All previous investigations were carried out by the Department of Highways Ontario and Dominion Soil Investigation Limited.

The GEOCREs sourced borehole (76-1, 76-2, 84-2, 134-1, 134-7, and 136-1 to 136-8) locations, as shown on Drawings 1 to 4, were identified on the drawings provided in the GEOCREs reports and cross-referenced with the base drawings provided by URS using the Highway 401 centreline and predominant surface features. Thus, borehole locations are considered approximate and have been converted to MTM NAD83 northing and easting coordinates, the ground surface elevations are referenced to Geodetic datum as taken from the Record of Borehole sheets.

The GEOCREs sourced boreholes used in this report have been re-numbered to show the MTO GEOCREs No. followed by the original borehole designation; for example, the boreholes from MTO GEOCREs 30M11-076 have been re-numbered to 76-X, where X is the original borehole number.

3.2 Current Investigation

The field work for the supplementary subsurface investigation was carried out by Golder between March 13 and 15, 2013, during which time six boreholes (designated as Boreholes 13-1 to 13-6) were advanced using a CME-55 truck mounted drill rig, supplied and operated by DBW Drilling of North York, Ontario. The boreholes were advanced using 101 mm diameter solid stem augers. Soil samples were obtained at 0.75 m and 1.5 m intervals of depth using a 50 mm outside diameter split-spoon sampler driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586).

The groundwater conditions were observed in the open boreholes during and immediately following the drilling operations. The boreholes were backfilled to immediately below ground surface with bentonite pellets upon completion, in accordance with Ontario Regulation 903 (as amended). The upper 1.3 m portion of each borehole above the bentonite backfill was capped using soil cuttings from the borehole and asphalt patch where appropriate.

The field work was observed on a full-time basis by a member of Golder's technical staff who located the boreholes in the field, arranged for the clearance of underground utilities, directed the drilling, sampling and in situ testing operations, and logged the boreholes. The soil samples were identified in the field, placed in labelled containers and transported to Golder's laboratory in Mississauga for further examination and laboratory testing. Index and classification tests (water contents, Atterberg limits and grain size distributions) were carried out on selected soil samples. All geotechnical laboratory testing was completed to ASTM and/or MTO LS standards, as applicable.

The borehole locations were measured on-site relative to the existing site features and the ground surface elevations were obtained from the Digital Terrain Model for the site, provided by URS. The borehole locations in MTM NAD83 northing and easting coordinates and ground surface elevations referenced to Geodetic datum, are summarized below and are shown on Drawings 1 to 4.



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Borehole No.	MTM NAD83 Northing	MTM NAD83 Easting	Ground Surface Elevation (m)	Borehole Depth (m)
13-1	4843397.0	309473.8	189.9	6.7 m
13-2	4843908.4	310067.4	187.5	6.7 m
13-3	4844530.7	310850.8	180.5	6.7 m
13-4	4841993.9	304833.0	142.1	6.7 m
13-5	4842257.2	305656.0	158.5	6.7 m
13-6	4842643.8	306802.2	184.5	6.7 m

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

The section of Highway 401 from Jane Street to Avenue Road is located within the physiographic region known as the Peel Plain, according to *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)¹.

A surficial till sheet, which generally follows the surface topography, is generally present throughout much of this area. The till is typically comprised of clayey silt to silty clay, with occasional silt to sand zones and is mapped in this area as the Halton Till. Shallow, localized deposits of loose silt and sand and/or soft clay can overlie this uppermost till sheet, and these represent relatively recent deposits, formed in small glacial melt water ponds scattered throughout the Peel Plain and concentrated near river valleys, such as the West Don River valley. The recent sand, silt and clay and uppermost till deposits in this area overlie and are interbedded with stratified deposits of sand, silt and clay.

4.2 Subsurface Conditions

As part of the current subsurface investigation, six boreholes (Boreholes 13-1 to 13-6) were advanced along the extent of proposed noise barrier wall replacement sections. The borehole locations and ground surface elevations are shown on Drawings 1 to 4.

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced as part of the current investigation and the results of in situ and laboratory testing are given on the Record of Borehole sheets contained in Appendix A; the results of geotechnical laboratory testing are contained in Appendix B. Copies of the relevant Record of Borehole sheets (and laboratory testing results) from previous investigations are presented in Appendix C.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from observations of drilling progress and from non-continuous sampling and, therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

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



A detailed description of the subsurface conditions encountered at the noise barrier wall locations is provided in the following sections.

4.2.1 Noise Barrier Wall 1 - Station 27+830 to Station 29+110

The boreholes pertinent to this section of noise barrier wall are Boreholes 13-4, 13-5, 134-1, 134-7, and 136-1 to 136-8. The existing ground surface at Highway 401 EBC along the proposed NBW1 location ranges from about Elevation 132 m at the west limit to Elevation 159 m at the east limit.

4.2.1.1 Asphalt/Granular Fill

An approximately 100 mm thick layer of asphalt underlain by a 0.7 m thick layer of granular fill comprised of sand and gravel, trace silt was encountered in Boreholes 13-4 and 13-5. A layer of fill comprised of sand, trace gravel, trace clay was encountered in Boreholes 136-8 and 134-1 below the then existing ground surface (Elevations 134.1 m and 124.5 m). The thickness of the deposit is about 0.9 m and 3.2 m in the respective boreholes.

The SPT 'N'-values within the sand and gravel fill are 16 blows and 34 blows per 0.3 m of penetration, indicating a compact to dense relative density. An SPT 'N'-value of 12 blows per 0.3 m of penetration was measured within the sand fill layer in Borehole 134-1, indicating a compact relative density.

The natural water content measured on a sample of the fill is about 5 per cent.

4.2.1.2 Clayey Silt Fill

A deposit of fill comprised of clayey silt some to with sand, trace gravel was encountered below the granular fill in Boreholes 13-4 and 13-5. The top of the fill deposit is at about Elevations 141.3 m and 157.7 m and the thickness of the deposit is about 1.4 m and 3.8 m in the respective boreholes. An approximately 3.5 m deposit of fill comprised of clayey silt, trace sand and gravel was also encountered in Borehole 134-7 located at the west limit of the proposed wall replacement. The top of the cohesive fill deposit in Borehole 134-7 is at about Elevation 125.3 m.

The measured SPT 'N'-values within the clayey silt fill deposit range from 6 blows to 16 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency.

The natural water content measured on six samples of the cohesive fill from the current investigation ranges from about 12 per cent to 19 per cent. The natural water content measured on one sample from the previous investigation is about 25 per cent.

The Result of a grain size distribution test completed on one selected sample of the cohesive fill deposit from the current investigation is shown on Figure B1 in Appendix B.

Atterberg limits tests were carried out on three samples of the cohesive fill and measured liquid limits between about 27 per cent and 30 per cent, plastic limits of about 14 per cent to 15 per cent, and plasticity indices between about 13 per cent and 15 per cent. The result of the Atterberg limits test carried out on a sample of the



clayey silt fill in the previous investigation measured a liquid limit of about 30 per cent, a plastic limit of about 20 per cent, and a plasticity index of about 10 per cent. The results of Atterberg limits test for the current investigation are shown on plasticity chart on Figure B2 and together with the results from the previous investigations indicate that the cohesive fill material is classified as clayey silt of low plasticity.

4.2.1.3 Upper Clayey Silt to Silty Clay Till

A till deposit comprised of clayey silt to silty clay some to with sand and trace gravel was encountered below the clayey silt fill in Boreholes 13-4 and 13-5 at depths of 2.2 m and 4.6 m below ground surface during the current investigation corresponding to Elevations 139.9 m and 153.9 m. Both boreholes terminated within this deposit penetrating it to a depth of about 6.7 m below ground surface (corresponding to Elevations 135.4 m and 151.8 m in respective boreholes). In the previous investigations the clayey silt to silty clay deposit was encountered below the fill in Boreholes 134-1, 134-7 and 136-8 and at the ground surface in Boreholes 136-1 to 136-4. Although the borehole records of the previous investigations do not designate this deposit as a glacial till (with the exception of 136-1) it is anticipated that the clayey silt to silty clay deposit is glacially derived. Boreholes 134-7, and 136-1 to 136-4 were terminated within this deposit at depths ranging from 6.0 m to 15.7 m below ground surface (Elevations 129.2 m to 115.4 m).

The measured SPT 'N'-values within this glacial deposit range from 4 blows to 62 blows per 0.3 m of penetration, suggesting a firm to hard consistency. Typically, the SPT 'N'-values range from 12 blows to 38 blows (average of 22 blows) per 0.3 m of penetration above Elevation 126 m and from 4 blows to 19 blows (average of 11 blows) per 0.3 m of penetration below Elevation 126 m, suggesting the deposit transitions from predominantly very stiff to stiff at depth.

The natural water content measured on selected samples of the till from the current investigation ranges from about 14 per cent to 18 per cent, which is consistent with the natural water contents shown on the previous borehole records in this deposit ranging from about 12 per cent to 37 per cent.

The grain size distribution test of one selected sample of the till deposit from the current investigation is shown on Figure B3 in Appendix B. The Results of grain size distribution tests in the clayey silt deposit from the previous investigation are shown on the copies of the borehole records in Appendix C.

Atterberg limits tests were carried out on three selected samples of the till from the current investigation and measured liquid limits between about 27 per cent and 31 per cent, plastic limits between about 12 per cent and 15 per cent and plasticity indices between about 14 per cent and 16 per cent. These test results, which are plotted on Figure B4 in Appendix B, indicate that the till consists of clayey silt of low plasticity. Atterberg limits tests performed on thirty samples of the till as shown on the borehole records of the previous investigations measured liquid limits between about 19 per cent and 45 per cent, plastic limits between about 10 per cent and 24 per cent and plasticity indices between about 6 per cent and 24 per cent, indicating that the till material is classified as clayey silt of low plasticity to silty clay of intermediate plasticity.

The results of fifteen field vane tests performed in the upper clayey silt till (below Elevation 126 m) during the previous investigation measured undrained shear strength ranging from about 26 kPa to 58 kPa as shown on the Record of Borehole sheets.



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The results of nine unconfined compression tests performed on the selected samples of the upper clayey silt till deposit are shown on the borehole records of the previous investigations and are summarized below.

Borehole	Depth (m)	Elevation (m)	Soil Type	*Shear Strength (KPa)	*Bulk Density (KN/m ³)
134-1	5.2	119	Silty Clay, trace sand & gravel	35	19.1
	7.9	115		25	18.0
	9.4	117		36	19.7
136-5	10.6	124	Clayey Silt with gravel	17	19.4
	12.6	122		16	19.2
	14.6	120		17	20
	17.6	117		23	20
134-7	6.3	119	Clayey Silt with sand	34	19.1
	9.3	116		17	19.5

*Measured from Unconfined Compression Test as indicated on Record of Borehole sheets.

Based on the results of the in situ and field vane tests and laboratory testing, the upper clayey silt till deposit below Elevation 126 m ranges in consistency from a soft to stiff, but is generally firm.

4.2.1.4 Sandy Silt to Silty Sand

A deposit of sandy silt to silty sand some gravel, was encountered underlying the clayey silt to silty clay (inferred "till") deposit in Boreholes 136-5 to 136-8. The top of the deposit was encountered at depths ranging from about 16.2 m to 19.8 m below the previous ground surface, corresponding to between Elevations 118.8 m and 114.3 m, and the thickness of the deposit ranges from about 4.6 m to 9.8 m.

The measured SPT 'N'-values within this deposit range from 11 blows per 0.3 of penetration to greater than 100 blows per 0.3 m of penetration, indicating a compact to very dense relative density.

The natural water content measured on selected samples of the sandy silt to silty sand from the previous investigation range from about 8 per cent to 19 per cent.

The results of grain size distribution tests completed on three samples of the sandy silt to silty sand are shown on the borehole records of the previous investigations and indicate the samples contain 7 per cent to 8 per cent clay, 25 per cent to 56 per cent silt, 30 per cent to 65 per cent sand, and 0 per cent to 7 per cent gravel.

4.2.1.5 Lower Clayey Silt Till

A till deposit comprised of clayey silt with sand and gravel was encountered underlying the sandy silt to silty sand deposit in Boreholes 136-5 to 136-8 and directly below the upper till in Borehole 134-1. The borehole records of the previous investigations indicate the presence of boulders within the till deposit. The lower till deposit in Borehole 134-1 is also interlayered with sandy silt lenses about 75 mm thick as indicated in Record of



Borehole sheet. The lower deposit was encountered at depths ranging from about 18.4 m to 27.4 m below the then existing ground surface, corresponding to between Elevations 112.1 m and 107.2 m.

The measured SPT 'N'-values within this deposit are generally greater than 100 blows per 0.3 m of penetration, suggesting a hard consistency. Although the 'N'-values in Borehole 134-1 range from about 15 blows to 52 blows per 0.3 m of penetration, suggesting a stiff to hard consistency.

The natural water content measured on selected samples of the lower clayey silt till deposit range from about 3 per cent to 16 per cent.

The results of a grain size distribution test completed on a sample of the transition between the sandy silt and the clayey silt till from the previous investigation indicates 10 per cent clay, 59 per cent silt, 21 per cent sand, and 10 per cent gravel.

4.2.1.6 *Bedrock*

Weathered to sound shale bedrock is reported to have been encountered below the clayey silt till deposit in Boreholes 136-5 to 136-8 during the previous investigation. The surface of the bedrock was encountered at depths ranging from about 29 m to 30.8 m below ground surface (between Elevation 105.9 m and 104.1 m) and the borehole records indicate the rock was cored to depths of up to 5 m.

4.2.2 Noise Barrier Wall 2 - Station 29+800 to Station 30+300

The boreholes pertinent to this section of noise barrier wall are Boreholes 13-6 and 84-2. The existing Highway 401 EBC road surface along the proposed NBW2 replacement location ranges from about Elevation 178 m at the west limit to about Elevation 185 m at the east limit the wall.

4.2.2.1 *Asphalt/Fill*

An approximately 150 mm thick layer of asphalt was encountered at the ground surface in Borehole 13-6 advanced on the right shoulder of the Highway 401 EBC lanes.

A 0.8 m thick deposit of granular fill consisting of sand and gravel, trace silt, was encountered below the asphalt in Borehole 13-6. A 0.9 m thick surficial deposit of topsoil and "road fill" was encountered in Borehole 84-2 located at the west limit of the site.

A measured SPT 'N'-value within the sand and gravel fill is 27 blows per 0.3 m of penetration, indicating a compact relative density.

4.2.2.2 *Clayey Silt to Silty Clay Fill*

A 4.7 m thick deposit of fill comprised of clayey silt to silty clay with sand, trace gravel was encountered below the granular fill in Borehole 13-6 at a depth of 0.8 m below ground surface (Elevation 183.7 m). The fill contains sand seams and trace organics (i.e. rootlets and wood fragments) in the upper 2.9 m portion of the deposit.



The measured SPT 'N'-values within the clayey silt to silty clay fill range from 8 blows to 22 blows per 0.3 m of penetration, suggesting a stiff to very stiff consistency.

The natural water content measured on selected samples of the cohesive fill ranged from 10 per cent to 22 per cent.

Atterberg limits tests were carried out on two samples of the cohesive fill and measured liquid limits of about 25 per cent and 37 per cent, plastic limits of about 14 per cent and 19 per cent, corresponding to plasticity indices of about 11 per cent and 18 per cent. These test results, which are plotted on Figure B5 in Appendix B, indicate that the cohesive fill material is classified as clayey silt of low plasticity to silty clay of intermediate plasticity.

4.2.2.3 *Clayey Silt Till*

A till deposit consisting of clayey silt, some to with sand, some gravel was encountered below the clayey silt to silty clay fill in Borehole 13-6 and below the topsoil and "road fill" in Borehole 84-2. The top of the clayey silt till was encountered at depths of about 5.5 m and 1.0 m below ground surface at Elevations 179 m and 176.9m in Borehole 13-6 and 84-2 respectively. Boreholes 13-6 and 84-2 were terminated within this deposit, at depths of 6.7 m and 15.7 m below ground surface (Elevation 177.8m and 162.1m) respectively.

The measured SPT 'N'-values within the clayey silt till deposit range from 24 blows to 52 blows per 0.3 m of penetration, suggesting a very stiff to hard consistency.

The natural water content measured on selected samples of the clayey silt till range from about 12 per cent to 15 per cent.

The result of a grain size distribution test completed on one selected sample of the cohesive till deposit from the current investigation is shown on Figure B6 in Appendix B.

Atterberg limits tests carried out on samples of the till deposit obtained during current and previous investigations measured liquid limits between about 19 per cent and 27 per cent, plastic limits between about 11 per cent and 15 per cent, and plasticity indices between about 9 per cent and 12 per cent. The test result for one sample from the current investigation is shown on plasticity chart on Figure B7 in Appendix B and together with the results from the previous investigations indicate that the till material is classified as clayey silt of low plasticity.

4.2.3 **Noise Barrier Wall 3 – Station 32+970 to Station 33+750**

The boreholes pertinent to this section of noise barrier wall are Boreholes 13-1 and 13-2. The existing Highway 401 EBC road and associated ramp road surface at the proposed wall replacement ranges from about Elevation 191 m at the west limit and to about Elevation 187 m at the east limit of the wall.



4.2.3.1 *Asphalt/Granular Fill*

An approximately 100 mm and 125 mm thick layer of asphalt was encountered immediately below the ground surface in Boreholes 13-1 and 13-2, which were drilled on the right shoulder of the Highway 401 EBC lane road surface. A layer of concrete about 180 mm thick was encountered below the asphalt in Borehole 13-2.

A 0.5 m to 0.7 m thick deposit of granular fill was encountered below the asphalt and the concrete in Boreholes 13-1 and 13-2, respectively. The fill consists of sand and gravel and silty sand and gravel, trace silt in Boreholes 13-1 and 13-2, respectively.

The measured SPT 'N'-values within the granular fill deposit are 11 blows and 16 blows per 0.3 m of penetration, indicating a compact relative density.

The natural water content measured on one selected sample of the granular fill is about 7 per cent.

4.2.3.2 *Clayey Silt Fill*

A fill deposit comprised of predominantly clayey silt trace to with sand, trace gravel was encountered below the granular fill at a depth of 0.8 m (Elevations 189.1 m and 186.7 m) and the overall thickness of the fill deposit is 3.1 m and 4.8 m thick in Boreholes 13-1 and 13-2, respectively. In Borehole 13-2, a 0.8 m thick pocket of sand fill as encountered within the clayey silt fill at a depth of 2.2 m (Elevation 185.3 m).

The measured SPT 'N'-values within the clayey silt fill deposit range from 5 blows to 22 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency. An SPT 'N'-value of 31 blows per 0.3 m of penetration was measured within the sand pocket, indicating a dense relative density.

The natural water content measured on selected samples of the cohesive fill ranged from 12 per cent to 15 per cent. The laboratory water content measured on one selected sample of the sand fill interlayer was 6 per cent.

The results of a grain size distribution test completed on one selected sample of the cohesive fill deposit from the current investigation are shown on Figure B8 in Appendix B.

Atterberg limits tests were carried out on three selected samples of the cohesive fill and measured liquid limits between about 22 per cent and 25 per cent, plastic limits between about 11 per cent and 13 per cent and plasticity indices between about 10 per cent and 12 per cent. These test results, which are plotted on Figure B9 in Appendix B, indicate that the fill material is classified as clayey silt of low plasticity.

4.2.3.3 *Clayey Silt*

A deposit of clayey silt, some sand and trace gravel was encountered underlying the clayey silt fill in Boreholes 13-1 and 13-2. Rootlets and wood fragments were also encountered in the upper zone of the clayey silt deposit in both boreholes. The clayey silt deposit was 1.1 m thick in both boreholes and Borehole 13-2 was terminated within this deposit at a depth of about 6.7 m below ground surface (Elevation 180.8 m).

The measured SPT "N"-values within the clayey silt deposit is 13 blows per 0.3 m of penetration, suggesting a stiff consistency.



The natural water content measured on two selected samples of the clayey silt is about 18 per cent and 20 per cent.

Atterberg limits tests were carried out on two samples of the cohesive deposit and measured liquid limits of about 28 per cent and 30 per cent, plastic limits of about 14 per cent, and corresponding plasticity indices of 14 and 16 per cent. These test results, which are plotted on Figure B10 in Appendix B, indicate that the material is classified as clayey silt of low plasticity.

4.2.3.4 Clayey Silt with Sand Till

A till deposit consisting of clayey silt with sand was encountered underlying the clayey silt deposit in Borehole 13-1. The borehole terminated within this deposit at a depth of 6.7 m (Elevation 183.2 m) penetrating it for a thickness of 1.1 m.

An SPT 'N'-value of 28 blows per 0.3 m of penetration was measured within the till deposit, suggesting a very stiff consistency.

The natural water content measured on one selected sample of the till is 12 per cent.

The results of a grain size distribution test completed on a sample of the clayey silt till deposit from the current investigation are shown on Figure B11 in Appendix B.

An Atterberg limits test was carried out on one selected sample of the till and measured a liquid limit of about 23 per cent, a plastic limit of about 13 per cent, and a corresponding plasticity index of about 10 per cent. The test results are shown on plasticity chart on Figure B12 in Appendix B and indicate that the material is classified as clayey silt of low plasticity.

4.2.4 Noise Barrier Wall 4 - Station 34+730 to Station 35+000

The boreholes pertinent to this section of noise barrier wall are Boreholes 13-3, 76-1 and 76-2. The existing Highway 401 EBC and Highway 401 West-Avenue Road N/S Ramp Road surface along the proposed noise barrier wall replacement ranges from about Elevation 182 m at the west limit to about 180 m near the middle of the wall replacement and then rises again to about Elevation 181 m at the east limit of the wall.

4.2.4.1 Granular Fill/Topsoil

A 0.8 m thick deposit of granular fill consisting of sand and gravel was encountered immediately below the existing ground surface in Borehole 13-3, which was advanced on the shoulder of the Highway 401W-Avenue Road N/S Ramp. A thin layer of topsoil was encountered at the ground surface in Boreholes 76-1 and 76-2 during the 1962 investigation.

An SPT 'N'-value of 15 blows per 0.3 m of penetration was measured within the sand and gravel deposit, indicating a compact relative density.



4.2.4.2 Clayey Silt Fill

A 0.6 m thick fill deposit comprised of clayey silt, trace sand and trace gravel, was encountered below the granular fill in Borehole 13-3.

An SPT 'N'-value of 8 blows per 0.3 m of penetration was measured within the clayey silt fill deposit, suggesting a firm consistency.

The natural water content measured on a selected sample of the cohesive fill is about 11 per cent.

4.2.4.3 Clayey Silt to Silty Clay Till

A till deposit of clayey silt to silty clay containing sand and trace gravel was encountered below the clayey silt fill in Borehole 13-3 and below the topsoil in Boreholes 76-1 and 76-2. The upper portion of the till deposit in Boreholes 76-1 and 76-2 is classified as a sandy clayey silt. Sandy silt and silt interlayers were encountered within this deposit and the presence of cobbles and boulders is inferred from auger advancement in Borehole 13-3. In Boreholes 76-1 and 76-2, the till deposit is interlayered by an approximately 1.5 m and 3.0 m thick deposits of brown to grey silt to sandy silt, with the surface of the deposit at about 3.8 m and 2.4 m below the then existing ground surface, respectively, corresponding to about Elevations 176.7 m and 177.8 m. Boreholes 13-3, 76-1, and 76-2 terminated within this deposit at depths ranging from about 6 m to 6.7 m below the ground surface (Elevation 173.8 m to 174.5 m), penetrating it for a thickness of between about 5.3 m and 5.7 m.

In Borehole 13-3, the measured SPT 'N'-values within the till deposit range from 16 blows to 58 blows per 0.3 m of penetration, suggesting a very stiff to hard consistency. The measured SPT 'N'-values in Boreholes 76-1 and 76-2 range from about 40 blows per 0.3 m of penetration to greater than 100 blows per 0.3 m of penetration which is consistent with the hard consistency of the deposit as measured during the current investigation. The SPT 'N'-values measured within the silt to sandy silt interlayer are greater than 146 blows per 0.3 m of penetration indicating a very dense relative density.

The natural water content measured on selected samples of the till range from about 11 per cent to 18 per cent.

The results of a grain size distribution test completed on a sample of the till deposit from the current investigation are shown on Figure B13 in Appendix B.

Atterberg limits tests were carried out on three selected samples of the till deposit and measured liquid limits between about 16 per cent and 39 per cent, plastic limits between about 10 per cent and 17 per cent and plasticity indices between about 5 per cent and 22 per cent. These test results, which are plotted on Figure B14 in Appendix B, confirm that the material may be classified as clayey silt of low plasticity to silty clay of intermediate plasticity.

4.2.5 Groundwater Conditions

The observed/recorded water levels in the open boreholes following completion of drilling are shown on the Record of Borehole sheets and are summarized below.



FOUNDATION REPORT - NOISE BARRIER WALLS

Noise Barrier Wall No.	Borehole Number	Ground Surface Elevation (m)	Depth to Water Level below Ground Surface (m)	Groundwater Elevation (m)	Date
NBW1	13-4	142.1	Dry	-	March 14, 2013
	13-5	158.5	Dry	-	March 14, 2013
	134-1	124.5	2.6	121.9	November 14, 1961
	136-1	134.4	9.8	124.6	July 10, 1962
	136-6	134.9	4.9	130.0	September 21, 1962
	136-7	134.9	2.2	132.2	September 27, 1962
	136-8	134.1	6.4	127.7	October 4, 1962
NBW2	13-6	184.5	Dry	-	March 15, 2013
	84-2	177.8	9.5	168.3	August 14, 1963
NBW3	13-1	189.9	Dry	-	March 14, 2013
	13-2	187.5	Dry	-	March 13, 2013
NBW4	13-3	180.5	6.1	174.4	March 14, 2013
	76-1	180.5	~ 1.7	~ 178.8	November 19, 1962
	76-2	180.2	~ 0.6	~ 179.6	November 19, 1962

- Water levels not recorded in Boreholes 134-7, 136-2 to 136-5.

The water levels presented above and on the Record of Borehole sheets may not represent stabilized groundwater conditions at the time of the investigation. It is also noted that the groundwater measured during the 1962 and 1963 investigations have likely changed over the past 50 years.

The water level at each site is expected to fluctuate seasonally in response to changes in precipitation and snow melt, and is expected to be higher during the Spring and periods of precipitation.



FOUNDATION REPORT - NOISE BARRIER WALLS

5.0 CLOSURE

This Foundation Investigation Report was prepared by Ms. Nikol Kochmanová, P.Eng., and reviewed by Mr. Kevin Bentley, P.Eng., an Associate and Senior Geotechnical Engineer at Golder. Mr. Jorge Costa, P.Eng., a Designated MTO Contact and Principal with Golder, conducted an independent review and quality control audit of this report.

GOLDER ASSOCIATES LTD.

Nikol Kochmanová, P.Eng.
Geotechnical Engineer



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



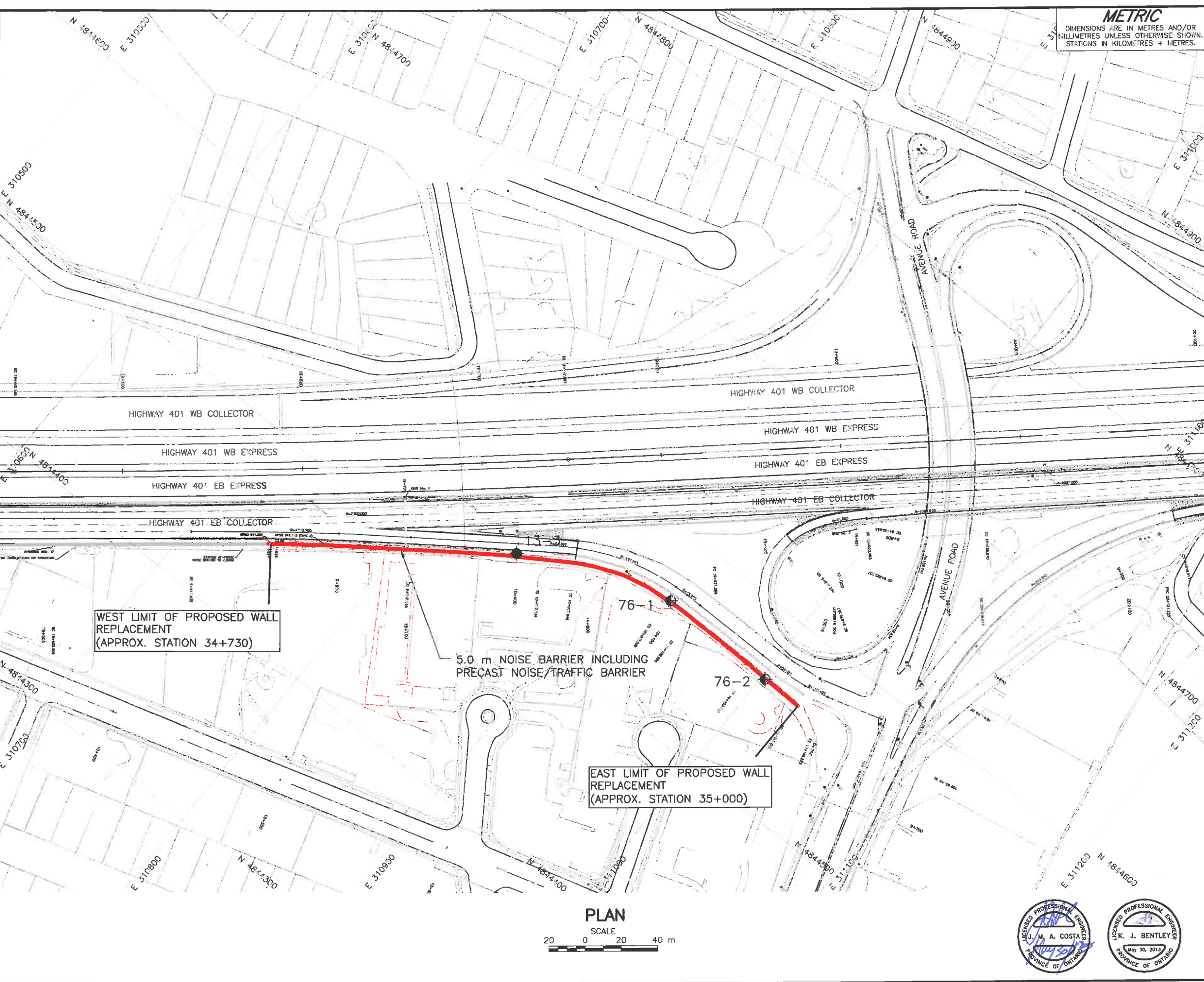
Jorge M.A. Costa, P.Eng.
Designated MTO Contact, Principal

MG/AV/NK/KJB/MA/CA

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\\golder.gds\gal\mississauga\active\2009\1111\09-1111-6007 urs hwy 401 rehab toronto\12 - addendum noise barrier walls\5 - reporting\09-1111-6007 fir 13may30 noise barrier walls.docx

MINISTRY OF TRANSPORTATION, ONTARIO
PROJECT DATE: May 20, 2013
FILE NAME: N:\Projects\2009\09-1111-6007\09-1111-6007 - Noise Barrier\09-1111-6007.dwg

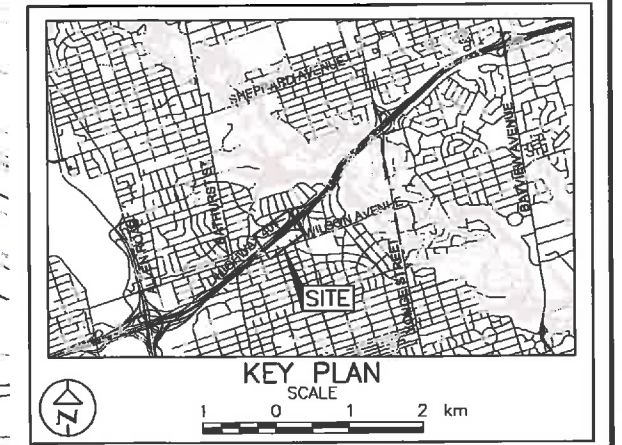


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2131-01-00

HIGHWAY 401 EBC REHABILITATION
NOISE BARRIER WALL 4
BOREHOLE LOCATIONS

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

Borehole - Current Investigation
 Approximate Borehole Location - Previous Investigation (Geocres No. 30M11-76)

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
13-3	180.5	4844530.7	310850.8
76-1	180.5	4844564.3	310934.0
76-2	180.2	4844563.3	311002.2

NOTES

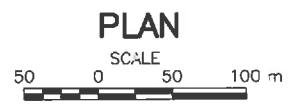
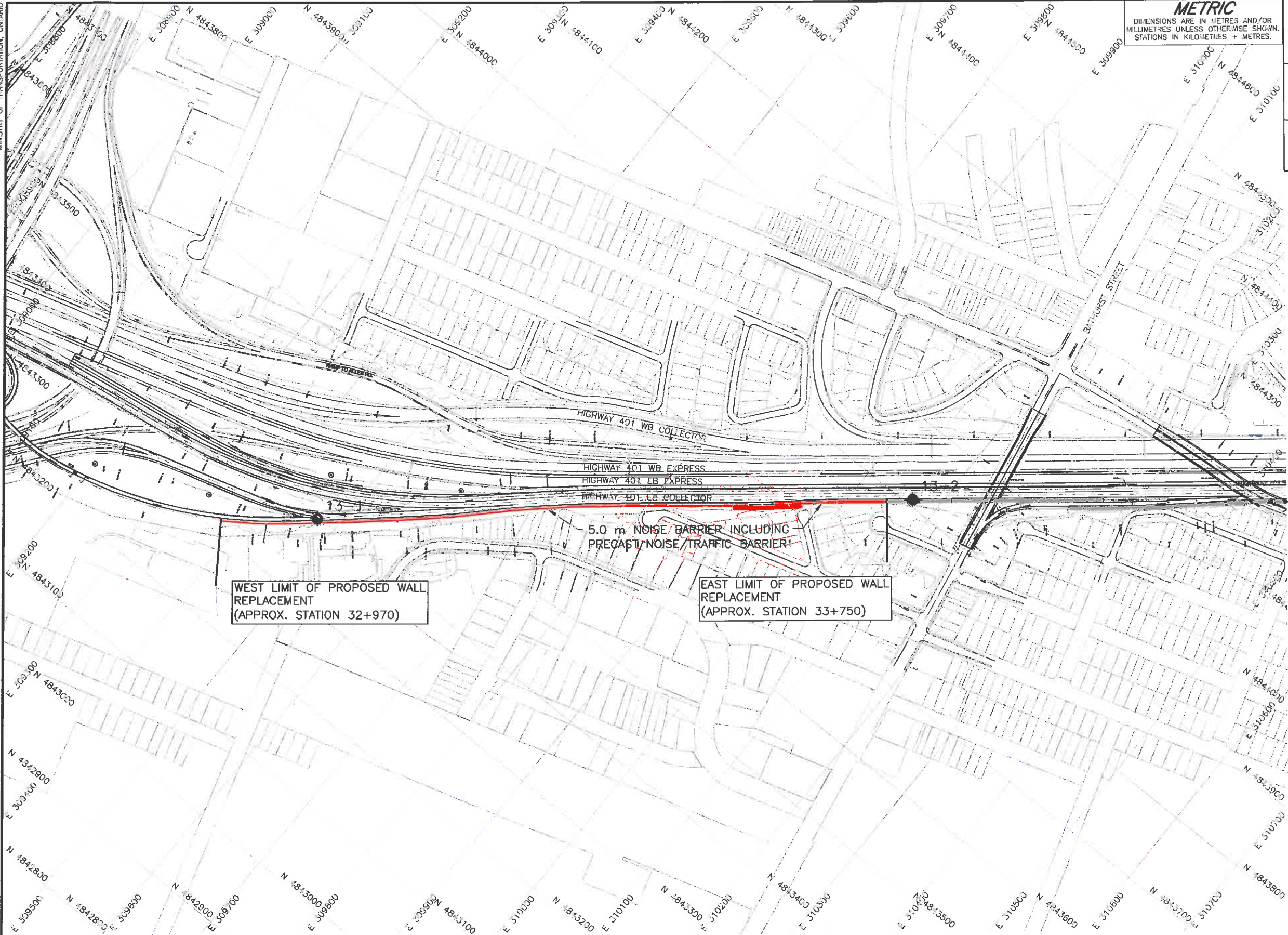
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The 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 provided in digital format by URS, drawing file names: Hwy401_b3d.dwg, received August 3, 2011 and Hwy401_alignment.dwg, Hwy401_plan_cont_2_Noise Barrier.dwg, received February 12, 2013.

NO.	DATE	BY	REVISION
Geocres No. 30M11-248			
HWY. 401		PROJECT NO. 09-1111-6007	DIST. Central
SUBM'D. AV	CHKD. NK	DATE: 4/12/2013	SITE:
DRAWN: JFC	CHKD. KJB	APPD. JMAC	DWG. 4



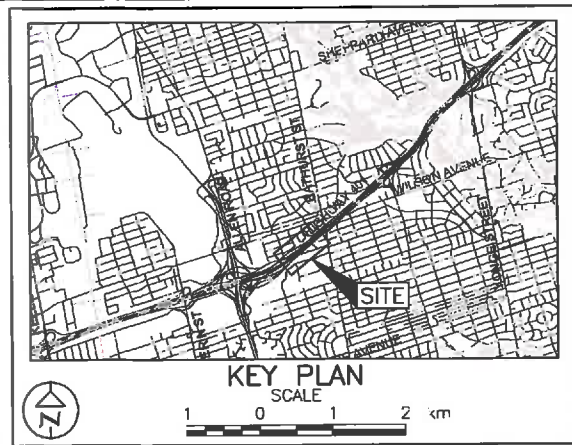
METRIC
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CONT No.
GWP No. 2131-01-00

HIGHWAY 401 EBC REHABILITATION
 NOISE BARRIER WALL 3
BOREHOLE LOCATIONS



Golder Associates Ltd.
 MISSISSAUGA, ONTARIO, CANADA



LEGEND

● Borehole - Current Investigation

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
13-1	169.9	4843397.0	309473.3
13-2	187.5	4843908.4	310057.5

NOTES

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REFERENCE

Base plans provided in digital format by URS, drawing file names: Hwy401_bgd.dwg, received August 3, 2011 and Hwy401_alignment.dwg, Hwy401_plan_cont 2_Noise Barrier.dwg, received February 12, 2013.

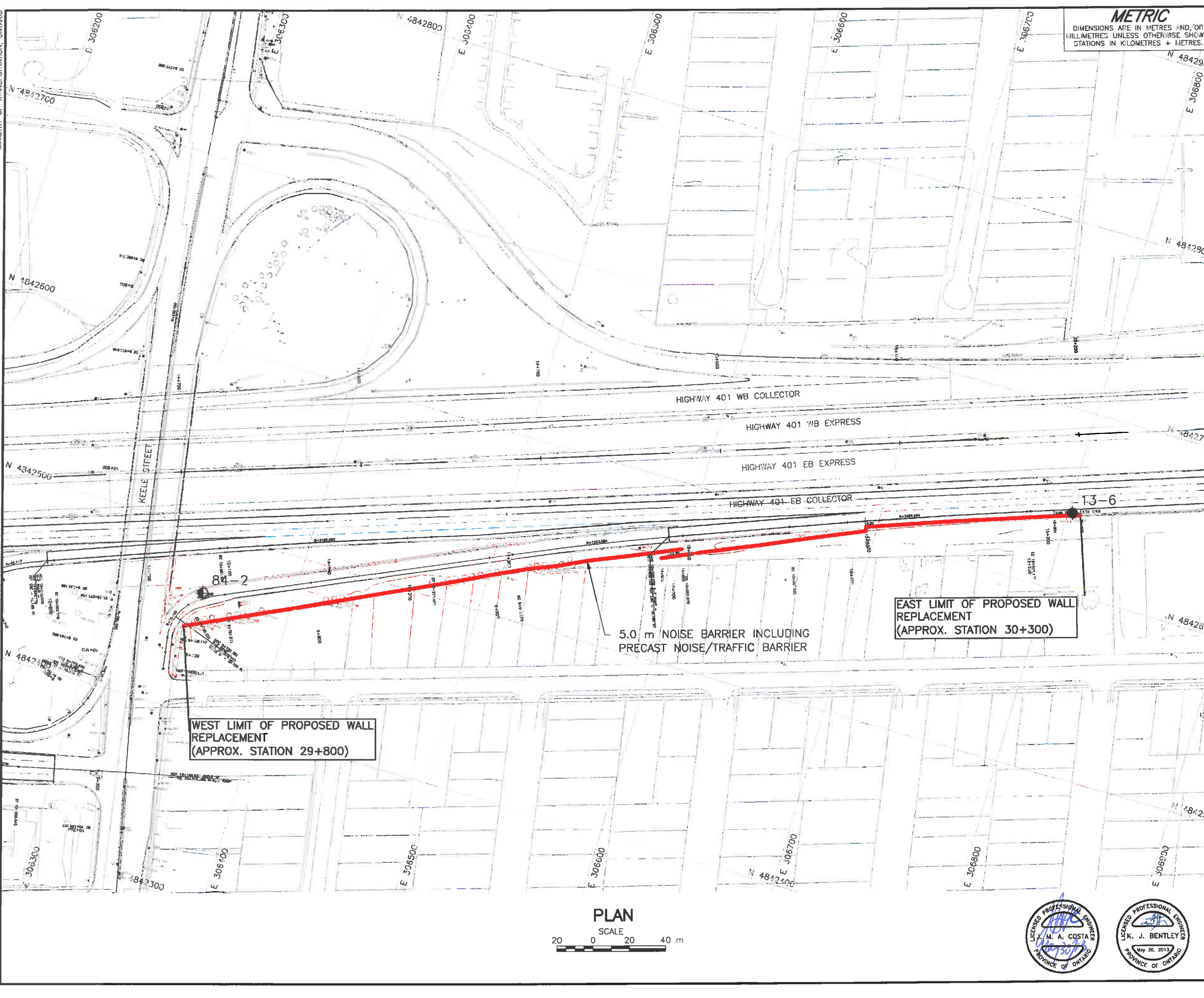


NO.	DATE	BY	REVISION

Geocres No. 30M11-248

HWY. 401	PROJECT NO. 09-1111-6007	DIST. Central
SUBM'D. AV	CHKD. NK	DATE: 4/12/2013
DRWN: JFC	CHKD. KJB	APPD. JMAC
		DWG. 3

MINISTRY OF TRANSPORTATION, ONTARIO

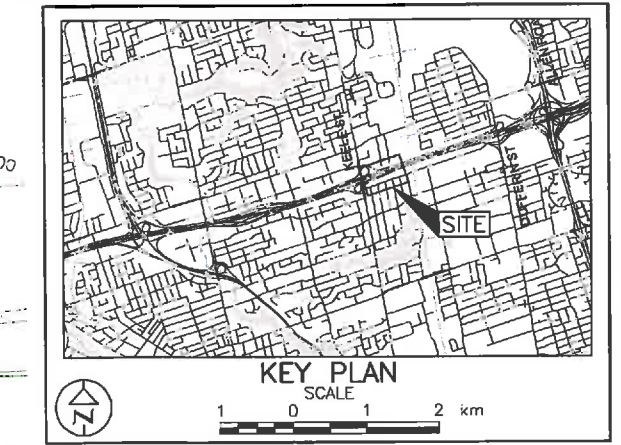


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STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2131-01-00

HIGHWAY 401 EBC REHABILITATION
NOISE BARRIER WALL 2
BOREHOLE LOCATIONS

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

Borehole - Current Investigation

Approximate Borehole Location - Previous Investigation (Geocres No. 30M11-84)

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
13-6	164.5	4842643.8	306802.2
84-2	177.8	4842465.9	306350.6

NOTES

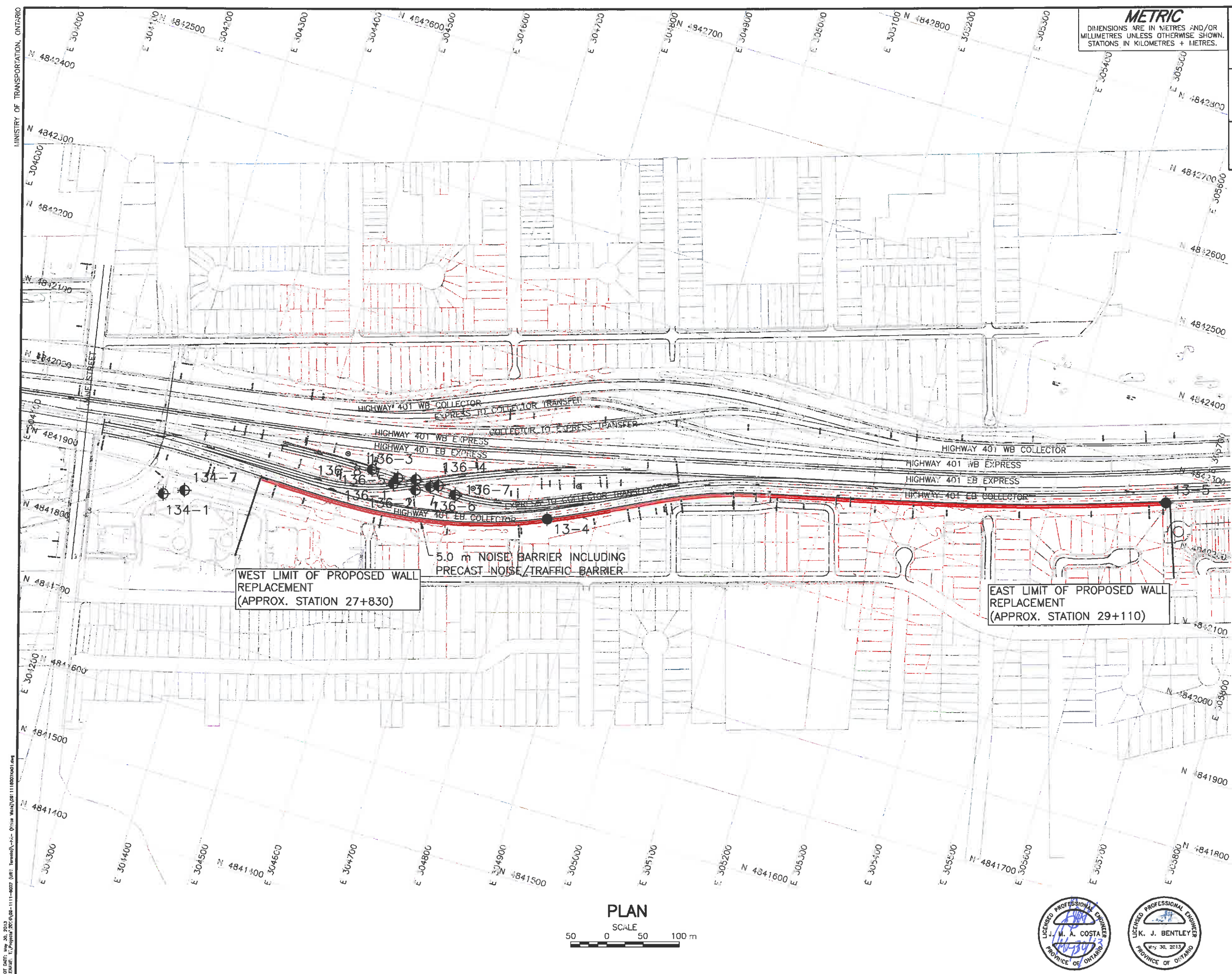
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REFERENCE

Base plans provided in digital format by URS, drawing file names: Hwy401_bgd.dwg, received August 3, 2011 and Hwy401_alignment.dwg, Hwy401_plan_cont 2_Noise Barrier.dwg, received February 12, 2013.

NO.	DATE	BY	REVISION
1			
Geocres No. 30M11-248			
HWY. 401	PROJECT NO. 09-1111-6007		DIST. Central
SUBM'D. AV	CHKD. NK	DATE: 4/12/2013	SITE:
DRAWN: JFC	CHKD. KJB	APPD. JMAC	DWG. 2

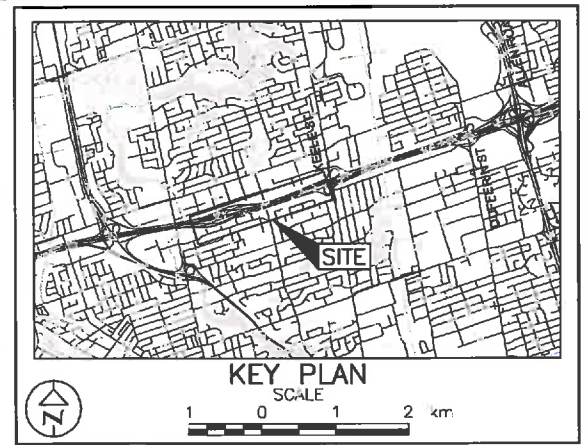


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2131-01-00

HIGHWAY 401 EBC REHABILITATION
NOISE BARRIER WALL 1
BOREHOLE LOCATIONS

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- Approximate Borehole Location - Previous Investigation (Geocres No. 30M11-134 and 30M11-136)

BOREHOLE CO-ORDINATES			
No.	ELEVATION	NORTHING	EASTING
13-4	142.1	4841993.9	304833.0
13-5	158.5	4842257.2	305656.0
134-1	124.5	4841874.4	304310.4
134-7	125.5	4841887.7	304337.4
136-1	134.4	4841979.9	304613.5
136-2	135.3	4841980.3	304645.9
136-3	135.0	4841994.3	304642.0
136-4	135.0	4841995.2	304674.7
136-5	134.6	4841985.1	304617.2
136-6	134.9	4841990.6	304664.4
136-7	134.9	4841989.7	304700.7
136-8	134.1	4841990.3	304579.4

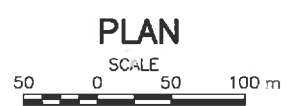
NOTES

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.

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REFERENCE

Base plans provided in digital format by URS, drawing file names: Hwy401_bgd.dwg, received August 3, 2011 and Hwy401_alignment.dwg, Hwy401_plan_cont 2_Noise Barrier.dwg, received February 12, 2013.



NO.	DATE	BY	REVISION
1			
Geocres No. 30M11-248			
HWY. 401	PROJECT NO. 09-1111-6007		DIST. Central
SUBM'D. AV	CHKD. NK	DATE: 4/12/2013	SITE:
DRAWN: JFC	CHKD. KJB	APPD. JMAC	DWG. 1

PLOT DATE: May 30, 2013
FILENAME: I:\Project\205\401-111-6007\09-111-6007.dwg
PLOTTER: HP DesignJet 5000-248



APPENDIX A

Record of Borehole Sheets from Current Investigation



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

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.)

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.

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

(b) Cohesive Soils Consistency

	C_u, S_u	
	kPa	psf
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

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.

V. MINOR SOIL CONSTITUENTS

Percent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (cohesionless) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand



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
F	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 $= \sigma'_p / \sigma'_{vo}$

(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

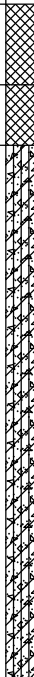
* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

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

PROJECT		RECORD OF BOREHOLE No 13-1		SHEET 1 OF 1		METRIC															
G.W.P. 09-1111-6007 (10000)		LOCATION N 4843397.0 ; E 309473.8		ORIGINATED BY SB																	
DIST Central HWY 401		BOREHOLE TYPE CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers		COMPILED BY NK																	
DATUM Geodetic		DATE March 13, 2013		CHECKED BY 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					WATER CONTENT (%)								
								20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p — W — W _L 10 20 30			γ kN/m ³			GR SA SI CL		
189.9	GROUND SURFACE																				
0.0	ASPHALT																				
189.1	Sand and gravel, trace silt (FILL) Compact Brown Moist		1	SS	11		189						○								
0.8	Clayey silt, trace to with sand, trace gravel (FILL) Firm to very stiff Brown Moist		2	SS	15		188						○								
			3	SS	14		187						—○—								
			4	SS	7		186														
			5	SS	22		185						—○—								
			6	SS	14		184						—○—								
185.4	CLAYEY SILT, some sand, trace gravel, trace rootlets and wood fragments Stiff Brown Moist		7	SS	13																
184.3	CLAYEY SILT with SAND, trace gravel (TILL) Very stiff Brown Moist		8	SS	28								—○—			5 39 46 10					
183.2	END OF BOREHOLE																				
6.7	NOTE: 1. Open borehole dry on completion of drilling.																				

PROJECT		RECORD OF BOREHOLE No 13-2		SHEET 1 OF 1		METRIC												
09-1111-6007 (10000)		LOCATION N 4843908.4 ; E 310067.5		ORIGINATED BY SB														
G.W.P. 2131-01-00		BOREHOLE TYPE CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers		COMPILED BY NK														
DIST Central HWY 401		DATE March 15, 2013		CHECKED BY KJB														
DATUM Geodetic																		
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					WATER CONTENT (%)					
187.5	GROUND SURFACE							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p — W — W _L 10 20 30			GR SA SI CL		
0.0	ASPHALT																	
0.3	CONCRETE																	
186.7	Silty sand and gravel (FILL) Compact		1	SS	16		187											
0.8	Brown and black Moist		2	SS	12													
	Clayey silt, some sand, trace gravel, contains sand interlayers (FILL)		3	SS	15		186											
185.3	Stiff to very stiff Brown and grey Moist																	
2.2	Sand, some silt, trace gravel (FILL)		4	SS	31		185											
184.5	Dense Brown Moist																	
3.0	Clayey silt with sand, trace gravel, contains sand pockets and interlayers (FILL)		5	SS	5		184											
	Firm to very stiff Brown Moist		6	SS	11													
			7	SS	16		183											
181.9							182											
5.6	CLAYEY SILT with SAND, trace rootlets																	
	Stiff Grey Moist		8	SS	13		181											
180.8																		
6.7	END OF BOREHOLE																	
	NOTE: 1. Open borehole dry upon completion of drilling.																	

PROJECT <u>09-1111-6007 (10000)</u>		RECORD OF BOREHOLE No 13-3		SHEET 1 OF 1		METRIC	
G.W.P. <u>2131-01-00</u>		LOCATION <u>N 4844530.7 ; E 310850.8</u>		ORIGINATED BY <u>SB</u>			
DIST <u>Central</u> HWY <u>401</u>		BOREHOLE TYPE <u>CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers</u>		COMPILED BY <u>NK</u>			
DATUM <u>Geodetic</u>		DATE <u>March 14, 2013</u>		CHECKED BY <u>KJB</u>			

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 (%)							
180.5	GROUND SURFACE																			
0.0	Sand and gravel, some silt (FILL) Compact Brown Moist			1	SS	15														
179.7																				
0.8	Clayey silt, trace sand, trace gravel (FILL) Firm Brown Moist			2	SS	8														
179.1																				
1.4	CLAYEY SILT to SILTY CLAY, trace sand, trace gravel, contains oxidation staining to 2.1 m, contains sand pockets between depths 3.6 m - 5.6 m (TILL) Very stiff to hard Brown becoming grey at a depth of 2.4 m Moist			3	SS	29														
	Inferred cobbles and boulders at a depth of 3.8 m			4	SS	21														
				5	SS	16														
			6	SS	58															
			7	SS	20															
			8	SS	25															
173.8	END OF BOREHOLE																			
6.7	NOTE: 1. Water level in open borehole at a depth of 6.1 m below ground surface (Elev. 174.4 m) on completion of drilling.																			

PROJECT 09-1111-6007 (10000)			RECORD OF BOREHOLE No 13-4			SHEET 1 OF 1			METRIC								
G.W.P. 2131-01-00			LOCATION N 4841993.9 ; E 304833.0			ORIGINATED BY SB											
DIST Central HWY 401			BOREHOLE TYPE CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers			COMPILED BY NK											
DATUM Geodetic			DATE March 14, 2013			CHECKED BY 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									
142.1	GROUND SURFACE																
0.0	ASPHALT																
0.1	Sand and gravel, trace silt (FILL) Compact Brown Moist		1	SS	16												
141.3																	
0.8	Clayey silt, some sand, trace gravel, contains sand pockets (FILL) Firm to Stiff Brown Moist		2	SS	8												
			3	SS	13												
139.9																	
2.2	Sandy CLAYEY SILT, trace gravel (TILL) Stiff to very stiff Brown becoming grey at a depth of 5.5 m Moist		4	SS	15												
			5	SS	13												
			6	SS	15												
			7	SS	18												
			8	SS	15												
135.4																	
6.7	END OF BOREHOLE																
	NOTE: 1. Open borehole dry on completion of drilling.																

PROJECT		RECORD OF BOREHOLE No 13-5		SHEET 1 OF 1		METRIC										
G.W.P. 09-1111-6007 (10000)		LOCATION N 4842257.2 ; E 305656.0		ORIGINATED BY SB												
DIST Central HWY 401		BOREHOLE TYPE CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers		COMPILED BY NK												
DATUM Geodetic		DATE March 14, 2013		CHECKED BY 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								
158.5	GROUND SURFACE															
0.0	ASPHALT															
157.7	Sand and gravel, trace silt (FILL) Dense Brown Moist		1	SS	34											
0.8	Clayey silt with sand, trace gravel (FILL) Stiff to firm Brown becoming grey at a depth of 3.0 m Moist		2	SS	14											
			3	SS	10											
			4	SS	9											
			5	SS	8											
			6	SS	6											
153.9	CLAYEY SILT, some sand, trace gravel, contains oxidation staining between depths of 4.6 m and 5.2 m (TILL) Stiff to very stiff Brown Moist		7	SS	13											
4.6			8	SS	17											
151.8	END OF BOREHOLE															
6.7	NOTE: 1. Open borehole dry on completion of drilling.															

PROJECT <u>09-1111-6007 (10000)</u>		RECORD OF BOREHOLE No 13-6		SHEET 1 OF 1		METRIC	
G.W.P. <u>2131-01-00</u>		LOCATION <u>N 4842643.8 ; E 306802.2</u>		ORIGINATED BY <u>SB</u>			
DIST <u>Central</u> HWY <u>401</u>		BOREHOLE TYPE <u>CME-55 Truck Mounted, 101 mm Diameter Solid Stem Augers</u>		COMPILED BY <u>NK</u>			
DATUM <u>Geodetic</u>		DATE <u>March 15, 2013</u>		CHECKED BY <u>KJB</u>			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
								20	40	60	80	100	W _p	W	W _L					
184.5	GROUND SURFACE																			
0.0	ASPHALT																			
183.7	Sand and gravel, trace silt (FILL) Compact Brown Moist		1	SS	27															
0.8	Clayey silt to silty clay with sand, trace gravel, contains sand pockets, contains rootlets and wood fragments below a depth of 3.7 m (FILL) Stiff to very stiff Brown becoming grey below a depth of 3.0 m Moist		2	SS	12															
			3	SS	8															
			4	SS	11															
			5	SS	11															
			6	SS	22															
			7	SS	14															
179.0																				
5.5	CLAYEY SILT with SAND, trace gravel (TILL) Very stiff Brown Moist		8	SS	24															
177.8																				
6.7	END OF BOREHOLE																			
	NOTE: 1. Open borehole dry on completion of drilling.																			



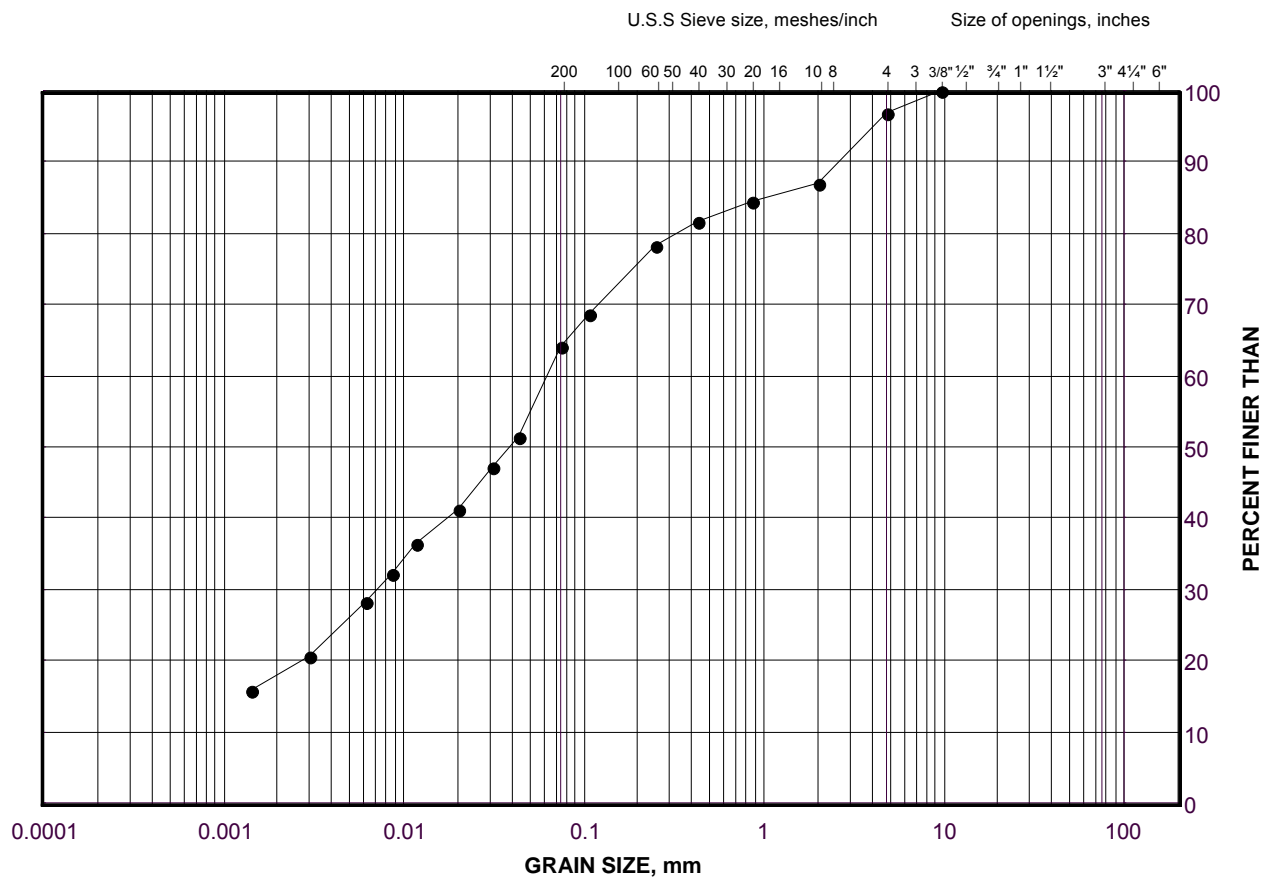
APPENDIX B

Laboratory Test Results

GRAIN SIZE DISTRIBUTION

Clayey Silt (Fill)
Noise Barrier Wall 1

FIGURE B1



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

LEGEND

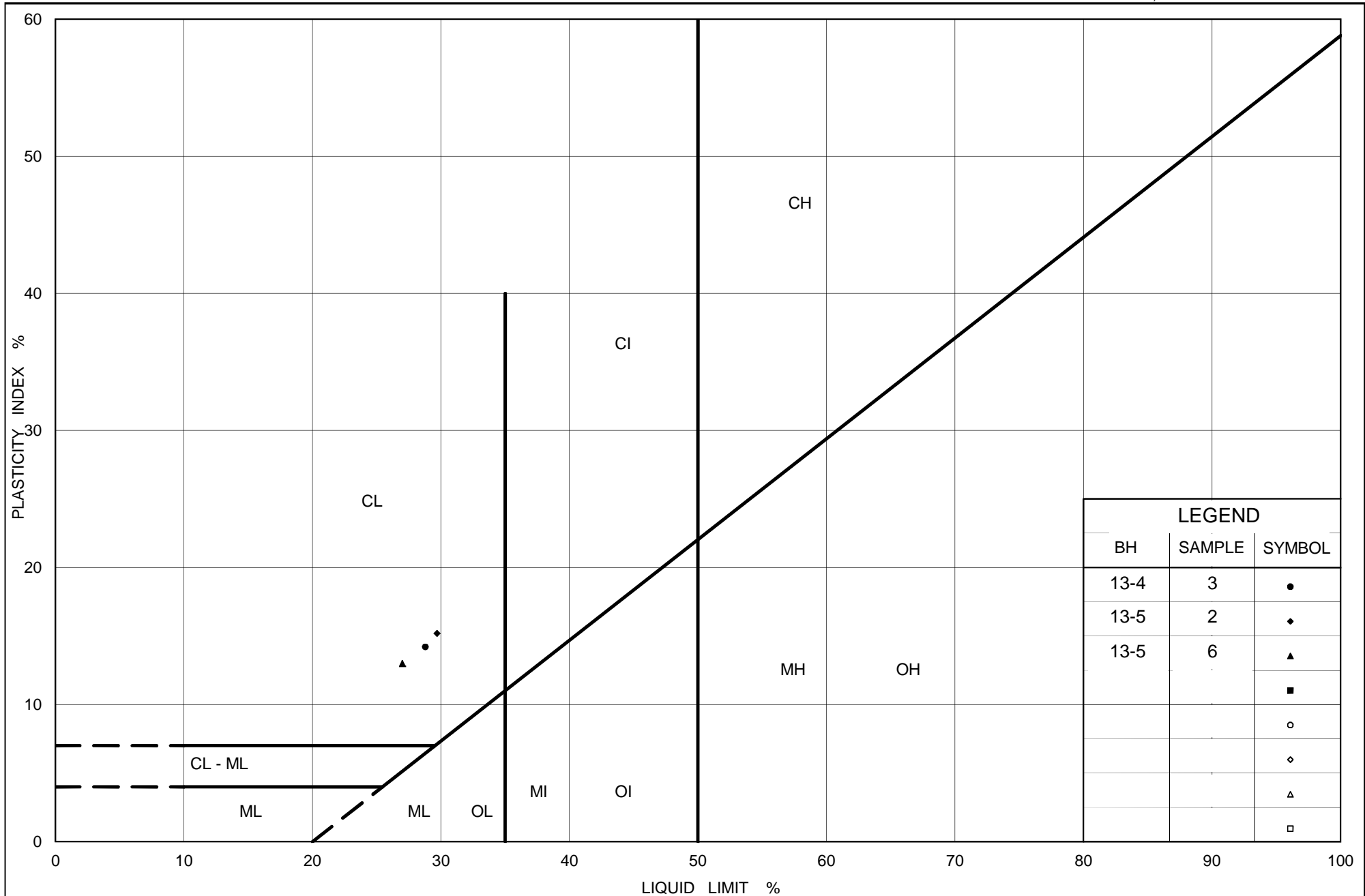
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-5	6	154.4

Project Number: 09-1111-6007

Checked By: KJB

Golder Associates

Date: 24-May-13



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt (Fill) Noise Barrier Wall 1

Figure No. B2

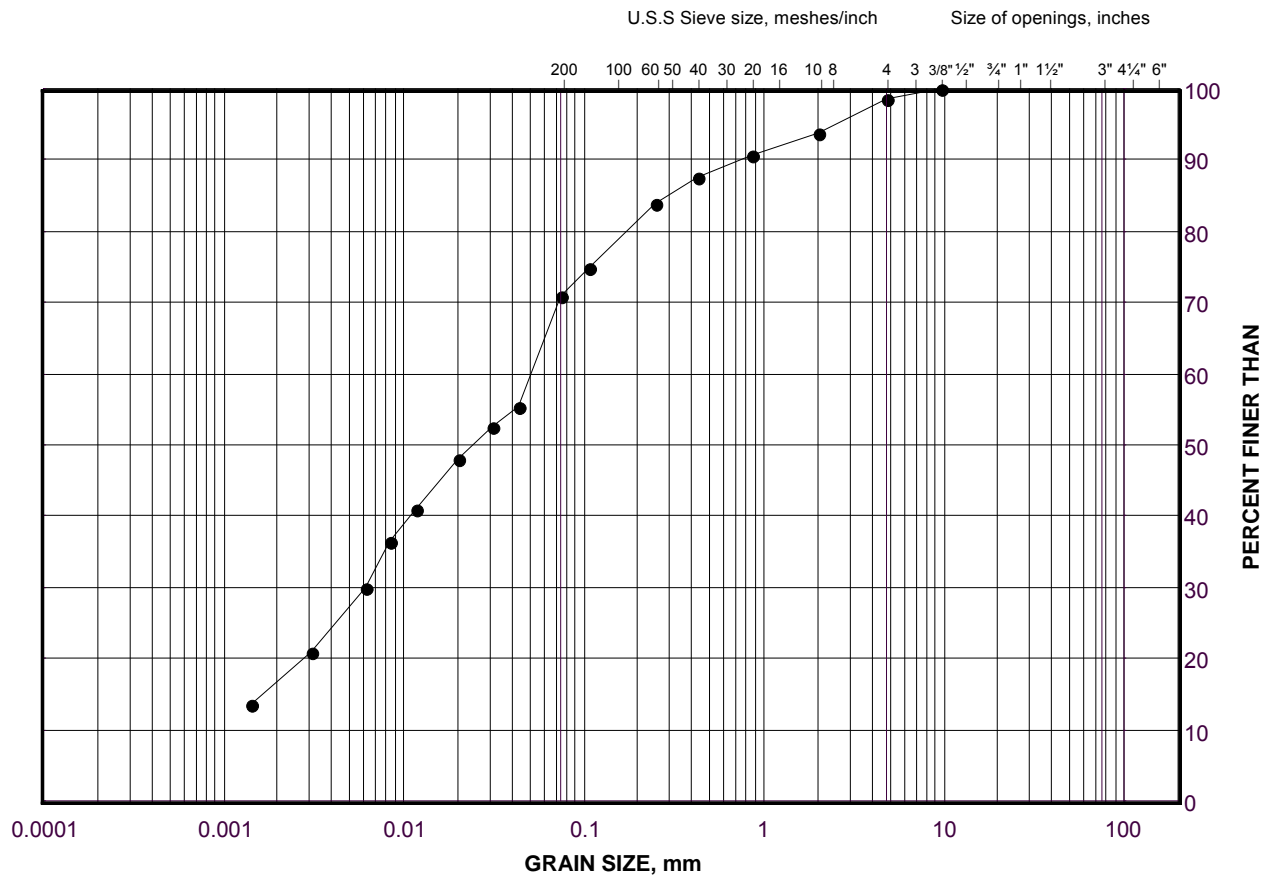
Project No. 09-1111-6007

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Till)
Noise Barrier Wall 1

FIGURE B3



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

LEGEND

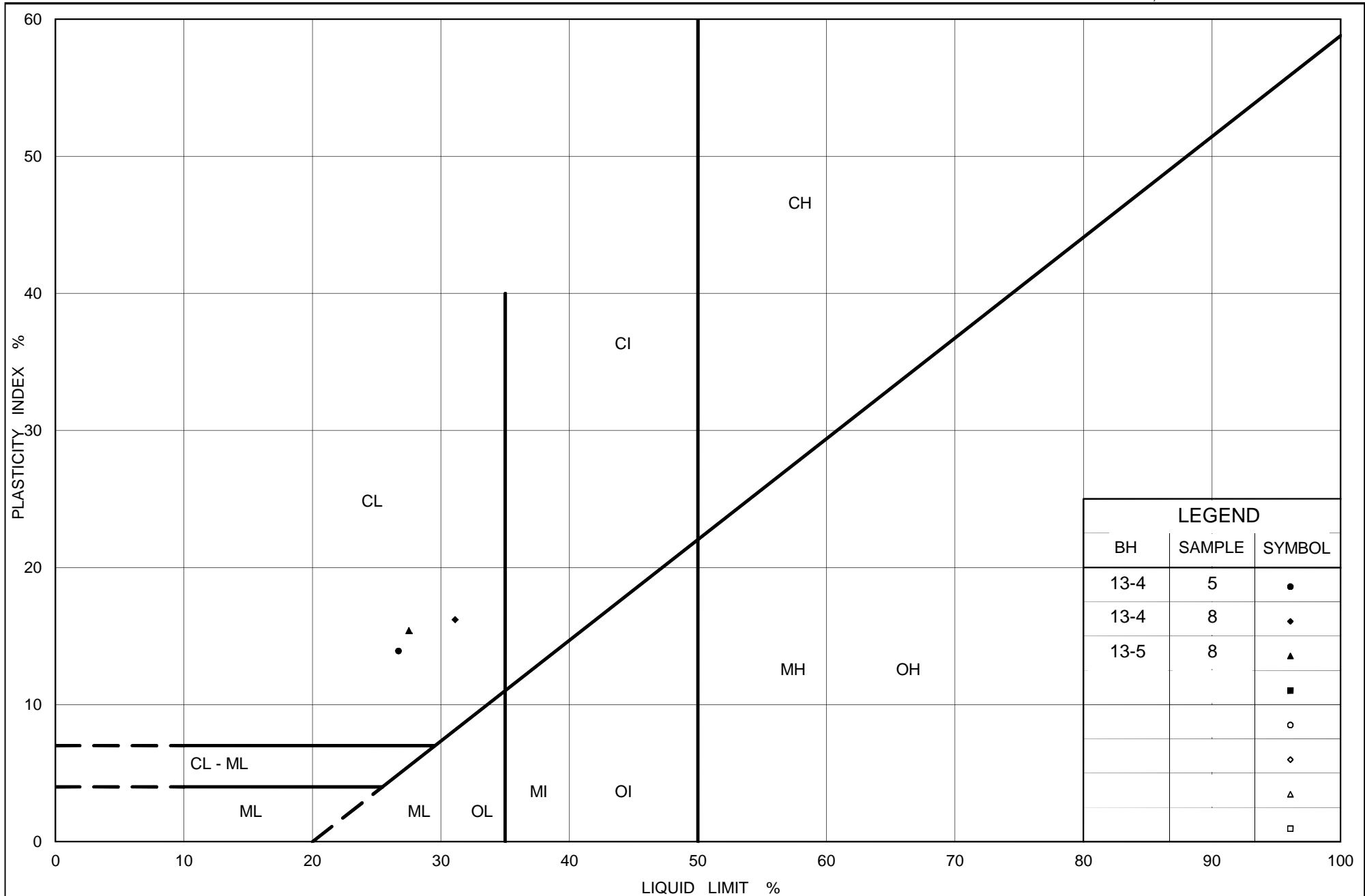
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-4	5	138.8

Project Number: 09-1111-6007

Checked By: KJB

Golder Associates

Date: 24-May-13



Ministry of Transportation

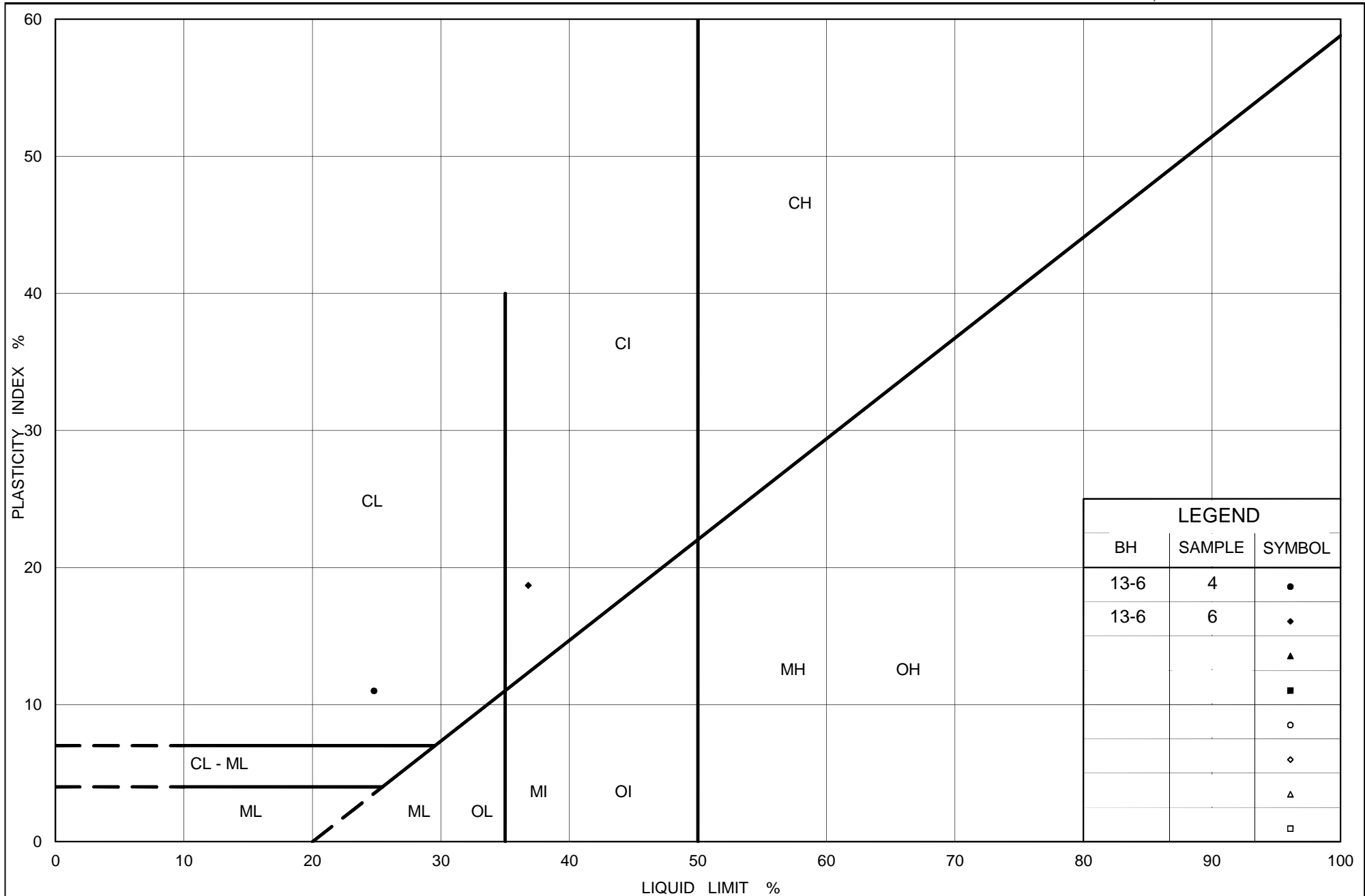
Ontario

PLASTICITY CHART Clayey Silt (Till) Noise Barrier Wall 1

Figure No. B4

Project No. 09-1111-6007

Checked By: KJB



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PLASTICITY CHART
 Clayey Silt to Silty Clay (Fill)
 Noise Barrier Wall 2

Figure No. B5

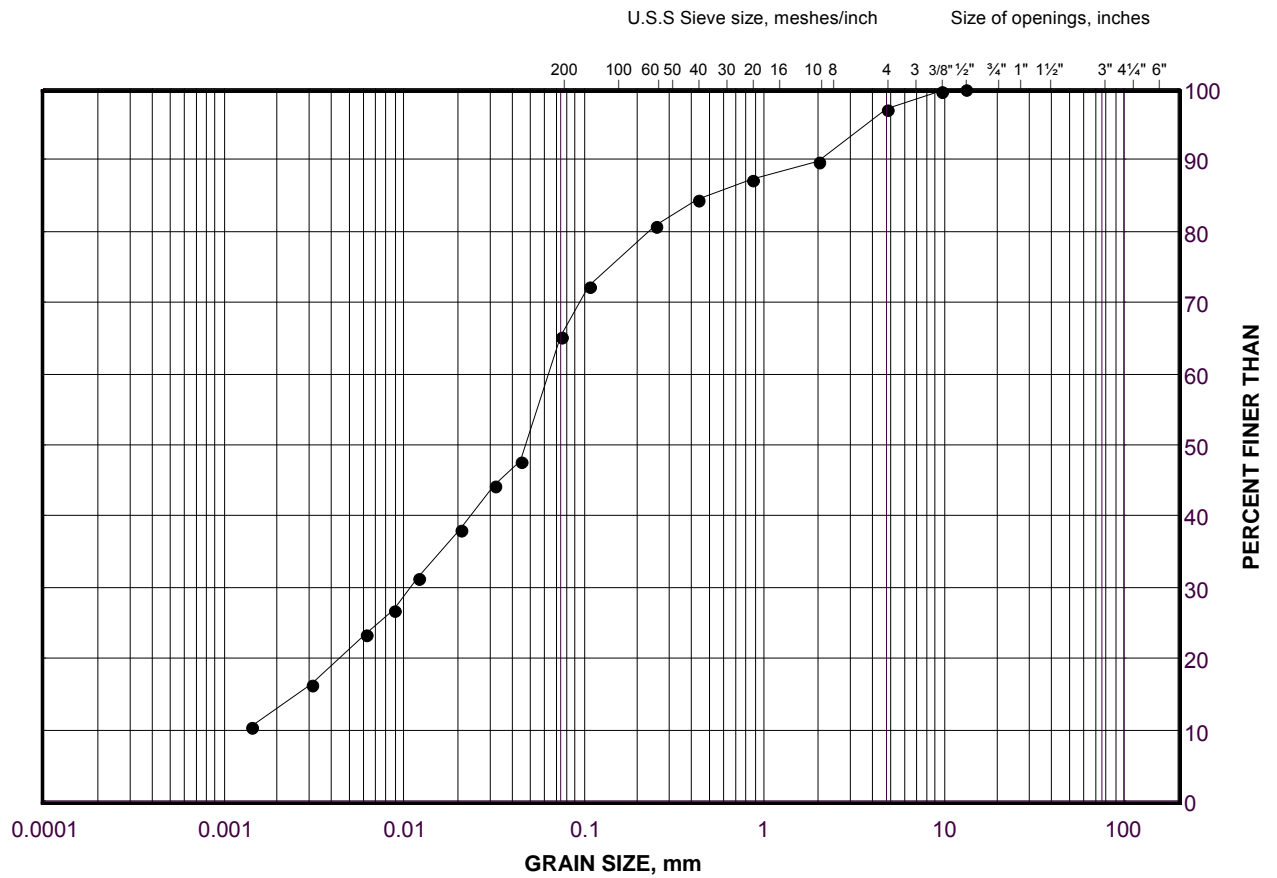
Project No. 09-1111-6007

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Till)
Noise Barrier Wall 2

FIGURE B6



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

LEGEND

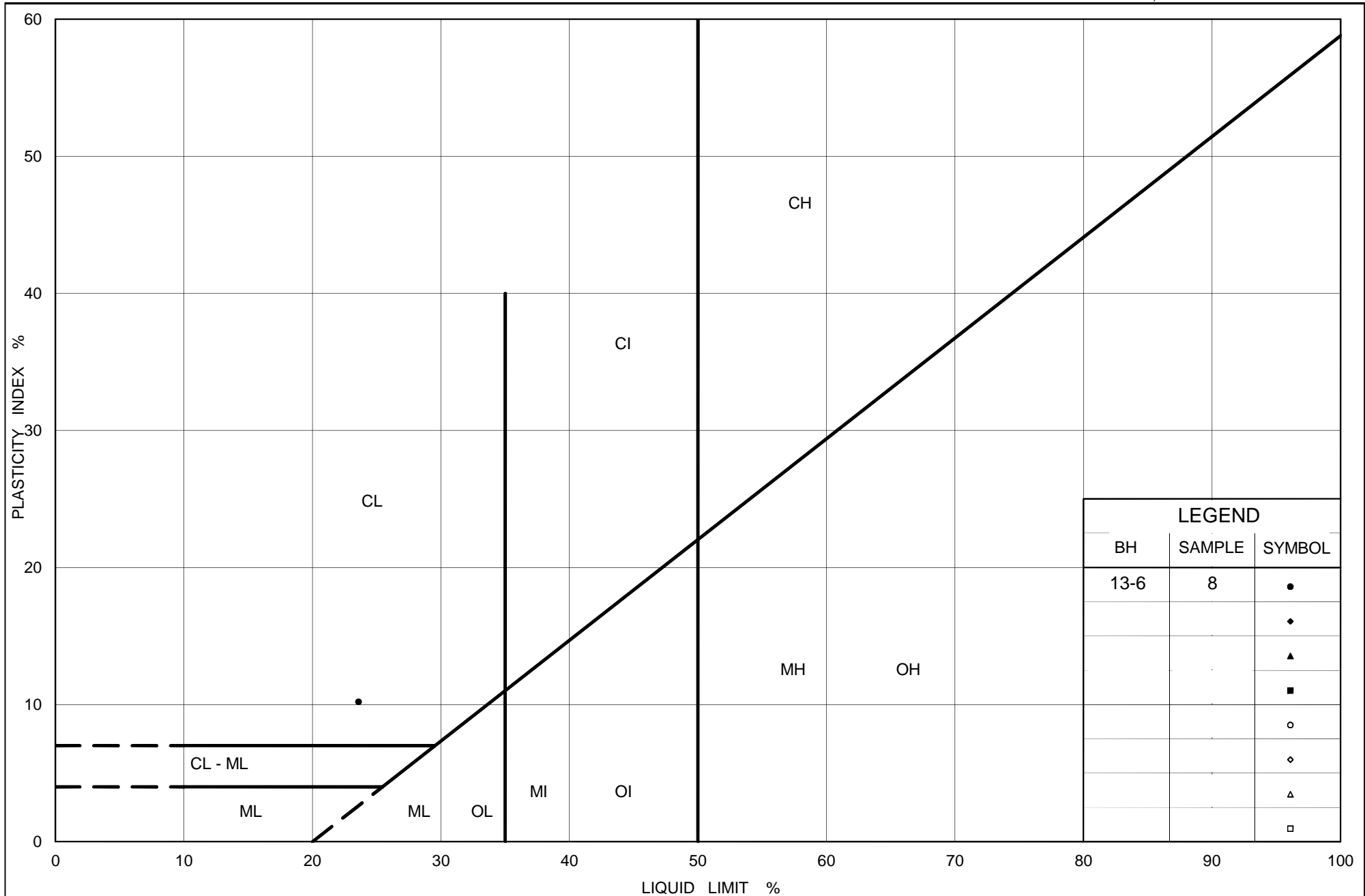
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-6	8	178.1

Project Number: 09-1111-6007

Checked By: KJB

Golder Associates

Date: 24-May-13



Ministry of Transportation

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PLASTICITY CHART Clayey Silt (Till) Noise Barrier Wall 2

Figure No. B7

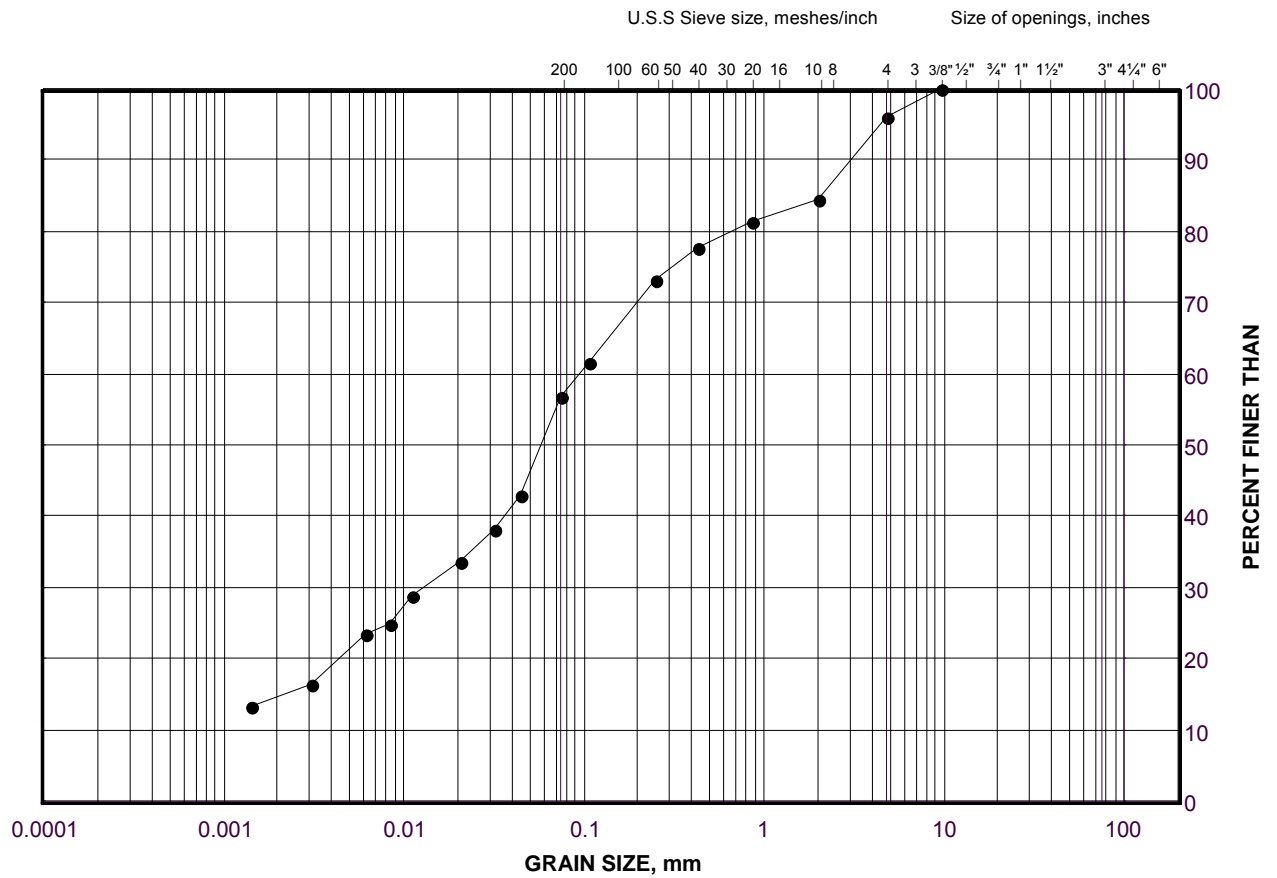
Project No. 09-1111-6007

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Fill)
Noise Barrier Wall 3

FIGURE B8



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

LEGEND

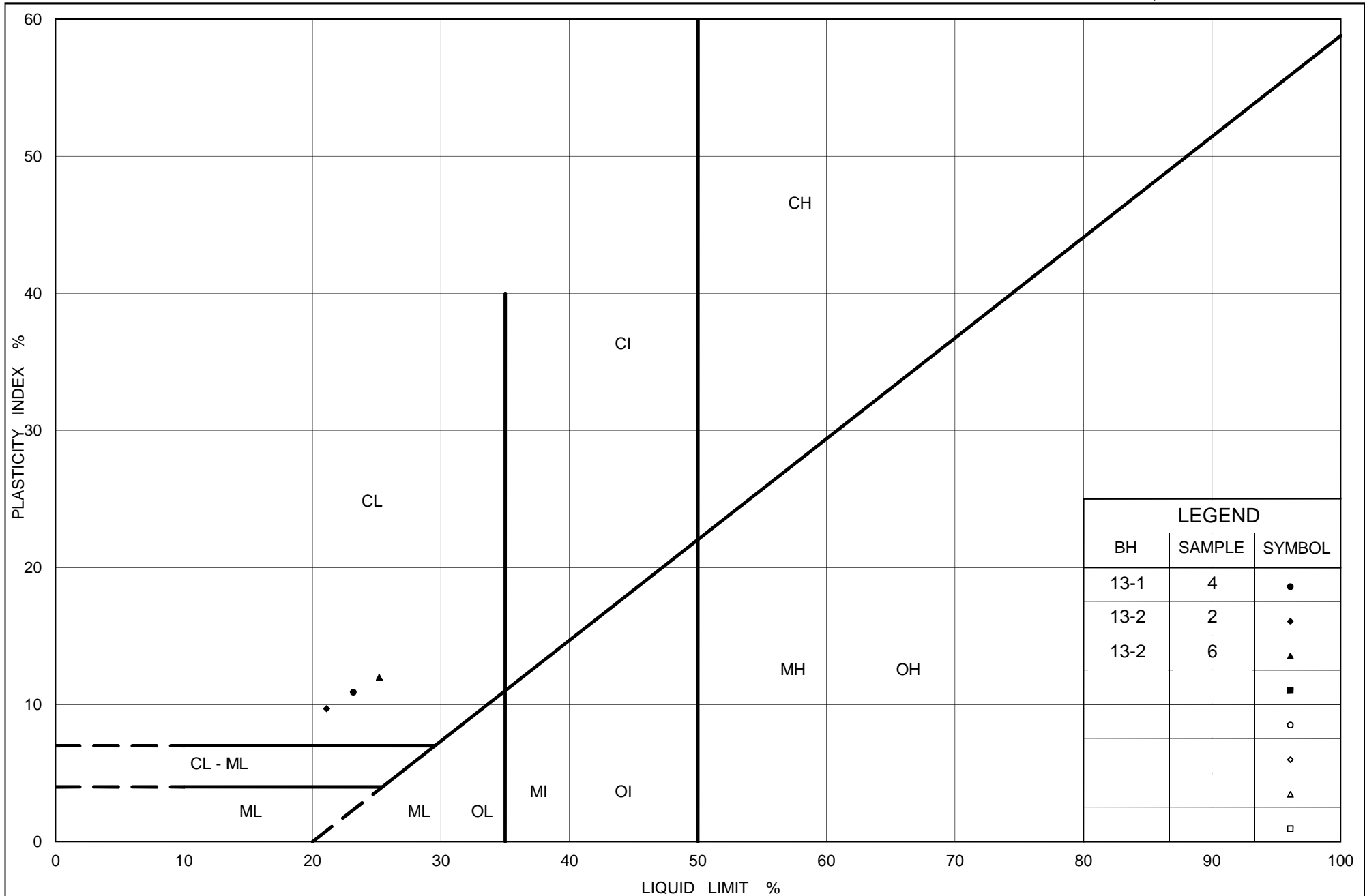
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-2	6	183.4

Project Number: 09-1111-6007

Checked By: KJB

Golder Associates

Date: 24-May-13



Ministry of Transportation

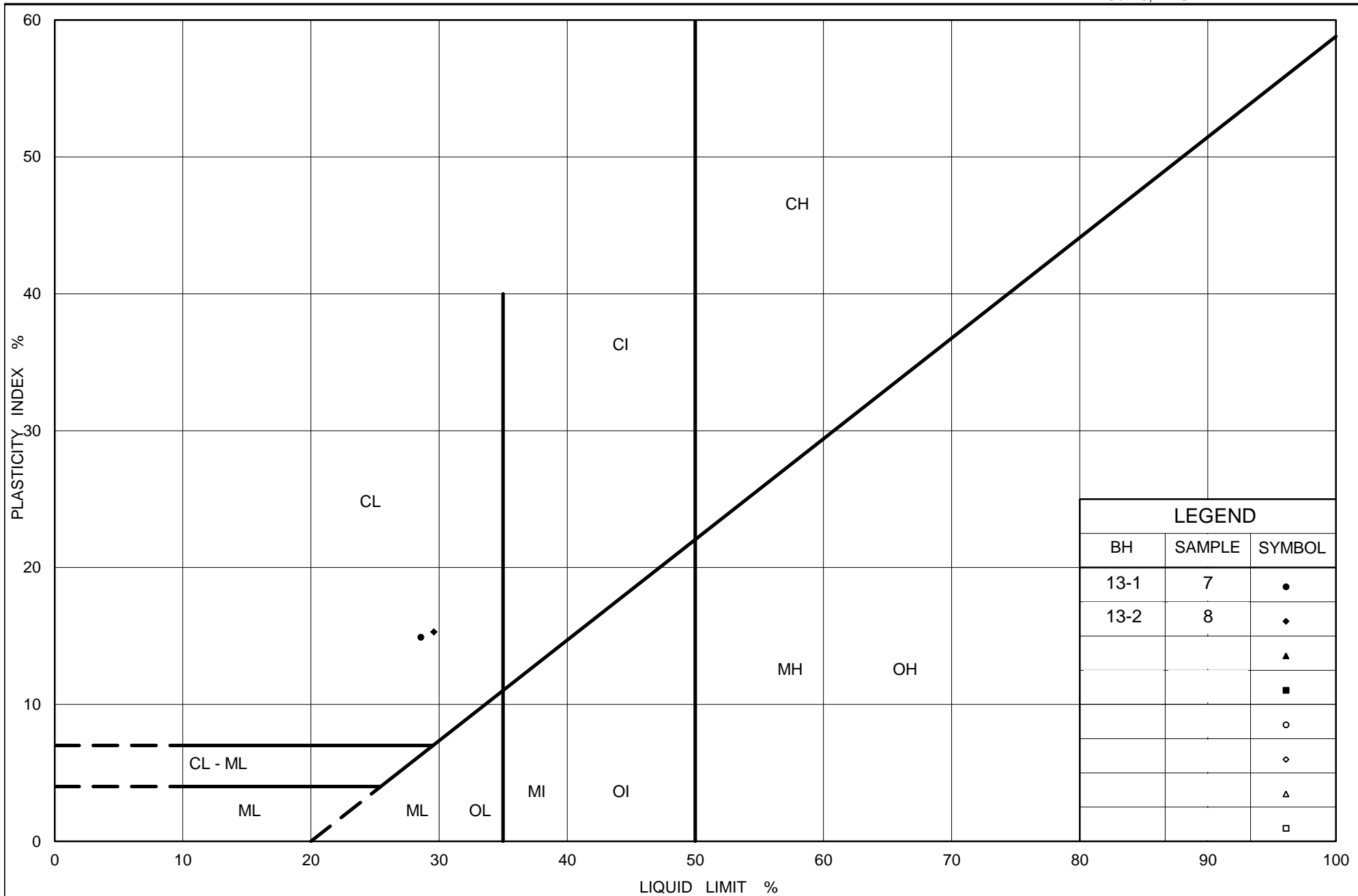
Ontario

PLASTICITY CHART Clayey Silt (Fill) Noise Barrier Wall 3

Figure No. B9

Project No. 09-1111-6007

Checked By: KJB



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PLASTICITY CHART
Clayey Silt
Noise Barrier Wall 3

Figure No. B10

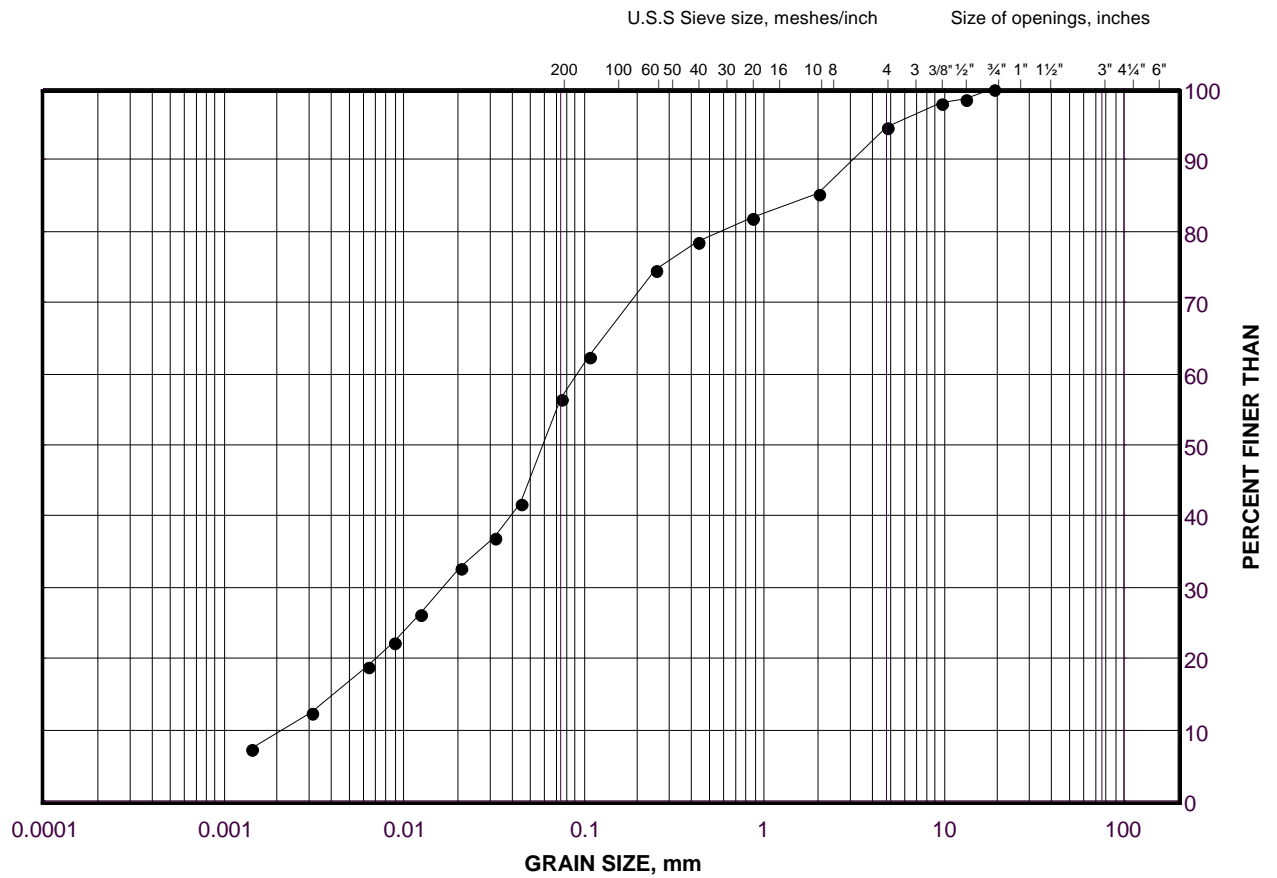
Project No. 09-1111-6007

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Till)
Noise Barrier Wall 3

FIGURE B11



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

LEGEND

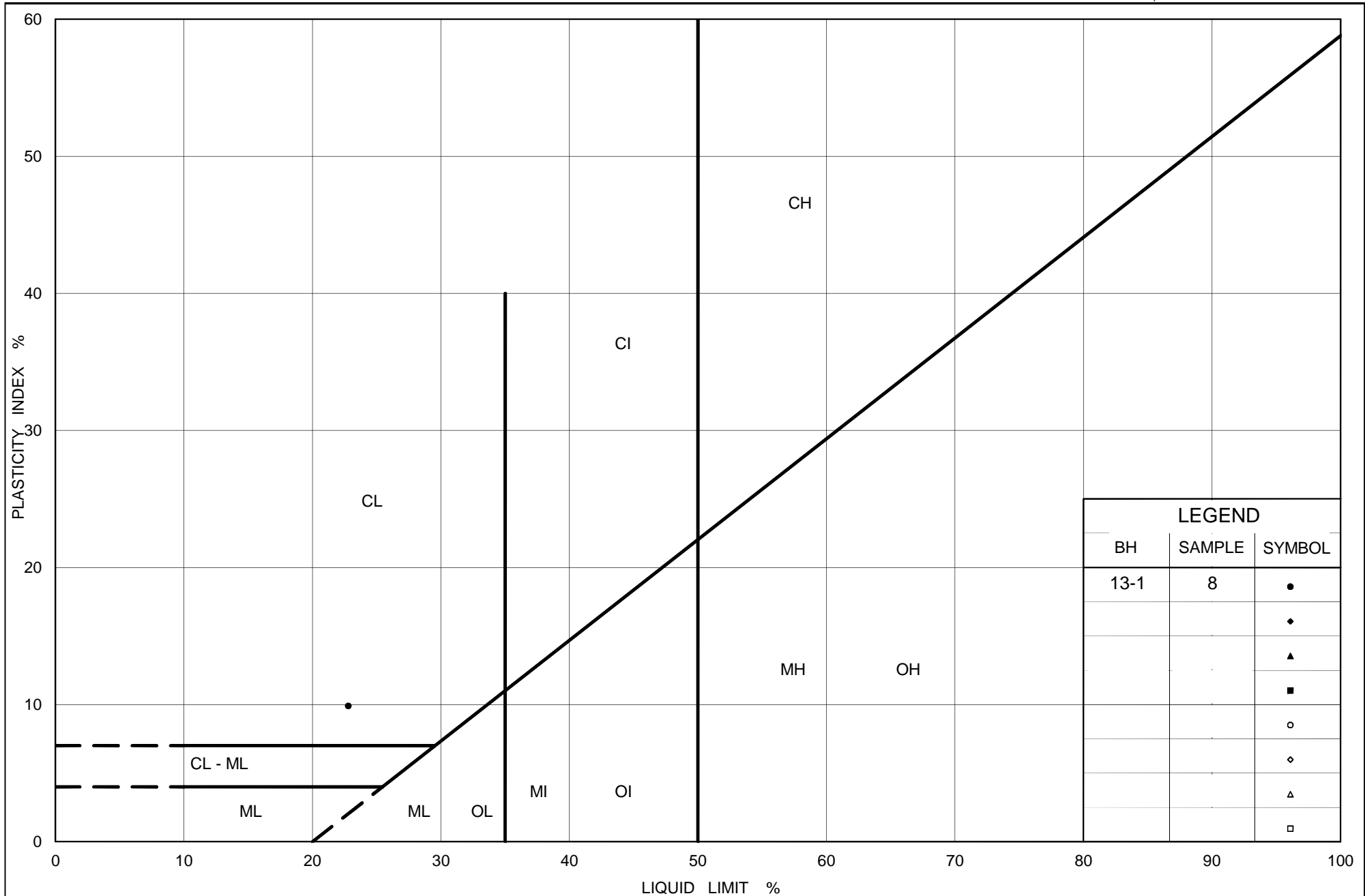
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-1	8	183.5

Project Number: 09-1111-6007

Checked By: _____

Golder Associates

Date: 24-May-13



Ministry of Transportation

Ontario

PLASTICITY CHART
Clayey Silt (Till)
Noise Barrier Wall 3

Figure No. B12

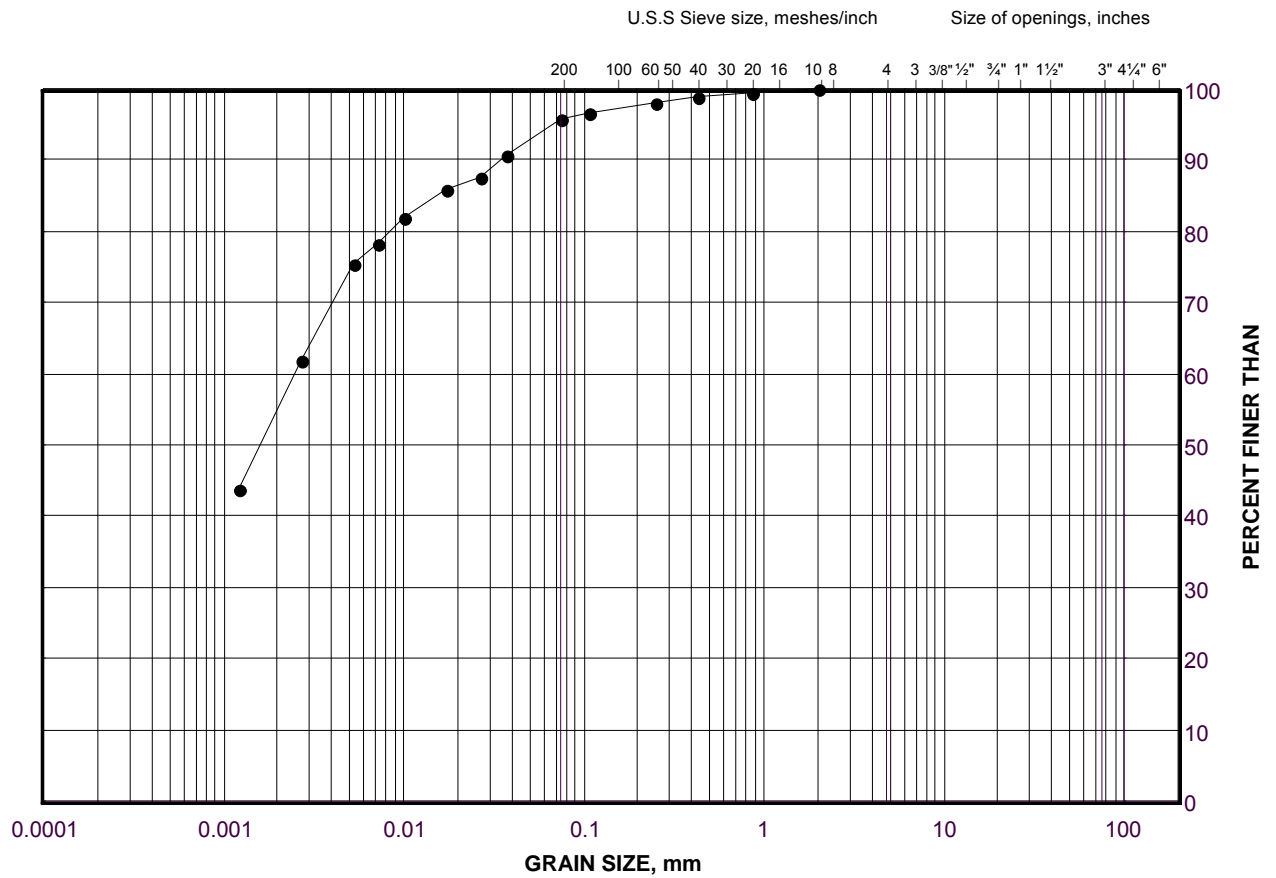
Project No. 09-1111-6007

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silty Clay (Till)
Noise Barrier Wall 4

FIGURE B13



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

LEGEND

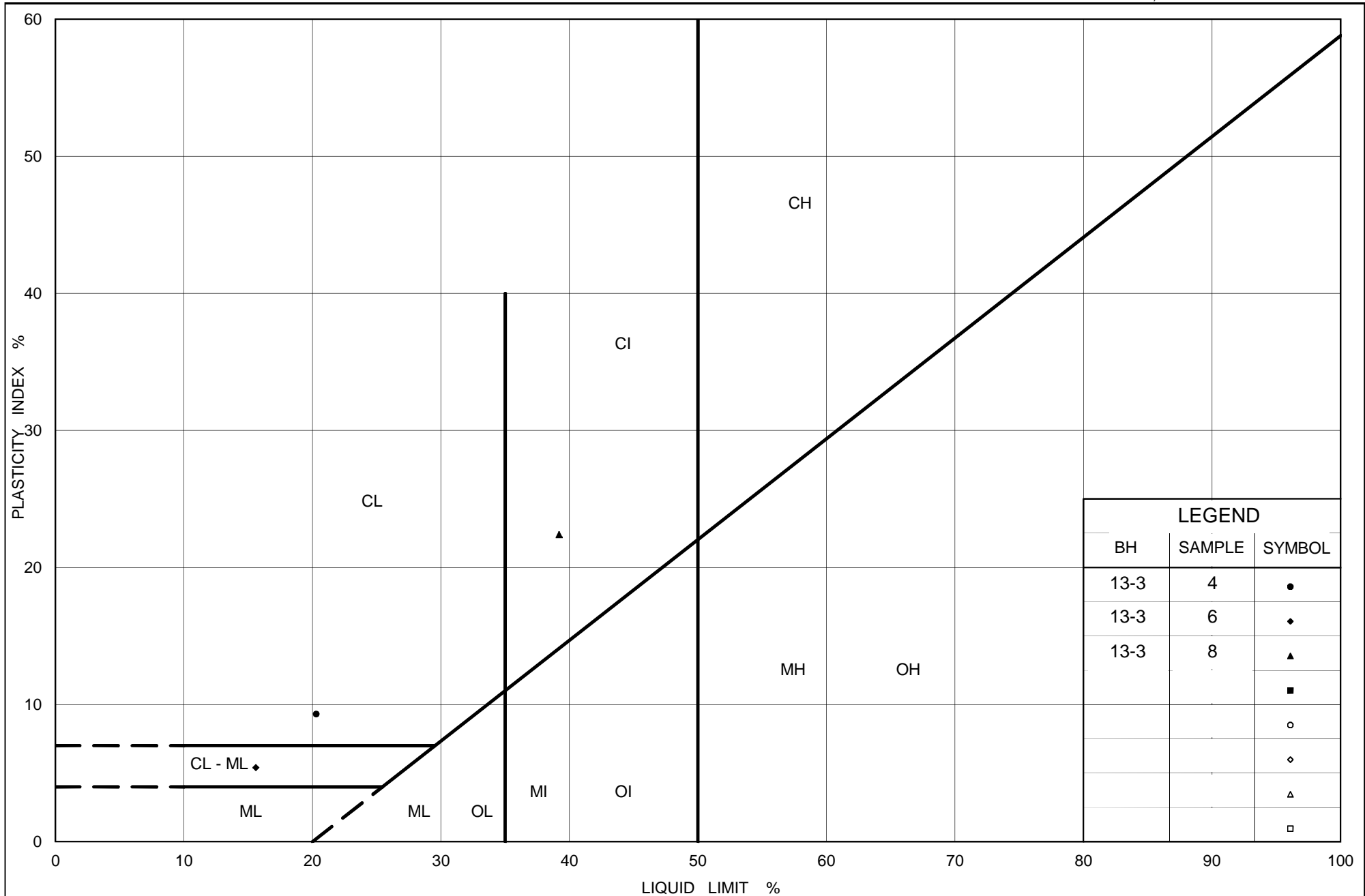
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	13-3	8	174.1

Project Number: 09-1111-6007

Checked By: KJB

Golder Associates

Date: 24-May-13



Ministry of Transportation

Ontario

PLASTICITY CHART Clayey Silt to Silty Clay Noise Barrier Wall 4

Figure No. B14

Project No. 09-1111-6007

Checked By: KJB



APPENDIX C

Records of Borehole Sheets from Previous Investigation

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1. BH76-1

OUR REFERENCE NO 2-II-2

CITY OF ONTARIO DEPARTMENT OF HIGHWAYS

METHOD OF BORING AUGERING

ENCLOSURE NO 3

PROJECT AVENUE ROAD - HWY 401 RETAINING WALL

DIAMETER OF BOREHOLE 6"

LOCATION SEE ENCL. 2.

DATE NOVEMBER 19, 1962.

DATUM ELEVATION 592.2

ELEVATION (m)

180.5

179.8

178.3

176.8

175.3

173.7

172.2

ELEVATION ft	DEPTH ft	STRATIFICATION SYMBOL	STRATIFICATION DESCRIPTION	SAMPLES			PENETRATION RESISTANCE			CONSISTENCY	REMARKS
				NO.	TYPE	BLOWS	0	120	140		
592.2	0		TOPSOIL								
590	2			1	SS	40					
585	5		DAMP HARD SANDY CLAYEY SILT TILL								HAMMER BOUNCING
580	10		brown grey	2	SS	75					
575	15		GREY DAMP VERY DENSE SILT slightly cemented	3	SS	450					
570	20		GREY HARD CLAYEY SILT TILL	4	SS	150					
565	25			5	SS	110					
	30										

DETAILS OF
EXTRAPOLATED
PENETRATION
RESISTANCES:

SA": BLOWS:

1	15/6"	25/6"
2	20/6"	30/6"
	15/2"	
3	75/2"	
4	38/6"	65/8"
5	36/6"	50/6"
	20/2"	

VERTICAL SCALE: 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE: MB

CH'D: R. R.

GEOTECHNICAL DATA SHEET FOR BOREHOLE **2 BH76-2**

DATE REFERENCE NO. 2-11-2

CLIENT: ONTARIO DEPARTMENT OF HIGHWAYS
 PROJECT: AVENUE RD - HWY 401 RETAINING WALL
 LOCATION: SEE ENCL. 2.
 DATUM ELEVATION: 591.2

METHOD OF BORING: AUGERING
 DIAMETER OF BOREHOLE: 6"
 DATE: NOVEMBER 19, 1962.

ENCLOSURE NO. 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE Blows per ft			CONSISTENCY water content %			REMARKS
				NO.	TYPE	TEST	0	20	40	60	80	100	
180.2	591.2	0	TOPSOIL										
179.8	590	1	BROWN DAMP HARD SANDY CLAYEY SILT TILL	1	SS	61							
178.3	585	5											
176.8	580	10	BROWN DAMP VERY DENSE SANDY SILT slightly cemented	2	SS	146							
175.3	575	15	GREY DAMP VERY DENSE SANDY SILT	3	SS	150							
			GREY HARD CLAYEY SILT	4	SS	130							
173.7	570	20											
172.2	565	25											

DETAILS OF
EXTRAPOLATED
PENETRATION
RESISTANCES:

SA²: BLOWS:
 2 27/6"
 73/6"
 3 75/6"
 4 35/6"
 65/6"

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: MB

CHD: *Recher*

RECORD OF BOREHOLE NO. 2 **BH84-2**

FOUNDATION SECTION

JOB 64-P-87 LOCATION Stn. 228+40 and 219' to left of E Hwy. 401 ORIGINATED BY B.M.G.
W P 231-60 BORING DATE Aug. 14, 1963. COMPILED BY B.M.G.
DATUM G.S.C. BOREHOLE TYPE Pennsylvania Auger - 3 1/2" Ø CHECKED BY A.G.S.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
583.3	177.8 Groundlevel								
	Topsoil & road fill.								
3.0		1	SS	35					
	Clayey silt - some sand and gravel (Glacial till)	2	SS	45					
	V. stiff to hard.	3	SS	32					
	Brown changing to grey at Elev. 570	4	SS	29					
	(173.7m)	5	SS	41					
		6	SS	38					
		7	SS	32					
		8	SS	52					
		9	SS	37					
531.8	162.1	10	SS	34					
51.6	End of borehole.								

WL
Elev. 552.3
(168.3m)

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.R. 85-59-3 BORE HOLE NO. 1 **BH134-1**

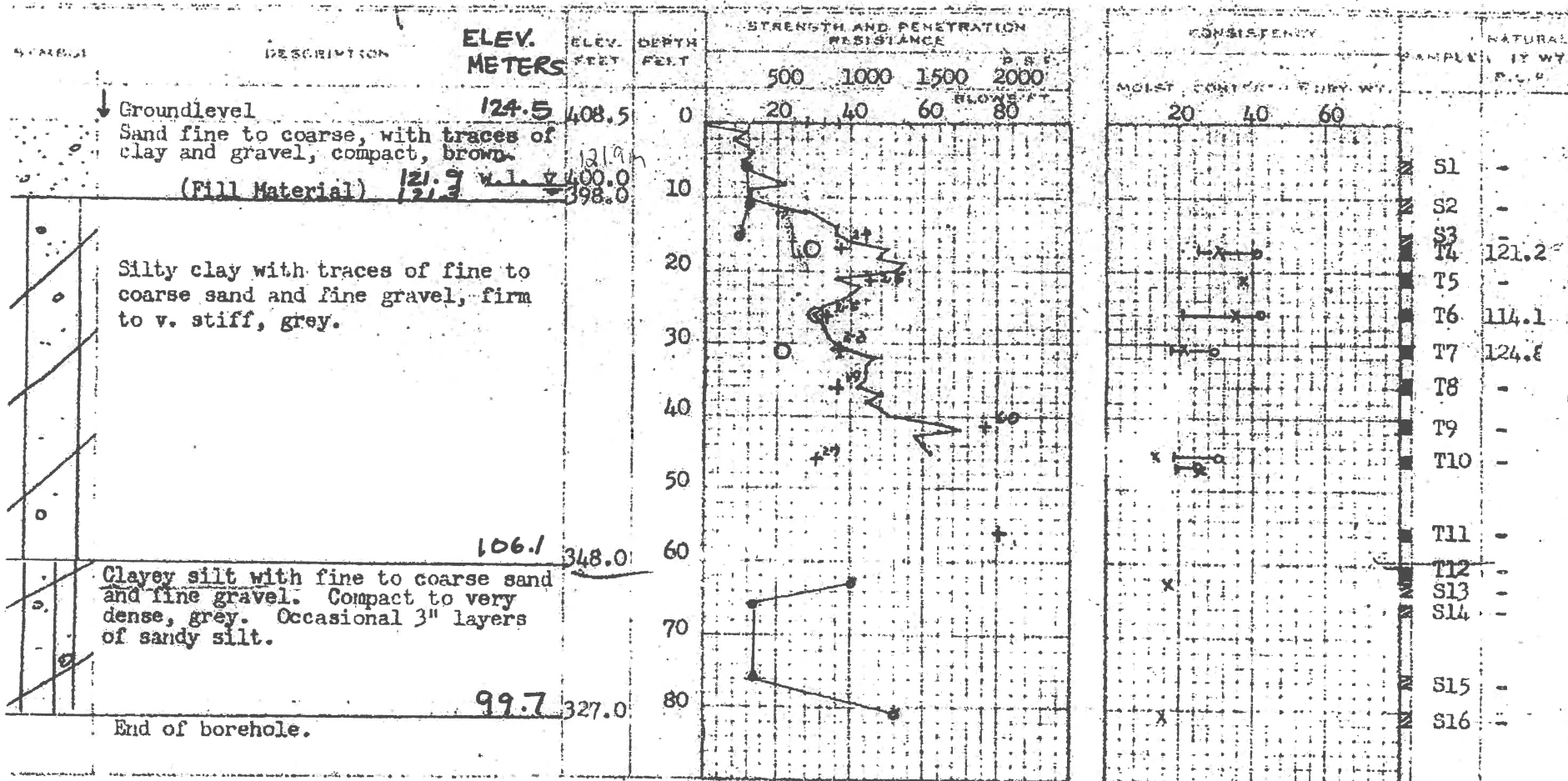
JOB 61-F-113 STATION 84+80 (121' Lt.)

DATUM 408.5 COMPILED BY I.H.

BORING DATE Nov. 14/61. CHECKED BY K.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (QU) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX LI
LIQUID LIMIT X
PLASTIC LIMIT


DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 7 BH134-7

FOUNDATION SECTION

JOB 61-F-113

LOCATION Stn. 8470 (112' to left of E. Hwy. 401)

ORIGINATED BY B.M.G.

W. P. 85-59-3

BOHRING DATE March 29, 1963.

COMPILED BY **B.M.G.**

DATUM Geodetic

BOREHOLE TYPE Washboring using NX casing.

CHECKED BY B.K.

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W	BULK DENSITY	REMARKS
ELEV. DEPTH (m)	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. ⊗ Field Vane Test ○ Remoulded Strength + Unconf. Shear Strength 400 800 1200 1600 2000	WATER CONTENT % 20 40 60	P.C.F.
125.5								
411.7	Groundlevel							
0.6	Clayey silt with traces of sand and gravel. (Fill Material) Stiff brown		1	SS	8			
121.8			2	SS	16			
399.7			3	SS	14			
12.0	Clayey silt with traces of sand. Stiff to firm Grey.		4	TW	P			
			5	TW	P			
115.4			6	TW	P			
378.7								
33.0	End of borshole.							

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1 BH136-1

FOUNDATION SECTION

JOA 62-F-86

LOCATION Hwy. #401, Sta. 95445, 173' Rt. of C

RECEIVED BY I.H.

W.P. 104-62

BORING DATE July 10, 1962.

COMPILED BY H.S.

DATUM 441.0

SOREHOLE TYPE 4 1/2" Auger Borehole.

CHECKED BY I.H.

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — %L PLASTIC LIMIT — %P WATER CONTENT — %W		BULK DENSITY P C F	REMARKS
ELEV DEPTH (m)	DESCRIPTION	STRAT. PLLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT %		
134.4 41.0 0.0	Groundlevel					440				
	Clayey silt with some fine to coarse sand and traces of fine gravel. <i>VERY STIFF.</i> Compact to dense. (Glacial Till)		1	SS	19					
			2	SS	26					133
			3	SS	38	430				
			4	SS	24					146
			5	SS	22					
			6	SS	22	420				
			7	SS	22	410				140
124.4 408.0 33.0	Clayey silt to silty clay stiff.		8	SS	19	410				
			9	SS	11	400				
121.3 398.0 43.0 (13.1m)	End of borehole.					390				
					Notes		Sensitivity			

[illegible]

RECORD OF BOREHOLE NO. 5 136-5

FOUNDATION SECTION

JOB 62-F-86

LOCATION Sta. 287+35 165' Lt. New C Hwy. #401

ORIGINATED BY H.S.

W. P. 104-62

BORING DATE Sept. 17/62

COMPILED BY H.S.

DATUM 441.6

BOREHOLE TYPE Washboring

CHECKED BY B.K.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 62-F-86

LOCATION Sta. 285+83 192' Lt. New G Hwy. #401

ORIGINATED BY H.S.

W.P. 104-62

BORING DATE Sept. 21, 1962.

COMPILED BY H.S.

DATUM 442.7

BOREHOLE TYPE Washboring.

CHECKED BY B.K.

SOIL PROFILE			SAMPLES			ELEV. SCALE	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		SHEAR STRENGTH P.S.F.			W P W WL WATER CONTENT % 20 40 60				
						450								
442.7 0.0	134.9 Groundlevel													
	Desiccated zone -													
	Very stiff.													
430.7 12.0	131.3 m		1	SS	12									WL in casing on 26/9/62
	Clayey silt with													
	fine gravel.		2	SS	11	420								
	Soft to firm.													
			3	SS	4									
389.7 53.0	118.8		4	SS	6	390								
	Sandy silt with some													
	gravel.		5	SS	13									Gr. 7%
	Dense to very dense.													Sa. 30%
			6	SS	55									Si. 51%
367.7 75.0	112.1													Cl. 12%
	Clayey silt with sand		7	SS	>100	360								Sa. 37%
	gravel and boulders.													Si. 56%
	(Glacial Till)													Cl. 7%
	Very dense.		8	RC	-									
341.7 101.0	104.2													
336.7	Weathered Bedrock.	NEW												
106.0	102.6	NEW	9	RC	-									
331.5	Sound Bedrock.													
111.2	(Grey Shale) 101.0													
	End of borehole.					330								

WL in casing
on 26/9/62426.7
16.0Gr. 7%
Sa. 30%
Si. 51%
Cl. 12%Sa. 37%
Si. 56%
Cl. 7%

RECORD OF BOREHOLE NO. 7 BHL36-7 FOUNDATION SECTION

JOB 62-F-86 LOCATION Sta. 284+69 218.5' Lt. of C. Hwy. #401 ORIGINATED BY H.S.
W.P. 104-62 BORING DATE Sept. 27, 1962. COMPILED BY H.S.
DATUM 442.6 BOREHOLE TYPE Washboring CHECKED BY B.K.

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— w _L	PLASTIC LIMIT ——— w _p	WATER CONTENT ——— w	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	(M) DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.				
442.6 0.0	134.9 Groundlevel					450					WL in borehole on 9/10/62 - 134.9
430.6 12.0	131.2										433.6 9.0
	Clayey silt with fine gravel.		1	SS	10	420					Sa. 17 Sl. 48% Cl. 51%
	Firm to stiff.		2	SS	6						
387.6	118.1		3	SS	24	390					
55.0 (16.8)	Sandy silt to silty sand with some gravel.		4	SS	11						Gr. 23 Sa. 65% Sl. 25% Cl. 8%
	Very dense.		5	SS	61						
361.6 81.0 (24.7m)	110.2 Clayey silt with sand, gravel and boulders. (Glacial Till) Very dense.		6	SS	100	360					Gr. 10% Sa. 21% Sl. 59% Cl. 10%
347.6 5.0 (13.3m)	105.9 Weathered Bedrock		6A	RC	-						
338.7 5.7 (15.8m)	104.8 Sound Bedrock (Grey Shale)		7	RC	-						
			8	RC	-						
330.9 11.7 (34.0m)	100.9 End of borehole.		9	RC	-	330					

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

JOB 62-F-86

LOCATION Sta. 288+57 (139' Lt. of E. Hwy. #401)

BH 136-8

ORIGINATED BY H.S.

W.P. 104-62

BORING DATE Oct. 4, 1962.

COMPILED BY H.S.

DATUM 440.1

BOREHOLE TYPE Washboring

CHECKED BY B.K.

SOIL PROFILE			SAMPLES			ELEV. SCALE	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		BLOWS / FOOT			SHEAR STRENGTH P.S.F.				
134.1														
440.1	Groundlevel					440								
437.1	Sand (Fill Material)													
3.0	133.2													
	Desiccated zone - Hard to very stiff.													
426.1														
14.0	129.9													
			1	SS	29									
	Clayey silt with occasional gravel. Firm to stiff.		2	SS	8	410								
			3	SS	9	380								
375.1	114.3													
65.0	Sandy silt with some gravel. Very dense.													
360.1	109.7		4	SS	>100									
80.0	Clayey silt with sand gravel and boulders. (Glacial Till) Very dense.		5	RC	-	350								
342.1	104.3													
98.0	Weathered Bedrock.		6	RC	-									
233.6	101.7													
106.5	Sound Bedrock		7	RC	-									
329.9	(Grey Shale)													
110.2	End of borehole.					320								

WL in borehole on 11/10/62

419.1

21.0

Sa. 1%

Si. 83%

Cl. 16%

Sa. 4%

Si. 73%

Cl. 23%

WL in bore-
hole on 11/10/62
= 419.1
= 21.0Sa. 14
Sl. 83%
Cl. 16%Sa. 4%
Sl. 73%
Cl. 23%

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