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**HYDROGEOLOGICAL INVESTIGATION
AND DESIGN REPORT
HIGHWAY 404 EXTENSION FROM
QUEENSVILLE SIDEROAD TO RAVENSHOE ROAD
TOWN OF EAST GWILLIMBURY
MINISTRY OF TRANSPORTATION, ONTARIO
W.P. 2005-07-00**

Submitted to:
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PART A

**HYDROGEOLOGY INVESTIGATION REPORT
HIGHWAY 404 EXTENSION FROM QUEENSVILLE SIDEROAD TO
RAVENSHOE ROAD
TOWN OF EAST GWILLIMBURY
MINISTRY OF TRANSPORTATION, ONTARIO
W.P. 2005-07-00**



1.0 INTRODUCTION

Golder Associates Ltd. ("Golder Associates") has been retained by AECOM on behalf of Ministry of Transportation, Ontario ("MTO") to provide a hydrogeological impact assessment of the proposed Highway 404 extension from Queensville Sideroad to Ravenshoe Road in East Gwillimbury, Ontario (i.e., the "Site"), shown on the Key Plan, Figure 1 that follows the text of this report.

The terms of reference for the Hydrogeological Assessment are presented in MTO's Request for Streamlined Proposals WP 2005-07-00, Consultant Agreement 2007-E-0034 dated January 2008, under Section 6.8 Foundations Engineering, Part B-Hydrogeological Specialty. The summary of the scope of work is presented in Golder's proposal P81-1069, dated February 22, 2008. An addendum to include hydrogeological and foundation investigation and design services for the proposed stormwater management ("SWM") ponds was outlined in our letter dated November 27, 2009 and approved by AECOM.

This report addresses the detailed hydrogeological investigation for the proposed new bridge structures to carry the Highway 404 Southbound Lanes ("SBL") and Northbound Lanes ("NBL") over Boag Road, the Maskinonge River Tributary Culvert and for the deep cut/high fill areas, and provides hydrogeological and foundation assessment at the stormwater management pond areas. The information contained in this report is for hydrogeological purposes only. The results of the geotechnical foundation investigation and detail design input for the SBL and NBL structures, Maskinonge River Tributary Culvert and deep cut/high fill areas are provided in separate reports. The work was carried out in accordance with Golder's Supplementary Specialty Quality Control Plan for this project dated August 15, 2008.

1.1 Overview and Purpose

The purpose of this hydrogeological assessment is to determine the need for construction dewatering and the potential for temporary and permanent impact to local groundwater and surface water resources as a result of the proposed construction of foundations and deep cuts (including stormwater management ponds). The assessment is based on a program of borehole and monitoring well drilling, in-situ testing, and a desk-top and field survey of existing groundwater and surface water resources.

The site of the proposed overpass structures at Boag Road is located approximately 1 km west of Woodbine Avenue in the Town of East Gwillimbury in the Region of York. Boag Road, an east-west Town of East Gwillimbury road, is currently a low volume, gravel surfaced two-lane road for eastbound and westbound traffic.

The deep cut/high fill areas identified for detail design level investigation along the proposed Highway 404 alignment from Queensville Sideroad to Ravenshoe Road are at the following locations:

Deep Cut/High Fill Area Designation	Station	Maximum Fill Height / Cut Depth
1 (High Fill)	33+900 to 34+160	Fill up to 8 m
2 (Deep Cut)	34+360 to 34+600	Cut up to 8.5 m
3 (Deep Cut)	34+780 to 34+880	Cut up to 4 m
4 (High Fill)	35+000 to 35+150	Fill up to 5 m
5 (Deep Cut)	35+750 to 35+900	Cut up to 5 m
6 (High Fill)	36+870 to 37+150	Fill up to 6 m
7 (Deep Cut)	37+400 to 37+760	Cut up to 6 m
8 (High Fill)	38+200 to 38+500	Fill up to 4 m



1.2 Previous Studies and Available Information

Golder Associates has previously completed various hydrogeological, geotechnical and pavement investigations on the Site as reported in:

- “Draft – Preliminary Pavement Design Report, Agreement # 2005-A-000585, Highway 404 Extension from Green Lane Northerly to Woodbine Avenue, Length 12.5 km and Highway 404 Extension/Bradford Bypass Freeway to Freeway Interchange, Central Region”. Reference No. 04-1181-111, report dated November 2004.
- “Draft – Planning Report Foundation Investigation and Design, Water Crossings, Highway 404 Extension from Green Lane to Highway 12/48”. Reference No. 04-1111-016-7, report dated December 2004.
- “Hydrogeological Assessment, Highway 404, Green Lane to Ravenshoe Road”. Reference No. 04-1111-016-A, report dated August 2005.
- “Preliminary Foundation Investigation and Design Report, Mt. Albert Road Overpasses, Highway 404 Extension from Green Lane to Highway 12/48, Agreement No. 2005-A-000585”. Reference No. 04-1111-016-1, report dated April 2006.
- “Preliminary Foundation Investigation and Design Report, Doane Road Underpass, Highway 404 Extension from Green Lane to Highway 12/48, Agreement No. 2005-A-000585”. Reference No. 04-1111-016-2, report dated April 2006.
- “Preliminary Foundation Investigation and Design Report, Boag Road Overpasses, Highway 404 Extension from Green Lane to Highway 12/48, Agreement No. 2005-A-000585”. Reference No. 04-1111-016-5, report dated April 2006.
- “Preliminary Foundation Investigation and Design Report, Woodbine Avenue Underpass, Highway 404 Extension from Green Lane to Highway 12/48, Agreement No. 2005-A-000585”. Reference No. 04-1111-016-6, report dated April 2006.
- “Highway 404 Extension (Green Lane to Woodbine Avenue) – Groundwater Protection Plan and Well Monitoring Program”. Reference No. 04-1111-016-A. Revised November 2006, report dated July 2006.
- “Preliminary Foundation Investigation and Design Report, Queensville Road Underpass, Highway 404 Extension from Green Lane to Highway 12/48, Agreement No. 2005-A-000585”. Reference No. 04-1111-016-3, report dated October 2006.

Pertinent information from these previous investigations has been included in this report, where applicable.

AECOM also provided to Golder Associates the proposed Highway 404 alignment, profile and cross-section drawings (dated April 21 and November 26, 2009) for the proposed Highway 404 extension from Queensville Sideroad to Ravenshoe Road.



2.0 INVESTIGATION PROCEDURES

2.1 Scope of Work

Golder Associates completed a foundations hydrogeological investigation in ten areas of the Site identified to potentially require construction dewatering to facilitate the installation of the proposed bridge structures over Boag Road (SBL and NBL) and eight other deep cut/high fill areas. The borehole drilling activities were completed concurrently with the geotechnical field investigation for foundations, and occurred between February 10 and 24, 2009 for the SBL Boag Road Structure; between February 17 and 26, 2009 for the NBL Boag Road Structure; and between February 18 and June 9, 2009 for the deep cut/high fill areas as follows:

- Six (6) boreholes (i.e., BR-1 through BR-6), with two completed as monitoring wells (i.e., BR-2 and BR-3) at the SBL Boag Road Structure; six (6) boreholes (i.e., BR-7 through BR-12), with 2 completed as monitoring wells (i.e., BR-8 and BR-9) at the NBL Boag Road Structure; and forty-three (43) boreholes (i.e., HD1-1 to HD1-3, C2-3 to C2-5, HD-1A/1B, HD2-2 to HD2-5, HD3-1 to HD3-3, HD4-1 to HD4-3, HD5-1 to HD5-4, HD6-1 to HD6-6, HD7-1 to HD7-8, and HD8-1 to HD8-7), with eighteen (18) completed as monitoring wells (i.e., HD1-1, HD1-2, C2-4, HD2-1A, HD2-1B, HD2-4, HD3-1, HD4-3, HD5-2, HD5-3, HD6-3, HD6-6, HD7-1, HD7-3, HD7-6, HD7-7, HD8-1, HD8-6) in the deep cut/high fill areas.

Hydrogeological field activities were also completed between March 12, 2009 and February 9, 2010 at the proposed Boag Road Structures, the deep cut/high fill areas and stormwater management pond areas and included:

- Drilling twelve (12) boreholes (i.e., SWM6-BH1, SWM6-BH2, SWM7-BH1, SWM7-BH2, Holborn-BH1, Holborn-BH2, SWM8-BH1 to SWM8-BH4, SWM9-BH1, SWM9-BH2), with two boreholes completed as monitoring wells (i.e., SWM8-BH3 and SWM8-BH4) at the proposed stormwater management pond locations;
- Collection and assessment of water levels in the monitoring well network;
- Sampling and chemical analysis of groundwater from a monitoring well at each of the Boag Road Structure locations, the proposed culvert location and the four deep cut locations (i.e., BR-3, BR-8, HD2-1A, HD3-1, HD5-2, HD7-1, C2-1);
- Sampling and chemical analysis of one surface water sample at the proposed culvert location;
- In-situ hydraulic testing in the form of rising head tests in selected monitoring wells (i.e., BR-2, BR-9, HD2-1A, HD2-1B, HD2-4, HD4-3, HD5-2, HD6-3, HD6-6, HD7-3 and HD8-1);
- A windshield (drive-by) reconnaissance of publicly accessible areas within approximately 100 m to 200 m of the alignment and a walk-over of the proposed alignment (where land-owner permission was granted) on November 17 and 18, 2008 as part of the Secondary Source Groundwater Investigation ("SSGI", see Section 2.4); and
- Voluntary private water well surveys for residents located within approximately 250 m of cuts greater than 3 m (including the Boag Road Structures), located in areas of reported high aquifer vulnerability and within 250 m of the edge of the proposed highway right-of-way, and residents located in the vicinity of proposed stormwater management ponds.



Based on the collected data, an assessment of the need for construction dewatering and a Permit To Take Water ("PTTW") from the Ontario Ministry of the Environment ("MOE"), together with an assessment of the impact of the proposed construction activities on existing groundwater and surface water resources, have been completed. A proposed monitoring program of the private water wells is recommended. These assessments and recommended monitoring program have been included in Part B of this report.

2.2 Drilling and Monitoring Well Installation

2.2.1 Boag Road Structures

The drilling program for the proposed Hwy 404 SBL Boag Road and NBL Boag Road Structures was carried out between February 10 and 24, 2009, and February 17 and 26, 2009, respectively, at which time twelve (12) boreholes (Borehole BR-1 to BR-12) were advanced at the approximate locations shown on Drawings A1 and B1 for the SBL and NBL, respectively in Appendices A and B. Two boreholes (Boreholes 503 and 504) were drilled as part of the previous preliminary investigation at the NBL site (Golder Project No. 04-1111-016-5, dated April 2006) and the approximate locations are also shown on Drawing B1 in Appendix B.

The field investigation was carried out using a track-mounted drill rig supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The boreholes were advanced using 108 mm outside diameter solid stem augers (for the approach embankment holes) and 108 mm inside diameter hollow stem augers (for the abutment holes) to depths ranging from 5.2 m to 28.0 m below existing ground surface ("mbgs") at the SBL structure and ranging from 4.4 m to 18.9 mbgs at the NBL structure. Soil samples were 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 D 1586).

The groundwater conditions in the open boreholes were observed throughout the drilling operations and piezometers were installed in Boreholes BR-2 and BR-3 at the SBL structure and in Boreholes BR-8 and BR-9 at the NBL structure to monitor the groundwater levels at the Site. The piezometers were constructed of nominal 50 mm diameter PVC pipe, with a slotted screen sealed at a selected depth within the borehole. The boreholes and annulus surrounding the well pipe 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 presented on the Record of Borehole sheets in Appendices A and B for the SBL and NBL, respectively.

The field work was monitored 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 Associates' laboratory in Mississauga for further examination and testing. All of the laboratory tests were carried out to MTO and/or ASTM Standards as appropriate. Classification testing (water content, Atterberg Limits and grain size distribution) was carried out on select soil samples. Organic content testing was carried out on one sample from Borehole BR-2. The results of the laboratory tests are presented in the respective Record of Borehole sheets and laboratory test sheets in Appendices A and B for the SBL and NBL respectively.

The borehole locations were surveyed in the field by J.D. Barnes Ltd. prior to the drilling operations. The as-drilled borehole locations presented in the Record of Borehole sheets and shown on Drawings A1 and B1 are referenced to NAD83 MTM co-ordinate system and ground surface elevations are referenced to geodetic datum.



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. Subsoil conditions will vary between and beyond the borehole locations. The inferred stratigraphy based on the results of the boreholes is shown on Drawings A2 and B2 in Appendices A and B for the SBL and NBL respectively.

2.2.2 Deep Cut / High Fill Areas

The drilling program for the deep cut / high fill areas (including the Maskinonge River Tributary Culvert) for this assignment along the proposed Hwy 404 alignment between Queensville Sideroad and Ravenshoe Road was carried out between February 18 and June 9, 2009, at which time boreholes were drilled in eight areas at the approximate locations shown on Drawings C1 to C8 presented in Appendix C, as follows;

Deep Cut / High Fill Area Designation	Station	Boreholes Advanced	Depth
1 (High Fill) ¹	33+900 to 34+160	9 (HD1-1 to HD1-3, and C2-1 to C2-6)	5.2 m to 9.8 m
2 (Deep Cut)	34+360 to 34+600	6 (HD2-1A/1B, HD2-2 to HD2-5)	2.1 m to 6.7 m
3 (Deep Cut)	34+780 to 34+880	3 (HD3-1 to HD3-3)	6.6 m to 6.7 m
4 (High Fill)	35+000 to 35+150	3 (HD4-1 to HD4-3)	5.0 m to 8.2 m
5 (Deep Cut)	35+750 to 35+900	4 (HD5-1 to HD5-4)	5.2 m to 9.8 m
6 (High Fill)	36+870 to 37+150	6 (HD6-1 to HD6-6)	4.2 m to 6.7 m
7 (Deep Cut)	37+400 to 37+760	8 (HD7-1 to HD7-8)	6.6 m to 9.8 m
8 (High Fill)	38+200 to 38+500	7 (HD8-1 to HD8-7)	1.5 m to 6.7 m

¹ Maskinonge River Tributary Culvert is located within the footprint of High Fill Area 1.

The field investigation was carried out using a track-mounted drill rig supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The boreholes were advanced using 108 mm outside diameter solid stem augers except Borehole HD8-3 which was drilled using a hand auger. Soil samples were obtained at 0.75 m and 1.5 m intervals of depth using 50 mm outside diameter split-spoon samplers driven by automatic and manual cat-head hammers in accordance with the Standard Penetration Test ("SPT") procedure (ASTM D 1586). Select samples of the cohesive soils were obtained using a 76 mm outside diameter thin walled Shelby Tube.

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 Site. The well installations and backfilling of open boreholes were carried out following the procedures described in Section 2.2.1. The piezometer installation details and water level readings are described on the Record of Borehole sheets in Appendix C.

The field work and laboratory testing programs were carried out following the protocols outlined in Section 2.2.1. The results of the classification testing are presented in the respective Record of Borehole sheets and laboratory test sheets in Appendix C of this report. Organic content testing was carried out on selected samples.



The borehole locations were surveyed in the field by J.D. Barnes Ltd. prior to the drilling operations. The as-drilled borehole locations presented on the Record of Borehole sheets and shown on Drawings C1 to C8 in Appendix C are referenced to NAD83 MTM co-ordinate system and the ground surface elevations are referenced to geodetic datum.

The stratigraphic boundaries shown on the Record of Borehole sheets are inferred and represent transitions between soil types rather than exact planes of geological change as explained in Section 2.2.1. The inferred soil stratigraphy based on the results of the boreholes is shown on Drawings C1 to C8 for each Deep Cut / High Fill Area 1 to 8 respectively.

2.2.3 Stormwater Management Ponds

The drilling program for the five stormwater management ponds was carried between March 12, 2009 and February 9, 2010, at which time twelve boreholes were advanced: ten boreholes (SWM6-BH1, SWM6-BH2, SWM7-BH1, SWM7-BH2, Holborn-BH1, Holborn-BH2, SWM8-BH1, SWM8-BH2, SWM9-BH1 and SWM9-BH2) were drilled at the proposed SWM Pond locations as part of the Pavement Investigation scope of work; and two boreholes (SWM8-BH3 and SWM8-BH4) were drilled as part of the foundations addendum work for SWM Pond 8 and the associated drop structure located near the Maskinonge River at Station 36+458. The Record of Borehole sheets and laboratory results from the Pavement Investigation have been supplemented with additional testing and reformatted for consistency with MTO Foundations standards. The Record of Borehole sheets provided in Appendix D of this report supersede the borehole logs provided in the Pavement Investigation Report for this project. Relevant boreholes from the deep cut/high fill investigations that are located near the stormwater ponds are also used to supplement the SWM Pond boreholes. The approximate locations of the boreholes at each SWM Pond area are shown on Drawings D1 to D5 presented in Appendix D, as follows:

Stormwater Management Pond Area Designation	Boreholes Advanced	Approx. Station	Borehole Depth (m)
SWM Pond 6	SWM6-BH1, SWM6-BH2 and HD1-1	33+910 to 33+950	3.5 - 5.2
SWM Pond 7	SWM7-BH1 and SWM7-BH2	34+640 to 34+730	3.5
Holborn SWM Pond	Holborn-BH1, Holborn-BH2 and HD4-2	35+060 to 35+130	3.5 – 5.2
SWM Pond 8	SWM8-BH1 to SWM8-BH4	36+260 to 36+420	3.5 – 11.3
SWM Pond 9	SWM9-BH1 and SWM9-BH2	38+610 to 38+740	4.3

The field investigations were carried out using a track-mounted drill rig supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The boreholes were advanced using 108 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 automatic and manual cat-head hammers in accordance with the Standard Penetration Test ("SPT") procedure (ASTM D1586). Auger samples were also taken at shallow depths.

The groundwater conditions in the open boreholes were observed throughout the drilling operations and piezometers were installed in select boreholes to monitor the groundwater level. The well installations and backfilling of open boreholes were carried out following the procedures described in Section 2.2.1. The



piezometer installation details and water level readings are described on the Record of Borehole sheets in Appendix D.

The field work and laboratory testing programs were carried out following the protocols outlined in Section 2.2.1. The results of the classification testing are presented in the respective Record of Borehole sheets and laboratory test sheets in Appendix D of this report.

The borehole locations and ground surface elevations for the relevant Deep Cut / High Fill Area boreholes (HD1-1 and HD4-2) and Boreholes SWM8-BH3 and SWM8-BH4 were surveyed in the field by J.D. Barnes Ltd. prior to the drilling operations. The remaining SWM Pond boreholes performed as part of the pavement investigation terms of references were located in the field by members of Golder's technical staff using measured offsets from the staked centreline of the proposed Highway 404 extension that was surveyed by J.D. Barnes Ltd. The ground surface elevations were estimated from the digital terrain model provided by AECOM. The as-drilled borehole locations presented on the Record of Borehole sheets and shown on Drawings D1 to D5 in Appendix D are referenced to MTM NAD83 co-ordinate system and the ground surface elevations are referenced to geodetic datum.

2.2.3.1 Subsoil Conditions

The detailed subsurface 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 D1 to D5 for SWM Pond 6, 7, Holborn, 8 and 9, respectively.

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. Subsoil conditions will vary between and beyond the borehole locations. The inferred soil stratigraphy, based on the results of the boreholes, are shown on Drawings D1 to D5 in Appendices D1 to D5 for each SWM Pond.

A detailed description of the site and subsurface conditions encountered in the boreholes advanced at each SWM Pond are provided in the following sections.

2.2.3.1.1 Stormwater Management Pond 6

The proposed SWM Pond 6 area is located on the south side of a shallow sloping valley that is currently grass covered east of the proposed High Fill Area 1. A tributary water course to the Maskinonge River flows from west to east along the valley located to the north of the pond area. The existing ground surface within the pond footprint ranges from about Elevation 256 m at the southwest corner to about Elevation 250 m at the northeast corner.

In general, the subsoil conditions at the site consist of a surficial layer of topsoil / re-worked clayey silt containing organics, underlain by a deposit of clayey silt till containing interlayers of sandy silt. A detailed description of the major soil layers and shallow groundwater conditions is provided below.

A layer of topsoil / reworked clayey silt containing organics was encountered at the surface of all boreholes advanced at this location (SWM6-BH1, SWM6-BH2, and HD1-1) and is 0.1 m to 0.3 m thick.

A layer of clayey silt was encountered below the topsoil / reworked clayey silt in Borehole HD1-1. The top of this layer was encountered at a depth of 0.1 m below ground surface (Elevation 253.7 m) and is 1.4 m thick. The



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measured SPT 'N'-values within the clayey silt are 6 and 11, suggesting a firm to stiff consistency. An Atterberg limits test carried out on one sample of the clayey silt measured a liquid limit of 22 percent, a plastic limit of 15 percent and a plasticity index of 7 percent. The results of the Atterberg limits testing are shown on Figure D1-1 and indicate that the material is a clayey silt of low plasticity. The measured water content on a sample of the clayey silt is 20 percent.

A layer of sandy silt till containing some clay, trace gravel was encountered below the topsoil in Borehole SWM6-BH1 at a depth of 0.3 m below ground surface (Elevation 251.5 m) and is 0.5 m thick.

A deposit of clayey silt till was encountered below the sandy silt till in Borehole SWM6-BH1, below the topsoil in Borehole SWM6-BH2 and below the clayey silt in Borehole HD1-1. The surface of this deposit was encountered at depths ranging from 0.3 m to 1.5 m below ground surface (Elevation 256.3 m to 251.1 m) and is 0.6 m to 3.7 m thick. This deposit typically contains trace to some sand, trace gravel and oxidation staining, and silty clay and sandy silt interlayers. Boreholes SWM6-BH1 and HD1-1 were terminated within the clayey silt till deposit at depths of 3.5 m and 5.2 m below ground surface (Elevation 248.3 m and 248.6 m), respectively. The measured SPT 'N'-values within the clayey silt till deposit range from 3 to 35 blows per 0.3 m of penetration, suggesting a soft to hard consistency. The results of two grain size distribution tests carried out on samples of the clayey silt till are shown on Figure D1-2. Atterberg limits testing carried out on two samples of the clayey silt till measured liquid limits of 19 and 21 percent, plastic limits of 12 and 13 percent and plasticity indices of 6 and 9 percent. The results of the Atterberg limits testing are shown on Figure D1-3 and indicate that the material is a clayey silt of low plasticity. The measured water content of six samples of the clayey silt till ranges from 12 to 25 percent.

A layer of sandy silt was encountered within the clayey silt till deposit in Boreholes SWM6-BH1 and SWM6-BH2 at depths of 1.4 m and 2.9 m below ground surface (Elevation 250.5 m and 253.7 m), respectively. The sandy silt layer is 1.5 m thick in SWM6-BH1 and SWM6-BH2 penetrated 0.6 m into this layer and was terminated at a depth of 3.5 m below ground surface (Elevation 253.1 m). The measured SPT 'N'-values within the sandy silt layer range from 9 to 21 blows per 0.3 m of penetration, indicating a loose to compact relative density. The measured water content of two samples of the sandy silt is 19 and 20 percent.

Water levels were noted within the boreholes during and after the drilling operations. A piezometer was sealed within the clayey silt till deposit in Borehole HD1-1 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 are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
SWM6-BH1	251.8	1.1	250.7	June 3, 2009	Open Borehole
SWM6-BH2	256.6	2.3	254.3	June 3, 2009	Open Borehole
HD1-1	253.8	5.2	248.6	June 5, 2009	Open Borehole Piezometer
		1.0	252.8	June 12, 2009	

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.



2.2.3.1.2 Stormwater Management Pond 7

The proposed SWM Pond 7 area is located between Deep Cut Areas 2 and 3 on the east side of the proposed highway extension. The existing ground surface within the proposed pond footprint slopes downward from the west (Elevation 251 m) to the east (Elevation 246 m) and is currently grass covered.

In general, the subsoil conditions encountered at the site consist of a surficial layer of topsoil underlain by a deposit of clayey silt till. A description of the major soils layers and shallow groundwater conditions is provided below.

Topsoil was encountered at the ground surface of Boreholes SWM7-BH1 and SWM7-BH2 and is 0.1 m and 0.2 m thick, respectively.

A deposit of clayey silt till with sand, trace gravel was encountered below the topsoil in both boreholes advanced in this area. Boreholes SWM7-BH1 and SWM7-BH2 penetrated 3.4 m and 3.3 m into this deposit and were terminated at a depth of 3.5 m below ground surface (Elevation 245.3 m and 242.5 m, respectively). The measured SPT 'N'-values within the clayey silt till range between 8 and 21 blows per 0.3 m of penetration, suggesting a firm to very stiff consistency. The results of two grain size distribution tests carried out on samples of the clayey silt till are shown on Figure D2-1. Atterberg limits testing carried out on two samples of the clayey silt till measured liquid limits of 17 and 22 percent, plastic limits of 12 and 13 percent and plasticity indices of 5 and 9 percent. The results of the Atterberg limits testing are shown on Figure D2-2 and indicate that the material is a clayey silt of low plasticity. The measured water contents of six samples of the clayey silt till range from 12 to 24 percent.

Water levels were noted within the boreholes during and after the drilling operations. The water levels recorded in the boreholes are summarized below:

Borehole	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
SWM7-BH1	248.8	1.5	247.3	Mar. 23, 2009	Open Borehole
SWM7-BH2	246.0	Dry	-	Mar. 23, 2009	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.

2.2.3.1.3 Holborn Stormwater Management Pond

The proposed Holborn SWM Pond is located in a farm field west of the proposed High Fill Area 4 and north of the existing Holborn Road. The area is generally flat-lying and the existing ground surface ranges from about Elevation 248 m to 249 m.

In general, the subsoil conditions encountered at the site consist of a surficial layer of topsoil or reworked clayey silt containing organics, underlain by a clayey silt till stratum or a sandy silt to silt and sand till deposit in places underlain by or interlayered with silty sand. In Borehole HD4-2, the till deposit is underlain by a deposit of clayey silt. A detailed description of the major soil layers and shallow groundwater conditions encountered is provided below.



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A surficial layer of topsoil / reworked clayey silt containing organics was encountered at the ground surface in all boreholes advanced at this location (Borehole Holborn-BH1, Holborn-BH2 and HD4-2) and is 0.2 m to 0.3 m thick.

An upper stratum of clayey silt to silty clay containing organics was encountered below the topsoil / reworked clayey silt in all boreholes advanced in this area. This stratum typically contains trace to some sand, trace gravel, oxidation staining and clay interlayers. Organics were present in this layer in Borehole Holborn-BH1 to a depth of 1.4 m below ground surface (Elevation 247.1 m). The surface of this stratum was encountered at depths between 0.2 m to 0.3 m below ground surface (Elevation 249.3 m to 248.3 m) and the stratum is 0.5 m to 1.9 m thick. The measured SPT 'N'-values within the clayey silt to silty clay stratum range from 4 to 8 blows per 0.3 m of penetration, suggesting a soft to stiff (generating firm) consistency. An Atterberg limits test carried out on a sample of the silty clay stratum measured a liquid limit of 48 percent, a plastic limit of 22 percent and a plasticity index of 26 percent as shown on Figure D3-1, indicating that the material is a silty clay of medium plasticity. An Atterberg limits test carried out on a clay interlayer within the silty clay to clayey silt stratum measured a liquid limit of 78 percent, a plastic limit of 28 percent and a plasticity index of 50 percent as shown on Figure D3-2, indicating that the clay interlayer is of high plasticity. The measured water content of six samples of the upper stratum of clayey silt to silty clay ranges from 27 to 39 percent.

A deposit of clayey silt till was encountered below the upper stratum of clayey silt to silty clay in Boreholes Holborn-BH1 and Holborn-BH2. This deposit typically contains some sand and trace gravel. The surface of this deposit was encountered at depths of 2.1 m and 1.4 m below ground surface (Elevation 246.4 m and 248.1 m) and is 0.8 and 0.7 m thick in Boreholes Holborn-BH1 and Holborn-BH2, respectively. Two measured SPT 'N'-values within the clayey silt till are 5 and 14 blows per 0.3 m of penetration, suggesting a firm to stiff consistency. The results of one grain size distribution test carried out on a sample of the clayey silt till are presented on Figure D3-3. The measured water content of one sample of the clayey silt till is 14 percent.

A deposit of sandy silt till to sand and silt till was encountered below the clayey silt stratum at a depth of 0.8 m below ground surface (Elevation 248.2 m) in Borehole HD4-2 and is 3.3 m thick. This deposit contains trace clay, trace gravel, clayey silt interlayers, cobbles and boulders. A 0.5 m thick layer of silty sand was encountered within the till deposit at a depth of 3.1 m below ground surface (Elevation 246.0 m). The measured SPT 'N'-values within the sandy silt till to sand and silt till range from 10 to 43 blows per 0.3 m of penetration, indicating a loose to dense relative density. The result of one grain size distribution test carried out on a sample of the sandy silt till is presented on Figure D3-4. An Atterberg limits test carried out on a sample of a clayey silt lens within the sandy silt till deposit measured a liquid limit of 17 percent, a plastic limit of 11 percent and a plasticity index of 6 percent. The result of the Atterberg limits test are shown on Figure D3-5 and indicates that the clayey silt lens is of low plasticity. The measured water content of two samples of the sandy silt to sand and silt till are 10 and 11 percent.

A layer of silty sand was encountered underlying the clayey silt till deposit in Boreholes Holborn-BH1 and Holborn-BH2 at depths of 2.9 m and 2.1 m below ground surface (Elevation 245.6 m and 247.4 m), respectively, and within the sandy silt till to sand and silt till deposit in Borehole HD4-2 as noted above. Boreholes Holborn-BH1 and Holborn-BH2 penetrated 0.6 m and 1.4 m into the silty sand layer and were terminated at a depth of 3.5 m below ground surface (Elevation 245.0 m and 246.0 m respectively). The measured SPT 'N'-values within the silty sand range from 25 to 50 blows per 0.3 m of penetration, indicating a compact to dense relative density. The measured water contents of two samples of the silty sand are 8 and 17 percent.



A lower stratum of clayey silt was encountered below the sand and silt till in Borehole HD4-2. The surface of this layer was encountered at a depth of 4.1 m below ground surface (Elevation 244.9 m). Borehole HD4-2 penetrated 1.1 m into the clayey silt stratum and was terminated at a depth of 5.2 m below ground surface (Elevation 243.8 m). Two measured SPT 'N'-values within the clayey silt are 31 and 51 blows per 0.3 m of penetration, suggesting a hard consistency. The measured water content of one sample of the clayey silt is 20 percent.

Water levels were noted within the boreholes during and after the drilling operations. The water levels recorded in the boreholes are summarized below:

Borehole	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
Holborn-BH1	248.5	Dry	-	June 5, 2009	Open Borehole
Holborn-BH2	249.5	Dry	-	June 5, 2009	Open Borehole
HD4-2	249.0	5.2	243.8	June 8, 2009	Open Borehole
		1.4	247.6	June 9, 2009	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.

2.2.3.1.4 Stormwater Management Pond 8

The proposed SWM Pond 8 is located on a gently sloping grass covered field on the west side of the proposed highway extension. The existing ground surface within the proposed pond footprint ranges from about Elevation 247 m at the northwest corner to about Elevation 241 m at the southeast corner.

In general, the subsoil conditions encountered at the site consist of a surficial layer of topsoil underlain by a deposit of clayey silt till in turn underlain by interlayered deposits of sandy silt till, silt, sandy silt, and sand. A detailed description of the major soil layers and shallow groundwater conditions encountered is provided below.

Topsoil was encountered at the ground surface of all boreholes (SWM8-BH1 to SWM8-BH3) advanced at this pond location and is 0.3 m to 0.4 m thick.

A deposit of clayey silt till containing variable amounts of sand and oxidation staining, and silty sand and silty clay interlayers was encountered below the topsoil. Cobbles and boulders were inferred to be present within this deposit by the grinding of augers as they advanced through the deposit. The surface of this deposit was encountered at depths between 0.3 m and 0.4 m below ground surface (Elevation 244.1 m to 242.8 m) and the deposit is 1.1 m to 2.4 m thick. In Borehole SWM8-BH3, the clayey silt till deposit was also encountered at a depth of 6.4 m below ground surface (Elevation 236.8 m) and is 2.3 m thick. The measured SPT 'N'-values within this deposit range from 3 to 49 blows per 0.3 m of penetration, suggesting a soft to hard consistency. The results of two grain size distribution tests carried out on samples of the clayey silt till are presented on Figure D4-1. Atterberg limits testing carried out on three samples of the clayey silt till measured liquid limits ranging from 20 to 29 percent, plastic limits of 12 to 14 percent and plasticity indices of 7 to 14 percent. The results of the Atterberg limits testing are shown on Figure D4-2 and indicate that the material is a clayey silt of low plasticity. The measured water contents of six samples of the clayey silt till range from 13 to 36 percent.



A 0.8 m thick deposit of sandy silt till was encountered underlying the clayey silt till in Borehole SWM8-BH1 at a depth of 2.1 m below ground surface (Elevation 242.4 m). A measured SPT 'N'-value within the sandy silt till is 14 blows per 0.3 m of penetration, indicating a compact relative density. The measured water content of one sample of the sandy silt till is 22 percent.

A layer of sandy silt to silt was encountered in Borehole SWM8-BH2 and SWM8-BH3 at depths of 1.4 m and 2.7 m below ground surface (Elevation 242.2 m and 240.4 m) and the layer is 0.7 m and 0.3 m thick, respectively, at these boreholes. Two measured SPT 'N'-values within the sandy silt to silt layer are 18 and 23 blows per 0.3 m of penetration, indicating a compact relative density. The result of one grain size distribution test carried out on a sample of the silt portion of the layer is presented on Figure D4-3. The measured water content of one sample of the silt is 19 percent.

A stratum of clayey silt was encountered below the sandy silt till and silt in Boreholes SWM8-BH1 and SWM8-BH2 at depths of 2.9 m and 2.1 m below ground surface (Elevation 241.6 m to 241.5 m), respectively. Boreholes SWM8-BH1 and SWM8-BH2 penetrated 0.6 m and 1.4 m into the clayey silt and were terminated at a depth of 3.5 m below ground surface (Elevation 241.0 m and 240.1 m, respectively). The measured SPT 'N'-values measured within the clayey silt range from 17 to 18 blows per 0.3 m of penetration, suggesting a very stiff consistency. The measured water content of one sample of the clayey silt is 27 percent.

A layer of sand was encountered below the sandy silt to silt layer in Borehole SWM8-BH3 at a depth of 3.0 m below ground surface (Elevation 240.1 m) and is 3.4 m thick. The measured SPT 'N'-values within the sand layer range from 28 to 106 blows per 0.3 m of penetration, indicating a compact to very dense relative density. The result of one grain size distribution test carried out on a sample of the sand is presented on Figure D4-4. The measured water content of two samples of the sand is 3 and 8 percent.

A deposit of silt was encountered below the lower portion of the clayey silt till stratum in Borehole SWM8-BH3 at a depth of 8.7 m below ground surface (Elevation 234.4 m). Borehole SWM8-BH3 penetrated 2.6 m into the silt deposit and was terminated at a depth of 11.3 m below ground surface (Elevation 231.8 m). This layer contains some clay and sand, wet silty sand interlayers and silty clay seams. The measured SPT 'N'-values within the silt deposit are 57 and 79 blows per 0.3 m of penetration, indicating a very dense relative density. The measured water content of a sample of the silt is 23 percent.

Water levels were noted within the boreholes during and after the drilling operations. A piezometer was sealed within the sand, lower clayey silt till and silt layers in Borehole SWM8-BH3 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 are summarized below:



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Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
SWM8-BH1	244.5	1.2	243.3	June 15, 2009	Open Borehole
SWM8-BH2	243.6	Dry	-	June 15, 2009	Open Borehole
SWM8-BH3	243.1	Dry 4.3	- 238.8	Feb. 9, 2010 Mar. 11, 2010	Piezometer

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.

2.2.3.1.5 Drop Structure at Station 36+458

Associated with SWM Pond 8, there is a proposed drop structure located about 200 m east of the pond which is part of the stormwater outlet drainage network that empties into the Maskinonge River. The proposed drop structure is located at the crest of the river valley at about Elevation 239 m and the adjacent Maskinonge River valley bottom is at about Elevation 234 m.

In general, the subsoil conditions encountered at the proposed drop structure (SWM8-BH4) consist of a surficial layer of topsoil underlain by a deposit of clayey silt till. The clayey silt till is underlain by successive layers of clayey silt, silty sand and sand. A detailed description of the major soil layers and shallow groundwater conditions is provided below.

A 0.2 m thick layer of topsoil was encountered at the ground surface. Underlying the topsoil, a 2 m thick stratum of clayey silt till containing variable amounts of sand, cobbles and boulders was encountered at approximately Elevation 238.5 m. The measured SPT 'N'-values within the clayey silt till deposit range from 11 to 68 blows per 0.3 m of penetration, suggesting a stiff to hard consistency. The result of one grain size distribution test carried out on a sample of the clayey silt till is presented on Figure D4-5. An Atterberg limits test carried out on a sample of the clayey silt till measured a liquid limit of 19, a plastic limit of 12, and a plasticity index of 7 percent as shown on Figure D4-6, indicating that the material is of low plasticity. The measured water content of three samples of the clayey silt till ranges from 8 to 29 percent.

An upper stratum of clayey silt was encountered below the clayey silt till in SWM8-BH4 at a depth of 2.2 m (Elevation 236.5 m) and is 2 m thick. The measured SPT 'N'-values range from 29 to 41 blows per 0.3 m of penetration, suggesting a very stiff to hard consistency. The measured water content of two samples of the clayey silt are 23 and 24 percent.

Layers of silty sand and sand were penetrated below the upper clayey silt stratum at a depth of 4.2 m below existing ground surface (Elevation 234.5 m) and the combined thickness of the layers is 4.6 m. The measured SPT 'N'-values within the silty sand to sand layer range from 31 to 67 blows per 0.3 m of penetration indicating a dense to very dense relative density. The results of two grain size distribution tests carried out on samples of the silty sand layer are presented on Figure D4-7. The measured water content of four samples of the silty sand and sand range from 11 to 15 percent.

A lower stratum of clayey silt was encountered below the sand layer in Borehole SWM8-BH4 at a depth of 8.8 m below ground surface (Elevation 229.9 m). Borehole SWM8-BH4 penetrated 2.5 m into the clayey silt layer and



was terminated at a depth of 11.3 m below ground surface (Elevation 227.4 m). The clayey silt layer contains some sand, trace gravel and silty sand and silty clay interlayers. Two measured SPT 'N'-values within the clayey silt layer are 20 and 87 blows per 0.3 m of penetration, suggesting a very stiff to hard consistency. The results of one grain size distribution test carried out on a sample of the clayey silt are presented on Figure D4-8. Atterberg limits testing performed on a sample of the clayey silt measured a liquid limit of 26 percent, a plastic limit of 14 percent and a plasticity index of 12 percent. The results of the Atterberg limits testing are presented on Figure D4-9 and indicate that the material is a clayey silt of low plasticity. The measured water content of two samples of the clayey silt are 14 and 21 percent.

A piezometer was sealed within the upper clayey silt and silty sand to sand layers in Borehole SWM8-BH4 to permit monitoring of the groundwater level. Details of the piezometer installation are shown on the Record of Borehole sheets in Appendix D. The water levels recorded in the piezometer are summarized below:

Borehole / Piezometer	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
SWM8-BH4	238.7	6.7	232.0	Feb. 9, 2010	Piezometer
		6.2	232.5	Mar. 11, 2010	

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.

2.2.3.1.6 Stormwater Management Pond 9

The proposed SWM Pond 9 is located on relatively flat ground that is currently covered with grass and tree-cover in places. The existing ground surface ranges from approximately Elevation 229 m to 230 m.

In general, the subsoil conditions consist of a surficial layer of topsoil underlain by glacial till deposits consisting of silty clay to clayey silt and silty sand to sand and silt. A detailed description of the major soil layers and shallow groundwater conditions is provided below.

Topsoil was encountered at the ground surface in Boreholes SWM9-BH1 and SWM9-BH2 advanced at this location and is 0.3 m thick.

A deposit of silty clay till to clayey silt till was encountered below the topsoil in Boreholes SWM9-BH1 and SWM9-BH2 at a depth of 0.3 m below ground surface (Elevation 229.3 m and 228.5 m, respectively). Boreholes SWM9-BH1 and SWM9-BH2 were terminated within the silty clay till to clayey silt till deposit at a depth of 4.3 m below ground surface (Elevation 225.3 m and 224.5 m, respectively). The measured SPT 'N'-values recorded within the silty clay to clayey silt till range from 10 to 28 blows per 0.3 m of penetration, suggesting a stiff to very stiff consistency. The result of one grain size distribution test carried out on a sample of the silty clay till to clayey silt till is presented on Figure D5-1. The measured water content of five samples of the silty clay till to clayey silt till ranges from 15 to 23 percent.

A layer of sandy silt till to sand and silt till containing some clay and trace gravel was encountered within the silty clay to clayey silt till in Borehole SWM9-BH1 at a depth of 1.4 m below ground surface (Elevation 228.2 m) and is 0.7 m thick. The measured SPT 'N'-value within the sandy silt till to sand and silt till is 16 blows per 0.3 m of



penetration, indicating a compact relative density. The result of a grain size distribution test carried out on a sample of the sandy silt till to sand and silt till is presented on Figure D5-2. The measured water content of one sample of the sandy silt till to sand and silt till is 11 percent.

Water levels were noted within the boreholes during and after the drilling operations. The water levels recorded in the boreholes are summarized below:

Borehole	Ground Surface Elevation (m)	Depth Below Ground Surface to Water Level (m)	Groundwater Level Elevation (m)	Date	Notes
SWM9-BH1	229.6	Dry	-	Mar. 13, 2009	Open Borehole
SWM9-BH2	228.8	1.8	227.0	Mar. 12, 2009	Open Borehole

It should be noted that groundwater levels will fluctuate seasonally and are expected to rise during wet periods of the year.

2.3 Groundwater Levels and Water Sampling

Water levels were measured in the monitoring wells, where possible, on March 12, April 2, and June 12, 2009 and are summarized in Table E-1, (Appendix E). Limited water levels were measured in two monitoring wells (SWM8-BH3 and SWM8-BH4) on March 11, 2010. Water level readings taken in the piezometers on June 12, 2009 or March 11, 2010 are shown on the Record of Borehole sheets (Appendices A, B, C and D).

The hydraulic conductivity of selected strata was estimated using the Hazen Equation (Freeze and Cherry, 1979) based on grain size distribution curve data (presented in Appendices A, B and C) for selected soil samples recovered during the drilling program. In addition, a rising head test was performed in each of the monitoring wells installed in Boreholes BR-2, BR-9, HD2-1A, HD2-1B, HD2-4, HD4-3, HD5-2, HD6-3, HD6-6, HD7-3 and HD8-1, between March 12 and April 2, 2009. The water level in each monitoring well was lowered by purging with a dedicated Waterra footvalve and tubing, and the resulting water level recovery with time was recorded and the results are summarized in Section 4.0.

Groundwater samples were collected on January 7, 2010 from monitoring wells at each of the Boag Road Structure locations, the proposed Maskinonge River Tributary culvert location and the four deep cut locations (i.e., Boreholes BR-3, BR-8, C2-1, HD2-1A, HD3-1, HD5-2, and HD7-1). Approximately one well volume was purged from each of the wells (at which time the monitoring wells were dry) prior to sampling. Samples were collected from each monitoring well location using a dedicated Waterra tubing and footvalve. Groundwater samples collected for metal parameters were filtered using a 0.45 µm Waterra filter prior to filling associated sample jars. One surface water sample (SW1) was collected at the proposed Maskinonge River Tributary culvert location adjacent to Borehole C2-1. Samples were stored in ice and submitted to AGAT Laboratories Limited ("AGAT") located in Mississauga, Ontario for analysis of general chemistry parameters, metals, benzene, toluene, ethylbenzene and xylenes ("BTEX") and Petroleum Hydrocarbon Fractions ("PHC") fractions F1 to F3. The results of the chemical analyses were compared to the MOE's "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act", March 2004 Table 2: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition ("MOE Table 2 Standards") and the Ontario Drinking



Water Quality Standards, Objectives and Guidelines, June 2006 ("ODWS"). The results of the chemical analysis of the surface water sample were compared to the Provincial Water Quality Objectives, July 1994 ("PWQO").

2.4 Groundwater Resource Assessment – Water Well Survey

An assessment of the use of groundwater in the vicinity of the Site was conducted as part of the Secondary Source Groundwater Investigation ("SSGI") for the Site, previously completed by Golder Associates (December, 2008). The assessment included obtaining a list from the MOE of registered water wells (i.e., a MOE Water Well Record Information System ("WWIS") print-out) within approximately 500 m of the Site (run date: December 3, 2008). The results were used to identify potential groundwater users, well characteristics and useable aquifers in the vicinity of the Site. A summary of the information found on the MOE WWIS print-out is provided as Table F-1 (Appendix F). A copy of the MOE WWIS print-out is presented as Table F-2 included in Appendix F. The locations of wells identified in the WWIS within approximately 500 m of the Site are shown on Figures F1 and F2. In addition, a visual "windshield" reconnaissance of the area was carried out from accessible areas of the Site to visually identify groundwater users not recorded in the well records. As well, specific feedback regarding groundwater resources from the public as part of the public information centres held for the project was considered.

Voluntary private water well surveys were carried out for residents located within approximately 250 m of cuts greater than 3 m (including the Boag Road Structures), located in areas of potential high aquifer vulnerability and within 250 m of the edge of the proposed highway right-of-way, and residents located in the vicinity of proposed stormwater management ponds. Residents completed a questionnaire which covered the dimensions of their well, pumping equipment, water levels, quality and historical issues.

2.5 Potential Contaminant Sources

Golder Associates conducted a limited review of potential contaminant sources in the vicinity of the Site, as defined in the Permit to Take Water ("PTTW") Manual (MOE, August, 2005). The review was based on topographic mapping, the MOE "Waste Disposal Site Inventory" and a cursory review of adjacent lands from the Site and public areas via the windshield reconnaissance.

3.0 EXISTING SITE CONDITIONS

3.1 Topography

Based on the information provided on topographic maps available on-line from National Resources Canada at <http://atlas.nrcan.gc.ca/site/english/maps/topo/map>, portions of the Site are located in the Maskinonge River watershed. The alignment is located between Leslie Street and Woodbine Avenue, extending north from Queensville Sideroad to Ravenshoe Road, crossing Woodbine Avenue at the northern extent of the alignment. The Site is located southeast of Cook's Bay (the southernmost tip of Lake Simcoe). Beyond the southern extent of the Site, the alignment crosses the Maskinonge River (south of Queensville Road), which flows northerly through the Site and then westerly into Cook's Bay north of the Site. The Site is crossed by several unnamed tributaries of the Maskinonge River, which were observed during the walk-over and are shown on Figures F1 and F2 (Appendix F).



The topography in the Site area is generally rolling, with drumlins (elongated hills formed by advancing glaciers during the last period of glaciation) present throughout with the ground surface ranging from approximately Elevation 230 metres above sea level ("masl") to Elevation 290 masl. The Maskinonge River flows in a northerly direction, with approximate Elevation 255 masl at Queensville Sideroad, to Elevation 230 masl at Ravenshoe Road. The shallow groundwater flow direction within the Site is expected to be variable, depending upon the local topography, but generally towards the Maskinonge River and its unnamed tributaries along the alignment. Regional groundwater flow is expected to be to the north to northwest towards Cook's Bay.

3.2 Geology

According to Barnett et al., (1997), the surficial geology of the Site area consists predominately of a drumlinized till plain, known regionally as the Newmarket Till consisting of sandy silt till to silt till. The Site area is generally located between two abandoned glacial lake shorelines, one located along most of the western edge of the Site area and the other located only along the northern portion of the eastern edge of the Site area. Numerous drumlins oriented northeast-southwest are mapped throughout the Site area (Chapman and Putnam, 1984), typically consisting of till. Some organic deposits of peat, muck and marl are mapped in the northeast portion of the Site area. River deposits consisting of gravel, sand, silt, clay and muck approximately 1 m to 2 m thick are mapped on the east side of the alignment in the central portion of the Site area. Glacial lake deposits of silt and clay are located in the southeast portion of the Site. According to the Ontario Geological Survey (1991) bedrock at the Site is reported to consist of Middle Ordovician shale and limestone of the Simcoe Group Formation. According to Barnett et al., the depth to the bedrock is approximately 50 m below ground surface ("mbgs") to 125 mbgs or approximately between Elevation 170 m and Elevation 130 m.

According to the surficial geological mapping, the above-described units are encountered along the proposed alignment as follows (boundaries are approximate):

- South project limit STA. 33+000 to STA. 36+500: sandy silt till to sand till (Newmarket Till);
- STA. 36+500 to STA. 36+800: river deposits of sand and gravel;
- STA. 36+800 to STA. 38+400: sandy silt till to sand till (Newmarket Till);
- STA. 38+400 to STA. 38+900: glacial lake deposits of sand and silty sand; and,
- STA. 38+900 to STA. 39+785.7 North project limit: organic deposits of peat, muck and marl.

According to Barnett et al., the Newmarket Till is underlain by the Thorncliffe Formation, comprised of sand, silt and clay deposits (upper confined aquifer), underlain by the Sunnybrook Drift consisting of silt till to clay till (aquitard), underlain by the Scarborough Formation, consisting of lacustrine sands (lower confined aquifer), underlain by bedrock.

MOE Water Well Records ("WWRs") indicate stratigraphy generally comprised of topsoil, underlain by clay/clay till to gravelly clay, underlain by sand to sand and gravel (upper confined aquifer), underlain by clay/clay till to gravelly clay, underlain by silt to sand and gravel (lower confined aquifer), underlain by bedrock. The majority of wells are screened in a confined sand to sand and gravel aquifer, likely the Thorncliffe Formation, with a few wells screened within shallow unconfined sands and gravels. Two wells are screened in the grey limestone bedrock, with reported depths to bedrock of 78 mbgs and 121 mbgs. The locations and types of wells are shown on Figures F1 and F2 (Appendix F).



3.3 Hydrogeology

The depth to the groundwater and the corresponding water level elevations as measured in the monitoring wells on June 12, 2009 or March 11, 2010 are summarized on the Record of Boreholes sheets in Appendices A to D. The June 12, 2009 measurements are included in Table E-1 (Appendix E).

On June 12, 2009, the depth to groundwater in the monitoring wells at the SBL structure were 2.18 mbgs (BR-2) and 2.22 mbgs (BR-3), corresponding to Elevation 240.09 masl (BR-2) and Elevation 241.32 masl (BR-3). The average depth to the static water levels in the SBL structure monitoring wells on June 12, 2009 (BR-2 and BR-3) was about 2.20 mbgs, with an average elevation of Elevation 240.71 masl.

The depth to groundwater in the monitoring wells at the NBL structure were 4.53 mbgs (BR-8) and 4.96 mbgs (BR-9), corresponding to Elevation 236.57 masl (BR-7) and Elevation 237.86 masl (BR-8). The average depth of the static water levels in the NBL structure monitoring wells on June 12, 2009 (BR-8 and BR-9) was about 4.74 mbgs, with an average elevation of Elevation 237.22 masl.

In the deep cut/high fill areas, the depth to the groundwater in the monitoring wells ranges from -0.38 mbgs (i.e., 0.38 m above ground surface) (HD8-6) to 4.37 mbgs (HD6-6), and from Elevation 230.64 masl (HD8-6) to Elevation 259.73 masl (HD2-1B). The average depth of the static water level in the monitoring wells in the deep cut areas (i.e., Area 2, 3, 5 and 7) on June 12, 2009 at the was about 1.70 mbgs, or an average elevation of Elevation 140.78 masl.

3.4 Groundwater Resources

Groundwater samples were collected on January 7, 2010 from monitoring wells at each of the Boag Road Structure locations, the proposed Maskinonge River Tributary culvert location and the four deep cut locations (i.e., Boreholes BR-3, BR-8, C2-1, HD2-1A, HD3-1, HD5-2, and HD7-1). One surface water sample (SW1) was collected at the proposed Maskinonge River Tributary culvert location adjacent to Borehole C2-1. Groundwater samples were analyzed for general chemistry, metals, BTEX and PHC fractions F1 to F3. A summary of the groundwater sampling results is provided in Table E-2, Appendix E. Groundwater samples were compared to the MOE Table 2 Standards and the ODWS. There were no exceedances of the ODWS. The following exceedances of MOE Table 2 standards are noted: PHC fraction F3 at BR-8 (2,100 µg/L), HD5-2 (1,200 µg/L), and HD3-1 (1,300 µg/L). The MOE Table 2 standard for the sum of PHC fractions F3 and F4 is 1,000 µg/L. Concentrations of F3 were also detected at Boreholes C2-1 and HD7-1 at values less than 1,000 µg/L.

A summary of the surface water sampling results is provided in Table E-3, Appendix E. The surface water sample (SW1) was analysed for selected general chemistry parameters and iron and results were compared to corresponding PWQO, where present. The concentration of iron at SW1 (8.68 mg/L, vs. the PWQO of 0.3 mg/L) exceeds the PWQO limit. The Certificates of Analysis are attached in Appendix E, following the text of this report.

All existing WWRs within approximately 500 m of the alignment were obtained from Golder Associates' existing information from the MOE WWR database and a WWR update from the MOE on December 3, 2008. A copy of the print-out for wells within 500 m of the alignment is included as Table F-2 (Appendix F). Using the stated coordinates of the wells and converting applicable coordinates to the most recent topographic mapping reference datum (i.e., MTM NAD 83), all wells within 500 m of the alignment were plotted on Figures F1 and F2 (Appendix F). It is noted that WWRs for large diameter shallow bored/dug wells commonly do not exist and may



be under-represented in the records. Under the Freedom of Information Act, owner names are no longer provided on the WWR summaries available from the MOE, making correlation of the WWR database print-out with field observations difficult.

Based on the MOE WWRs from our database, 36 water wells were located within about 500 m of the alignment. Based on reported information:

- 20 of the wells are small diameter (i.e., drilled), with 2 wells reportedly completed in the limestone bedrock aquifer and the remaining 18 wells completed in the overburden aquifer(s), typically of sand or sand and gravel. Of the 20 drilled wells, 14 are reported for domestic use; 1 is reported for commercial use; 1 is reported for domestic/livestock use; 1 is reported as an observation well; 2 are reportedly not used; and the use is not specified for 1 of the wells.
- 16 of the wells are reported to be large diameter (i.e., dug/bored) wells, all completed within overburden aquifer(s). The dug/bored wells are completed in sand, gravel or sand and gravel. 13 of these wells are reported for domestic use; 1 is reported for domestic/livestock use; 1 is reportedly not used; and 1 does not specify a use.

A summary of the well types, depths, yields, casing diameters, and water use is given in Table F-1, Appendix F.

Three of the wells are reportedly large volume water wells, with well yields at or greater than 20 Imperial gallons per minute ("IGPM") (1.5 L/sec), all of which are reported for domestic use.

No "municipal supply" or "public supply" wells are designated in the WWRs within 500 m of the Site.

No wells were directly observed during the initial windshield reconnaissance or walk-over, which may be attributed to snow cover and inaccessibility to some of the properties. Also, many of the properties located along the proposed alignment have residences/wells located greater than 500 m from the proposed alignment making identification difficult. These wells located outside the 500 m radius from the Site are not expected to be impacted by construction activities.

It is noted however, that all of the residences within the 500 m radius of the Site are rural residences, and it is expected that they all rely on private water supply. In addition to private water supply, these residences are inferred to also utilize private sewage disposal systems, although none were positively identified during the windshield survey and walk-over.

A door-to-door water well survey was completed by Golder staff on January 14, 2010 for all residences within 250 m of cuts greater than 3.0 m, areas of potential high aquifer vulnerability within 250 m of the proposed highway right-of-way, and residences within 250 m of the proposed stormwater management ponds. Residents that were available during the survey were asked to provide details about their private wells by completing a voluntary survey form. Residents that were not available during the door-to-door survey were provided with a survey form, an explanatory letter and contact details to complete the survey by telephone or mail. Two residents were surveyed in person, four residents completed the survey by telephone, and one resident faxed in the completed water well survey form. Three residents did not reply. Of those surveyed: three residents had shallow large diameter dug wells (1861 Boag Road, 1989 Boag Road, and 22372 Woodbine Avenue); two residents had deep drilled wells (1982 Queensville Sideroad, and 1925 Boag Road); the owner of 1742 Queensville Sideroad did not complete a water well survey, however indicated that the house was vacant and



therefore the well was no longer in use; and the owners of 1742 Boag Road indicated that the well was decommissioned approximately four years ago.

The residence at 1861 Boag Road is located approximately 150 m from the proposed Boag Road Structure. The well is approximately 8.0 m deep and the water level is approximately 4.3 m below ground surface. The residents expressed their concerns about quality and quantity impacts to their well as a result of construction activities. The residence at 22372 Woodbine Avenue is located approximately 100 m from proposed Stormwater Pond #9. The well is approximately 4.5 m deep and the water level is approximately 2.3 m below ground surface. The residents also expressed their concerns about quality and quantity impacts to their well as a result of construction activities. None of the respondents noted any quality or quantity issues in the past. Completed water well surveys forms are attached in Appendix F.

Based on a previous groundwater study by Golder (2005), five residences located near the Maskinonge River crossing reported problems with their wells. The information was gathered directly from well owners and residents as part of a door-to-door well survey. The addresses may or may not relate to the WWRs described above. The following issues were reported:

- 1774 Queensville Sideroad – Contamination due to rotting piping;
- 1888 Queensville Sideroad – Interference, historically gone dry;
- 1973 Queensville Sideroad – Interference; and
- 20236 Woodbine Avenue – Interference.

The residents at 20236 Woodbine Avenue indicated that they required a water truck to supply their water during shortages.

Based on email correspondence provided by AECOM on September 29, 2009, Mr. Fred Forth, a resident on Boag Road (1989 Boag Road) has expressed concern of the effect of the proposed construction on his well. His well is reported to be 6.7 m deep and has experienced reductions in its water level over a period of years. Mr. Forth expressed concern related to a reduction in the quantity of water in his well related to reduced recharge in watershed and an impact on quality from road spray as a result of the development of the new highway alignment.

In addition to the reported problems, it is our experience that there may be groundwater problems typical of the hydrogeological setting of this project. These include:

- Water quality in bedrock aquifers: Bedrock aquifers in this area commonly produce groundwater that is hard and high in dissolved solids including iron. As well, bedrock wells can also produce natural gas (methane) and hydrogen sulphide gas;
- Water quality in shallow overburden aquifers: Bacterial contamination within or in the vicinity of the site is common with shallow bored/dug wells and in our opinion may affect greater than 50 percent of the wells. In addition, shallow bored/dug wells are susceptible to impact from infiltrating surface water, including road salt impact; and,
- Shallow bored/dug wells commonly experience water quantity problems in summer and early autumn, resulting from a seasonal drop in the water table elevation. Of concern is that this drop in the water table



elevation occurs within the typical peak construction season and the causes of such quantity interruptions can be misinterpreted by residents.

3.5 Potential Contaminant Sources

Based on topographic mapping available on-line from National Resources Canada at <http://atlas.nrcan.gc.ca/site/english/maps/topo/map> and a windshield reconnaissance from accessible areas of the Site, the proposed highway alignment will extend through land that is currently being used primarily for agricultural purposes or is undeveloped forested land. Beyond the southern extent of the Site, the alignment crosses the Maskinonge River (south of Queensville Road), which flows northerly (east of the highway alignment) and then westerly into Cook's Bay north of the Site. The Site is crossed by several unnamed tributaries of the Maskinonge River.

Based on a review of topographic mapping, and cursory review of adjacent properties from publicly accessible areas, it is likely that the majority of residences in the vicinity of the Site are dependent on small private septic systems, including: residences located along Leslie Street and Woodbine Avenue, between Queensville Sideroad and Ravenshoe Road; and along Holborn Road and Boag Road, between Leslie Street and Woodbine Avenue. However, these residences are not located within the anticipated radius of influence from the proposed dewatering works.

Based on a review of the MOE's Waste Disposal Site Inventory (June, 1991), no active or closed waste disposal sites are reported within 500 m of the Site.

Based on the results of the windshield survey, a Petro Canada gas station is located at the northwest corner of Ravenshoe Road and Woodbine Avenue, within 500 m of the proposed alignment and may be a potential contaminant source.

Based on the limited review of topographic mapping, the MOE "Waste Disposal Inventory" and a visual windshield reconnaissance, no potential groundwater quality concerns within the anticipated radius of influence from the proposed works are known to Golder Associates, other than the groundwater quality problems typical of the rural setting of this project such as nitrate and impact from agricultural practices and in-ground septic disposal systems.

4.0 AQUIFER TESTING RESULTS

The hydraulic conductivity of the confined sand unit in the high fill Area 6 and the sandy silt unit in the deep cut Area 5 was estimated using the Hazen Equation (Freeze and Cherry, 1979) and grain size distribution data for selected samples from HD6-2, HD6-4, and BH502.

Data from the rising head tests conducted at the SBL Boag Road Structure (monitoring wells BR-2 and BR-3), the NBL Boag Road Structure (monitoring wells BR-7 and BR-9), and in the high fill/deep cut areas (monitoring wells HD2-1A, HD2-1B, HD2-4, HD4-3, HD5-2, HD6-3, HD6-6, HD7-3, and HD8-1) were analyzed using AQTESOLV for Windows (1996-2007) according to the Bouwer and Rice Method (1976), KGS Method (1998), or the Cooper-Bredehoeft-Papadopoulos Method (1967) to estimate hydraulic conductivity for the unconfined and confined aquifer units.



HYDROGEOLOGICAL REPORT

HIGHWAY 404 EXTENSION, W.P. 2005-07-00

The estimates of hydraulic conductivity of the hydrogeological units in each foundation area are summarized below.

Location	Geological Unit Analysed/Tested	Method	Data Source	Estimated Hydraulic Conductivity (K in cm/s)
SBL Boag Road				
BR-1	Silty Sand	Hazen	Grain Size Distribution	2×10^{-3}
BR-2	Sand	Cooper-Bredehoeft-Papadopoulos	Rising Head Test	2×10^{-4}
NBL Boag Road				
BR-8	Sand	Hazen	Grain Size Distribution	4×10^{-3}
BR-9	Clayey Silt	Bouwer & Rice	Rising Head Test	1×10^{-5}
BR-10	Silty Sand	Hazen	Grain Size Distribution	2×10^{-3}
Deep Cut/High Fill Areas				
HD2-1A	Sand/Sand and Silt Till	Bouwer & Rice	Rising Head Test	2×10^{-4}
HD2-1B	Clayey Silt Till	N/A	Rising Head Test	Inconclusive
HD2-4	Clayey Silt	Bouwer & Rice	Rising Head Test	9×10^{-7}
HD4-3	Sand & Silt Till	KGS	Rising Head Test	2×10^{-4}
HD6-2	Sand	Hazen	Grain Size Distribution	4×10^{-3}
HD6-3	Sandy Silt/Clayey Silt Till	Bouwer & Rice	Rising Head Test	5×10^{-5}
HD6-4	Sand	Hazen	Grain Size Distribution	5×10^{-3}
HD6-6	Sand & Silt Till	Bouwer & Rice	Rising Head Test	7×10^{-5}
HD7-3	Clayey Silt Till	KGS	Rising Head Test	6×10^{-6}
HD8-1	Silty Clay/Silt	KGS	Rising Head Test	9×10^{-5}
SWM8-BH3	Sand	Hazen	Grain Size Distribution	5×10^{-3}
SWM8-BH4	Silty Sand	Hazen	Grain Size Distribution	2×10^{-3}



5.0 CLOSURE

The field drilling and well installation was supervised by Mr. Ted Beadle and Mr. Chris Radway. The in-situ testing and well monitoring survey was performed by Mr. Greg Meek. This Hydrogeology Investigation Report was prepared by Mr. Shawn Lytle, P.Geo. a Senior Hydrogeologist and Principal of Golder Associates, and reviewed by Mr. Chris Kozuskanich, P.Geo., a Senior Hydrogeologist and Associate with Golder Associates. Mr. Jorge M.A. Costa, P.Eng., a Principal of Golder Associates and a Designated MTO Contact for Foundations carried out a quality control review of this report.



Report Signature Page

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PART B

**HYDROGEOLOGY DESIGN REPORT
HIGHWAY 404 EXTENSION FROM QUEENSVILLE SIDEROAD TO
RAVENSHOE ROAD
TOWN OF EAST GWILLIMBURY
MINISTRY OF TRANSPORTATION, ONTARIO
W.P. 2005-07-00**



6.0 DEWATERING ASSESSMENT AND NEED FOR PERMIT TO TAKE WATER

A Permit To Take Water ("PTTW") from the MOE is required for works for which dewatering in excess of 50,000 L/day will occur. Therefore an assessment of the potential dewatering requirements was completed for the Boag Road SBL and NBL structures and for the deep cut areas (including the stormwater management pond areas) associated with the extension of Highway 404 between Queensville Sideroad and Ravenshoe Road. Dewatering is not anticipated to be required in the high fill areas, since it is proposed to remove only up to 1.5 m of the surficial soils and place up to 8 m of fill material in embankment construction areas, and therefore any excavations below the water table are anticipated to be minimal.

The rate of groundwater abstraction required during the proposed dewatering activities was estimated using equilibrium equations (Powers, 1981), the estimated hydraulic conductivities derived from the gradation of the subsoils using the Hazen formula and the results of the rising head tests, and the approximate dimensions of the anticipated excavation for each structure based on the drawings provided by AECOM.

6.1 Boag Road SBL Structure

The dewatering rates required to facilitate the construction and installation of the bridge foundations at the SBL abutment were estimated based on the following assumptions:

- the dimensions of the proposed excavation for each abutment would be 5 m wide by 16 m long by approximately 6 m deep (i.e., the proposed dewatering of each excavation is to 1 m below the bottom of the excavation at Elevation 236 masl);
- excavation walls will be sloped to within 1.2 m of the bottom at a gradient of 1 horizontal to 1 vertical (1H:1V);
- the excavation will encounter primarily sand and silt till or clayey silt till soils, although layers of silty sand to sand are expected as encountered in Boreholes BR-1 and BR-2. The hydraulic conductivity of the silty sand to sand is 2×10^{-4} cm/s, based on the rising head test conducted in Borehole BR-2;
- the static water level is approximately 1.2 mbgs at Elevation 241.1 masl, based on the highest groundwater level recorded in Borehole BR-2 on April 2, 2009 and the corresponding required drawdown below the average static water level is estimated to be about 4.7 m and potentially up to 5.1 m; and
- a contingency allowance for a 30 mm precipitation event within a 24 hour period.

Based on these assumptions, and using equilibrium dewatering equations for a confined and a mixed aquifer, the estimated dewatering rate for the installation of the bridge abutment footings is up to 16,500 L/day following the initial dewatering of groundwater stored within the excavation. The initial volume of groundwater storage to be removed from the excavation is estimated to be up to 370,000 L.

However, to allow for quick removal of the initial groundwater storage in the excavations and to allow for simultaneous dewatering from more than one excavation, which may result in dewatering in excess of 50,000 L/day, it is recommended that a Permit To Take Water ("PTTW") from the MOE be obtained.

Using the estimated hydraulic conductivity of the unconfined aquifer of 2×10^{-4} cm/s and the maximum groundwater drawdown of 5.1 m, the radius of influence related to dewatering up to 1 m below the proposed



bottom of the excavation (i.e., Elevation 236 masl) is estimated to be 21 m using the Sichart Approximation (Powers, 1981). The water table is expected to fluctuate by 0.5 m or more annually in response to climatic factors however, for the purpose of this assessment, the effective zone of influence from the proposed dewatering program is considered to be a change in water level greater than 0.5 m. Using this value, the estimated effective zone of influence is estimated to be 16 m.

6.2 Boag Road NBL Structure

The dewatering rates required to facilitate the construction and installation of the bridge footings at the NBL abutment were estimated based on the following assumptions:

- the dimensions of the proposed excavation for each abutment would be 5 m wide by 16 m long by approximately 6 m deep (i.e., the proposed dewatering of each excavation to 1 m below the bottom of the excavation at Elevation 236 masl);
- the excavation walls will be sloped to within 1.2 m of the bottom at a gradient of 1 horizontal to 1 vertical (1H:1V);
- the excavations are expected to encounter primarily clayey silt to sand and silt till soils, although some layers of silty sand to sand may be encountered and the base of the excavations may be in sandy silt to sand soils. The hydraulic conductivity of the silty sand to sand is 2×10^{-4} cm/s, based on the rising head test conducted in Borehole BR-2;
- the static water level is approximately 4.5 m below ground surface at Elevation 238.3 masl based on the higher groundwater level recorded in Borehole BR-9 on April 2, 2009 and the corresponding drawdown below the average static water level is estimated to be about 1.2 m and potentially up to 2.3 m; and
- a contingency allowance for a 30 mm precipitation event within a 24 hour period.

Based on these assumptions, and using equilibrium dewatering equations for a confined and a mixed aquifer, a dewatering rate up to 25,500 L/day is estimated following the initial dewatering of groundwater stored within the excavation for the installation of the bridge abutment footings. The initial volume of groundwater storage to be removed from the excavation is estimated to be up to 170,000 L.

However, to allow for quick removal of the initial groundwater storage in the excavations and to allow for simultaneous dewatering from more than one excavation, which may result in dewatering in excess of 50,000 L/day, it is recommended that a Permit To Take Water ("PTTW") from the MOE be obtained.

Using the estimated hydraulic conductivity of the unconfined aquifer of 2×10^{-4} cm/s and the maximum groundwater drawdown of 2.3 m, the radius of influence related to dewatering up to 1 m below the proposed bottom of the excavation (i.e., Elevation 236 masl) is estimated to be 9.4 m using the Sichart Approximation (Powers, 1981). The water table is expected to fluctuate by 0.5 m or more annually in response to climatic factors however, for the purpose of this assessment, the effective zone of influence from the proposed dewatering program is considered to be a change in water level greater than 0.5 m. Using this value, the estimated effective zone of influence is estimated to be 6 m.



6.3 Deep Cut Areas

Based on the roadway profile drawings provided by AECOM, Areas 2, 3, 5 and 7 will require deep cuts up to 8.5 m below present ground surface. Based on the Record of Borehole information, the cuts will extend through various soil layers and encounter different groundwater conditions, which may be summarized as follows:

- Area 2: clayey silt till to sandy silt till underlain by clayey silt. Layers of silty sand to sand were also observed in some areas within the clayey silt till and clayey silt units (i.e., HD2-1 and HD2-3). Groundwater was observed between 1.3 m and 1.8 mbgs on June 12, 2009.
- Area 3: clayey silt underlain by sandy silt till underlain by clayey silt. Silty sand was observed at the ground surface at one location (HD3-3), and groundwater was observed at approximately 1.0 mbgs on June 12, 2009.
- Area 5: clayey silt till or sand and silt or sand and silt till underlain by clayey silt, with groundwater observed between 2.7 m and 2.9 mbgs on June 12, 2009.
- Area 7: sand and silt till, underlain by clayey silt at one location (HD7-6). A thin layer of sand and gravel was observed at the ground surface in HD7-2, and groundwater was observed to range from approximately 1.0 m to 2.0 mbgs on June 12, 2009.

Based on the above information, excavations below the groundwater table will be required in the deep cut areas to achieve the design roadway surface grades of the Highway 404 extension. However, given that the topography of the Site generally consists of rolling terrain with drumlins, and the Deep Cut Areas 2, 3, 5 and 7 generally correspond to cuts through the drumlins which are comprised mainly of till material and/or fine grained clayey silt/silty clay material of relatively low hydraulic conductivity with silty sand to sand layers of moderate hydraulic conductivity (refer to Section 4.0), groundwater seepage from the drumlins is anticipated to be relatively slow (slightly greater in areas with silty sand to sand layers). Therefore, positive dewatering in excess of 50,000 L/day is not anticipated to be required during construction, as the initial local groundwater flows out of the cut and subsequent seepage can be handled by properly filtered sumps within the excavation as required. As such, the anticipated radius of influence of active (i.e., pumping during excavation operations) or subsequent passive dewatering associated with Deep Cut Areas 2, 3, 5 and 7 is anticipated to be less than 25 m.

6.4 Maskinonge River Tributary Culvert

Based on the Record of Borehole information, the temporary excavation for the Maskinonge River Tributary Culvert will be up to 2 m below present ground surface and up to 1.7 m below the groundwater level measured during the investigation. The temporary excavations will be predominantly through surficial organics, clayey silt, clayey silt till, and sandy silt to silt and groundwater seepage is anticipated to be relatively slow and can be handled by properly filtered sumps. Surface water that collects above/outside of the excavation should be diverted using ditches/berms (i.e. passive methods) and/or contained upstream and pumped downstream of the construction area using temporary pipes/hoses. Therefore, positive dewatering (of groundwater) in excess of 50,000 L/day is not anticipated to be required during construction.

6.5 Stormwater Management Ponds

Based on the stormwater pond cross-section drawings provided by AECOM, SWM Pond 6, 7, Holborn, 8 and 9 are proposed to be constructed partially in cut and partially in fill; the cuts extend to depths up to about 4.5 m,



4 m, 2.5 m, 6 m and 2 m, respectively, below existing ground surface. Details of the geotechnical investigation and design are provided in Section 10 of this report. Based on the Record of Borehole information, the cuts will extend through various soil layers and will encounter different groundwater conditions, which may be summarized as follows:

- SWM Pond 6: clayey silt underlain by clayey silt till and sandy silt till. Layers of sandy silt were observed in some areas within and below the clayey silt till unit (SWM6-BH1 and SWM6-BH2). Groundwater was observed about 1 mbgs in the well installed in HD1-1, on June 12, 2009.
- SWM Pond 7: clayey silt till, with groundwater observed about 1.5 mbgs in an open borehole (SWM7-B1) during drilling on March 23, 2009.
- Holborn SWM Pond: silty clay to clayey silt underlain by clayey silt till to sandy silt/sand and silt till. Layers of silty sand were observed below the till units. Groundwater was observed at 1.4 mbgs in an open borehole (HD4-2) during drilling on June 9, 2009.
- SWM Pond 8: clayey silt till with layers of sandy silt, silt, and sand (refer to Section 4.0 for estimated hydraulic conductivity of these layers) underlain by clayey silt to silt. Groundwater was observed between 1.2 mbgs and 4.3 mbgs in an open borehole (SWM8-BH1) during drilling and in a monitoring well (SWM8-BH2), on June 15, 2009 and March 11, 2010, respectively.
- SWM Pond 9: silty clay to clayey silt till with interlayers of sandy silt till to sand and silt till. Groundwater was observed at 1.8 mbgs in an open borehole (SWM9-BH2) during drilling operations.

Based on the above information, excavations below the groundwater table will be required in the pond cut areas for the Highway 404 extension to achieve the design pond grades and to install inlet / outlet structures. The topography of the site generally consists of rolling terrain with drumlins, and the SWM Pond Areas are generally through or near drumlins which are comprised of till material and/or fine grained clayey silt / silty clay. At SWM Pond Areas 7 and 9, dewatering in excess of 50,000 L/day is not anticipated to be required during construction. SWM Pond Areas 6, Holborn, and 8 contain significant layers of sand, silty sand and sandy silt within the proposed cut depth for the ponds and may require dewatering in excess of 50,000 L/day to allow for removal of the initial groundwater storage and seepage in the excavations and to allow for simultaneous dewatering from more than one excavation. It is recommended that a Permit To Take Water ("PTTW") from the MOE be obtained for SWM Pond 6, Holborn SWM Pond, and SWM Pond 8. At all SWM Pond areas, the initial local groundwater flows out of the cuts and subsequent seepage can be handled by filtered sumps within the excavation or drained using trenches/ditches/pipes as required.

6.6 Permit to Take Water Application

As a follow up to the recommendation that a PTTW be obtained for the project, Golder Associates has initiated the process to obtain a Category 3 PTTW under the Memorandum of Understanding between MTO and MOE dated February 7, 2007. We have assumed that the required groundwater management for the project will fall under the criteria of a Category 3 PTTW and a copy of the Draft PTTW Application form is included in Appendix H which should be reviewed, modified (if necessary) and submitted once the Contractor's proposed management system for excavation groundwater is known.



7.0 ABSTRACTED WATER DIVERSION

Although a discharge method for the groundwater pumped during construction has not yet been defined for the Site, it is recommended that any abstracted groundwater be discharged in a sediment-free manner after settling of sediments (e.g., via a settling tank or through filter bags), to the Maskinonge River or its tributaries. Water should be discharged in a non-turbid state and in a manner that will not result in erosion or scouring of the river bed or banks or cause significant thermal alteration of the surface water temperature. Approvals from MOE, MNR, the Lake Simcoe Region Conservation Authority and others may be required prior to pumping the groundwater into the natural environment. Monitoring of groundwater quality should be carried out prior to and during construction dewatering activities and appropriate treatment, if required, should be applied to the abstracted groundwater prior to discharge to the Maskinonge River or its tributaries to ensure that the quality of the abstracted groundwater meets the PWQO. Discharge of appropriately treated, abstracted groundwater which meets the PWQO is not anticipated to impact the quality of surface water at its discharge location.

8.0 IMPACT ANALYSIS

8.1 Groundwater Resources

Based on the coordinates provided in the WWRs, no private water wells are located within the estimated effective radius of influence for the anticipated dewatering of the excavation for the Boag Road Bridge Structures (i.e., 16 m from the SBL and 6 m from the NBL) as the closest well identified in the survey is located at 1861 Boag Road. One well is located within the anticipated radius of influence of potential dewatering activities (i.e., 25 m) in each of Deep Cut Areas 2 and 3, and no wells are located within the anticipated radius of influence of Deep Cut Areas 5 and 7. According to the WWRs, the well located within 25 m of Deep Cut Area 2 is listed as an observation well, and the well within 25 m of Deep Cut Area 3 is reportedly not used. According to the WWRs, the closest private water well is located about 100 m from the SWM Ponds (i.e. at SWM Pond 9) and groundwater interference from construction dewatering of the SWM Ponds is not expected. Based on the windshield reconnaissance, no wells were observed within the anticipated radius of influence of the proposed areas requiring deep cuts.

As such, given the relatively small radius of influence from dewatering and excavation activities at the Boag Road Bridge Structures and Deep Cut Areas, and given that no wells are being used as a potable source based on the WWRs and survey within the radius of influence, no impacts to water quantity or quality in shallow domestic supply water wells on private properties are anticipated. As described in Section 10.6, we understand that a pond liner system will be incorporated into each of the five stormwater management ponds in order to provide for some separation between the natural groundwater and the stormwater contained within the pond and will mitigate water quality interference during and after construction of the ponds.

Based on a review of topographic mapping, and cursory review of adjacent properties from publicly accessible areas, it is likely that the majority of residences in the vicinity of the Site are dependent on septic systems, including residences located along Leslie Street and Woodbine Avenue between Queensville Sideroad and Ravenshoe Road, and along Holborn Road and Boag Road between Leslie Street and Woodbine Avenue. However, these septic systems are not expected to be present within the anticipated radius of influence from the proposed dewatering works.



Based on a review of the MOE's Waste Disposal Site Inventory (June, 1991), no active or closed waste disposal sites are reported within 500 m of the Site.

Based on the review of topographic mapping, the MOE "Waste Disposal Inventory" and a visual windshield reconnaissance, no potential groundwater contamination sources within the anticipated radius of influence from the proposed works are known to Golder Associates. As noted in Section 3.5, groundwater quality issues typical of the rural hydrogeological setting should be anticipated such as due to septic systems and possible farming operations, as described below. In addition, samples of groundwater collected from the monitoring wells for chemical analysis detected petroleum hydrocarbon fraction F3 impact above the MOE Table 2 Standards as follows:

- PHC fraction F3 at the SBL Boag Road Structure, BR-8 (2,100 µg/L); at Deep Cut Area 5, HD5-2 (1,200 µg/L); and at Deep Cut Area 3 HD3-1 (1,300 µg/L). The MOE Table 2 standard for the sum PHC fractions F3 and F4 is 1,000 µg/L.

Based on our observations there is no obvious source for this impact and re-sampling and analysis of groundwater samples from these monitoring wells is recommended by the Quality Verification Engineer ("QVE") to confirm the results.

In our experience, local groundwater problems typical of the hydrogeological setting of this project should be anticipated. These include:

- Water quality in bedrock aquifers: Bedrock aquifers in this area commonly produce groundwater that is hard and high in dissolved solids including iron. As well, bedrock wells can also produce natural gas (methane) and hydrogen sulphide gas;
- Water quality in shallow overburden aquifers: Bacterial contamination within or in the vicinity of the Site is common with shallow bored/dug wells and in our opinion may affect greater than 50 per cent of the wells. In addition, shallow bored/dug wells are susceptible to impact from infiltrating surface water, including road salt impact; and,
- Shallow bored/dug wells commonly experience quantity problems in summer and early autumn, resulting from a seasonal drop in water table elevation. Of concern is that this drop in the water table elevation occurs within the typical peak construction season and the causes of such quantity interruptions can be misinterpreted by residents.

Based on email correspondence provided by AECOM on September 29, 2009, Mr. Fred Forth, a resident on Boag Road (1989 Boag Road) has expressed concern of the effect of the proposed construction on his well. His well is reported to be 6.7 m deep and has experienced reductions in its water level over a period of years. Mr. Forth expressed concern related to a reduction in the quantity of water in his well related to reduced recharge in the watershed and an impact on quality from road spray as a result of the development of the new highway alignment.

Shallow wells located near the alignment may be susceptible to impact by road de-icing salt application. Chloride, which is highly mobile in the subsurface, is a major constituent of road salt. Chloride at high concentrations (> 250 mg/L) may produce an aesthetic impact on the taste of water. Sodium, which is the other major constituent of road salt, is less mobile in the subsurface, but elevated concentrations may be of concern to



persons suffering from hypertension or other medical conditions. Given that the proposed highway extension does not replace an existing road, road salting practices will be introduced where they previously did not exist within the area of the Site. Potential for contamination of shallow dug/bored wells exists for wells within close proximity (i.e. less than 250 m) to the travelled roadway. Golder Associates is not aware of any issues relating to road salting in the past within the Study Area.

8.2 Surface Water Resources

Due to the anticipated short duration of construction dewatering at the Boag Road SBL and NBL Structures, the relatively low groundwater taking rates at both the Boag Road Structures and at the Deep Cut Areas and SWM Pond Areas, the relatively small radii of influence, and assuming that the discharge of extracted groundwater (subsequent to any necessary treatment) from the bridge structures and the deep cuts (as necessary) will be directed to the Maskinonge River or its tributaries, no impacts to base flow of the Maskinonge River are anticipated.

Samples of the abstracted groundwater should be collected by the QVE prior to discharge to the watercourse and submitted for analysis of parameters to meet the Ontario Provincial Water Quality Objectives ("PWQO"). As indicated above, samples of groundwater from three monitoring wells throughout the Site were found to exceed the MOE Table 2 Standards for some petroleum related parameters.

A surface water sample (SW1) from the Maskinonge River Tributary Culvert location was analysed for general chemistry and metals parameters. The surface water sample was compared to the PWQO and no exceedances with the exception of iron (8.68 mg/L, vs. PWQO of 0.3 mg/L) were detected.

9.0 PROPOSED MONITORING, MITIGATION AND CONTINGENCY PLAN

9.1 Monitoring Plan

A pre-construction door-to-door water well monitoring survey is recommended for residences located within approximately 250 m of each of the SWM pond and Boag Road structures area. A summary of private wells to be monitored, subject to the owner's willingness to participate, is presented in Table F-3 in Appendix F of this report. The pre-construction door-to-door water well survey will include, subject to the owner's willingness to participate, completion of a Domestic Well Survey Form with the owner to document the presence and condition of the well, collection of a water level measurement in the well, collection of an untreated water sample for analysis of drinking water quality parameters and confirmation of the owner's participation in the on-going monitoring program.

Groundwater levels and quality should be monitored in observation wells to be installed in the vicinity of the water takings and local private wells and this data will be used to assess potential complaints of loss or impact to water supply. A summary of the proposed monitoring wells, including locations, is included in Table F-4 of Appendix F of this report. A Non-Standard Special Provision ("NSSP") for installation, monitoring, and decommissioning of the proposed monitoring wells is included in Appendix G. In addition, an NSSP for decommissioning of existing monitoring wells that are to be removed as part of the construction (as they cannot be used for monitoring purposes) is included in Appendix G. Groundwater levels should be monitored prior to the commencement of construction and should continue monthly, as a minimum frequency, during the project. Groundwater samples for water quality analysis should be collected prior to construction from the proposed



monitoring wells. During the period of active excavation for the stormwater management ponds and the Boag Road structures, groundwater levels should be monitored weekly. In the event that monitoring of the wells suggests that the radius of influence of the excavations and dewatering is observed to be greater than what was predicted, an expanded private water well monitoring program should be considered and implemented as necessary. Groundwater quality should be analysed in the monitoring wells prior to the commencement of the project and should be monitored quarterly through the duration of the project.

In addition to the groundwater level monitoring, the water quality in the abstracted water discharge should be monitored at the commencement of pumping to check that it meets the PWQO. Treatment of discharge water will be required should the water quality be found to be unacceptable.

9.2 Triggers, Mitigation and Contingency Measures

As noted above, impacts to water supplies are not expected as a result of the proposed construction works. However, as part of the monitoring program the following triggers, contingency and mitigation measures would be similar to the following:

- If significant impact to available drawdown is observed through monitoring shallow private wells and the on-Site monitoring wells, it is recommended that an assessment be conducted to determine if additional shallow private wells should be included in the water quality sampling program (given owner permission);
- If through monitoring, a deterioration of water quality in private shallow wells attributed to dewatering impact is identified, temporary water supplies should be available to the affected property and an assessment completed to identify if other private wells should be included in the water quality monitoring program;
- If through monitoring, a reduction in available drawdown of 25% related to construction dewatering is observed (in wells with adequate water supply), it is recommended that the appellant or their designate be notified that temporary water supply may be required to be mobilized and connected on short notice;
- If through monitoring, a reduction in available drawdown of 50% related to construction dewatering is observed (in wells with adequate water supply), it is recommended that the appellant or their designate immediately contact the affected well owner/tenant to arrange for connection of a temporary potable water supply; and
- If a complaint of impaired well water quantity or quality is received from an adjacent well owner/tenant, an investigation of the potential construction-related impact to that well is recommended.

10.0 GEOTECHNICAL DISCUSSION FOR SWM PONDS

10.1 General

This section provides geotechnical / foundation design recommendations for the proposed five stormwater management ponds, designated as SWM Pond 6, SWM Pond 7, Holborn SWM Pond, SWM Pond 8, and SWM Pond 9. The recommendations are based on interpretation of the factual data obtained from the boreholes advanced during subsurface investigations (foundations and pavement) at this site. The interpretation and recommendations are intended to provide the designers with sufficient information to complete the design of the proposed SWM Ponds. Where comments are made on construction, they are provided in order to highlight



those aspects which could affect the design of the project, and for which special provisions or operational constraints may be required in the Contract Documents. Those requiring information on aspects of construction should make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods, scheduling and the like. The details of each pond location are provided below:

SWM Pond Area Designation	Approximate Station Limits	Approximate Pond Size (Length x Width)	Pond Base Elevation (m)	Top (Crest) of Pond Berm Elevation (m)	Maximum Fill Height (m)	Maximum Cut Depth (m)
SWM Pond 6	33+900 to 34+000	100m x 50m	250.5	253.8	2.5	4.5
SWM Pond 7	34+640 to 34+730	90m x 50m	245.0	249.0	3.0	4.0
Holborn SWM Pond	35+060 to 35+130	80m x 50m	247.0	250.6	2.0	2.5
SWM Pond 8	36+260 to 36+410	150m x 80m	237.5	241.5	0.5	6.0
SWM Pond 9	38+610 to 38+740	100m x 80m	228.0	232.0	2.5	2.0

10.2 Stability

The SWM Pond perimeter slopes are to be constructed partially of fill and partially in cut. Slope stability analyses were performed using the commercially available program "Slide", produced by Rocscience Inc. and hand calculations at critical sections for the pond locations to verify that the Factor of Safety is greater than or equal to 1.3 for the design pond slopes in cut and perimeter berms of fill. The soil parameters used for the analyses were estimated from empirical correlations (CHBDC, 2006) with the available borehole, laboratory and SPT information at each pond area. Based on the pond design drawings provided by AECOM, we have interpreted the interior side-slopes of each pond to be 4H:1V or shallower, for both slopes in cut and perimeter berms constructed of fill, below the top (crest) of the perimeter berm elevation and that the bottom of the excavations will extend to about 1 m lower than the design pond bottom to account for temporary subexcavation for a proposed liner and ballast system. The interior side-slopes above the top (crest) of the perimeter berm elevation in cut and the exterior side-slopes of the pond containment berms (in fill) are assumed to be 2H:1V.

The piezometric conditions used in the analyses are based on the highest groundwater levels noted during drilling or measured in the piezometer installations and assume a stabilized groundwater level after the proposed ponds have been constructed to the design grades.

The results of the analyses indicate that a Factor of Safety greater than 1.3 is calculated for the proposed permanent cut and fill slopes at SWM Pond 6, 7, Holborn, 8 and 9. It is noted that gravel sheeting may be required to control surficial sloughing of cut slopes through saturated silty sand to sand layers, where encountered. Determination of the frequency, extent and locations of the seepage zone(s) from the limited borehole data is not possible. Therefore, consideration should be given to the observational approach involving examination of the cut slopes during and following construction to identify any areas of surficial instability, and provide gravel sheeting where required.



10.3 Settlement

Based on the pond design drawings, pond containment fill berms up to 2.5 m, 3 m, 2 m, 0.5 m and 2.5 m high are required at SWM Pond 6, 7, Holborn, 8 and 9, respectively. Settlement analyses were performed using hand calculations to estimate the settlement of the foundation soils underlying the proposed berms.

It is assumed that the pond containment berms will be constructed of engineered fill consisting of suitable earth fill as described in Section 10.4. A bulk unit weight of 20 kN/m³ has been assumed for the berm fill in calculating the embankment loading on the founding subsoils. The foundation soil parameters are based on field and laboratory test data and accepted correlations (CHBDC, 2006). It is assumed that all topsoil will be removed from below the footprint of each berm area prior to engineered fill placement. Based on the results of the settlement analyses, the total settlements are comprised of immediate (i.e., settlement during or shortly after construction) and consolidation settlement (i.e., time-dependant settlement after-construction). The estimated maximum settlements of the pond containment berms constructed in fill at each pond area are summarized below:

SWM Pond Area	Total Estimated Settlement (mm)	Initial Settlement Component (mm)	Consolidation Settlement Component (mm)
SWM Pond 6	25	20	5
SWM Pond 7	40	35	5
Holborn SWM Pond	50	10	40
SWM Pond 8	10	5	5
SWM Pond 9	40	35	5

It is noted that the total settlement will be differential relative to other areas of the containment berm where fill heights are lesser than the values assumed in the analysis and relative to areas where the top of pond is constructed in cut.

10.4 Subgrade Preparation and Engineered Fill Placement

Based on the borehole results, topsoil and/or clayey silt containing organics is present at the ground surface in the vicinity of the proposed pond containment berms to be constructed in fill. Prior to the placement of any fill for the proposed pond containment berms, all topsoil and clayey silt soils containing organics (up to 0.4 m thick) should be stripped from below the proposed berm footprints in accordance with SP206S03 (Earth Excavating, Grading).

After stripping, the exposed subgrade soils should be inspected by the QVE prior to placement of engineered fill, proofrolled to identify soft/loosened areas, and poorly performing areas should be subexcavated and replaced with suitable backfill. A NSSP should be included in the Contract to address the subgrade inspection procedure prior to placement of the engineered fill and suggested wording is included in Appendix G.

Construction of the pond containment berm fill or backfill (i.e., engineered fill) may be carried out using suitable earth fill such as cohesive soils or cohesive tills, but not granular materials which could lead to loss of pond water due to seepage. All engineered fill is to be placed and compacted in accordance with SP206S03 (Earth Excavation, Grading).



Any groundwater seepage into the excavated area of subgrade preparation should be able to be handled by diversion channels, perimeter ditches/channels, and pumping using sump pumps. A NSSP for dewatering during stripping and backfilling operations is included in Appendix G. Surface water should be directed away from the stripping/excavation areas at all times.

To reduce surface water erosion on the containment berm exterior side-slopes and interior side-slopes above the high water level, topsoil and seeding or pegged sod should be placed as soon as possible in accordance with OPSS 572 (Construction Specification for Seed and Cover). If this protection is not in place before Winter, then alternate protection, such as covering the slope with stone or gravel sheeting, is recommended to reduce the potential for remedial works required on the side slopes in the Spring prior to topsoil and seeding.

General recommendations related to foundations for the fill areas of the ponds are summarized in Table 1 following the text of this report.

10.5 Excavation

The proposed SWM Pond profiles will require excavations at SWM Pond 6, SWM Pond 7, Holborn SWM Pond, SWM Pond 8 and SWM Pond 9 to depths up to 4.5 m, 4 m, 2.5 m, 6 m, and 2 m, respectively, below present ground surface. Permanent and temporary excavations for the pond cuts and drainage structures will be made through the surficial topsoil, clayey silt to silty clay, clayey silt till to silty clay till, sandy silt till to sand and silt till, and through layers of sandy silt, sand and silty sand. The groundwater levels measured in the piezometers and in the open boreholes during drilling (where piezometers were not installed) range from 1 m to 4.3 m below existing ground surface at the pond locations, corresponding to groundwater levels ranging from less than 1 m to 3.3 m above the proposed base of the ponds.

We understand that a liner system is to be incorporated into the design of the SWM Ponds. As a result, temporary excavations below the permanent base grade level will be required to permit construction of the liner (e.g., compacted clay) and/or ballast (i.e., required due to high groundwater levels).

Given that the majority of the pond areas have relatively high groundwater levels relative to the proposed subexcavation level, it is recommended that the ponds be excavated to allow sufficient time for the cut slopes to drain. Where the surrounding grade permits, the ponds should be excavated and ditches or sub-drains/trenches installed to allow for gravity drainage in advance of the final base grades and side-slopes being excavated, to allow the groundwater to drain thereby reducing the risk of surficial instability along the side-slopes and disturbance/softening and heaving of the subgrade soils. Consideration could be given to sequencing the excavation to allow construction of the drainage outlet pipes first to provide a passive drainage system for dewatering during the actual pond excavation. A more elaborate dewatering system may be required at the Holborn SWM Pond and at the southern portion of SWM Pond 6, where water levels may fluctuate (located in a natural drainage path) and where silty sand to sandy silt layers are present near the base of excavation, in order to allow for excavation and placement of the liner in the dry and to avoid heaving of the liner and ballast system prior to the stabilized permanent pool conditions. If excavation operations are to progress during wet periods of the year (i.e., Spring and Fall), gravel sheeting in combination with rip-rap may be required to control erosion due to groundwater seepage. As a result, it is recommended that excavation for the ponds be performed during the dry period of the year (Summer months). A NSSP for dewatering during excavation of the ponds is included in Appendix G.



Provided pond cuts are allowed sufficient time to drain, permanent side-slopes no steeper than 2H:1V above the top (crest) of the pond perimeter berms and no steeper than 4H:1V below the top (crest) of the pond perimeter berms are considered adequate for the excavation provided a contingency/allowance for slope protection using gravel sheeting (as per OPSS 511 Granular Sheeting) is included in the Contract.

For temporary excavations (e.g. for drainage pipes, structures, headwalls, etc.), the surficial topsoil and clayey silt with organics are considered to be Type 3 soils and the remaining soils are considered to be Type 2 soils according to the Occupational Health & Safety Act & Regulation for Construction Projects ("OHSA"). As such, temporary excavations in Type 2 soils should be carried out with walls sloped to within 1.2 m of the bottom with a slope having a minimum gradient of 1H:1V provided water is allowed sufficient time to drain. All excavations must be carried out in accordance with the latest edition of the OHSA.

General recommendations related to foundations for the cut areas of the ponds are summarized in Table 1 following the text of this report.

10.6 Pond Liner Considerations

We understand that a pond liner system is required for each of the five stormwater management ponds in order to provide for separation between the natural groundwater and the stormwater contained within the pond, to provide for temporary storage of stormwater and allow for passive desedimentation of stormwater prior to discharge via the outlet structure. We understand that liner options include the use of geosynthetics (e.g., a geosynthetic clay liner or a geomembrane) and soil (i.e., compacted low-permeability clay liner). Considering the relatively high groundwater levels combined with the deep cuts through soils with permeable sand layers, there is a high risk of unbalanced hydrostatic pressure causing "ballooning" or heaving of geosynthetic liners which could lead to rupture or failure of the liner system. A compacted clay liner will provide a barrier between the groundwater and stormwater while allowing groundwater levels to reach a state of equilibrium and reducing "build-up" of unbalanced hydrostatic pressures. The installation of a compacted clay liner is also considered to be a more standard construction practice as compared to more specialized procedures / specifications for geosynthetic liners. From a geotechnical perspective, a compacted clay liner is considered to be the preferred option for the SWM Ponds to provide separation between the groundwater and surface inflow ponded water.

In areas where the pond side-slopes and base consist of a minimum thickness of 0.6 m of native silty clay to clayey silt or silty clay till to clayey silt till, it is considered that a compacted clay liner is not required. Based on the existing borehole information, a sufficient thickness of native clayey material is present at SWM Pond 7, SWM Pond 9 and partial areas of the other pond areas. Compacted clay liners are likely required for the southern half of the base of SWM Pond 6, the base of Holborn SWM Pond, and possibly areas of SWM Pond 8. During construction, test pits should be excavated to verify the thickness of the native clayey soils at the pond subgrade level to determine whether subexcavation and placement of a compacted clay liner is required.

From a constructability perspective, the compacted clay liner should consist of a minimum 0.6 m thick layer of low-permeability compacted clay covered with sufficient thickness of ballast/cover soil to counteract hydrostatic pressures for a "dry-pond" condition, but not less than 0.3 m thick as a protective layer. Based on the assumed operating / normal pond water level at the various SWM Pond locations, as interpreted from the design drawings, the following minimum ballast/cover soil thicknesses are recommended: 0.6 m at SWM Pond 6, 0.3 m at SWM Pond 7, 0.6 m at Holborn SWM Pond, and 0.6 m at SWM Pond 8, and 0.3 m at SWM Pond 9.



The liner material should consist of native clayey silt to silty clay, or clayey silt till to silty clay till which is present within the proposed cut areas at the SWM Ponds and in other deep cut areas along the proposed highway alignment. To be generally consistent with the native cohesive soils on Site, the clay liner material should have the following properties.

- Plasticity Index greater than 7 percent (ASTM D422);
- Meet the following gradation requirements (ASTM D 422)
 - 100 percent of the particles passing the 75 mm sieve size;
 - Not less than 50 percent of the particles, by weight, passing the U.S. No. 200 standard sieve (75 μ m openings);
 - Not less than 15 percent of the particles, by weight, greater than 0.002 mm size;
 - Placed in accordance with SP206S03 in maximum 0.3 m thick lifts and compacted to a minimum 95% Standard Proctor Maximum Dry Density of the material.

The compacted clay liner specification provided in the Contract Documents should take into consideration the properties listed above. A NSSP for construction of the clay liner at the stormwater management pond areas is included in Appendix G.

The ballast/cover soil should consist of suitable earth fill available from excavation of the ponds and/or other cut areas and typically consist of sandy silt till to sand and silt till and/or clayey silt till to silty clay till or granular materials. Ballast/cover (earth fill) should be placed and compacted in accordance with SP206S03. In areas near inlet / outlet structures, erosion protection should be provided as discussed in the following section.

It is recommended that the groundwater level be maintained at least 0.6 m below the pond excavation subgrade level, as required to accommodate the thickness of the liner and ballast/cover soil below the proposed final bottom of pond level in order to construct the liner in the dry and to achieve adequate compaction of the clay liner material. Dewatering methods as described in Section 10.5 should be implemented during and following construction in order to prevent basal heave of the liner system and to allow the groundwater and pond water levels to reach a stabilized condition at the permanent pond level. Depending on groundwater levels and the rate of water seepage into the excavations during construction, water may need to be introduced into the ponds (e.g. SWM Pond 6, Holborn SWM Pond, and SWM Pond 8) immediately after the liner is completed in order to prevent basal heave of the liner once dewatering of the pond excavation has ceased. Consideration of basal heave of the liner system needs to be considered in future maintenance of the ponds if the pond water is emptied and groundwater conditions are not allowed sufficient time to stabilize.

10.7 Inlet / Outlet Structure Foundations

Based on the pond design drawings, inlet pipe structures consist of a headwall meeting the specifications of OPSD 804.040 (Concrete Headwall) and outlet structures typically consist of concrete drop structures. The width of the footing for the headwalls are shown on the drawings to be about 0.5 m wide and the concrete base dimensions for the outlet structures are shown to range from about 1 m to 3 m wide.

Consideration has been given to using shallow spread footing and deep foundation options for the support of the outlet structures. However, given the relatively competent nature of the subsoils and relatively small net



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additional loading acting on the foundation soils below the structures, deep foundations are not considered to be a practical option.

Spread footings for the headwalls and outlet structures (i.e., the concrete base of the outlet structure is considered to act like a rigid spread footing) have been considered for design and details are provided below for each pond area.

Pond Area Designation	Structure	Founding Soil	Structure Founding Elevation (Depth below proposed base of pond)	Factored Geotechnical Resistance at ULS	Geotechnical Resistance at SLS (for 25 mm of settlement)
SWM Pond 6	Inlet Headwall (0.5 m wide)	Compact Sandy Silt / Very Stiff to Hard Clayey Silt Till	251 m (1.5 m)	250 kPa	175 kPa
	Outlet Structures (1 m to 2 m wide)	Loose Sandy Silt / Very Stiff to Hard Clayey Silt Till	250 m to 249 m (3 m to 5 m)	250 kPa	175 kPa
SWM Pond 7	Inlet Headwall (0.5 m wide)	Very Stiff Clayey Silt Till	245.5 m (1.5 m)	250 kPa	175 kPa
	Outlet Structures (1 m to 2 m wide)	Stiff to Very Stiff Clayey Silt Till	244 m (3 m to 5 m)	300 kPa	200 kPa
Holborn SWM Pond	Inlet Headwall (0.5 m wide)	Firm Clayey Silt Till / Dense Silty Sand / Compact to Dense Sandy Silt Till	247.5 m (1.5 m)	200 kPa	150 kPa
	Outlet Structures (1 m to 2 m wide)	Stiff Clayey Silt Till / Compact Silty Sand	246 m (3 m to 4.5 m)	250 kPa	175 kPa
SWM Pond 8	Inlet Headwall (0.5 m wide)	Very Stiff to Hard Clayey Silt Till / Compact Sandy Silt Till / Very Dense Silt	237.5 m (1.5 m)	250 kPa	175 kPa
	Outlet Structures (1 m to 2 m wide)	Very Stiff to Hard Clayey Silt Till / Very Dense Silt	236 m (3 m to 5.5 m)	300 kPa	200 kPa
Drop Structure at Station 36+458	Outlet Drop Structure (2 m to 3 m wide)	Very Stiff to Hard Clayey Silt / Dense to Very Dense Silty Sand to Sand	234.5 m (4.5 m)	350 kPa	250 kPa



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Pond Area Designation	Structure	Founding Soil	Structure Founding Elevation (Depth below proposed base of pond)	Factored Geotechnical Resistance at ULS	Geotechnical Resistance at SLS (for 25 mm of settlement)
SWM Pond 9	Inlet Headwall (0.5 m wide)	Compact Sandy Silt to Sand and Silt Till / Stiff to Very Stiff Silty Clay Till to Clayey Silt Till	228 m (1.5 m)	250 kPa	175 kPa
	Outlet Structure (1.5 m to 2.5 m wide)	Compact Sandy Silt to Sand and Silt Till / Stiff to Very Stiff Silty Clay to Clayey Silt Till	228 m (1.5 m)	250 kPa	175 kPa

All footings should be provided with a minimum 1.5 m of soil cover or equivalent thickness of insulation below the footings for frost protection (OPSD 3090.101) in the event that the ponds or the outlet structures are empty. As a guide, 25 mm (1 inch) of rigid polystyrene foam insulation may be used for every 0.3 m reduction in soil cover.

Temporary excavations for the headwalls and outlet structures will extend to depths up to 5.5 m below proposed bottom of the ponds (up to 7.5 m below existing ground surface). Temporary excavations should be made in accordance with Section 10.5. Given the water levels encountered in the open boreholes during drilling and the piezometers, groundwater levels are expected to be up to about 3.5 m, 1.5 m, 1 m, and 2 m above the founding level of the proposed inlet and/or outlet structures at SWM Pond 6, SWM Pond 7, Holborn SWM Pond and SWM Pond 8, respectively. At SWM Pond 9 and at the drop structure located at Sta. 36+458 near SWM Pond 8, the groundwater levels are to be at or slightly below the founding level of the proposed inlet and/or outlet structures. As a result, temporary dewatering measures are required to reduce the potential for basal heave / softening of the founding soil conditions for temporary excavations at the inlet / outlet structure sites. It is recommended that water levels be lowered to at least 0.6 m below the founding elevation of each structure foundation.

Given the relative density and grain size distribution for the silt and sand till and clayey silt till in these areas, and the results of hydraulic conductivity testing performed within the sandy layers along the Highway 404 alignment, it is considered likely that pumping from within trenches/ditching with adequately sized and properly filtered pumps will be sufficient to control the groundwater inflow. Surface water should be directed away from the excavations at all times.

10.8 Erosion Protection

The requirements for design of erosion protection measures for the inlet and outlet sewer pipes should be assessed by the hydraulic design engineer. As a minimum, rip-rap treatment for the inlet and outlet of the sewer pipes should be consistent with the standard presented in OPSD 810.010 (Rip-Rap Treatment for Sewer and Culvert Outlets) Rip-Rap Treatment Type A, with the rip-rap placed to above the pipe invert, in combination with the cut-off headwalls. Similarly, rip-rap should be provided over the full extent of the side slopes and base grade below and adjacent to the sewer inlet / outlet locations. It is also recommended that the active water line zone (i.e., from high water level to low water level) should be protected with a minimum 150 mm thick layer of rip-rap meeting classification R-10 according to OPSS 1004 (Material Specification for Aggregates).



11.0 CLOSURE

This Hydrogeology Design Report was prepared by Mr. Shawn Lytle, P.Geo., a Principal and Senior Hydrogeologist with Golder Associates and reviewed by Mr. Chris Kozuskanich, P.Geo., a Senior Hydrogeologist and Associate with Golder Associates. The SWM Pond design (Section 10) was prepared by Mr. Kevin Bentley, P.Eng., a geotechnical engineer and Associate with Golder. Mr. Jorge M.A. Costa, P.Eng., a Principal of Golder Associates and a Designated MTO Contact for Foundations conducted an independent quality control review of the report.



Report Signature Page

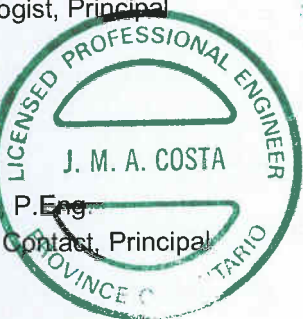
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REFERENCES

- Barnett, P.J., Cowan, W.R., and Henry, A.P. 1991. Quaternary Geology of Ontario, Southern Sheet; Ontario Geological Survey, Map 2556, scale 1:1,000,000.
- Barnett, P.J., and Gwyn, Q.H.J., 1997: Surficial Geology of the Newmarket Area, NTS 31D/3, southern Ontario; Geological Survey of Canada, Open File 3329, Scale 1:50 000.
- Bouwer, H. and Rice, R.C., 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. *Water Resources Research*, v. 12, pp. 423-428.
- Butler, J.J.Jr., 1998. *The Design, Performance, and Analysis of Slug Tests*. Lewis Publishers, Boca Raton, Florida.
- Canadian Highway Bridge Design Code (CHBDC) and Commentary on CAN/CSA S6 06. 2006. CSA Special Publication, S6.1 06. Canadian Standard Association.
- Chapman, L.J., and Putnam, D.F. 1984. Physiography of Southern Ontario; Ontario Geological Survey, Map P.2715 (coloured). Scale 1:600,000.
- Cooper, H.H., Jr., J.D. Bredehoeft, and I.S. Papadopoulos, 1967. Response of a finite diameter well to an instantaneous charge of water. *Water Resources Research*, V.3, n.1, pp. 263-269.
- Freeze, R.A., and Cherry, J.A., 1979. *Groundwater*. Prentice-Hall, Toronto. ISBN 0-13-365312-9, 604 p.
- Golder Associates Ltd., August 2005. Hydrogeological Assessment, Highway 404, Green Lane to Ravenshoe Road. Project No. 04-1111-016-A.
- Lake Simcoe Region Conservation Authority. 1998. Maskinonge River Remedial Strategy, Final Report. Website: <http://www.lsrca.on.ca/studies/masknonge.html>.
- Natural Resources Canada. The Atlas of Canada, Toporama, Topographic Maps. Website: <http://atlas.nrcan.gc.ca/site/english/maps/topo/map>.
- Ontario Geological Survey. 1991. Bedrock Geology of Ontario, Southern Sheet; Ontario Geologic Survey Map 2544, scale 1:1,000,000.
- Ontario Ministry of the Environment, Environmental Monitoring and Reporting Branch, (December 3, 2008). Water Well Records Print-Out.
- Ontario Ministry of the Environment and Energy, July, 1994. Provincial Water Quality Objectives, Table 2 – Table of PWQOs and Interim PWQOs.
- Ontario Ministry of the Environment, Waste Management Branch, June 1991. Waste Disposal Site Inventory. ISBN 0-7729-8409-3, PIBS 256.
- Powers, J. P., 1981. *Construction Dewatering*. John Wiley & Sons, Inc., Toronto. ISBN 0-471-69591-2. 484



STANDARDS:

ASTM International:

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

Contract Design Estimating and Documentation (CDED):

Special Provision 206S03 Amendment to OPSS 206 – Earth Excavation, Grading. July 2007.

Ontario Provisional Standard Drawing:

OPSD 3090.101 Foundation Frost Depths for Southern Ontario. November 2005.

OPSD 804.040 Concrete Headwall for Sewer or Culvert Pipe Outlet. November 2006.

OPSD 810.010 Rip-Rap Treatment for Sewer and Culvert Outlets. November 2007.

Ontario Provisional Standard Specifications:

OPSS 572 Construction Specification for Seed and Cover. November 2003

OPSS 511 Construction Specification for Rip-Rap, Rock Protection and Granular Sheeting. Nov. 2008

OPSS 1004 Material Specification for Aggregates – Miscellaneous. November 2006

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

(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



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.

TABLE 1
SUMMARY OF STORMWATER MANAGEMENT POND FOUNDATION RECOMMENDATIONS
HIGHWAY 404 EXTENSION FROM QUEENSVILLE SIDEROAD TO RAVENSHOE ROAD
W.P. 2005-07-00

<i>Stormwater Management Pond Designation</i>	<i>Proposed Maximum Depth of Cut and/or Height of Fill</i>	<i>Topography and Subsurface Conditions</i>	<i>Recommended Cut and/or Fill Side Slope</i>	<i>Recommended Dewatering Measures for Pond Excavation</i>	<i>Other Considerations</i>
SWM Pond 6	Cut (up to 4.5 m) to base of pond and Fill (up to 2.5 m) to top of containment berm on north side.	Generally flat ground surface consisting of farm fields. Cut through clayey silt till and sandy silt layers.	Cut in native soils with 2H : 1V side-slopes above top of adjacent containment berm and with 4H:1V slopes below top of berm. Earth Fill with 2H:1V side-slopes for the containment berm.	Excavate pond from north to south with drainage trench/pipe at north end to allow for gravity drainage of groundwater prior to excavating final side-slopes and base grade. Alternatively, pumping from sumps within the excavation should be adequate. Temporary ditches / trenches will be required to lower water level during excavation / liner construction due to high water table and presence in wet silty sand soils near the base of excavation.	Allowance for gravel sheeting should be provided in the Contract. Dewatering measures for construction of headwalls, outlet structures, pipes, and liner are consistent with recommendations for the pond excavation. Basal heave of the liner is considered to be a significant risk at the south portion of the pond. An increased thickness of ballast material, possibly combined with a more elaborate active dewatering system (consisting of wells) is required if the permanent pool water level cannot be established immediately after construction of the liner and for protection of the liner in the event of low ponded water levels or dry pond conditions. Diversion of water seepage from cut above the top of pond on the south side needs to be considered (possibly diverted and drained using the top of pond bench).
SWM Pond 7	Cut (up to 4 m) to base of pond and Fill (up to 3 m) to top of pond containment berm on east side.	Gentle sloping ground within farm field and grassy area. Cut through clayey silt till.	Cut in native soils with 2H : 1V side-slopes above top of containment berm and with 4H:1V slopes below top of berm. Earth Fill with 2H:1V side-slopes for the containment berm.	Excavate pond from west to east with drainage trench at east end to allow for gravity drainage of groundwater prior to excavating final side-slopes and base grade. Alternatively, pumping from sumps within the excavation should be adequate.	Allowance for gravel sheeting should be provided in the Contract. Dewatering measures for construction of headwalls, outlet structures, pipes, and liner are consistent with recommendations for the pond excavation.

TABLE 1
SUMMARY OF STORMWATER MANAGEMENT POND FOUNDATION RECOMMENDATIONS
HIGHWAY 404 EXTENSION FROM QUEENSVILLE SIDEROAD TO RAVENSHOE ROAD
W.P. 2005-07-00

<i>Stormwater Management Pond Designation</i>	<i>Proposed Maximum Depth of Cut and/or Height of Fill</i>	<i>Topography and Subsurface Conditions</i>	<i>Recommended Cut and/or Fill Side Slope</i>	<i>Recommended Dewatering Measures for Pond Excavation</i>	<i>Other Considerations</i>
Holborn SWM Pond	Cut (up to 2.5 m) to base of pond and Fill (up to 2 m) to top of pond containment berm.	Generally flat ground surface consisting of farm field. Cut through silty clay to clayey silt, clayey silt till, sandy silt till, and silty sand layers.	Cut in native soils with 2H : 1V side-slopes above top of pond containment berm and with 4H:1V slopes below top of berm. Earth Fill with 2H:1V side-slopes for the containment berm.	Dewatering using sumps during the excavation, combined with temporary ditches / trenches will be required to lower water level during excavation / liner construction. Active dewatering using pumping wells within the excavation may be required if significant wet silty sand soils are present near the base of excavation.	Allowance for gravel sheeting should be provided in the Contract. Dewatering measures for construction of headwalls, outlet structures, pipes, and liner are consistent with recommendations for the pond excavation. Active dewatering from the silty sand layer may be required to lower the water level to construct the liner in the dry and to prevent basal heave of the liner immediately after construction and prior to the pond water level reaching the permanent pool level. An increased thickness of ballast material may be required for protection of the liner in the event of low ponded water levels or dry pond conditions.
SWM Pond 8	Cut (up to 6 m) to base of pond and Fill (up to 0.5 m) to top of pond containment berm.	Gently sloping ground from west to east towards the Maskinonge River consisting of grassy areas and localized tree covered areas. Cut through clayey silt till, sand, sandy silt to silt, and sandy silt till.	Cut in native soils with 2H : 1V side-slopes above top of pond containment berm with 4H:1V slopes below top of berm. Earth Fill with 2H:1V side-slopes for the containment berm.	Construct drainage outlet pipe and outfall prior to excavating pond. Excavate pond during gravity drainage of groundwater through outlet pipe prior to excavating final side-slopes and base grade. Alternatively, pumping from sumps and/or using diversion trenches/ditches within the excavation should be adequate.	Allowance for gravel sheeting should be provided in the Contract. Dewatering measures for construction of headwalls, outlet structures, pipes, and liner are consistent with recommendations for the pond excavation. Diversion of water seepage from deep cut above the top of pond on the west side needs to be considered (possibly diverted and drained using the top of pond bench).
SWM Pond 9	Cut (up to 2 m) to base of pond and Fill (up to 2.5 m) to top of pond containment berm.	Generally flat ground surface consisting of grass field with tree-covered areas. Cut through silty clay to clayey silt till and sandy silt to sand and silt till.	Cut in native soils with 2H:1V side-slopes above top of pond containment berm with 4H:1V slopes below top of berm. Earth Fill with 2H:1V side-slopes for the containment berm.	Existing water levels are near or below the base pond level. Dewatering using sumps during the excavation should be adequate to lower the water level during excavation / liner construction.	Dewatering measures for construction of headwalls, outlet structures, pipes, and liner are consistent with recommendations for the pond excavation.

Drawing file: N:\CAD\2008\08-1111-0022\08-1111-0022(3000)-001 2009'10'- Key Map for 404 ext-Fig 1.dwg Feb 11, 2010 - 2:33pm



ALL LOCATIONS ARE APPROXIMATE

LEGEND

- 500 m BOUNDARY
- PROPOSED HIGHWAY 404

PROJECT

Highway 404 Extension: QUEENSVILLE
SIDEROAD TO RAVENSHOE ROAD

TITLE

KEY PLAN



**Golder
Associates**
Whitby, Ontario

PROJECT No. 08-1111-0022

FILE No. 001

DESIGN

CADD PJV Oct. 2009

CHECK

REVIEW

SCALE AS SHOWN REV.

FIGURE 1



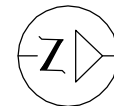
APPENDIX A

Highway 404 - Boag Road SBL Structure

Drawings, Record of Boreholes and Laboratory Test Results

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

CONT No.
WP No.2005-07-00



HIGHWAY 404
BOAG ROAD OVERPASS - SBL
BOREHOLE LOCATION AND SOIL STRATA

SHEET

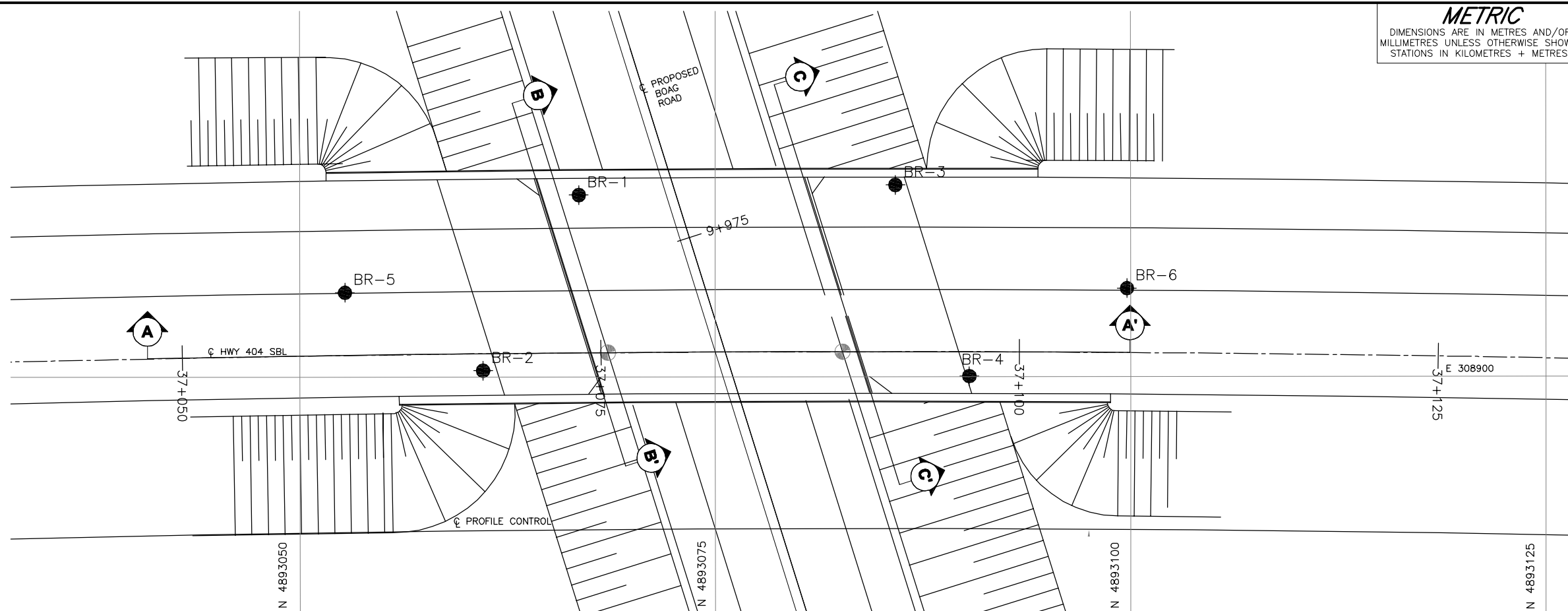


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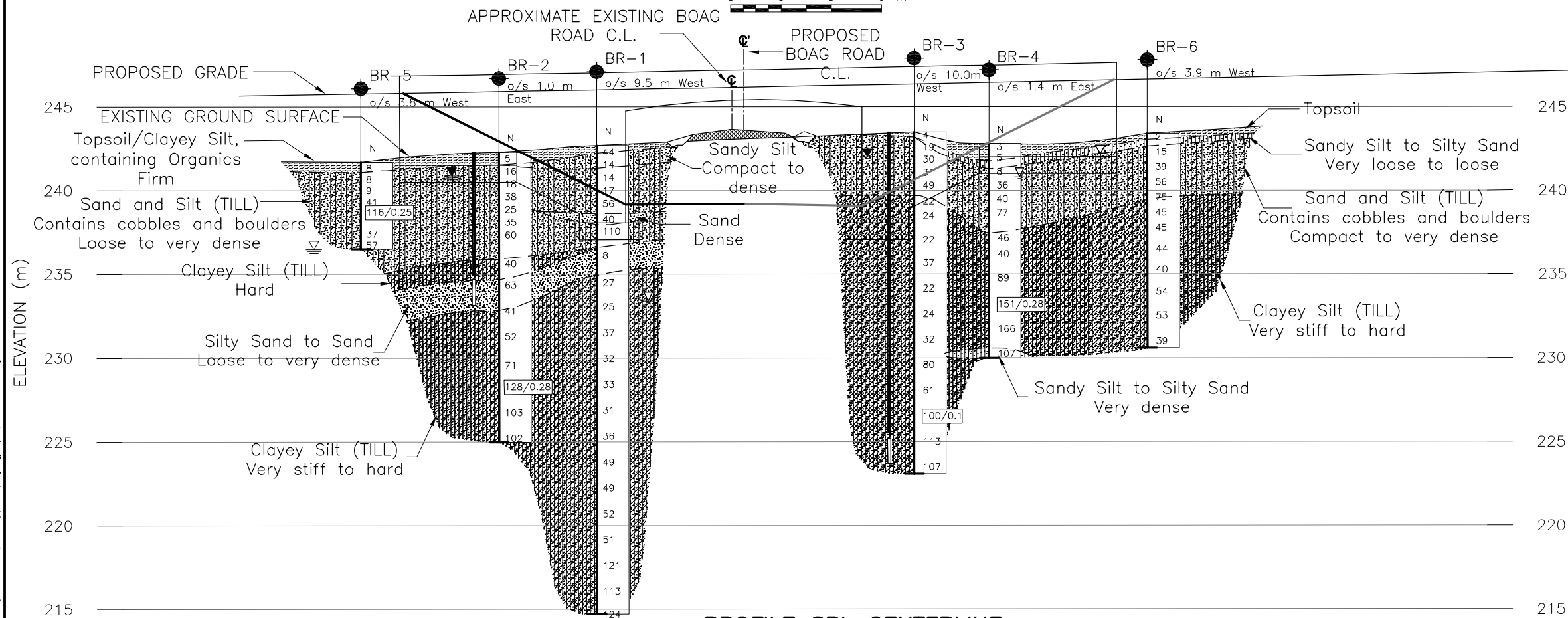
KEY PLAN

SCALE
1.5 0 1.5 3 km



PLAN

SCALE
3 0 3 6 m



PROFILE SBL CENTERLINE

SCALE
3 0 3 6 m

LEGEND

- Borehole - Current Investigation
- ⊥ 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 May 20, 2009
- ≡ WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
BR-1	242.7	4893066.8	308889.1
BR-2	242.3	4893061.0	308899.6
BR-3	243.5	4893085.8	308888.5
BR-4	242.8	4893090.3	308900.0
BR-5	241.7	4893052.7	308894.9
BR-6	243.4	4893099.8	308894.7

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.

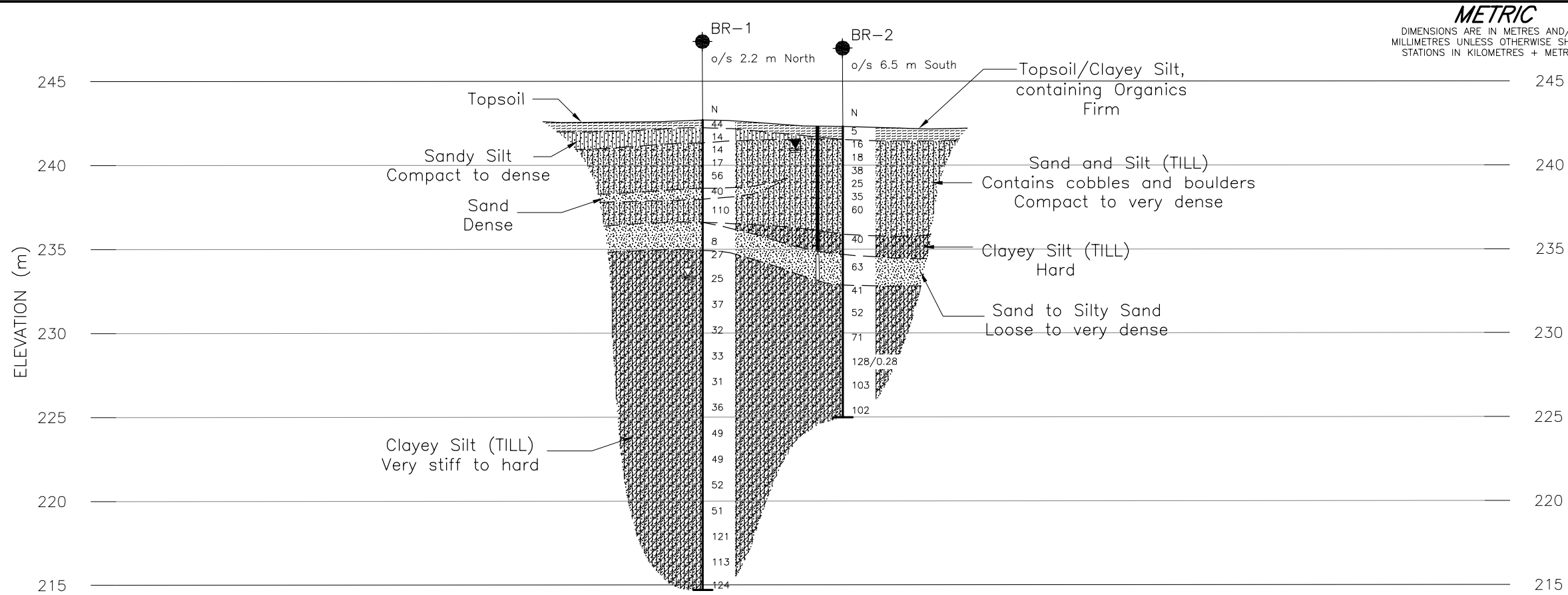
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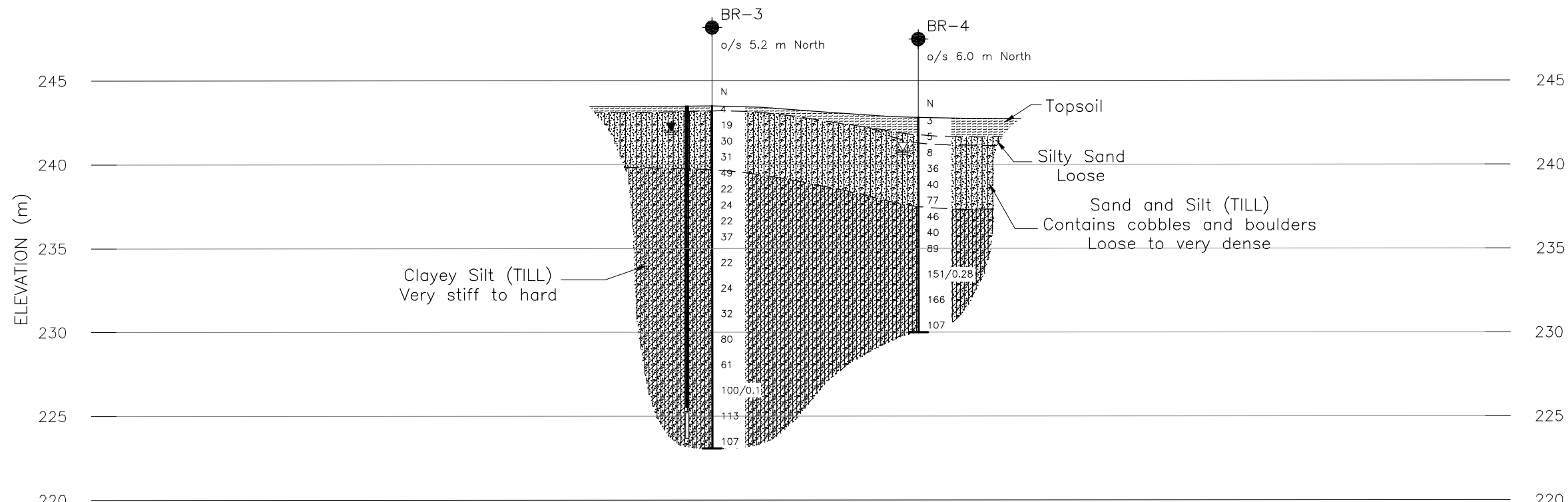
NO.	DATE	BY	REVISION
1	Nov. 18, 2009	KJB	UPDATED BASE DRAWING

Geocres No. 31D-499

HWY.	404	PROJECT NO.	08-1111-0022	DIST.
SUBM'D.		CHKD.	TB	DATE: Nov. 2009
DRAWN:	DD	CHKD.	KJB	APPD. JMAC
				DWG. A1



SECTION B-B' ALONG SOUTH ABUTMENT



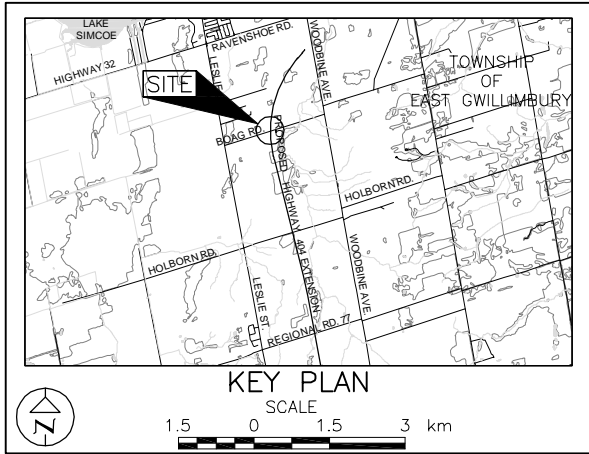
SECTION C-C' ALONG NORTH ABUTMENT

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

CONT No.
WP No.2005-07-00

HIGHWAY 404
BOAG ROAD OVERPASS - SBL
SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND	
	Borehole - Current Investigation
	Seal
	Piezometer
	Standard Penetration Test Value
	Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
	WL in piezometer, measured on May 20, 2009
	WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
BR-1	242.7	4893066.8	308889.1
BR-2	242.3	4893061.0	308899.6
BR-3	243.5	4893085.8	308888.5
BR-4	242.8	4893090.3	308900.0

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

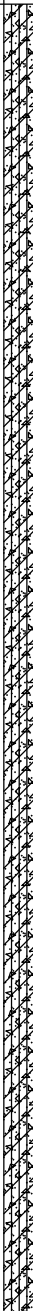
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1	Nov. 18, 2009	KJB	UPDATED BASE DRAWING
NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Nov. 2009	SITE:
DRAWN: DD	CHKD. KJB	APPD. JMAC	DWG. A2

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

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

PROJECT _____		RECORD OF BOREHOLE No BR-1		2 OF 3 METRIC	
2005-07-00		LOCATION N 4893066.8 ; E 308889.1		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE February 19, 2009		CHECKED BY JB	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	w _p	w	w _L						
	--- CONTINUED FROM PREVIOUS PAGE ---																				
	CLAYEY SILT, trace to some sand, trace to some gravel, containing sandy silt interlayers (TILL) Very stiff to hard Grey Moist		14	SS	31																
			15	SS	36																
			16	SS	49																
			17	SS	49																

Continued Next Page

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

MIS-MTO.001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____	RECORD OF BOREHOLE No BR-1	3 OF 3 METRIC
2005-07-00	LOCATION N 4893066.8 ;E 308889.1	ORIGINATED BY TB
DIST _____ HWY 404	BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger	COMPILED BY SC
DATUM Geodetic	DATE February 19, 2009	CHECKED BY JB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	REMOULDED	w _p	w		w _L				
	--- CONTINUED FROM PREVIOUS PAGE ---																				
	END OF BOREHOLE																				
	NOTE: 1. Water level inside augers at a depth of 9.3 m (Elev. 233.4 m) below ground surface upon completion of drilling. * The 'N' value of 8 may be the result of "blowing" sands during drilling operations and may not be representative of the in-situ relative density of the sand layer.																				

MIS-MTO.001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No BR-2		1 OF 2 METRIC	
2005-07-00		LOCATION N 4893061.0 ; E 308899.6		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE February 23, 2009		CHECKED BY JB	

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		
								20 40 60 80 100	20 40 60 80 100	10 20 30				
242.3	GROUND SURFACE													
0.0	CLAYEY SILT, some sand, trace gravel, containing organics and rootlets Firm Brown Moist		1	SS	5									OC=2.6%
241.5			2	SS	16									
0.8	SAND and SILT, trace to some clay, trace to some gravel, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		3	SS	18									
			4	SS	38									
			5	SS	25									10 33 45 12
			6	SS	35									
			7	SS	60									3 44 50 3
235.9														
6.4	CLAYEY SILT, some sand, trace gravel, contains sand seams (TILL) Hard Grey Moist to wet		8	SS	40									
234.7														
7.6	Silty SAND, trace clay Very dense Brown Moist		9	SS	63									
232.9			10A	SS	41									
9.5	CLAYEY SILT, trace sand, trace gravel, contains sandy silt seams (TILL) Hard Grey Moist		10B											
			11	SS	52									
			12	SS	71									
			13	SS	128/0.24									0 2 77 21

Continued Next Page

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

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No BR-2				2 OF 2 METRIC											
2005-07-00		LOCATION N 4893061.0 ; E 308899.6				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 23, 2009				CHECKED BY JB											
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					WATER CONTENT (%)				
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					W _p W W _L 10 20 30					
225.0	CLAYEY SILT, trace sand, trace gravel, contains sandy silt seams (TILL) Hard Grey Moist		14	SS	103		227										
							226										
			15	SS	102		225										
17.3	END OF BOREHOLE																
	NOTES: 1. Auger refusal on inferred boulder at 5.8 m depth (Elev. 236.5 m). Drill rig moved 1 m North and continued drilling. 2. Water level inside augers at a depth of 6.4 m (Elev. 235.9 m) during drilling operations. 3. Water level in piezometer at a depth of 1.4 m (Elev. 240.9 m) below ground surface on March 12, 2009. 4. Water level in piezometer at a depth of 1.3 m (Elev. 241.0 m) below ground surface on May 20, 2009. 5. Water level in piezometer at a depth of 2.2 m (Elev. 240.1 m) below ground surface on June 12, 2009.																

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

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

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No BR-3		2 OF 2 METRIC	
2005-07-00		LOCATION N 4893085.8 ; E 308888.5		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE February 10 and 11, 2009		CHECKED BY JB	

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					WATER CONTENT (%)							
								20	40	60	80	100	W _p	W	W _L					
	--- CONTINUED FROM PREVIOUS PAGE ---																			
	CLAYEY SILT, trace to some sand, trace gravel, containing sandy silt interlayers (TILL) Very stiff to hard Brown to grey Moist Oxide staining to a depth of 6.1 m		14	SS	61															
				15	SS	100/0.10														
				16	SS	113														

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

PROJECT _____		RECORD OF BOREHOLE No BR-4				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893090.3 ; E 308900.0				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 10, 12 and 13, 2009				CHECKED BY JB								
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						
242.8 0.0	GROUND SURFACE TOPSOIL		1	SS	3									
241.8 1.0	Silty SAND, trace clay, containing rootlets		2	SS	5									
241.3 1.5	Loose Brown Moist		3	SS	8									
	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL)		4	SS	36									2 50 43 5
	Loose to very dense Moist Brown		5	SS	40									
			6	SS	77									
237.5 5.3	CLAYEY SILT, trace to some sand, trace gravel, contains sandy silt interlayers (TILL)		7	SS	46									
	Hard Grey Moist to wet		8	SS	40									
			9	SS	89									
			10	SS	151/0.28									5 15 64 16
	Becoming wet below a depth of 10.7 m		11	SS	166									0 1 74 25
230.6 12.2	Sandy SILT to Silty SAND, trace clay		12	SS	107									
230.0 12.8	Very dense Grey Wet													
	END OF BOREHOLE													
NOTES: 1. Water level in open borehole measured at a depth of 2.0 m (Elev. 240.8 m) below ground surface upon completion of drilling.														

PROJECT _____		RECORD OF BOREHOLE No BR-5				1 OF 1 METRIC											
2005-07-00		LOCATION N 4893052.7 ; E 308894.9				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 24, 2009				CHECKED BY JB											
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 20 40 60 80 100									
241.7 0.0	GROUND SURFACE TOPSOIL		1	SS	8												
241.1 0.6	SAND and SILT, some gravel, trace to some clay, containing cobbles and boulders and oxidation staining (TILL) Loose to very dense Brown Moist		2	SS	8												14 33 44 9
			3	SS	9												
			4	SS	41												14 36 42 8
			5	SS	116/0.25												
			6	SS	37												
236.5 5.2	Becoming grey/brown at a depth of 4.9 m END OF BOREHOLE		7	SS	57												
NOTES: 1. Water level in open borehole measured at a depth of 5.2 m (Elev. 236.5 m) below ground surface upon completion of drilling.																	

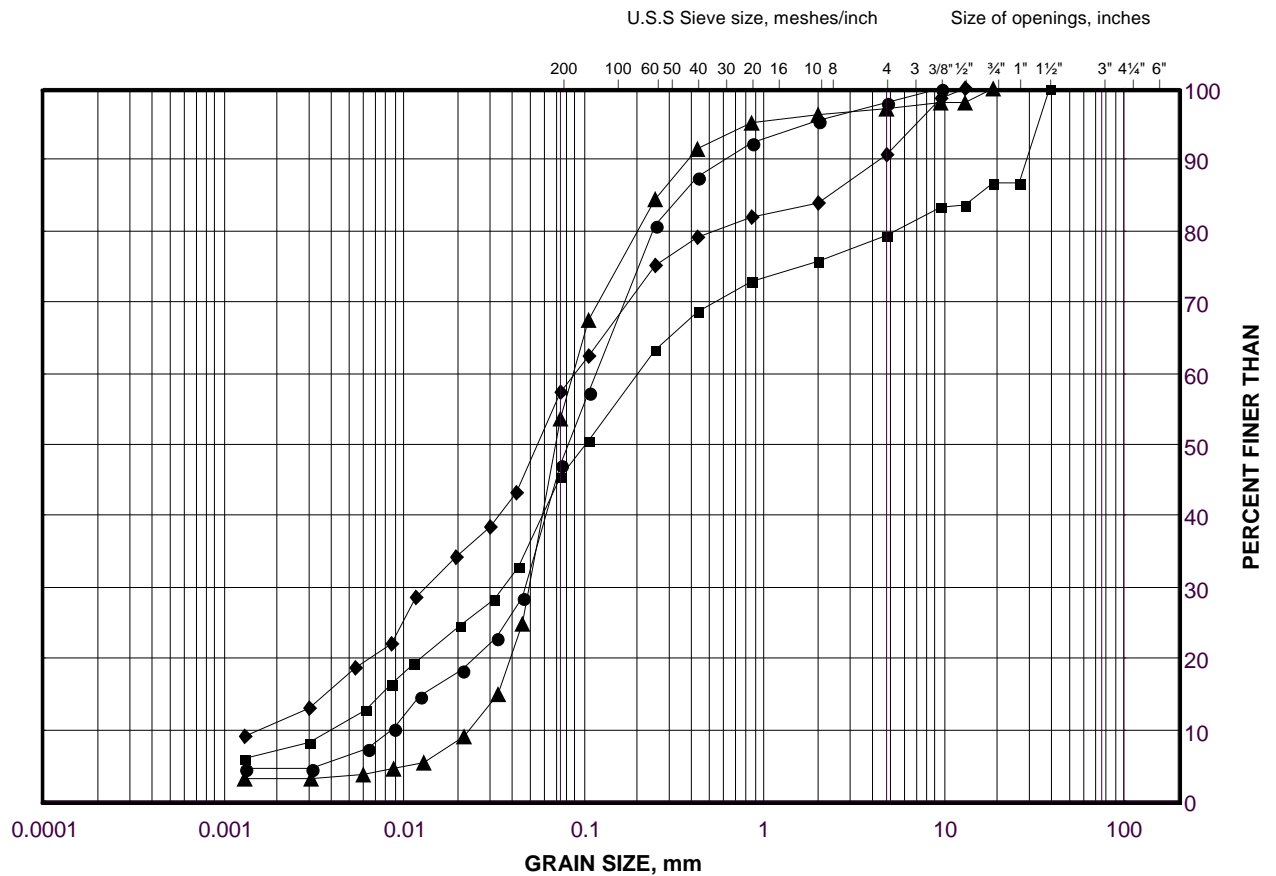
PROJECT _____		RECORD OF BOREHOLE No BR-6				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893099.8 ; E 308894.7				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 13, 2009				CHECKED BY JB								
SOIL PROFILE			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						
243.4	GROUND SURFACE							20 40 60 80 100						
0.0	TOPSOIL		1	SS	2		243							
243.0														
242.6	Sandy SILT, trace clay, trace gravel, containing rootlets		2	SS	15		242							
0.8	Very loose Brown Wet													
	SAND and SILT, trace to some clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		3	SS	39		241							5 39 48 8
			4	SS	56									
			5	SS	75		240							
239.4	CLAYEY SILT, trace to some sand, trace gravel, contains sandy silt interlayers (TILL) Hard Brown Moist		6	SS	45		239							
4.0			7	SS	45									
	Becoming grey below a depth of 5.2 m						238							
			8	SS	44		237							2 10 64 24
							236							
			9	SS	40		235							
							234							
			10	SS	54									
							233							
			11	SS	53		232							
			12	SS	39		231							
230.6	END OF BOREHOLE													
12.8	NOTES: 1. Water level in open borehole measured at a depth of 1.2 m (Elev. 242.2 m) two hours after completion of drilling.													

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

GRAIN SIZE DISTRIBUTION

Sand and Silt Till

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)
●	BR-4	4	240.2
■	BR-1	4	240.1
◆	BR-2	5	238.9
▲	BR-2	7	237.5

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10

Sand and Silt Till

U.S.S. Sieve size, meshes/inch

Size of openings, inches

PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Sieve Size (mesh/inch)	Percent Finer Than (%)
0.075	20/30	55
0.15	10/20	85
0.3	60/100	95
0.6	30/60	98
1.18	16/30	100

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

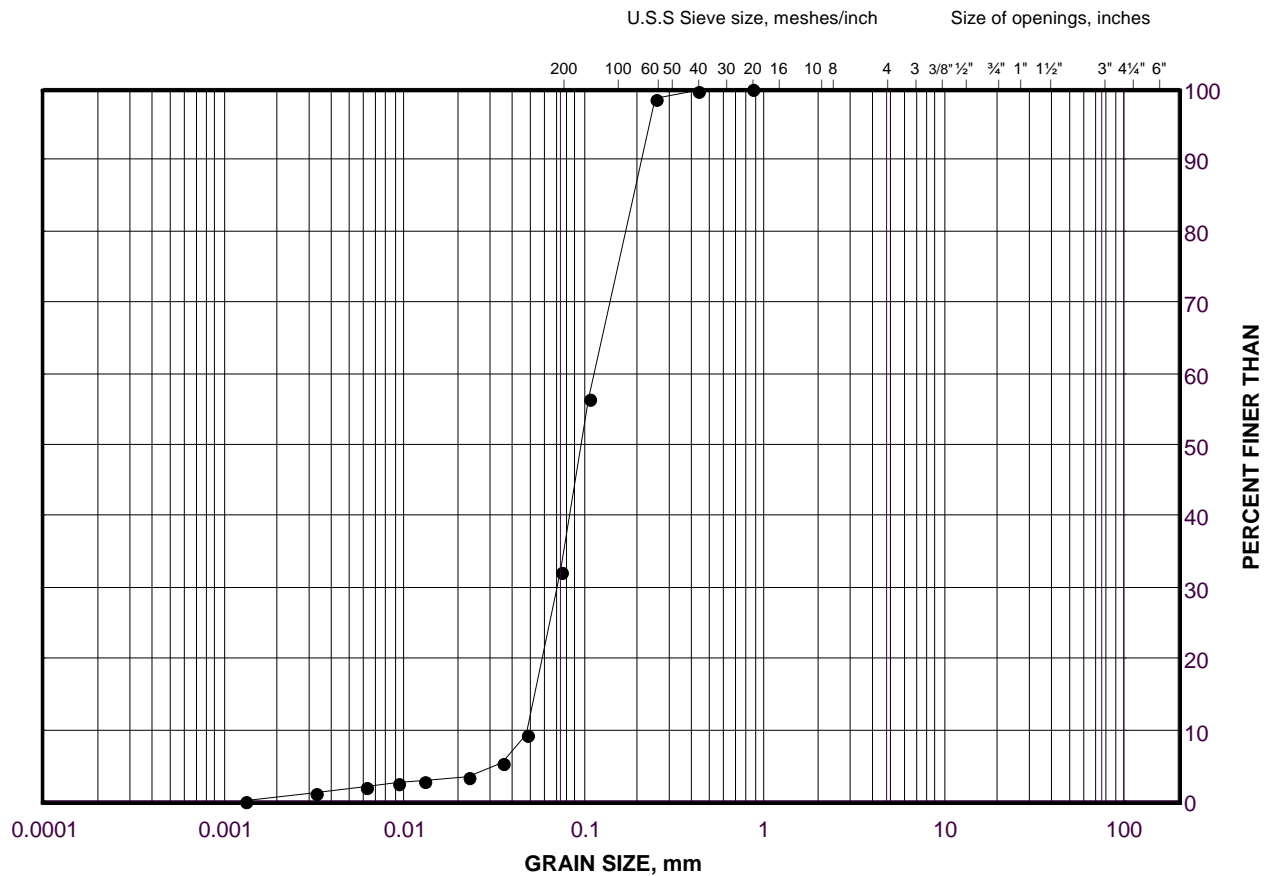
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-5	2	240.7
■	BR-6	4	240.8
◆	BR-5	4	239.1

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Silty Sand

FIGURE A3



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	BR-1	8	236.2

Project Number: 08-1111-0022E

Checked By: KJB

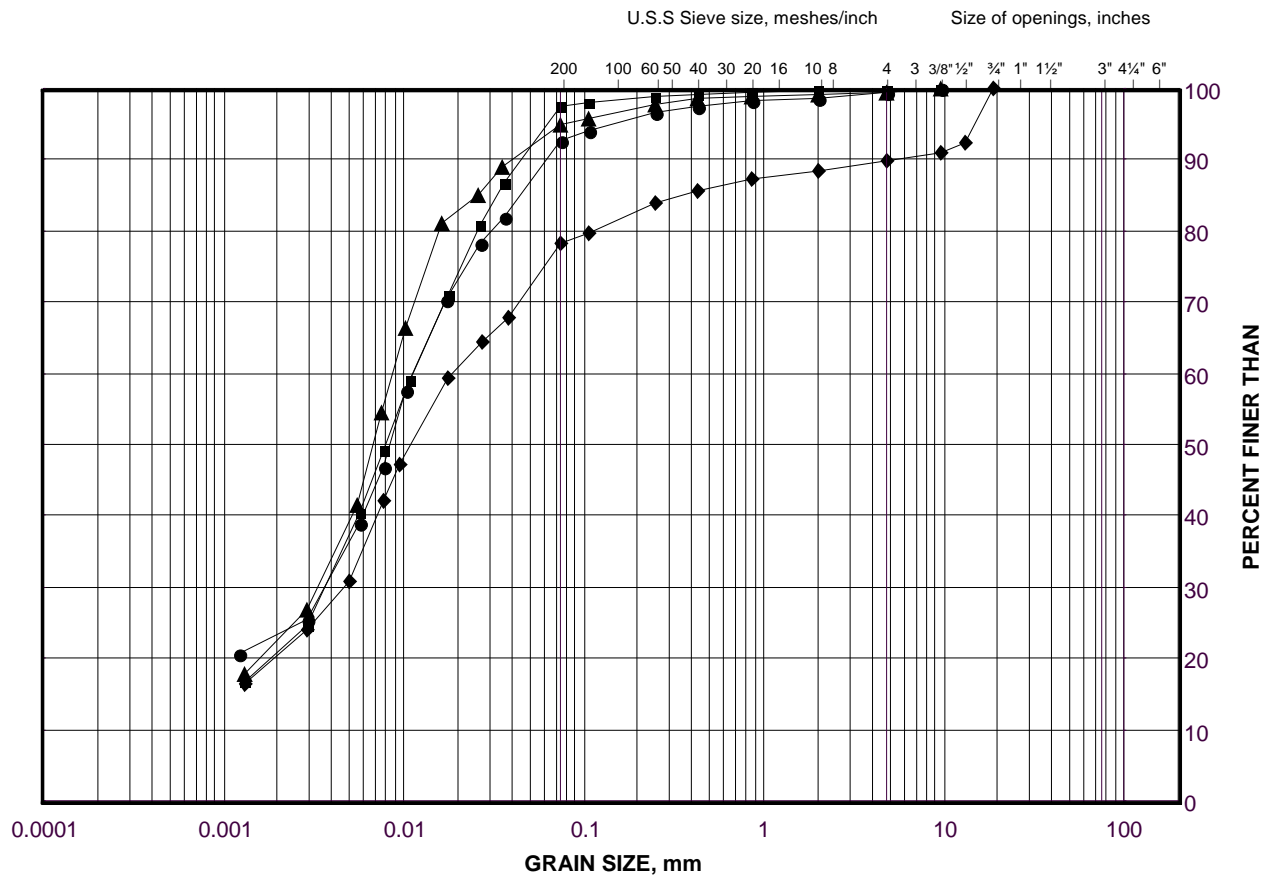
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE A4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-1	12	230.2
■	BR-2	13	228.3
◆	BR-1	16	224.1
▲	BR-3	6	239.4

Project Number: 08-1111-0022E

Checked By: KJB

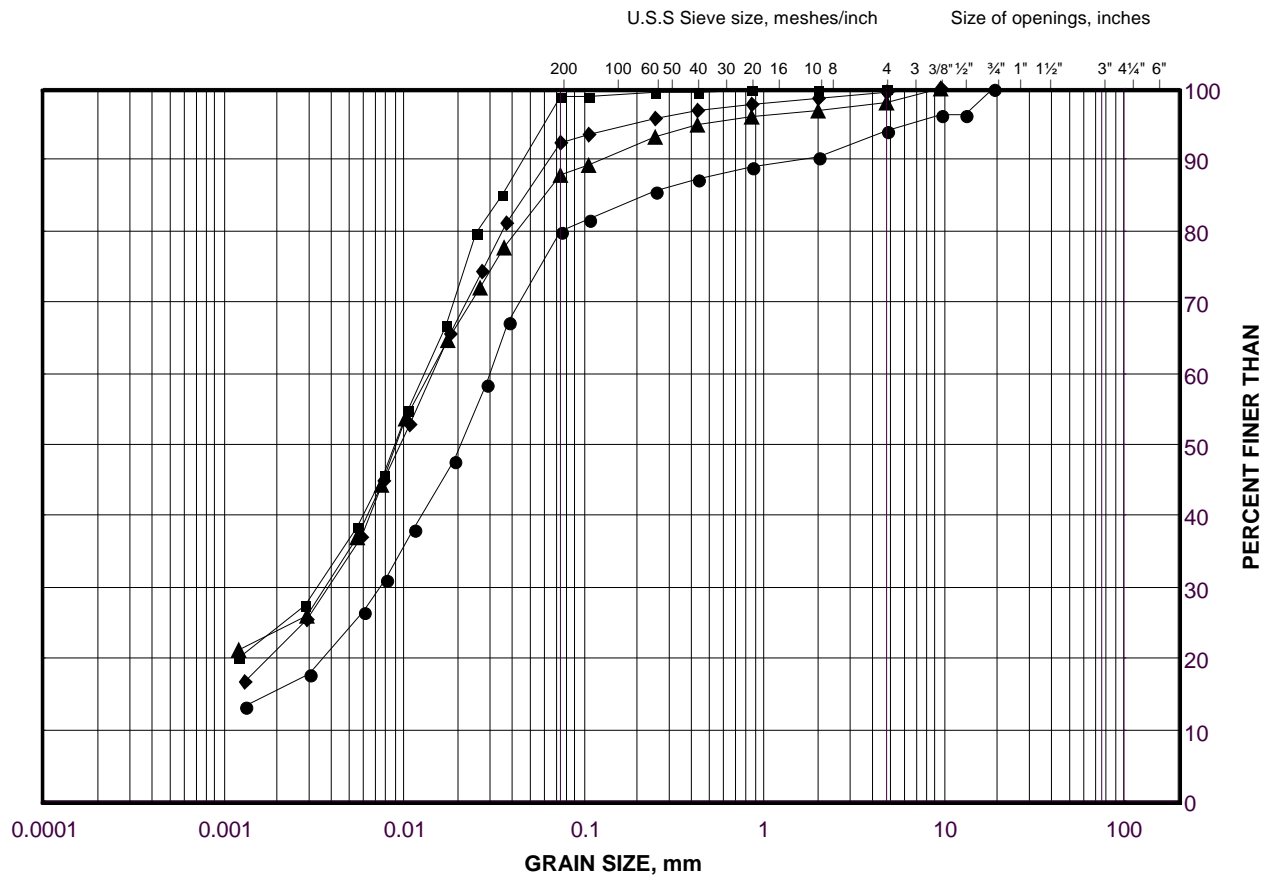
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE A5



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

LEGEND

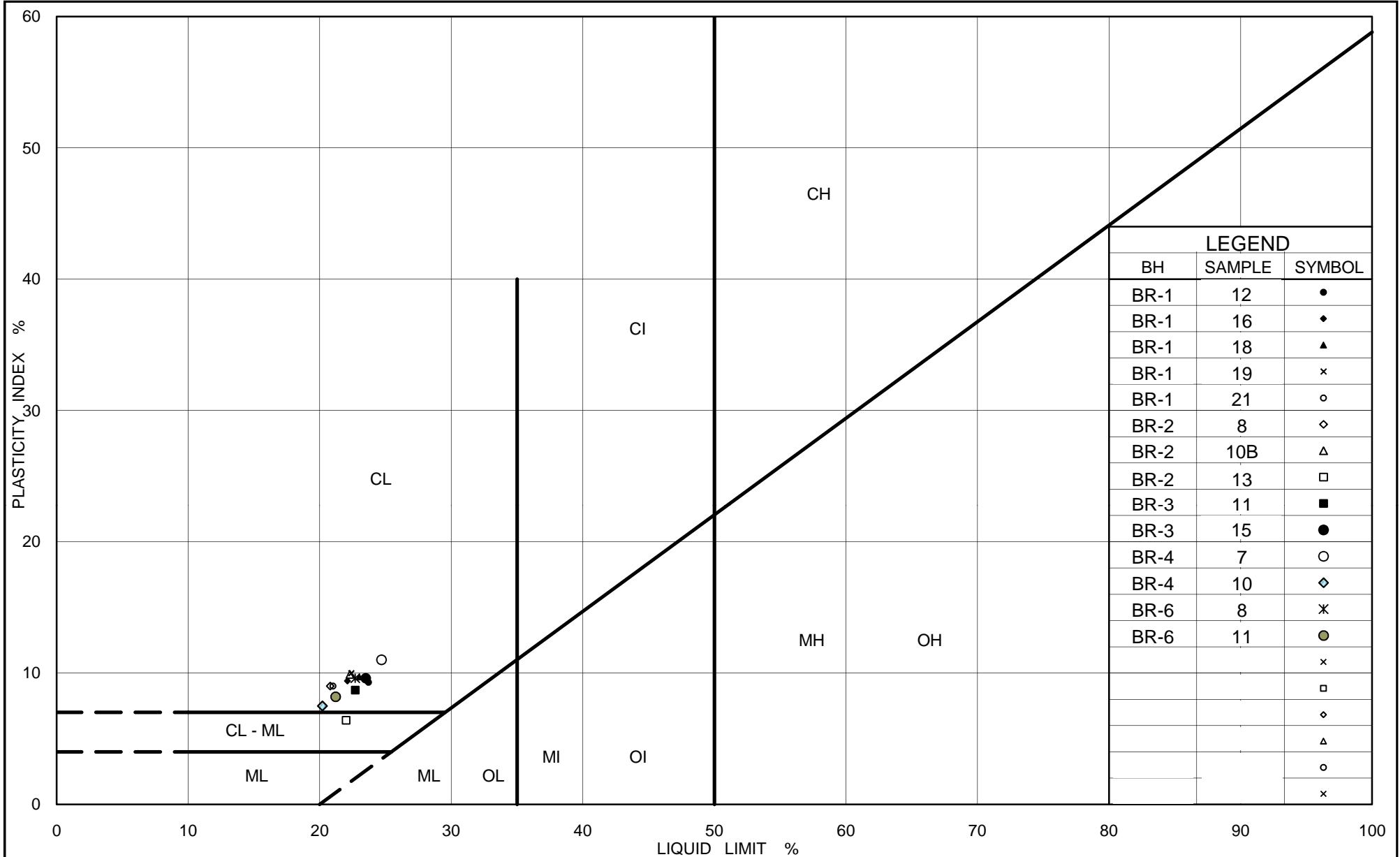
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-4	10	233.4
■	BR-4	11	231.8
◆	BR-3	11	232.5
▲	BR-6	8	237.0

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ontario

Ministry of
Transportation

PLASTICITY CHART

Clayey Silt Till

Figure No. A6

Project No. 08-1111-0022E

Checked By: KJB



APPENDIX B

Highway 404 - Boag Road NBL Structure
Drawings, Record of Boreholes and Laboratory Test Results

E 308925

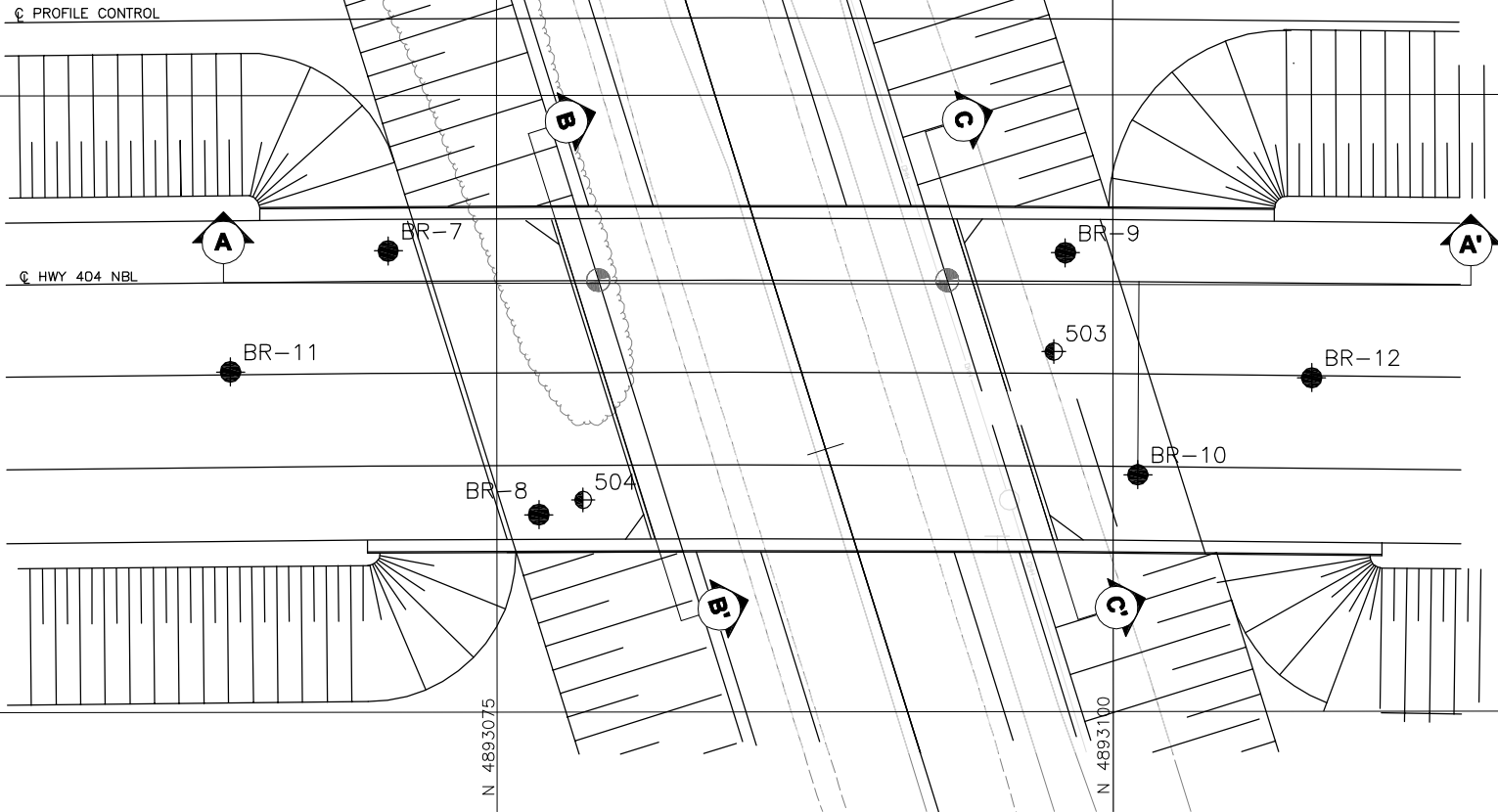
E 308950

N 4893050

N 4893075

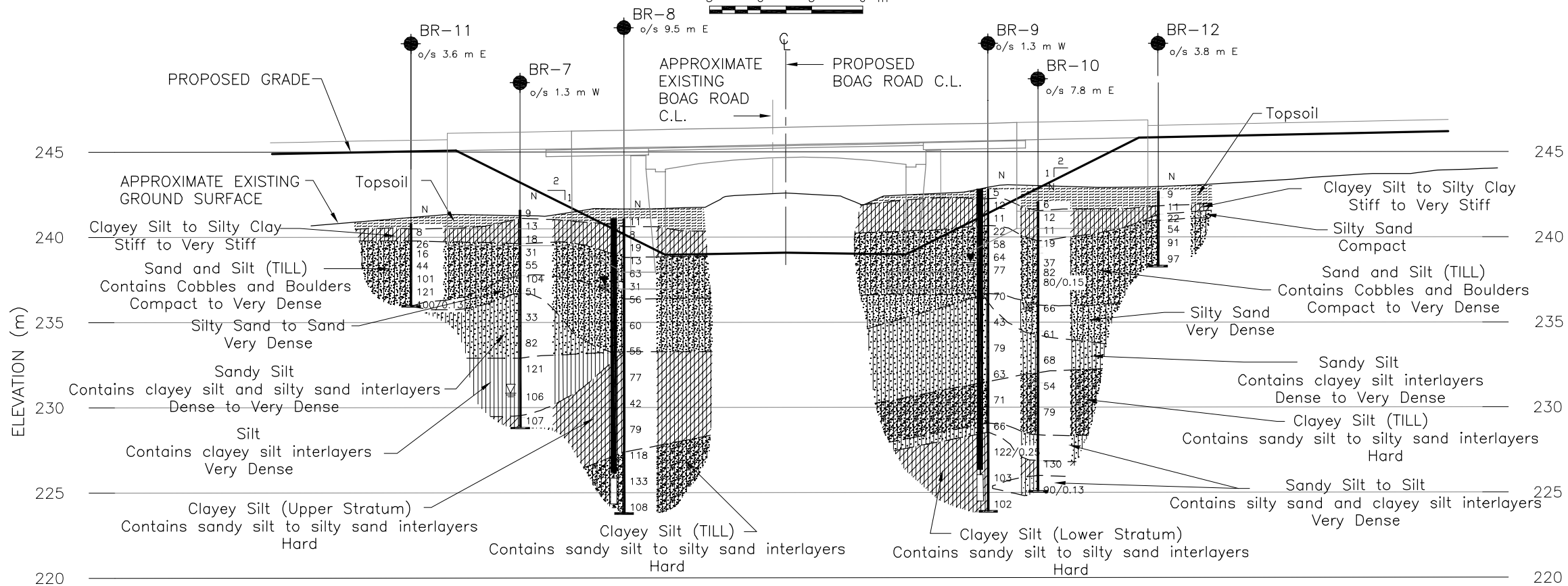
N 4893100

N 4893125



PLAN

SCALE
0 3 6 m



PROFILE NBL CENTERLINE

SCALE
0 3 6 m

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

CONT No.
WP No. 2005-07-00



HIGHWAY 404
BOAG ROAD OVERPASS - NBL
BOREHOLE LOCATION AND SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

SCALE

0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - Previous Investigation (Golder, 2004)
- ⊕ 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 May 20, 2009
- ≡ WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
BR-7	241.6	4893070.6	308931.3
BR-8	241.1	4893076.7	308942.0
BR-9	242.8	4893098.1	308931.4
BR-10	242.1	4893101.0	308940.4
BR-11	240.8	4893064.2	308936.2
BR-12	242.7	4893108.1	308936.5
503	242.5	4893097.6	308935.4
504	241.4	4893078.5	308941.4

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.

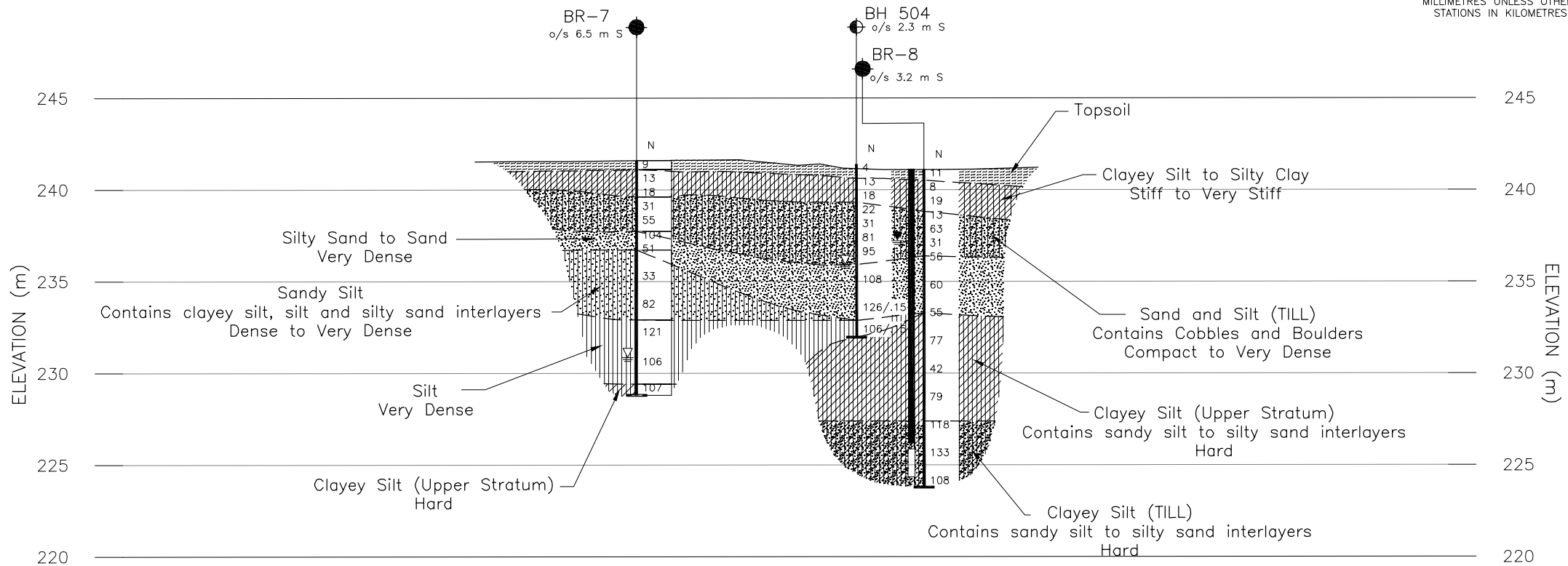
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

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.

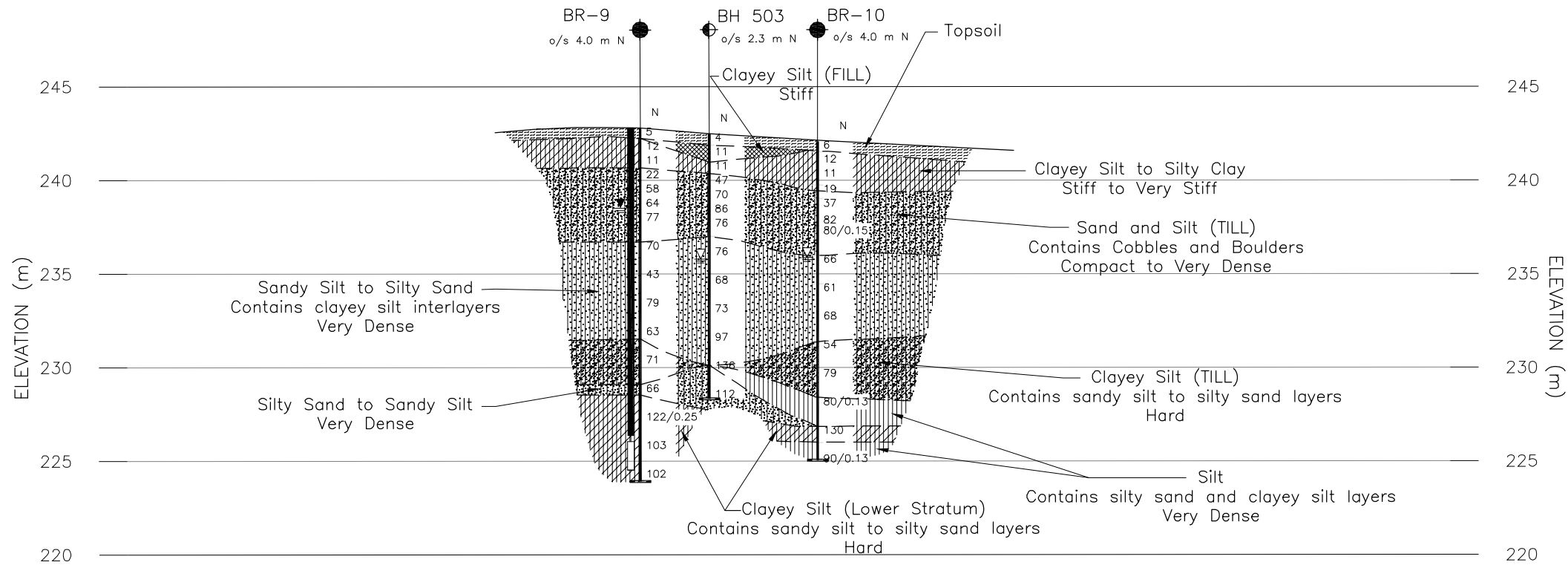
REFERENCE

Base plans provided in digital format by AECOM
(drawing file 2538-199-ST-0001-NBL-To Golder-090930.dwg,
received October 09, 2009).

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: September 10 SITE:	
DRAWN: DD	CHKD. KJB	APPD. JMAC	DWG. B1



SECTION B-B' ALONG SOUTH ABUTMENT



SECTION C-C' ALONG NORTH ABUTMENT



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

CONT No.
WP No. 2005-07-00

HIGHWAY 404
BOAG ROAD OVERPASS - NBL
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole - Current Investigation
- ⊙ Borehole - Previous Investigation (Golder, 2004)
- ⊥ 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 May 20, 2009
- ≡ WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
BR-7	241.6	4893070.6	308931.3
BR-8	241.1	4893076.7	308942.0
BR-9	242.8	4893098.1	308931.4
BR-10	242.1	4893101.0	308940.4
BR-11	240.8	4893064.2	308936.2
BR-12	242.7	4893108.1	308936.5
503	242.5	4893097.6	308935.4
504	241.4	4893078.5	308941.4

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.

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 provided in digital format by AECOM
(drawing file 2538-199-ST-0001-NBL-To Golder-090930.dwg,
received October 09, 2009).

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: September 10 SITE:	
DRAWN: DD/RJ	CHKD. KJB	APPD. JMAC	DWG. B2

PROJECT _____		RECORD OF BOREHOLE No BR-7				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893070.6 ; E 308931.3				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 26, 2009				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						
241.6	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100					
0.0	TOPSOIL		1	SS	9		241							
241.1	SILTY CLAY, trace to some sand, trace gravel Stiff to very stiff Brown Moist		2	SS	13		240							3 10 41 46
0.5														
239.6			3	SS	18		240							
2.0	SAND and SILT, trace to some clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL) Dense to very dense Brown Moist		4	SS	31		239							2 35 56 7
237.7														
3.9			5	SS	55		238							
236.7	Silty SAND, trace to some gravel Very dense Brown Moist		6	SS	104		237							
4.9														
232.9			7	SS	51		236							
8.7	Sandy SILT, trace gravel, containing clayey silt and silty sand interlayers Dense to very dense Brown to grey below 6.1 m Moist		8	SS	33		235							
			9	SS	82		234							1 2 75 22
232.9	SILT, some clay, trace sand, containing clayey silt interlayers Very dense Grey Moist		10	SS	121		233							
			11	SS	106		232							
229.4	CLAYEY SILT, trace to some sand, trace gravel, containing sandy silt to silty sand interlayers Hard Grey Moist						231						NP	0 3 83 14
12.2														
228.8														
12.8	END OF BOREHOLE		12	SS	107		229							
NOTE: 1. Water level in open borehole measured at a depth of 10.8 m (Elev. 230.8 m) below ground surface upon completion of drilling.														


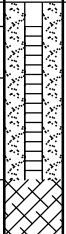

PROJECT _____		RECORD OF BOREHOLE No BR-8		1 OF 2 METRIC	
2005-07-00		LOCATION N 4893076.7 ; E 308942.0		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE February 25, 2009		CHECKED BY KJB	

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					WATER CONTENT (%)							
								\circ UNCONFINED \bullet QUICK TRIAXIAL	$+$ FIELD VANE \times REMOULDED	20	40	60	80	100	w_p					
241.1	GROUND SURFACE																			
0.0	TOPSOIL		1	SS	11															
240.6																				
0.5	SILTY CLAY, trace to some sand Stiff to very stiff Brown Moist		2	SS	8															
			3	SS	19															
238.8																				
2.3	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		4	SS	13															
			5	SS	63															
			6	SS	31															
236.4																				
4.7	SAND, some silt, trace gravel, trace clay Very dense Brown Moist		7	SS	56															
			8	SS	60															
	Becoming wet below 6.7 m depth																			
233.3																				
7.8	CLAYEY SILT, some sand, containing sandy silt to silty sand interlayers Hard Grey Moist to wet		9	SS	55															
			10	SS	77															
			11	SS	42															
			12	SS	79															
227.4																				
13.7	CLAYEY SILT, trace to some sand, trace gravel, containing sandy silt to silty sand interlayers (TILL) Hard Grey Moist		13	SS	118															

Continued Next Page

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


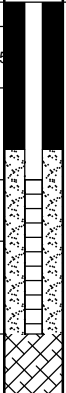
MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No BR-8				2 OF 2 METRIC											
2005-07-00		LOCATION N 4893076.7 ; E 308942.0				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 25, 2009				CHECKED BY 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					WATER CONTENT (%)				
	--- CONTINUED FROM PREVIOUS PAGE ---						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100					W _p W W _L 10 20 30					
223.8	CLAYEY SILT, trace to some sand, trace gravel, containing sandy silt to silty sand interlayers (TILL) Hard Grey Moist		14	SS	133		226										
							225										
			15	SS	108		224										
17.3	END OF BOREHOLE																
	NOTE: 1. Auger refusal on inferred cobble/boulder at a depth of 2.9 m (Elev. 238.2 m). Borehole moved 1 m North and drilling resumed. 2. Water level in piezometer at a depth of 4.3 m below ground surface (Elev. 236.8 m) on March 12, 2009. 3. Water level in piezometer at a depth of 3.9 m below ground surface (Elev. 237.2 m) on May 20, 2009. 4. Water level in piezometer at a depth of 4.5 m (Elev. 236.6 m) below ground surface on June 12, 2009.																

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MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

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

PROJECT _____		RECORD OF BOREHOLE No BR-9				2 OF 2 METRIC													
2005-07-00		LOCATION N 4893098.1 ; E 308931.4				ORIGINATED BY TB													
DIST _____ HWY 404		BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC													
DATUM Geodetic		DATE February 17, 2009				CHECKED BY KJB													
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL 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	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W _p W W _L			WATER CONTENT (%) 10 20 30							
--- CONTINUED FROM PREVIOUS PAGE ---																			
223.9	CLAYEY SILT, trace to some sand, containing sandy silt to silty sand interlayers Hard Grey Moist		14	SS	122/0.25		227												
			15	SS	103		226												
							225												
			16	SS	102		224												
18.9	END OF BOREHOLE																		
NOTES: 1. Water level in piezometer at a depth of 4.7 m below ground surface (Elev. 238.1 m) on February 18, 2009. 2. Water level in piezometer at a depth of 4.8 m below ground surface (Elev. 238.0 m) on February 26, 2009. 3. Water level in piezometer at a depth of 4.6 m below ground surface (Elev. 238.2 m) on March 12, 2009. 4. Water level in piezometer at a depth of 4.3 m below ground surface (Elev. 238.5 m) on May 20, 2009. 5. Water level in piezometer at a depth of 5.0 m (Elev. 237.9 m) below ground surface on June 12, 2009.																			

RECORD OF BOREHOLE No BR-10

1 OF 2 **METRIC**

PROJECT _____ 2005-07-00 LOCATION N 4893101.0 ; E 308940.4 ORIGINATED BY TB
DIST _____ HWY 404 BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger COMPILED BY SC
DATUM Geodetic DATE February 18, 2009 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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × REMOULDED									
242.1	GROUND SURFACE						20 40 60 80 100											
0.0	TOPSOIL		1	SS	6		242											
241.5			2	SS	12		241											
0.6	SILTY CLAY, trace to some sand Stiff Brown Moist		3	SS	11		240											
239.8			4A	SS	19		239											
239.4	CLAYEY SILT, some sand, trace gravel, containing oxidation staining Very stiff Brown Wet		4B	SS	37		238											
2.7	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		5	SS	82		237											
			6	SS	80/0.15		236											
			7	SS			235											
236.0			8	SS	66		234											
6.1	Silty SAND, trace clay Very dense Brown Moist to wet		9	SS	61		233											
234.5			10	SS	68		232											
7.6	Sandy SILT, trace clay, containing clayey silt interlayers Very dense Grey Wet		11	SS	54		231											
			12	SS	79		230											
231.4							229											
10.7	CLAYEY SILT, some sand, trace gravel, containing sandy silt to silty sand interlayers (TILL) Hard Grey Moist		13	SS	80/0.13		228											
228.4																		
13.7	SILT, trace to some sand, trace clay Very dense Grey Wet																	

Continued Next Page

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

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PROJECT _____				RECORD OF BOREHOLE No BR-10				2 OF 2 METRIC									
2005-07-00				LOCATION N 4893101.0 ; E 308940.4				ORIGINATED BY TB									
DIST _____ HWY 404				BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger				COMPILED BY SC									
DATUM Geodetic				DATE February 18, 2009				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									
	--- CONTINUED FROM PREVIOUS PAGE ---							20	40	60	80	100					
226.9							227										
15.2	CLAYEY SILT, some sand, trace gravel, containing sandy silt to silty sand interlayers		14	SS	130												0 13 68 19
226.0	Hard Grey Wet						226										
16.1	SILT, trace to some clay, trace sand																
225.1	Very dense Grey Wet		15	SS	90/0.13												0 1 91 8
17.0	END OF BOREHOLE																
NOTES: 1. Water level in open borehole at a depth of 6.2 m below ground surface (Elev. 235.9 m) two hours after completion of drilling.																	

PROJECT _____		RECORD OF BOREHOLE No BR-11				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893064.2 ; E 308936.2				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 25, 2009				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						
240.8	GROUND SURFACE							20 40 60 80 100						
0.0	TOPSOIL		1	SS	8			20 40 60 80 100						
0.3	SILTY CLAY, some sand, trace gravel Stiff Brown Moist		2	SS	26			20 40 60 80 100						
239.8								20 40 60 80 100						
1.0	SAND and SILT, trace to some gravel, trace to some clay, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		3	SS	16			20 40 60 80 100						
			4	SS	44			20 40 60 80 100						
			5	SS	101			20 40 60 80 100						
			6	SS	121			20 40 60 80 100						
236.0			7	SS	100/0.13			20 40 60 80 100						
4.9	END OF BOREHOLE							20 40 60 80 100						
	NOTE: 1. Open borehole dry upon completion of drilling.							20 40 60 80 100						

PROJECT _____		RECORD OF BOREHOLE No BR-12				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893108.1 ; E 308936.5				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 18, 2009				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						
242.7 0.0	GROUND SURFACE TOPSOIL		1A	SS	9									
242.3 0.4	CLAYEY SILT, trace to some sand, containing rootlets Stiff Brown Moist		1B											
241.3	Trace gravel below 1.2 m depth		2	SS	11									
241.0 1.7	Silty SAND, trace clay Compact Brown Moist		3A	SS	22									
	SAND and SILT, trace to some gravel, trace to some clay, containing sand seams and cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown Moist		3B											
			4	SS	54									
			5	SS	91									
			6	SS	97									
238.3 4.4	END OF BOREHOLE													
NOTE: 1. Open borehole dry upon completion of drilling.														

PROJECT _____		RECORD OF BOREHOLE No BH 503				1 OF 2 METRIC								
2005-07-00		LOCATION N 4893097.6 ; E 308935.4				ORIGINATED BY PKS								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm Diameter Solid Stem Augers				COMPILED BY NK								
DATUM Geodetic		DATE JUNE 10, 2004				CHECKED BY LCC								
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						
242.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	Topsoil		1	SS	4									
241.9			2	SS	11									
0.6	Clayey Silt, some sand, trace gravel (FILL) Stiff Brown Moist													
241.0			3	SS	11									
1.5	Clayey Silt to Silty Clay, trace to some sand, trace gravel Stiff Brown Moist													
240.4			4	SS	47									
2.1	Sand and Silt, some clay, trace to some gravel (TILL) Dense to very dense Brown Moist		5	SS	70									
			6	SS	86									
			7	SS	76									
237.0														
5.5	Silty Sand to Sandy Silt, trace gravel, containing thin interlayers of clay and sand Very dense Grey Moist becoming wet at 6.7 m depth		8	SS	76									
			9	SS	68									
			10	SS	73									
			11	SS	97									
			12	SS	136									
			13	SS	112									
228.3														
14.2														

Continued Next Page

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

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PROJECT _____		RECORD OF BOREHOLE No BH 503					2 OF 2 METRIC									
2005-07-00		LOCATION N 4893097.6 ;E 308935.4					ORIGINATED BY PKS									
DIST _____ HWY 404		BOREHOLE TYPE 108 mm Diameter Solid Stem Augers					COMPILED BY NK									
DATUM Geodetic		DATE JUNE 10, 2004					CHECKED BY LCC									
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								
	--- CONTINUED FROM PREVIOUS PAGE ---						20	40	60	80	100					
	End of Borehole															
	Note:															
	1. Water encountered during drilling at about 6.7 m depth (Elevation 235.8 m)															

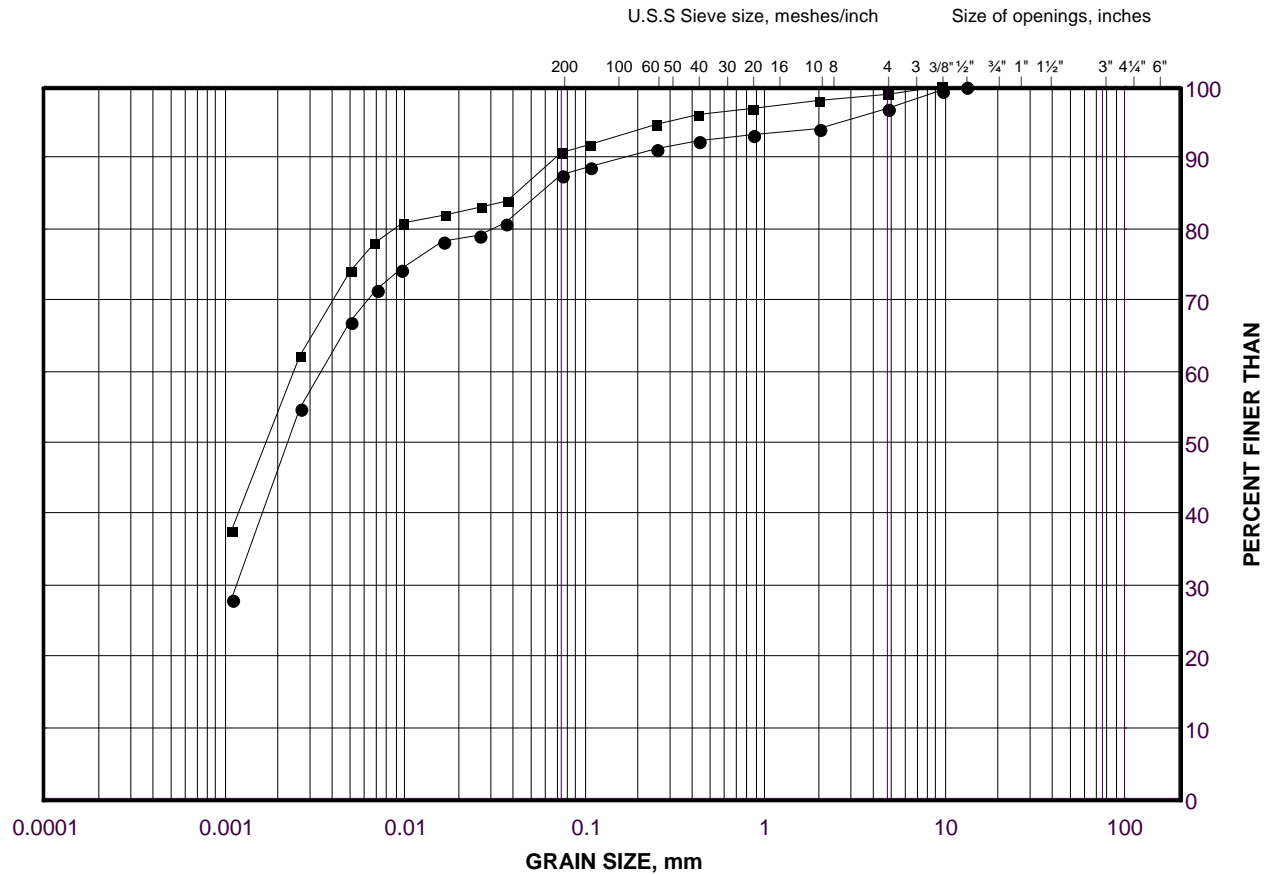
MIS-MTO.001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No BH 504				1 OF 1 METRIC								
2005-07-00		LOCATION N 4893078.5 ; E 308941.4				ORIGINATED BY PKS								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm Diameter Solid Stem Augers				COMPILED BY NK								
DATUM Geodetic		DATE JUNE 10, 2004				CHECKED BY LCC								
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						
241.4	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	Topsoil		1	SS	4		241							
240.8	Clayey Silt to Silty Clay, trace sand and gravel Stiff to very stiff Brown Moist		2	SS	13		240							
0.6			3	SS	18									
			4	SS	22									
239.3	Sand and Silt, some clay, trace to some gravel, containing cobbles (TILL) Compact to very dense Brown Moist		5	SS	31		239							
2.1			6	SS	81		238							
			7	SS	95									
			8	SS	108									
235.9	Silty Sand, trace gravel Very dense Brown Moist becoming wet at 6.1 m depth		9	SS	126/.15		235							
5.5							234							
232.9	Silt, trace sand, containing clayey silt layers Very dense Grey Wet						233							
8.5							232							
232.0	End of Borehole Note: Water level at 5.5 m depth (Elevation 235.9 m) upon completion of drilling													
9.5														

GRAIN SIZE DISTRIBUTION

Clayey Silt to Silty Clay

FIGURE B1



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

LEGEND

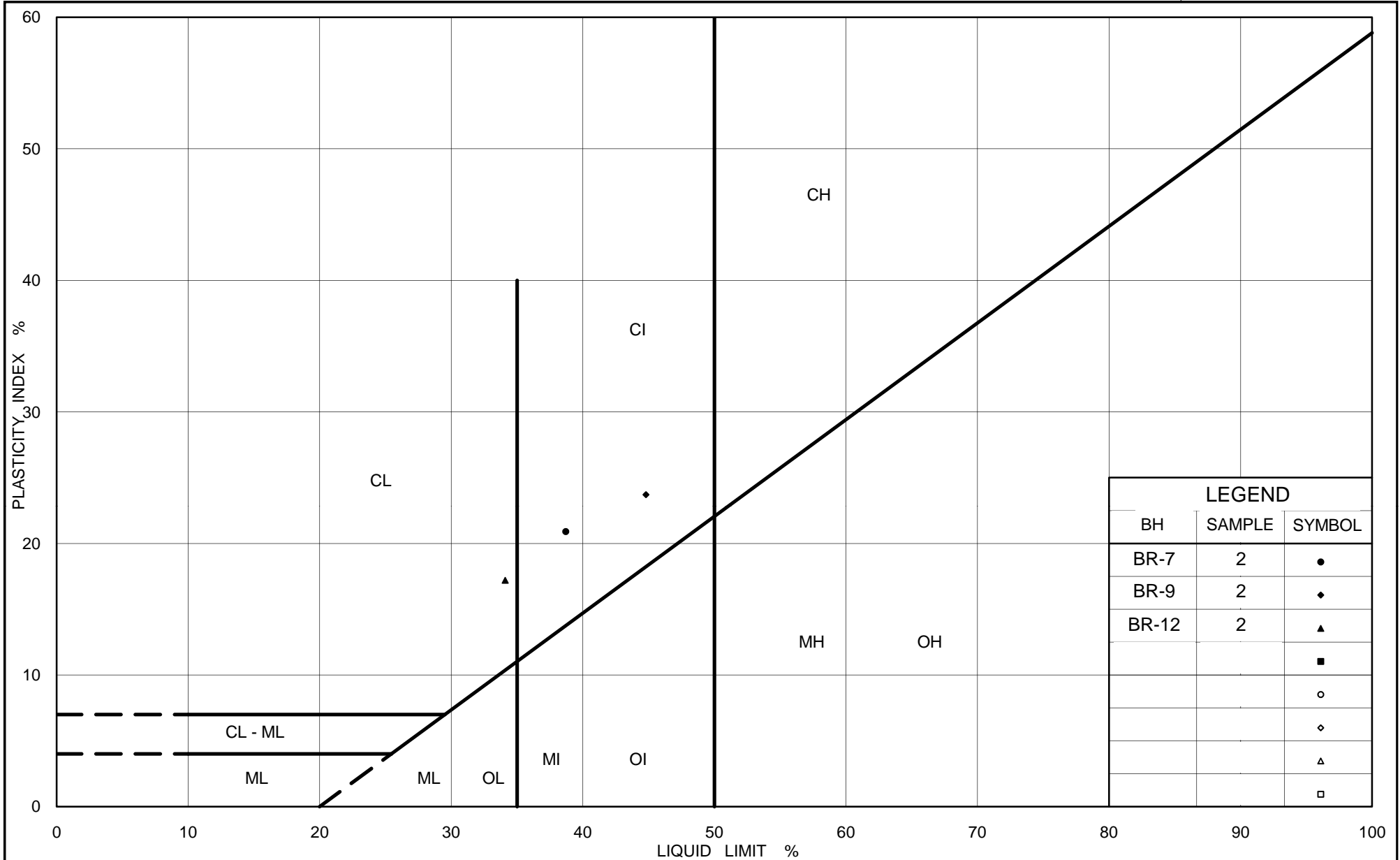
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-7	2	240.5
■	504	3	239.7

Project Number: 08-1111-0022E

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Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt to Silty Clay

Figure No. B2

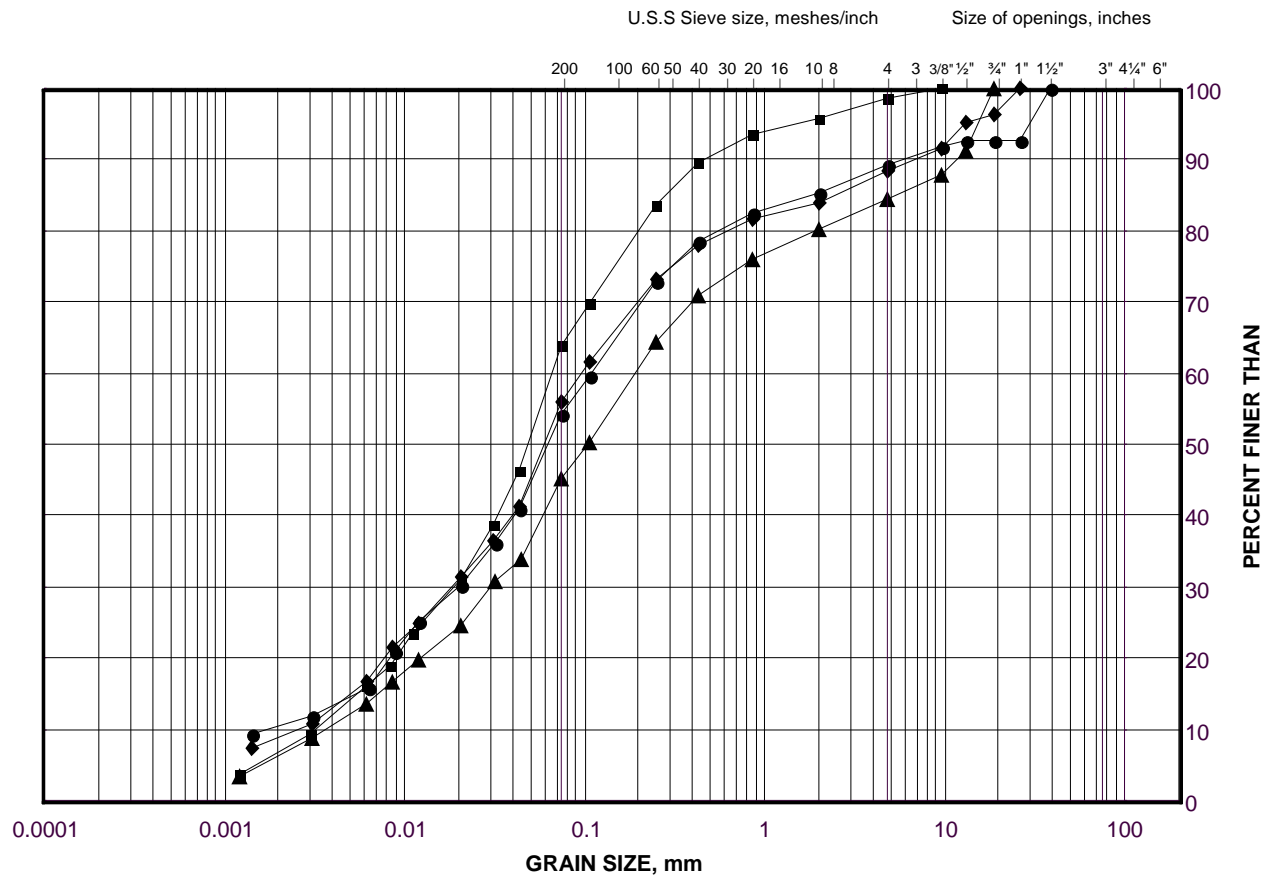
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Sand and Silt Till

FIGURE B3



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

LEGEND

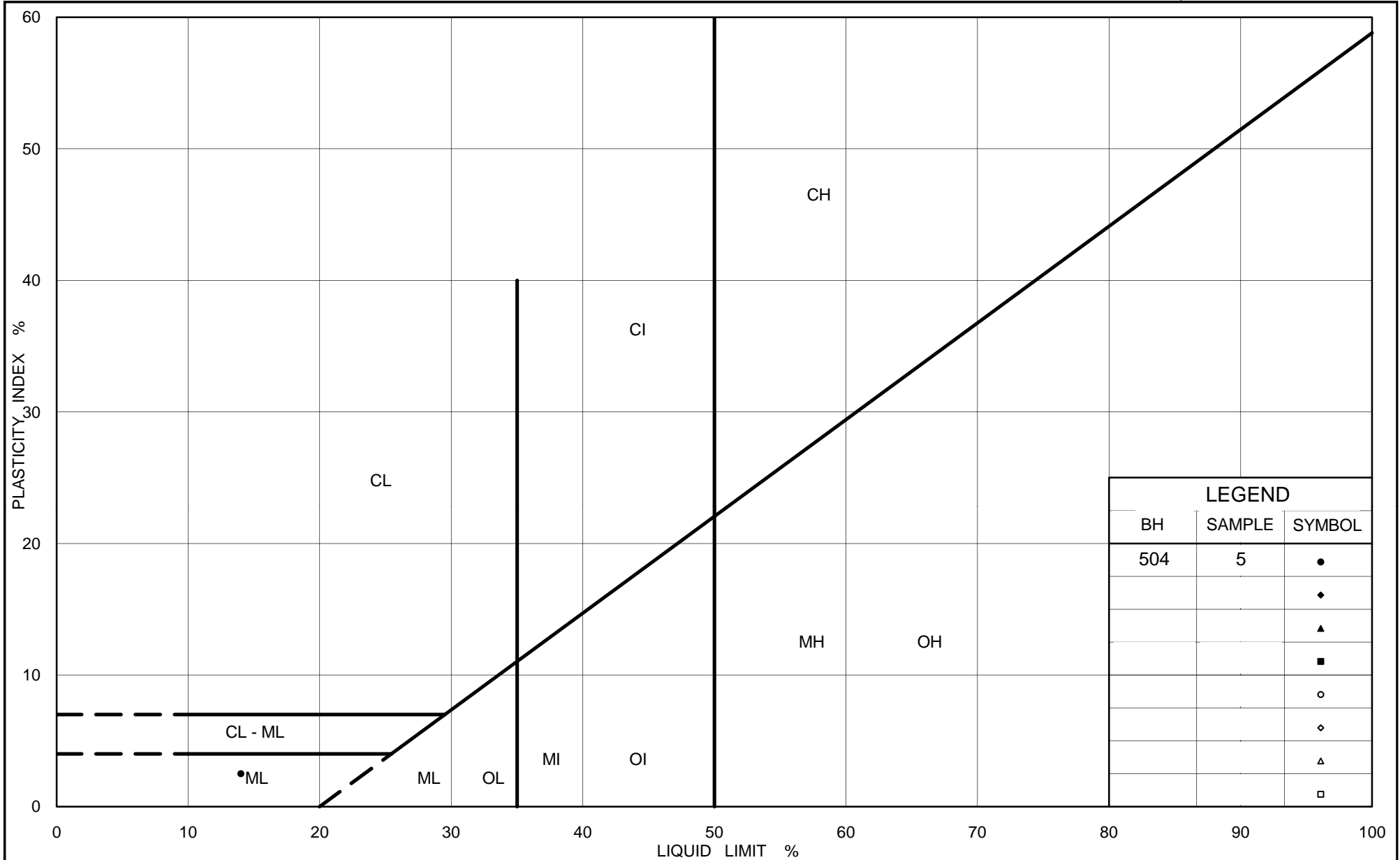
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-12	4	240.1
■	BR-7	4	239.0
◆	BR-11	5	237.4
▲	BR-9	5	239.4

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PLASTICITY CHART Sand and Silt Till

Figure No. B4

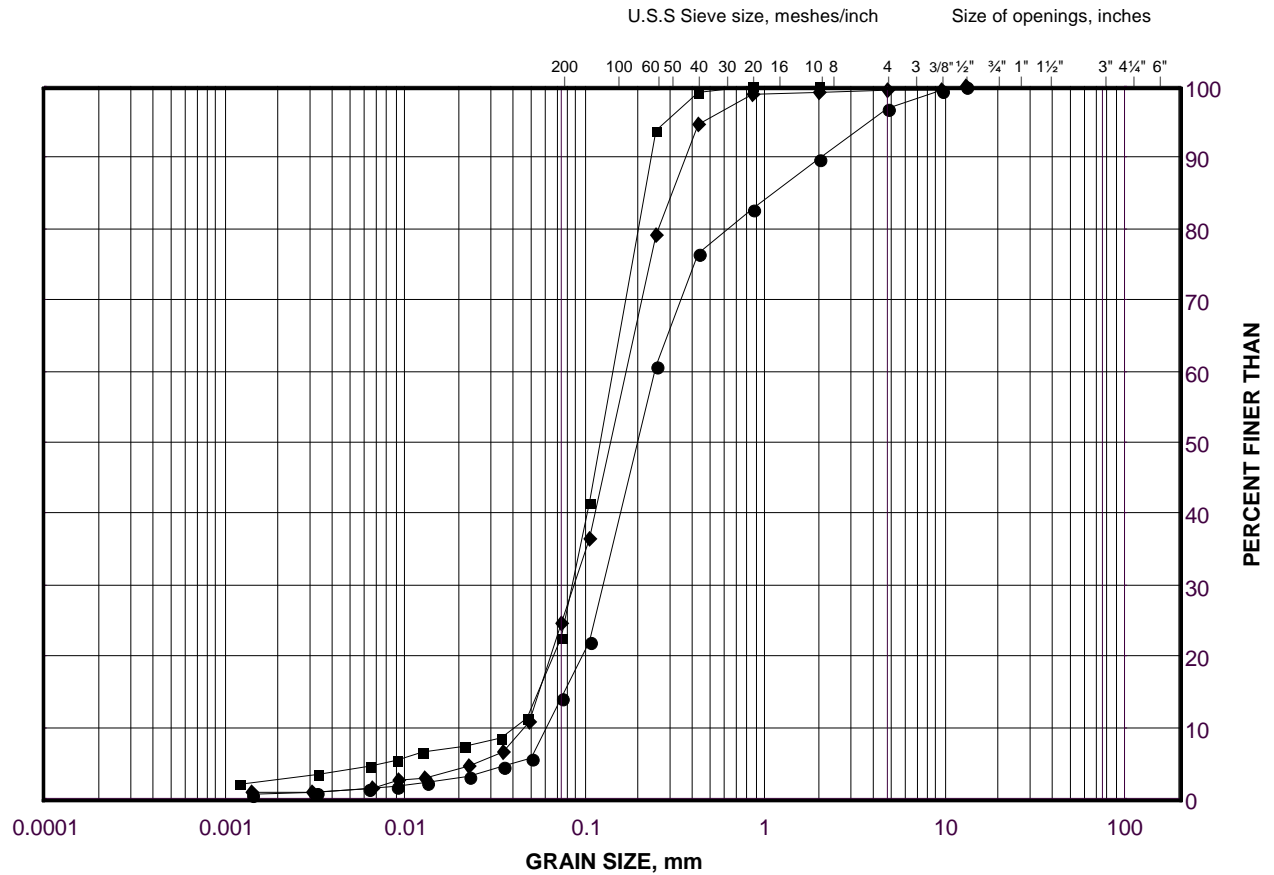
Project No. 08-1111-0022E

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GRAIN SIZE DISTRIBUTION

Silty Sand to Sand

FIGURE B5



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

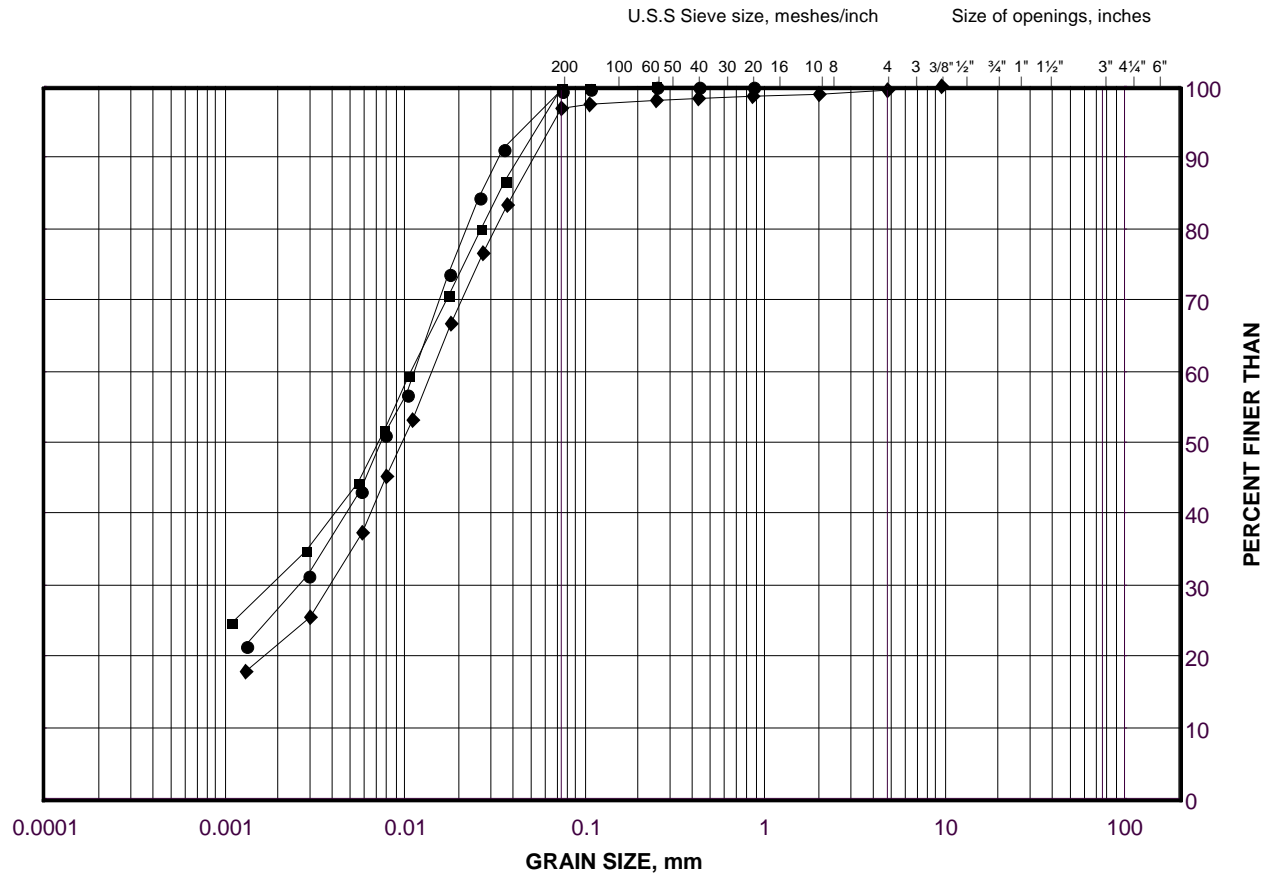
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-8	7	236.2
■	504	8	235.1
◆	BR-10	8	235.7

GRAIN SIZE DISTRIBUTION

Sandy Silt (Clayey Silt Interlayers)

FIGURE B6



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

LEGEND

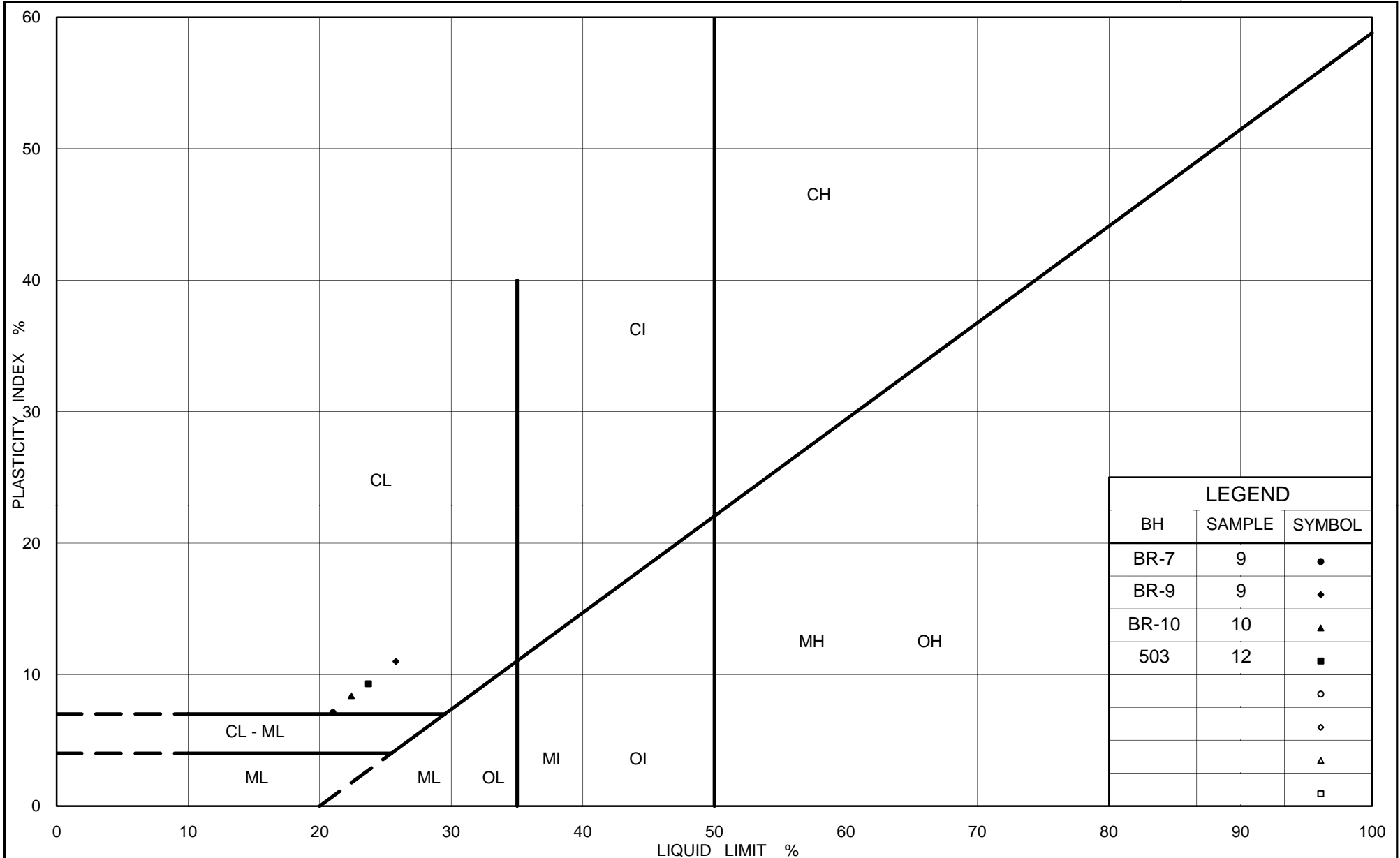
SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BR-10	10	232.7
■	503	12	230.2
◆	BR-7	9	233.7

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PLASTICITY CHART Sandy Silt (Clayey Silt Interlayer)

Figure No. B7

Project No. 08-1111-0022E

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Silt

Grain Size (mm)	Percent Finer Than (%) - Soil 1 (Squares)	Percent Finer Than (%) - Soil 2 (Circles)
0.075	100	100
0.060	100	100
0.0475	100	100
0.0375	100	100
0.030	100	100
0.025	100	100
0.020	100	100
0.015	100	100
0.0125	100	100
0.010	100	100
0.0075	100	100
0.0060	100	100
0.00475	100	100
0.00375	100	100
0.030	80	75
0.025	70	65
0.020	60	55
0.015	50	45
0.0125	40	35
0.010	30	25
0.0075	20	15
0.0060	15	10
0.00475	10	5
0.00375	5	0
0.030	0	0

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

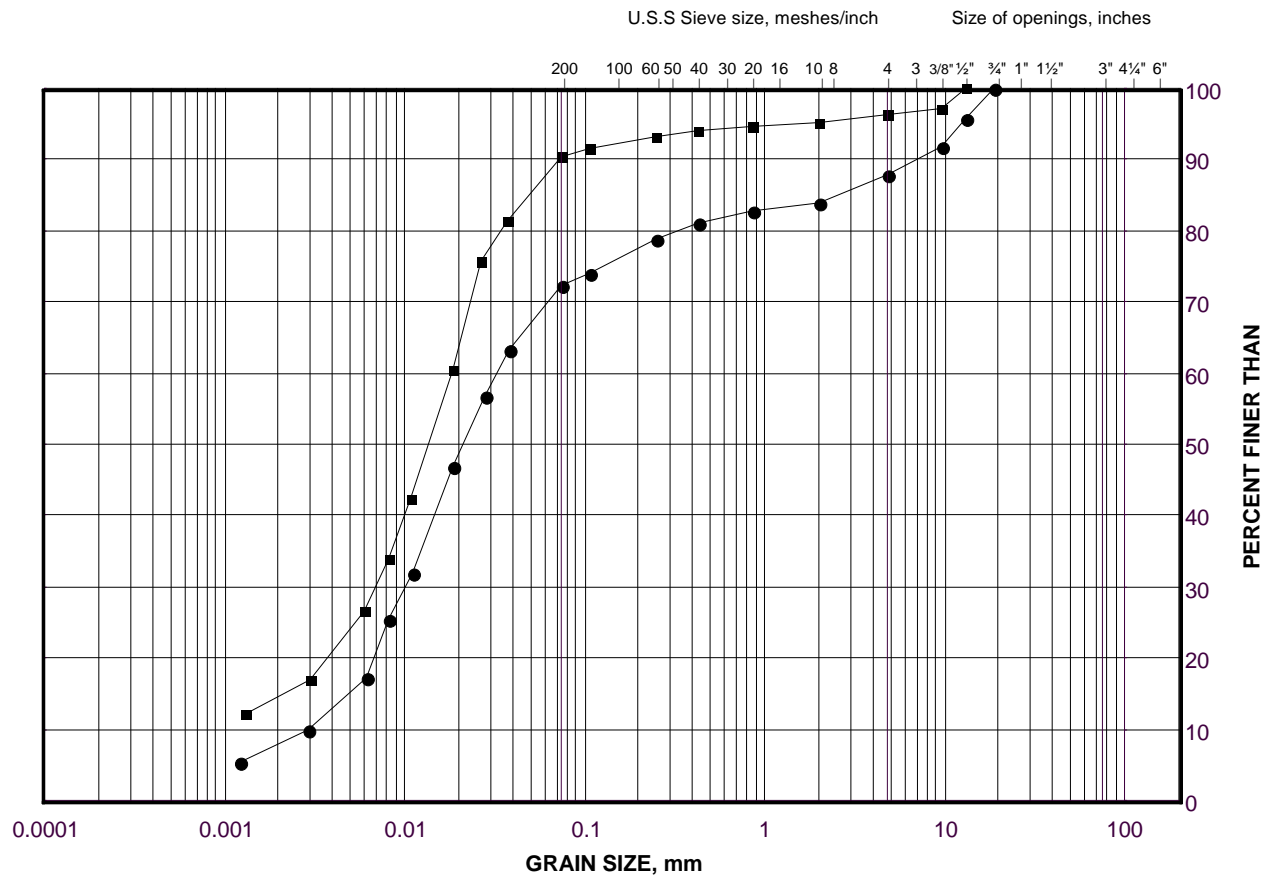
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	504	10	232.1
■	BR-7	11	230.7

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE B9



LEGEND

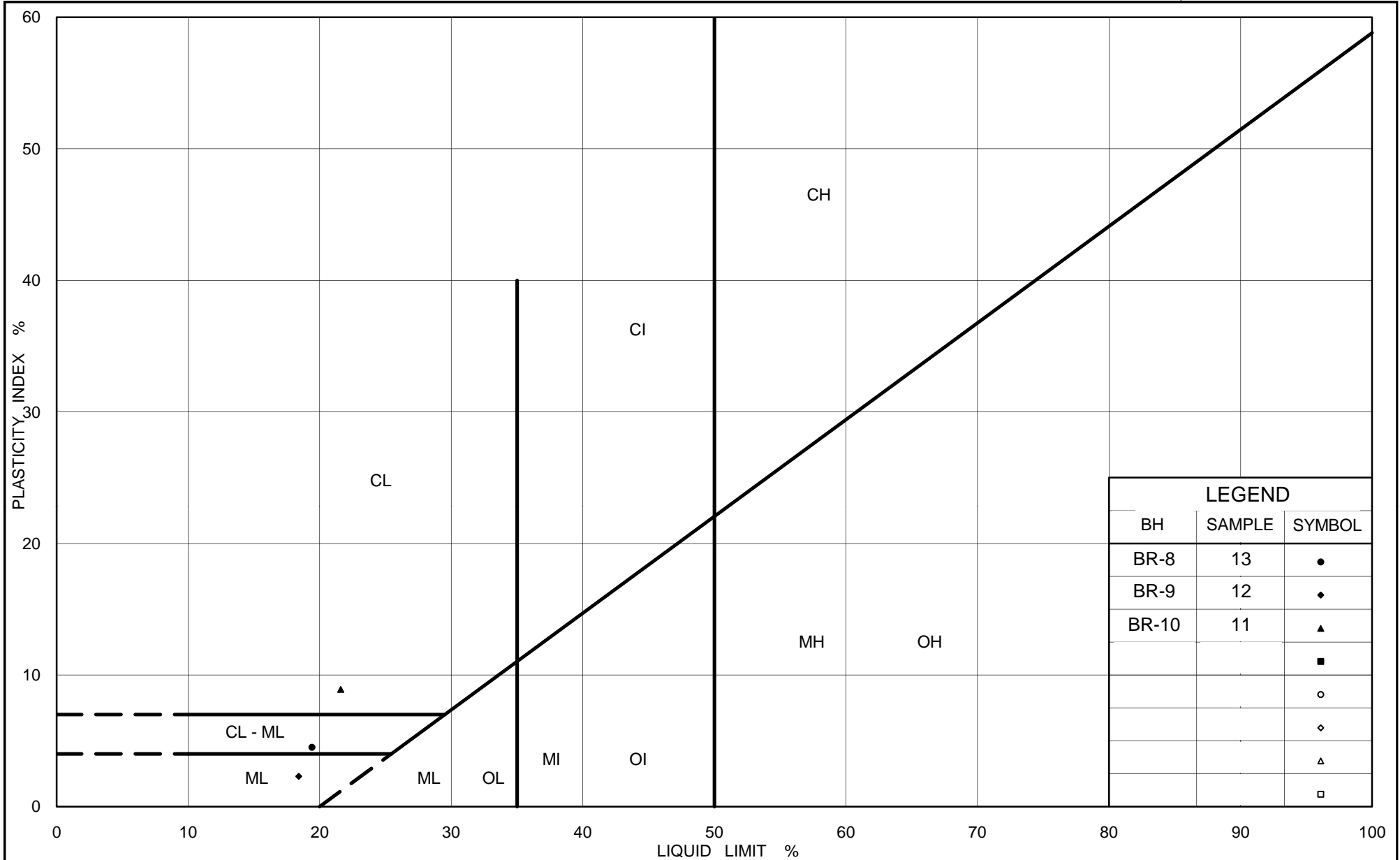
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	BR-9	12	230.3
■	BR-8	13	227.1

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PLASTICITY CHART

Clayey Silt Till

Figure No. B10

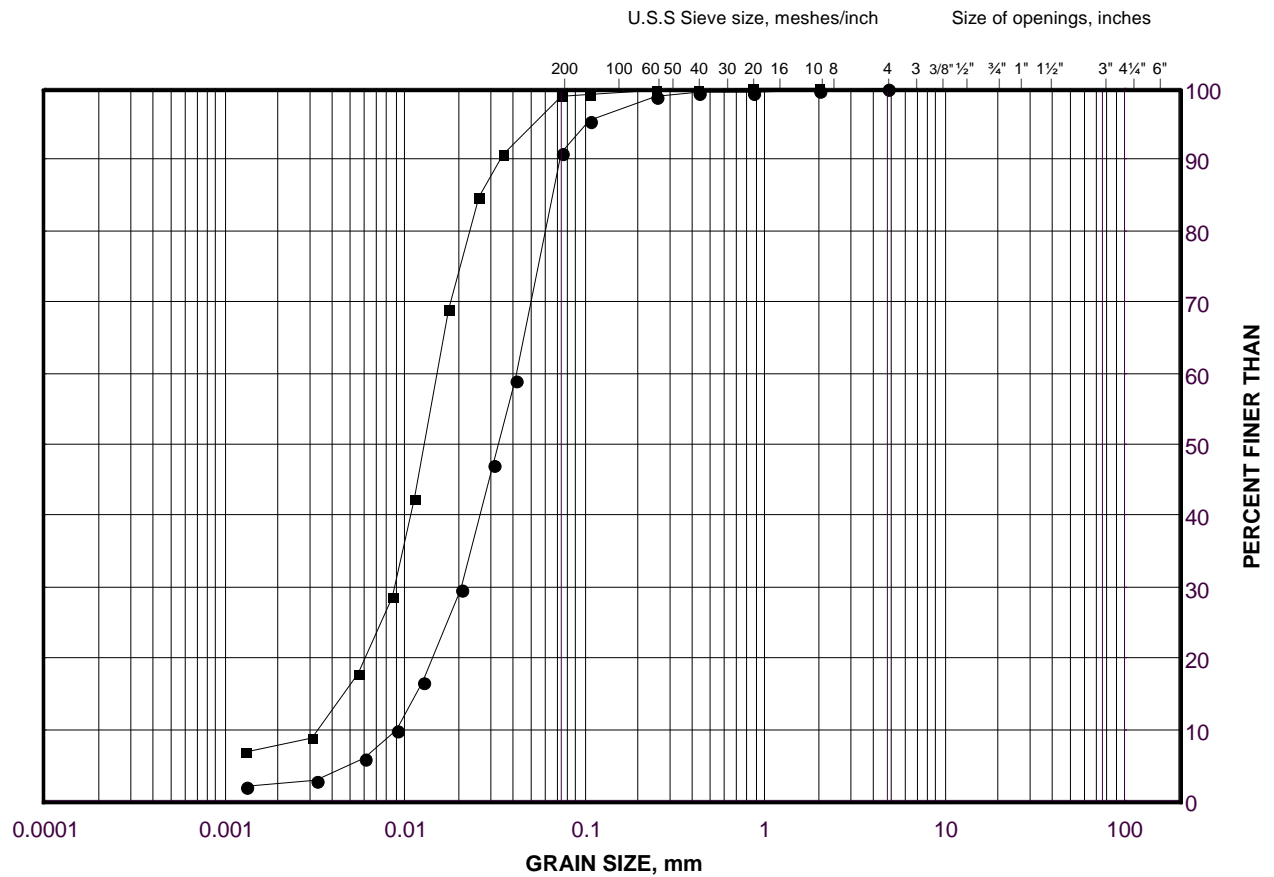
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silt

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)
●	BR-10	13	228.1
■	BR-10	15	225.2

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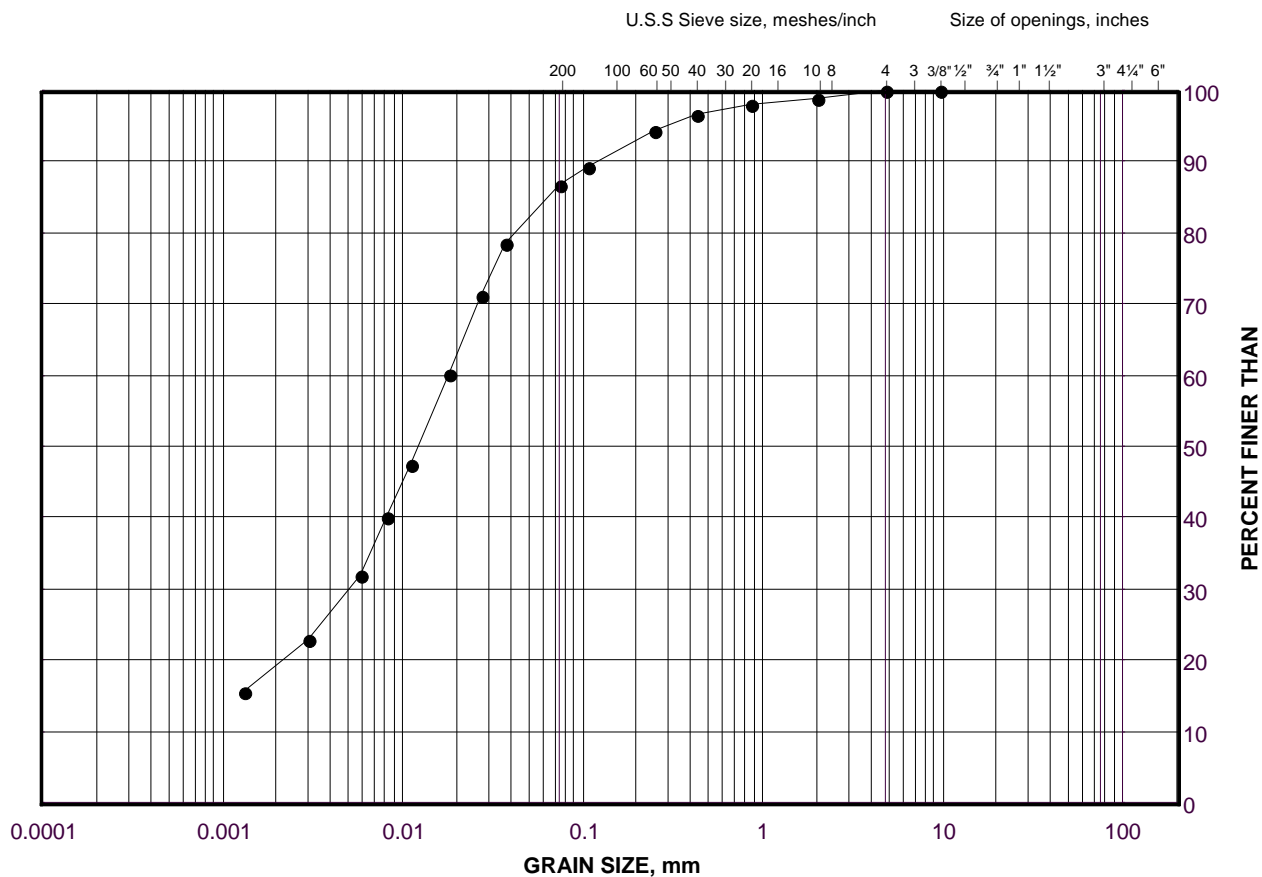
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt (Lower Stratum)

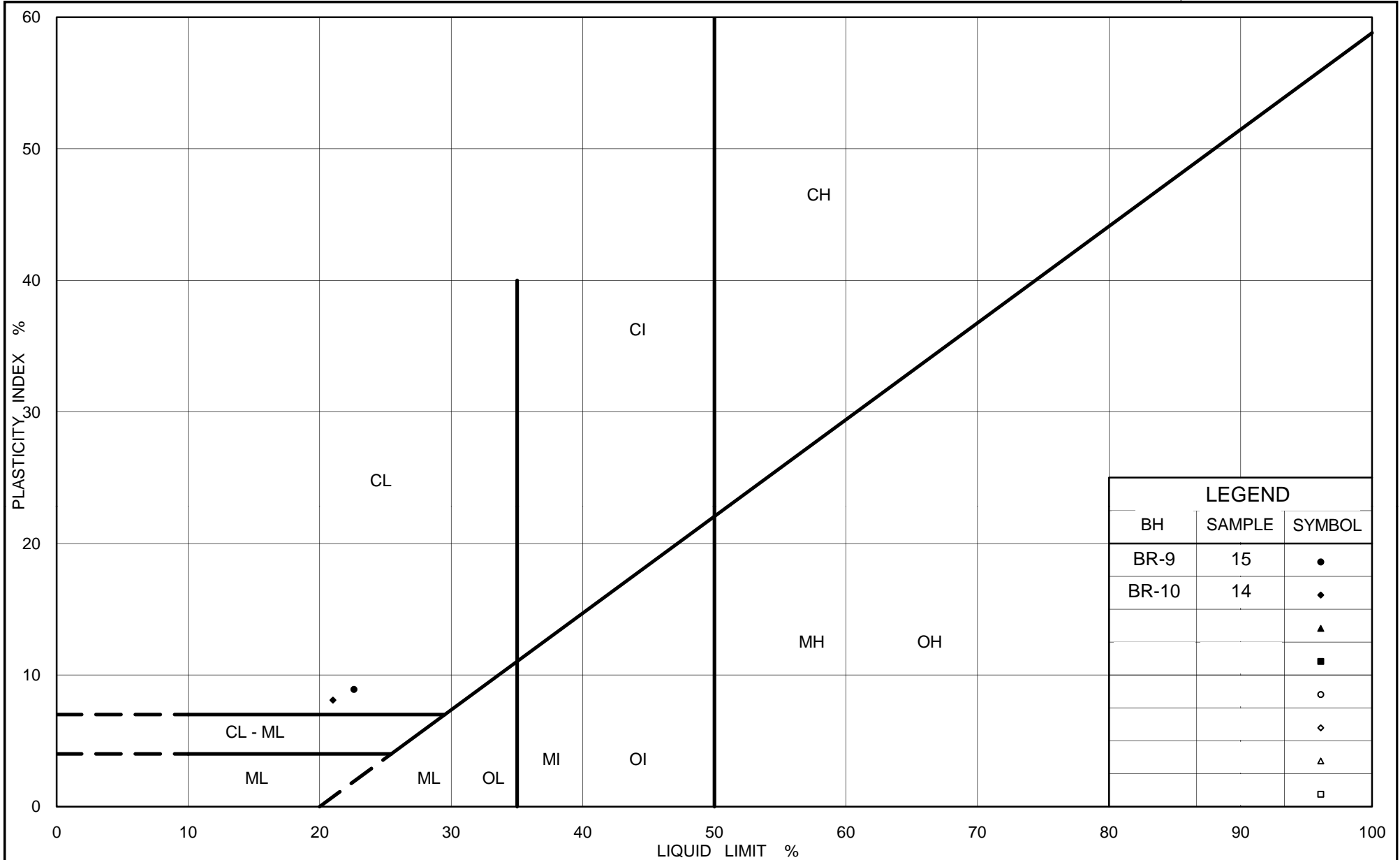
FIGURE B12



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	BR-10	14	226.6



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PLASTICITY CHART

Clayey Silt (Lower Stratum)

Figure No. B13

Project No. 08-1111-0022E

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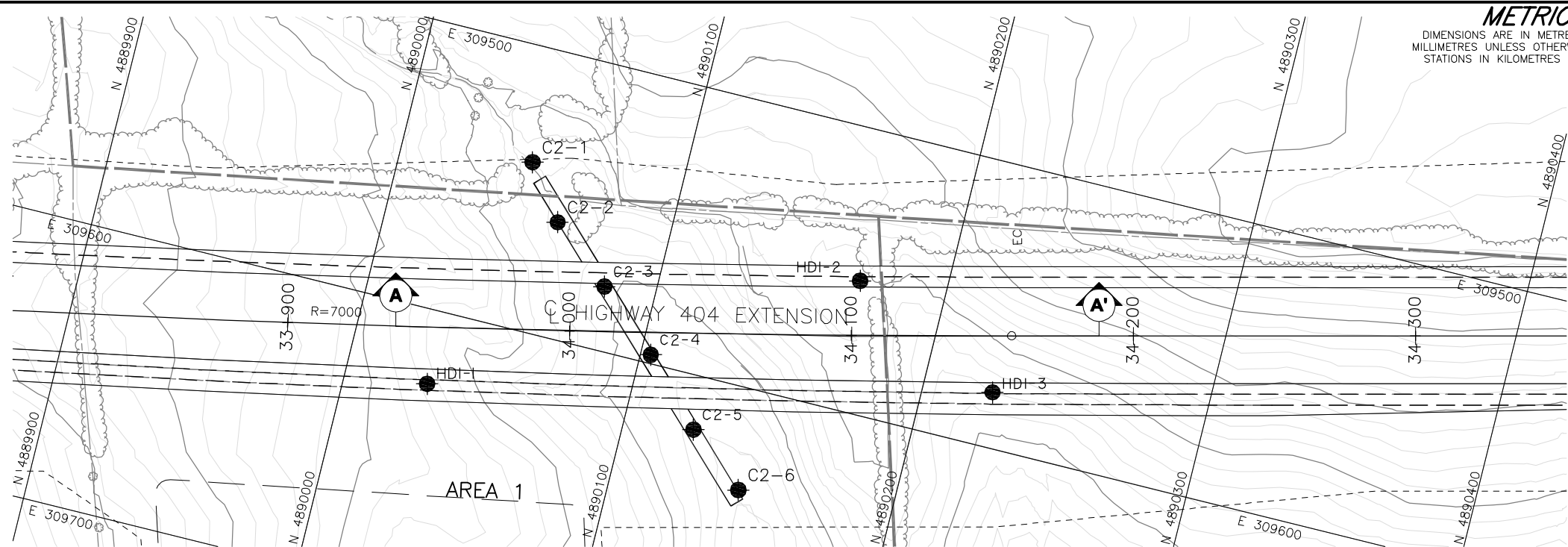
APPENDIX C

Highway 404 Extension Deep Cuts/High Fills

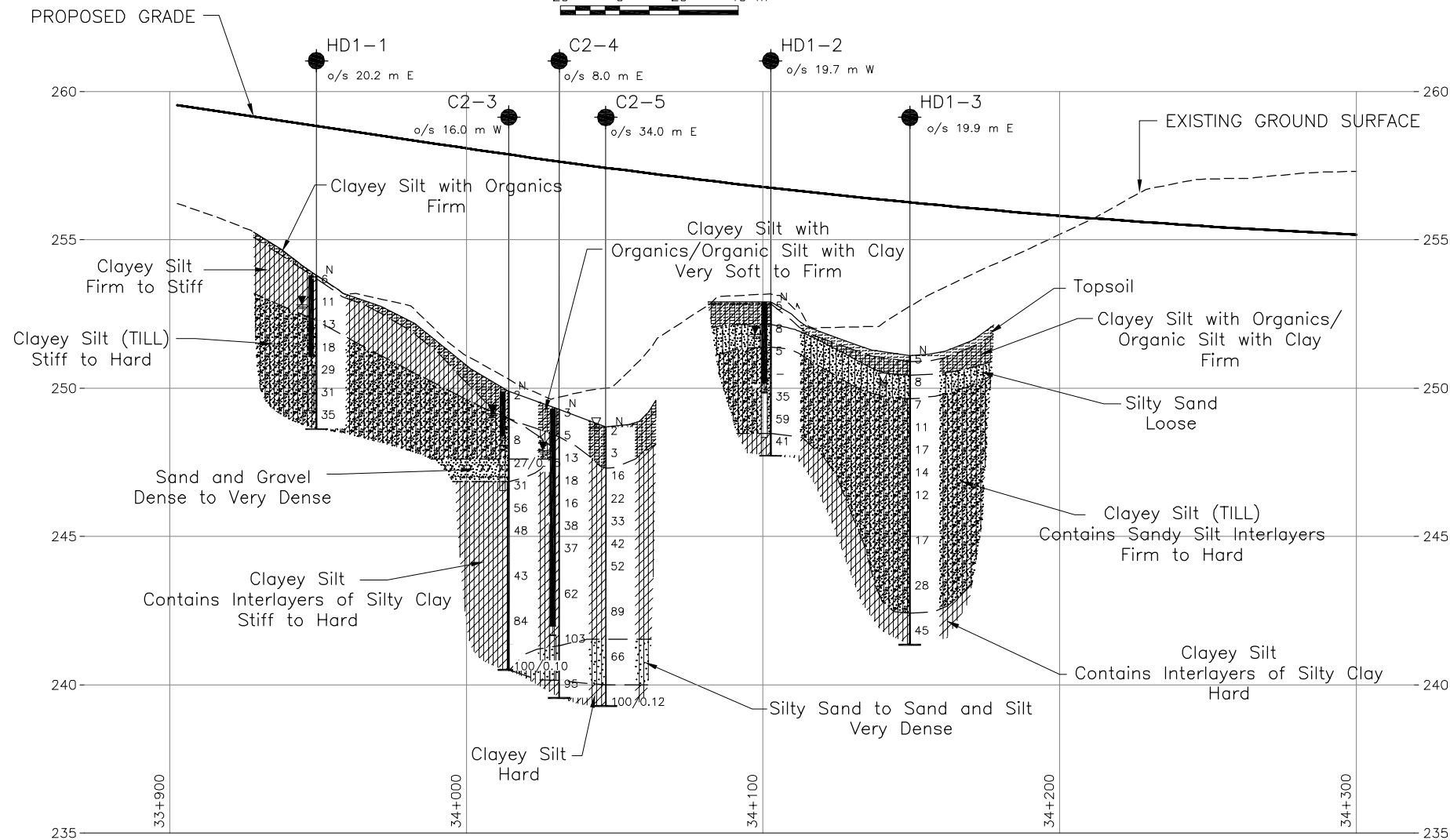


APPENDIX C1

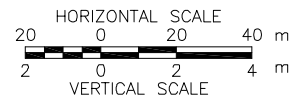
Highway 404 - STA. 33+900 to STA. 34+160 (High Fill Area 1)
Drawing, Record of Boreholes and Laboratory Test Results



PLAN



CENTRELINE PROFILE



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

CONT No.
WP No. 2005-07-00

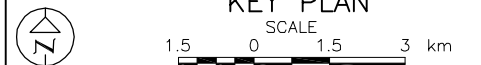
HIGHWAY 404 EXTENSION
STA. 33+900 to STA. 34+160
BOREHOLE LOCATION AND SOIL STRATA



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

- Borehole - Current Investigation
- 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 June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
C2-1	251.2	4890050.4	309545.5
C2-2	250.6	4890064.2	309564.0
C2-3	249.9	4890085.8	309582.1
C2-4	249.3	4890107.6	309601.6
C2-5	248.7	4890128.7	309623.7
C2-6	248.0	4890149.3	309640.6
HD1-1	253.8	4890029.2	309626.0
HD1-2	252.9	4890169.4	309553.5
HD1-3	251.1	4890224.5	309580.5

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 provided in digital format by AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00_ct-xprofile.dwg", received April 21, 2009.


NO.	DATE	BY	REVISION
HWY. 404	PROJECT NO. 08-1111-0022	DIST.	
SUBM'D.	CHKD. TB	DATE: 9/23/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C1


PROJECT _____			RECORD OF BOREHOLE No HD1-1			1 OF 1 METRIC											
2005-07-00			LOCATION N 4890029.2 ; E 309626.0			ORIGINATED BY TB											
DIST _____ HWY 404			BOREHOLE TYPE 108 mm O.D. Solid Stem Auger			COMPILED BY SC											
DATUM Geodetic			DATE June 5, 2009			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 (%)			γ kN/m³	GR SA SI CL
							20 40 60 80 100	20 40 60 80 100	Wp	W	WL	10 20 30					
253.8	GROUND SURFACE																
0.1	CLAYEY SILT with organics, some sand, containing rootlets (Reworked) Dark brown Moist		1	SS	6		253										
	CLAYEY SILT, trace to some sand, containing oxidation staining Firm to stiff Brown Moist		2	SS	11												
252.3							252										
1.5	CLAYEY SILT, trace to some sand, trace gravel, containing oxidation staining (TILL) Stiff to hard Brown Moist		3	SS	13												
			4	SS	18		251										
			5	SS	29												
			6	SS	31		250										
			7	SS	35		249										
248.6	END OF BOREHOLE																
5.2	NOTES: 1. Water level in open borehole at a depth of 5.2 m below ground surface (Elev. 248.6 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.0 m below ground surface (Elev. 252.8 m) on June 12, 2009.																

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

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

PROJECT		08-1111-0022		RECORD OF BOREHOLE No C2-1				1 OF 1 METRIC						
G.W.P.		2005-07-00		LOCATION		N 4890050.4 ; E 309545.5		ORIGINATED BY TB						
DIST		HWY 404		BOREHOLE TYPE		108 mm O.D. Solid Stem Auger		COMPILED BY JFC						
DATUM		Geodetic		DATE		June 5, 2009		CHECKED BY 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		WATER CONTENT (%)				
251.2	GROUND SURFACE						20 40 60 80 100	20 40 60 80 100	10 20 30					
0.0	CLAYEY SILT with organics, trace to some sand, containing rootlets, oxidation staining and layers of silty clay		1	SS	1	251							$\gamma = 18.2$ $D_{sk} = 2.74$	0 1 76 23
250.5	Very soft Dark brown Moist		2	TO	PH	250								
0.7	CLAYEY SILT, trace to some sand, containing oxidation staining and interlayers of silty clay and sandy silt		3	SS	11	249								
	Firm to very stiff Brown to grey Moist		4	SS	13	248								
			5	SS	19	247								
247.4	Sandy SILT, trace clay	6	SS	37	247									
247.1	Dense Grey Wet	7	SS	26	246									
4.1	CLAYEY SILT, trace sand, containing interlayers of silty clay	8	SS	39	245									
	Very stiff to hard Grey Moist	9	SS	83	244									
244.0	SILT, trace sand, containing interlayers of clayey silt and silty clay	10	SS	116	243									
7.2	Very dense Grey Moist				242									
241.5	END OF BOREHOLE													
9.8	NOTES: 1. Water level in open borehole at ground surface upon completion of drilling. 2. Water level in piezometer at a depth of 0.3 m below ground surface (Elev. 250.9 m) on June 12, 2009. 3. Laboratory Consolidation Test performed on clayey soil taken from Sample No. 2. 4. Water level in piezometer at a depth of 0.3 m (Elev. 250.9 m) below ground surface on June 12, 2009.													

PROJECT 08-1111-0022		RECORD OF BOREHOLE No C2-2				1 OF 1 METRIC									
G.W.P. 2005-07-00		LOCATION N 4890064.2 ; E 309564.0				ORIGINATED BY TB									
DIST HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY JFC									
DATUM Geodetic		DATE June 3, 2009				CHECKED BY 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			
250.6	GROUND SURFACE														
0.0	CLAYEY SILT with organics, some sand, containing rootlets and oxidation staining		1	SS	3										
249.8	Soft Dark brown Moist		2	SS	6										
0.8	Sandy SILT to SILT, some sand, trace to some clay, trace gravel Loose to compact Brown to grey Wet		3	SS	16										
248.2	CLAYEY SILT, trace to some sand Very stiff to hard Grey Moist		4	SS	19										
2.4			5	SS	34										
			6	SS	38										
			7	SS	163										
245.0	Silty SAND, trace clay Very dense Grey Wet		8	SS	68										
5.6															
244.0	SILT, trace clay Very dense Grey Wet		9	SS	68										
6.7															
241.9	Silty SAND, trace clay Very dense Grey Wet		10	SS	110										
8.7															
240.9	END OF BOREHOLE														
9.8	NOTES: 1. Water level at ground surface upon completion of drilling.														


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

PROJECT 08-1111-0022			RECORD OF BOREHOLE No C2-4			1 OF 1 METRIC											
G.W.P. 2005-07-00			LOCATION N 4890107.6 ; E 309601.6			ORIGINATED BY TB											
DIST HWY 404			BOREHOLE TYPE 108 mm I.D. Hollow Stem Auger			COMPILED BY JFC											
DATUM Geodetic			DATE June 4, 2009			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 (%)			γ	GR SA SI CL
							20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	10 20 30					
249.3	GROUND SURFACE																
0.0	CLAYEY SILT with organics, trace to some sand, containing rootlets and oxidation staining Soft to firm Dark brown Moist		1	SS	3		249										
248.4			2	SS	5		248										
0.9	CLAYEY SILT, trace to some sand, containing interlayers of silty clay below 1.5 m, containing oxidation staining to 6.1 m Firm to hard Brown Moist		3	SS	13		247										
			4	SS	18		246										
			5	SS	16		245										
	Becoming grey below a depth of 3.8 m		6	SS	38		244										
			7	SS	37		243										
			8	SS	62		242										
241.3			9	SS	103		241										
8.0	Silty SAND, trace gravel, trace clay, containing cobbles and boulders Very dense Grey Wet						240										
240.2			10	SS	95												
9.1	CLAYEY SILT, trace sand Hard Grey Moist																
239.6																	
9.8	END OF BOREHOLE																
NOTES:																	
1. Water level in open borehole at a depth of 3.9 m below ground surface (Elev. 245.4 m) upon completion of drilling.																	
2. Water level in piezometer at a depth of 1.4 m below ground surface (Elev. 247.9 m) on June 12, 2009.																	

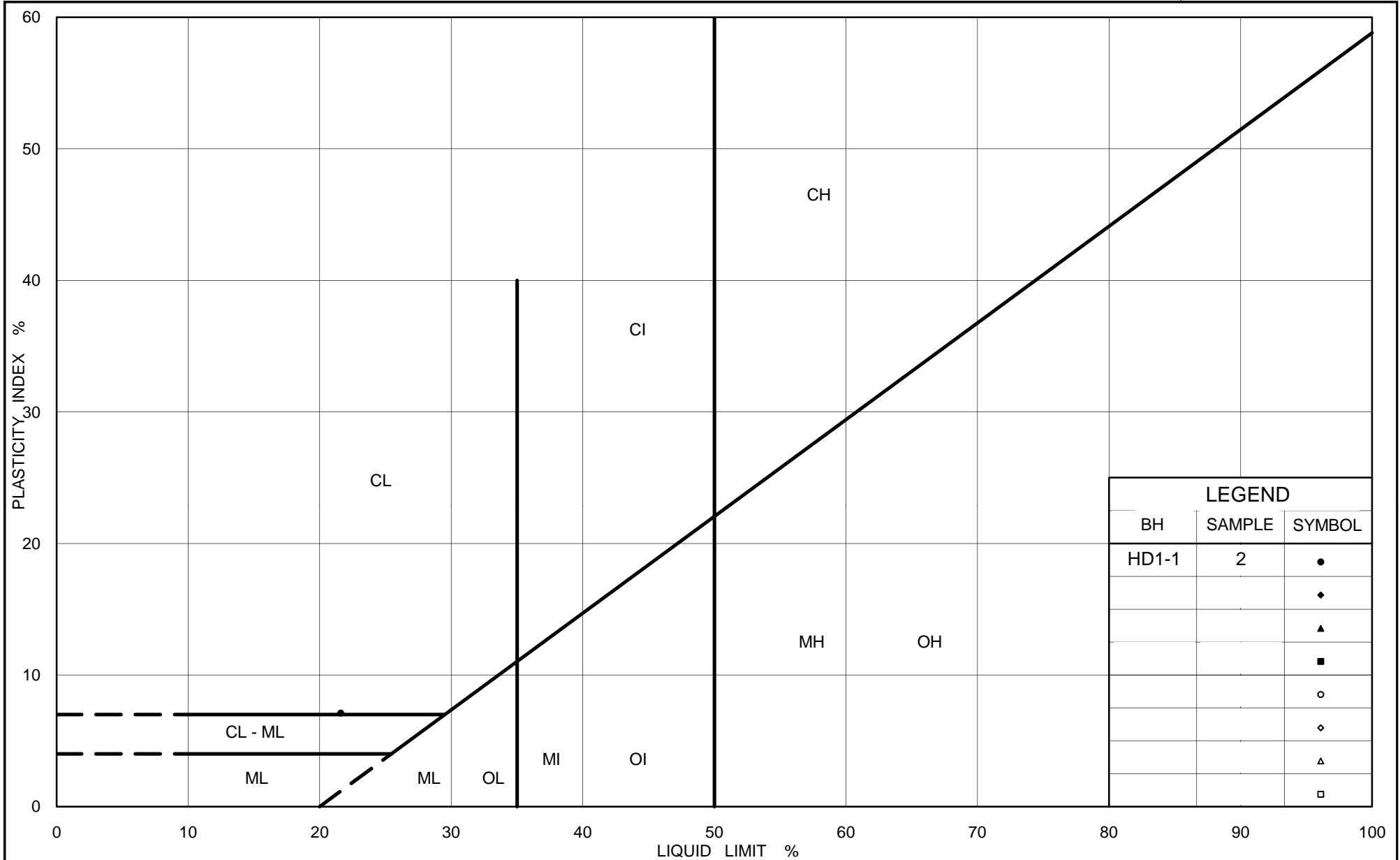
MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 10/3/10 DD/SAC

PROJECT 08-1111-0022		RECORD OF BOREHOLE No C2-5				1 OF 1 METRIC											
G.W.P. 2005-07-00		LOCATION N 4890128.7 ; E 309623.7				ORIGINATED BY TB											
DIST HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY JFC											
DATUM Geodetic		DATE June 3, 2009				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									WATER CONTENT (%)
248.7	GROUND SURFACE																
0.0	Organic SILT with clay, trace to some sand, containing rootlets and oxidation staining Very soft to soft Dark brown to brown Moist		1	SS	2												
			2	SS	3												
247.2																	
1.5	CLAYEY SILT, trace to some sand, containing interlayers of silty clay, containing oxidation staining to a depth of 3.1 m Very stiff to hard Brown Moist Becoming grey at a depth of 2.7 m		3	SS	16												
			4	SS	22												
			5	SS	33												
			6	SS	42												
			7	SS	52												
			8	SS	89												
241.5																	
7.2	SAND and SILT, trace clay Very dense Grey Wet		9	SS	66												
240.0																	
8.7	CLAYEY SILT, trace sand Hard Grey Moist																
239.3			10	SS	100/0.12												
9.4	END OF BOREHOLE																
	NOTES: 1. Water level at ground surface upon completion of drilling.																

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PROJECT 08-1111-0022			RECORD OF BOREHOLE No C2-6			1 OF 1 METRIC															
G.W.P. 2005-07-00			LOCATION N 4890149.3 ; E 309640.6			ORIGINATED BY TB															
DIST _____ HWY 404			BOREHOLE TYPE 108 mm O.D. Solid Stem Auger			COMPILED BY JFC															
DATUM Geodetic			DATE June 7, 2009			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 (%)			γ					
248.0	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	10 20 30								
0.0	Organic SILT with clay, some sand, containing rootlets, oxidation staining and sand interlayers Very soft to soft Dark brown Moist to wet		1	SS	2																
246.9			2A	SS	4		247														
1.1	CLAYEY SILT, trace to some sand, trace gravel, containing interlayers of silty clay and oxidation staining to a depth of 4.6 m Firm to hard Brown to grey Moist		2B																		
			3	SS	19		246														
			4	SS	31		245														
			5	SS	31		244														
			6	SS	31		243														
			7	SS	51		242														
							241														
240.8			8	SS	181		240														
7.2	Silty SAND, trace clay Very dense Grey Wet		9	SS	118		239														
238.5			10A	SS	111																
9.8	CLAYEY SILT, trace to some sand Hard Grey Moist END OF BOREHOLE		10B																		
	NOTES: 1. Water level in open borehole at a depth of 0.1 m below ground surface (Elev. 247.9 m) upon completion of drilling. 2. Water level in piezometer at a depth of 2.8 m below ground surface (Elev. 245.2 m) on June 12, 2009.																				

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PLASTICITY CHART

Clayey Silt (Upper Stratum)

Figure No. C1-1

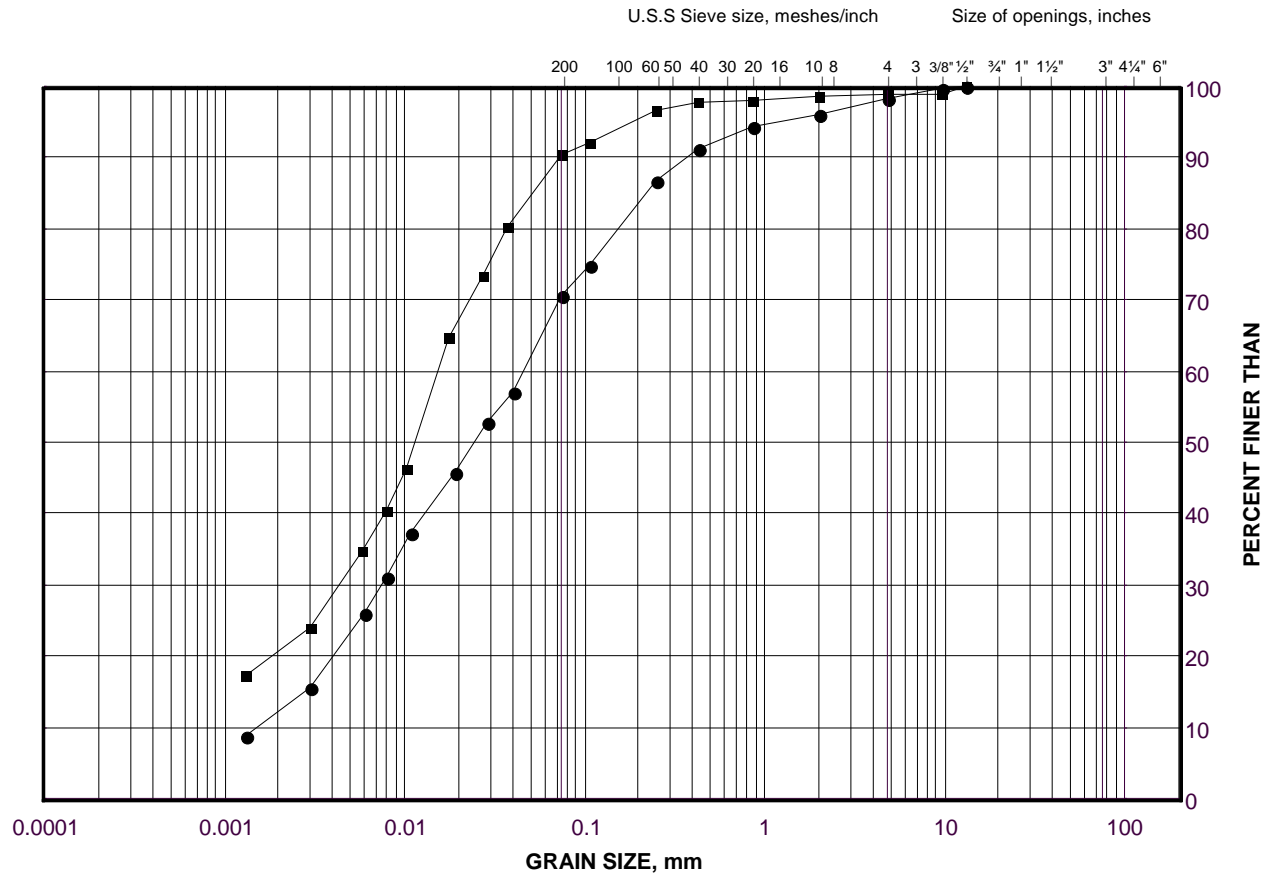
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE C1-2



LEGEND

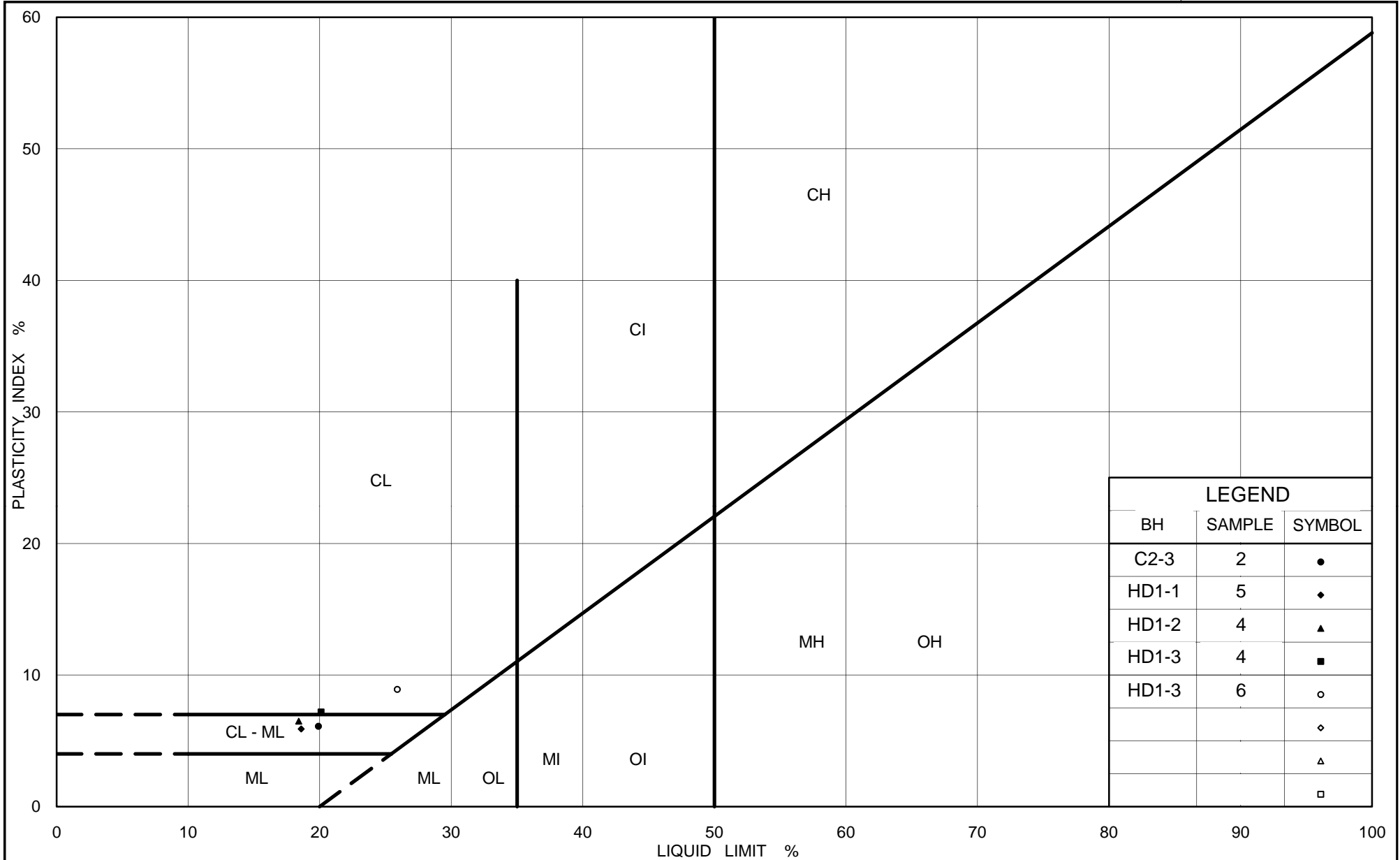
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD1-2	4	250.3
■	HD1-1	5	250.4

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

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PLASTICITY CHART

Clayey Silt Till

Figure No. C1-3

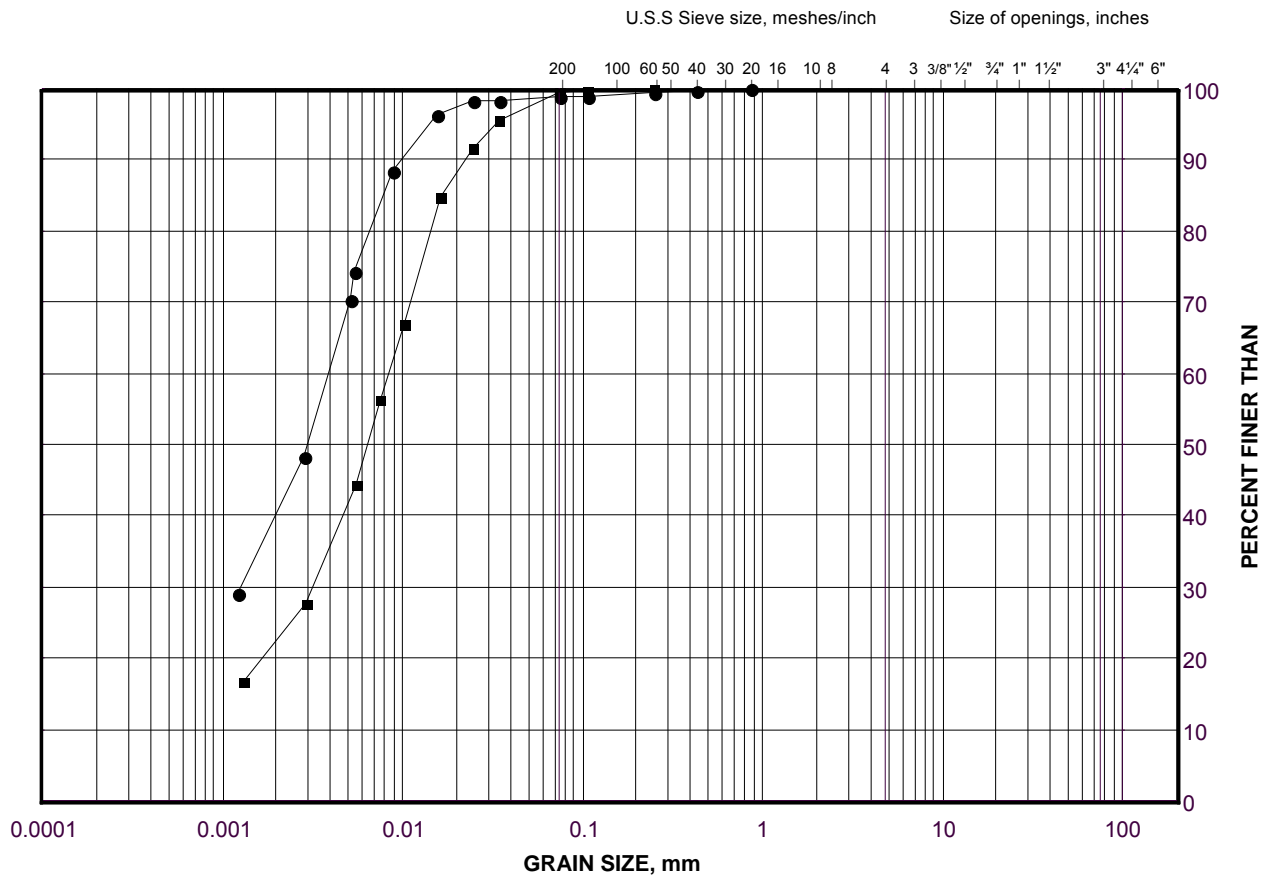
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Silty Clay Interlayer)

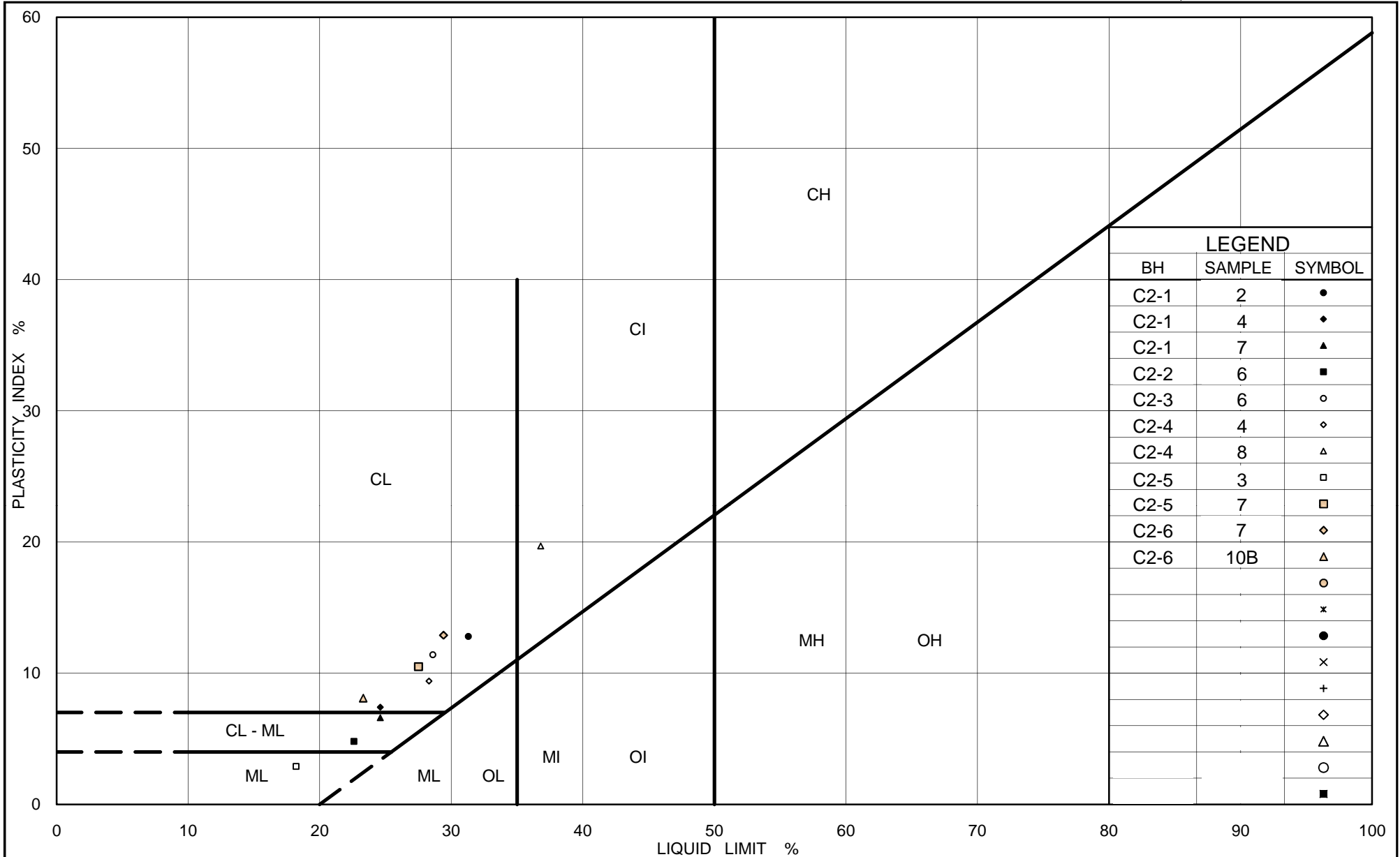
FIGURE C1-4



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	C2-5	7	243.8
■	C2-1	7	246.3



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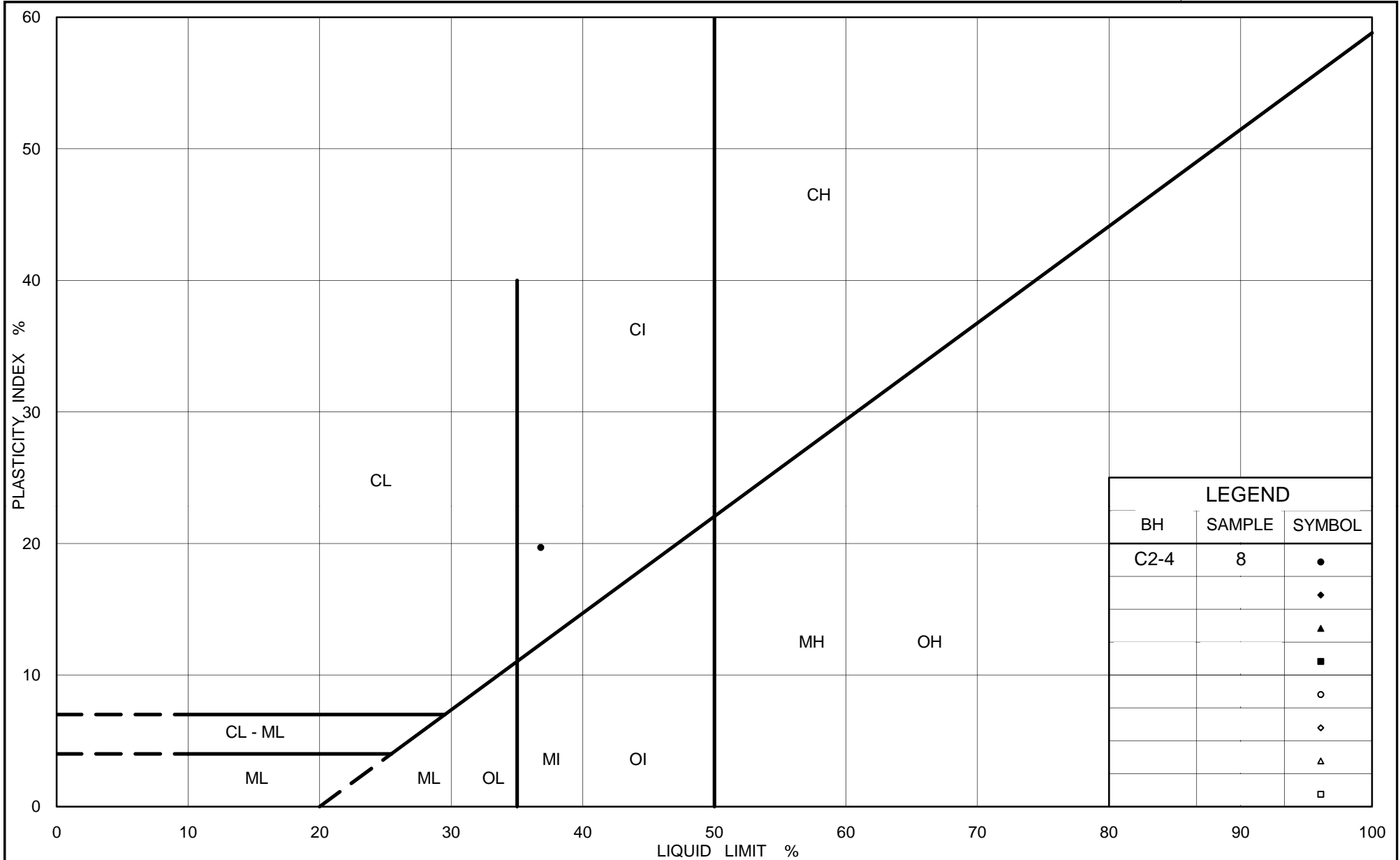
PLASTICITY CHART

Clayey Silt (Contains Silty Clay Inter-Layers)

Figure No. C1-5

Project No. 08-1111-0022E

Checked By: KJB



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Ontario

PLASTICITY CHART Clayey Silt (Silty Clay Interlayer)

Figure No. C1-6

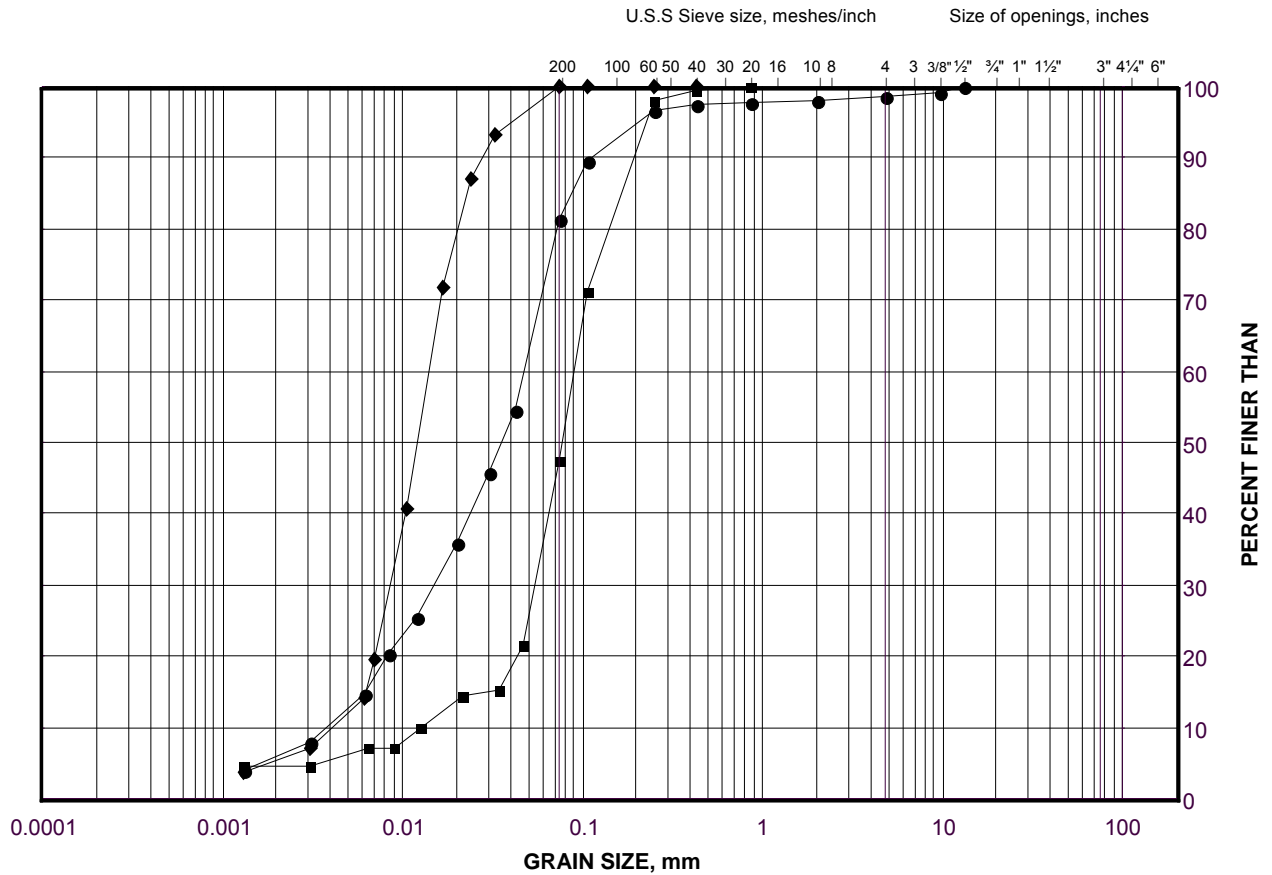
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Sand and Silt

FIGURE C1-7



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

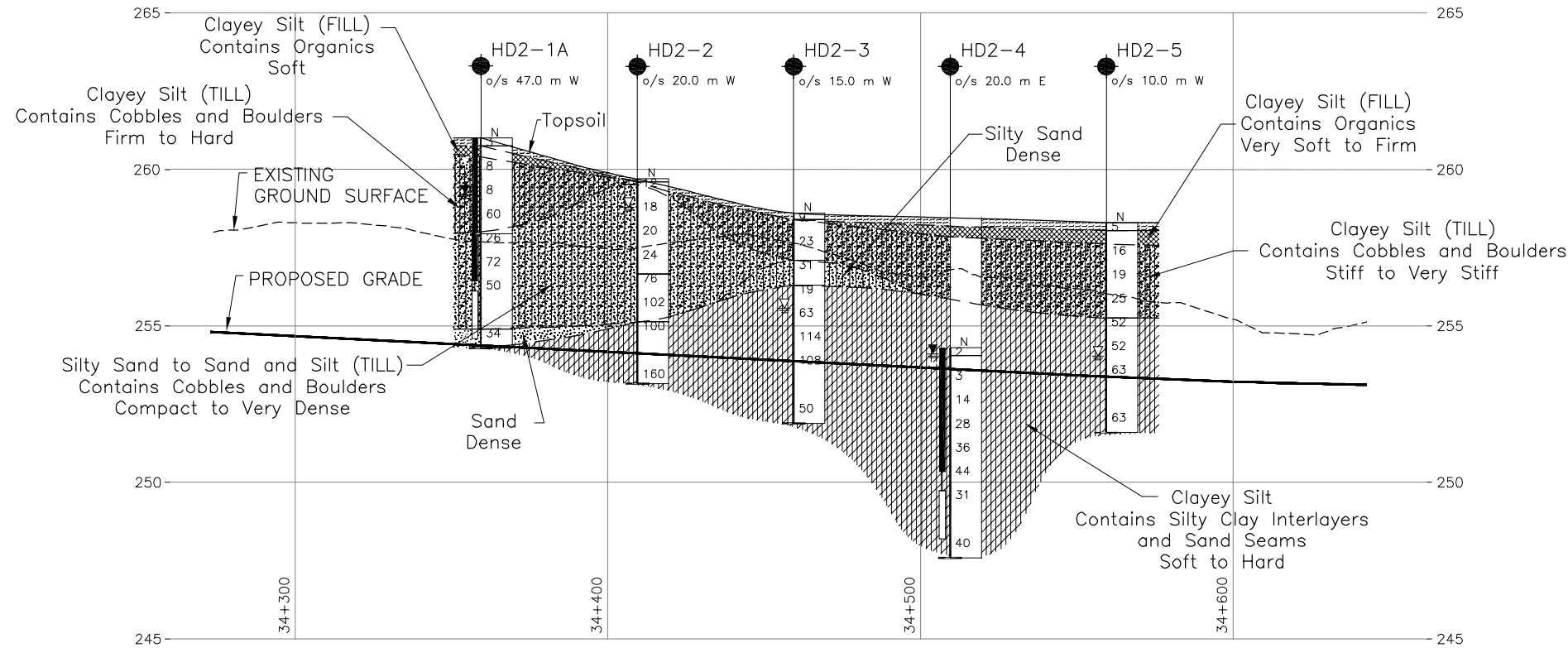
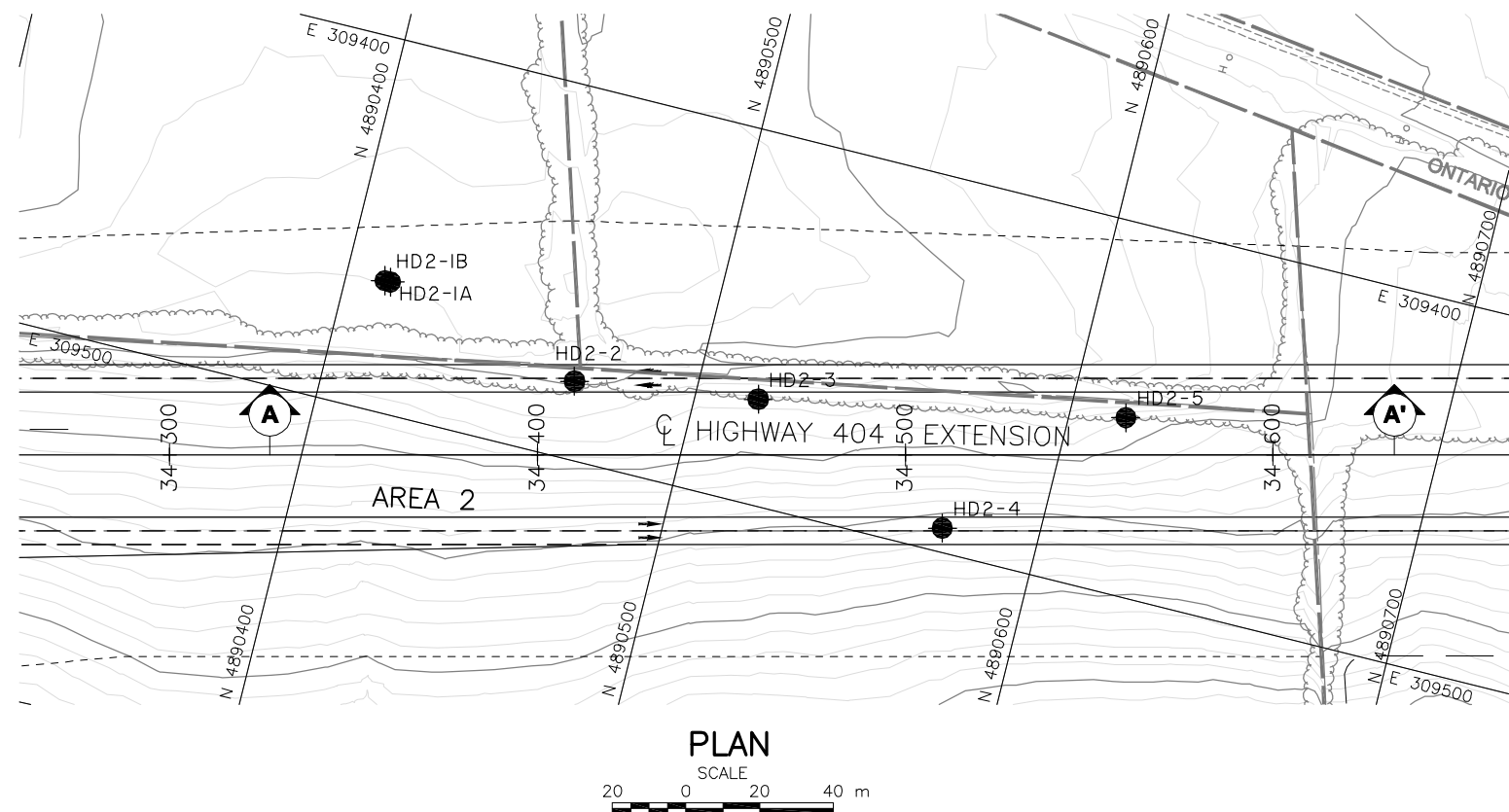
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	C2-2	3	248.8
■	C2-5	9	240.8
◆	C2-2	9	242.7



APPENDIX C2

Highway 404 – STA. 34+360 to STA. 34+600 (Deep Cut Area 2)
Drawing, Record of Boreholes and Laboratory Test Results



CENTRELINE PROFILE

HORIZONTAL SCALE
20 0 20 40 m

VERTICAL SCALE
2 0 2 4 m

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

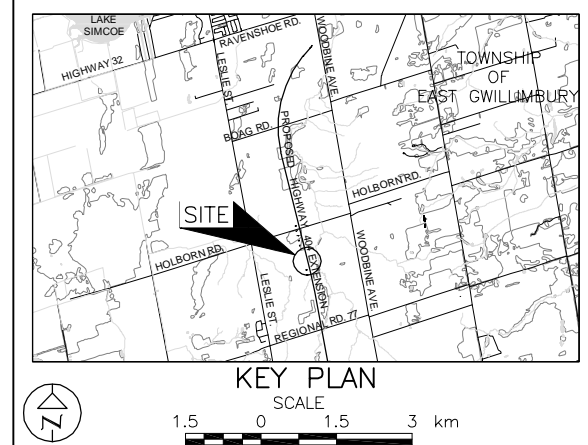
CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION

STA. 34+360 to STA. 34+600

BOREHOLE LOCATION AND SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND

- Borehole – Current Investigation
- Seal
- Piezometer
- Standard Penetration Test Value
- Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL in piezometer, measured on June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD2-1A	261.0	4890412.1	309464.8
HD2-1B	261.0	4890410.6	309464.8
HD2-2	259.7	4890467.2	309478.9
HD2-3	258.6	4890516.9	309471.6
HD2-4	254.3	4890573.9	309493.5
HD2-5	258.3	4890615.1	309452.3

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 provided in digital format by AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00-ct-xprofile.dwg", received April 21, 2009.

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C2

PROJECT _____		RECORD OF BOREHOLE No HD2-1A				1 OF 1 METRIC								
2005-07-00		LOCATION N 4890412.1 ; E 309464.8				ORIGINATED BY CR								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE March 23, 2009				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		WATER CONTENT (%)				
261.0	GROUND SURFACE							20 40 60 80 100						
0.0	TOPSOIL		1A	SS	3									
260.4	Clayey silt, trace sand and gravel, contains organics/rootlets (FILL) Soft Brown Moist		1B	SS	8									
0.6	CLAYEY SILT, some sand, trace gravel, contains cobbles and boulders, containing oxidation staining (TILL) Firm to hard Brown Moist		2	SS	8									
			3	SS	8									
			4	SS	60									
258.0														
3.1	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders and oxidation staining (TILL) Compact to very dense Brown to grey Moist		5	SS	26									
	Becoming grey at a depth of 4.6 m		6	SS	72									
			7	SS	50									
254.9														
6.1	SAND, some silt, trace clay, trace gravel Dense Brown Wet		8	SS	34									
254.3	END OF BOREHOLE													
6.7	NOTES: 1. Water level in open borehole at a depth of 0.9 m below ground surface (Elev. 260.1 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.8 m below ground surface (Elev. 260.2 m) on April 2, 2009. 3. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 259.2 m) on June 12, 2009.													

PROJECT _____		RECORD OF BOREHOLE No HD2-1B				1 OF 1 METRIC						
2005-07-00		LOCATION N 4890410.6 ; E 309464.8				ORIGINATED BY CR						
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC						
DATUM Geodetic		DATE March 23, 2009				CHECKED BY TB/KJB						
SOIL PROFILE			SAMPLES			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	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa				W _p W W _L
261.0 0.0	GROUND SURFACE TOPSOIL							20 40 60 80 100	20 40 60 80 100	10 20 30		
260.4 0.6	Clayey silt, trace sand and gravel, contains organics/rootlets (FILL) Soft Brown Moist						260					
258.9 2.1	CLAYEY SILT, some sand, trace gravel, containing cobbles, boulders and oxidation staining (TILL) Soft to hard Brown Moist						259					
END OF BOREHOLE												
NOTES:												
1. Soil strata inferred from Borehole HD2-1A.												
2. Water level in open borehole at a depth of 0.9 m below ground surface (Elev. 260.1 m) upon completion of drilling.												
3. Water level in piezometer at a depth of 0.7 m below ground surface (Elev. 260.3 m) on April 2, 2009.												
4. Water level in piezometer at a depth of 1.3 m below ground surface (Elev. 259.7 m) on June 12, 2009.												

PROJECT _____		RECORD OF BOREHOLE No HD2-2				1 OF 1 METRIC										
2005-07-00		LOCATION N 4890467.2 ; E 309478.9				ORIGINATED BY CR										
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC										
DATUM Geodetic		DATE March 20, 2009				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								
259.7	GROUND SURFACE															
0.9	TOPSOIL		1A		12											
	Silty SAND, trace clay, trace gravel, containing oxidation staining (TILL) Compact Brown Moist to wet below a depth of 1.1 m		1B	SS												
			2	SS	18											
			3	SS	20											
			4	SS	24											
256.7																
3.1	SAND and SILT, trace to some clay and gravel, containing cobbles and oxidation staining (TILL) Very dense Brown Moist		5	SS	76											
			6	SS	102											
255.1																
4.6	CLAYEY SILT, some sand, trace gravel, contains sand seams Hard Grey Moist		7	SS	100/0.10											
253.2			8	SS	160											
6.6	END OF BOREHOLE															
NOTES: 1. Water level in open borehole at a depth of 0.9 m below ground surface (Elev. 258.8 m) upon completion of drilling.																

PROJECT _____		RECORD OF BOREHOLE No HD2-3		1 OF 1 METRIC	
2005-07-00		LOCATION N 4890516.9 ; E 309471.6		ORIGINATED BY CR	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE March 20, 2009		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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	W _p	W	W _L						
258.6	GROUND SURFACE																				
0.0	TOPSOIL		1A																		
0.2	CLAYEY SILT, trace to some sand, trace gravel, containing oxidation staining (TILL) Stiff to very stiff Brown Moist		1B	SS	9																
			2	SS	23																
257.1																					
1.5	Silty SAND, trace clay Dense Brown Moist		3	SS	31																
256.3																					
2.3	CLAYEY SILT, trace to some sand, trace gravel Very stiff to hard Grey Moist		4	SS	19																
			5	SS	63																
			6	SS	114																
			7	SS	108																
	Containing interlayers of silty clay below a depth of 6.1 m		8	SS	50																
251.9																					
6.7	END OF BOREHOLE																				
	NOTES: 1. Water level in open borehole at a depth of 3.1 m below ground surface (Elev. 255.5 m) upon completion of drilling.																				

PROJECT _____		RECORD OF BOREHOLE No HD2-4				1 OF 1 METRIC								
2005-07-00		LOCATION N 4890573.9 ; E 309493.5				ORIGINATED BY CR								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE March 23, 2009				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						
254.3 0.0	GROUND SURFACE TOPSOIL		1A	SS	2									
253.7 0.6	Clayey silt, trace sand and gravel, contains organics/rootlets (FILL) Very soft to soft Brown Moist		1B	SS	3									
	CLAYEY SILT, some sand, containing interlayers of silty clay and sand seams, contains oxidation staining Soft to hard Brown Moist		2	SS	3									
			3	SS	14									
			4	SS	28									
			5	SS	36									
			6	SS	44									
			7	SS	31									
			8	SS	40									
247.6 6.7	END OF BOREHOLE													
NOTES: 1. Water level in open borehole at a depth of 0.8 m below ground surface (Elev. 253.5 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.2 m below ground surface (Elev. 254.1 m) on April 2, 2009. 3. Piezometer noted as destroyed on June 12, 2009.														

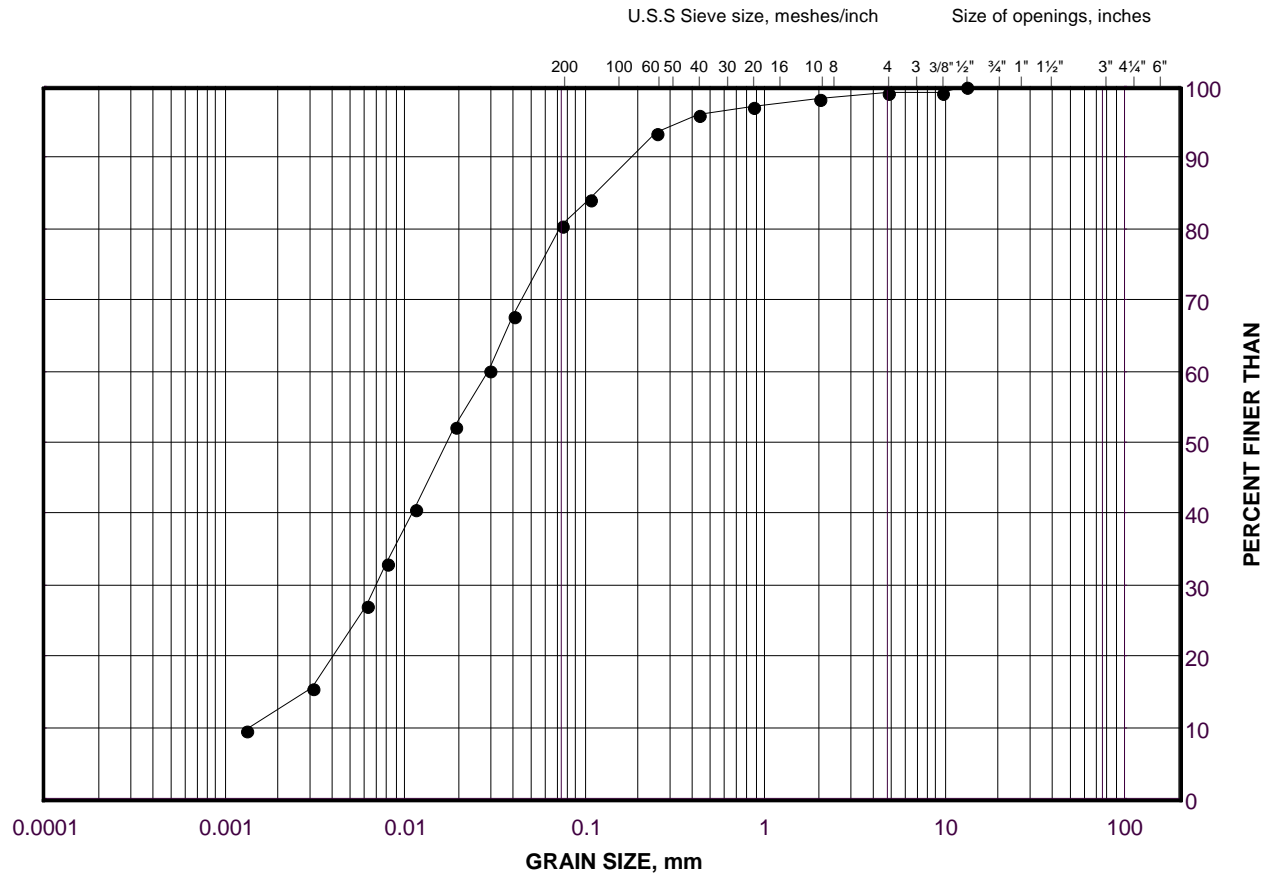
PROJECT _____		RECORD OF BOREHOLE No HD2-5		1 OF 1 METRIC	
2005-07-00		LOCATION N 4890615.1 ; E 309452.3		ORIGINATED BY CR	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE March 23, 2009		CHECKED BY TB/KJB	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT LIMIT			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 (%)				
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × REMOULDED								
258.3	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL		1A	SS	5												
257.7	Clayey silt, trace sand and gravel, contains organics (FILL) Firm Brown Moist CLAYEY SILT, some sand, trace gravel, containing oxidation staining (TILL) Very stiff Brown Moist		1B														
0.6			2	SS	16												
			3	SS	19												
			4	SS	25												
255.3	CLAYEY SILT, trace sand, containing sand seams and oxidation staining Hard Brown Moist Becoming grey below a depth of 4.6 m																
3.1			5	SS	52												
			6	SS	52												
			7	SS	63												
			8	SS	63												
251.6	END OF BOREHOLE																
6.7	NOTES: 1. Water level in open borehole at a depth of 4.3 m below ground surface (Elev. 254.0 m) upon completion of drilling.																

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE C2-1



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

LEGEND

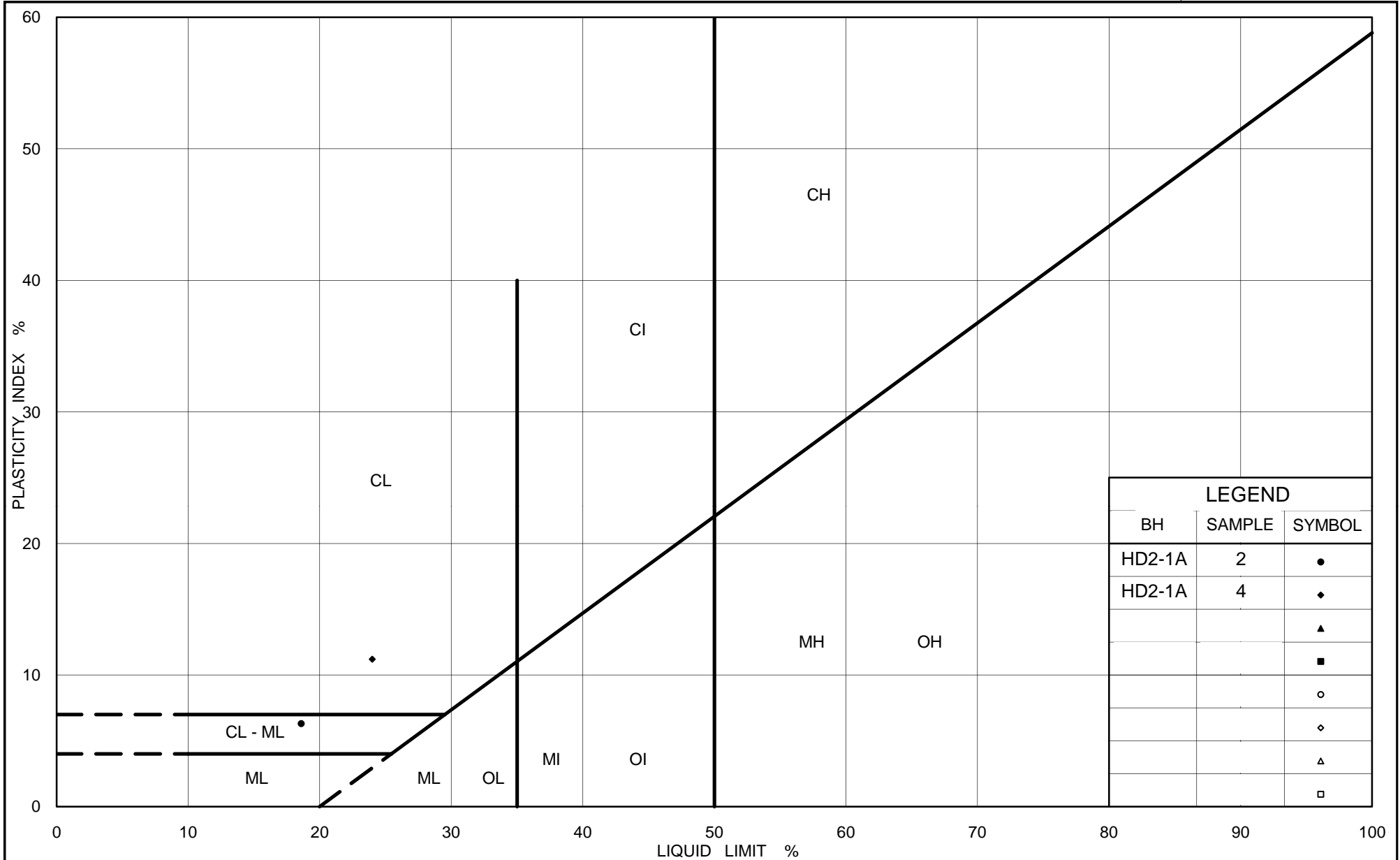
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD2-5	4	255.7

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt Till

Figure No. C2-2

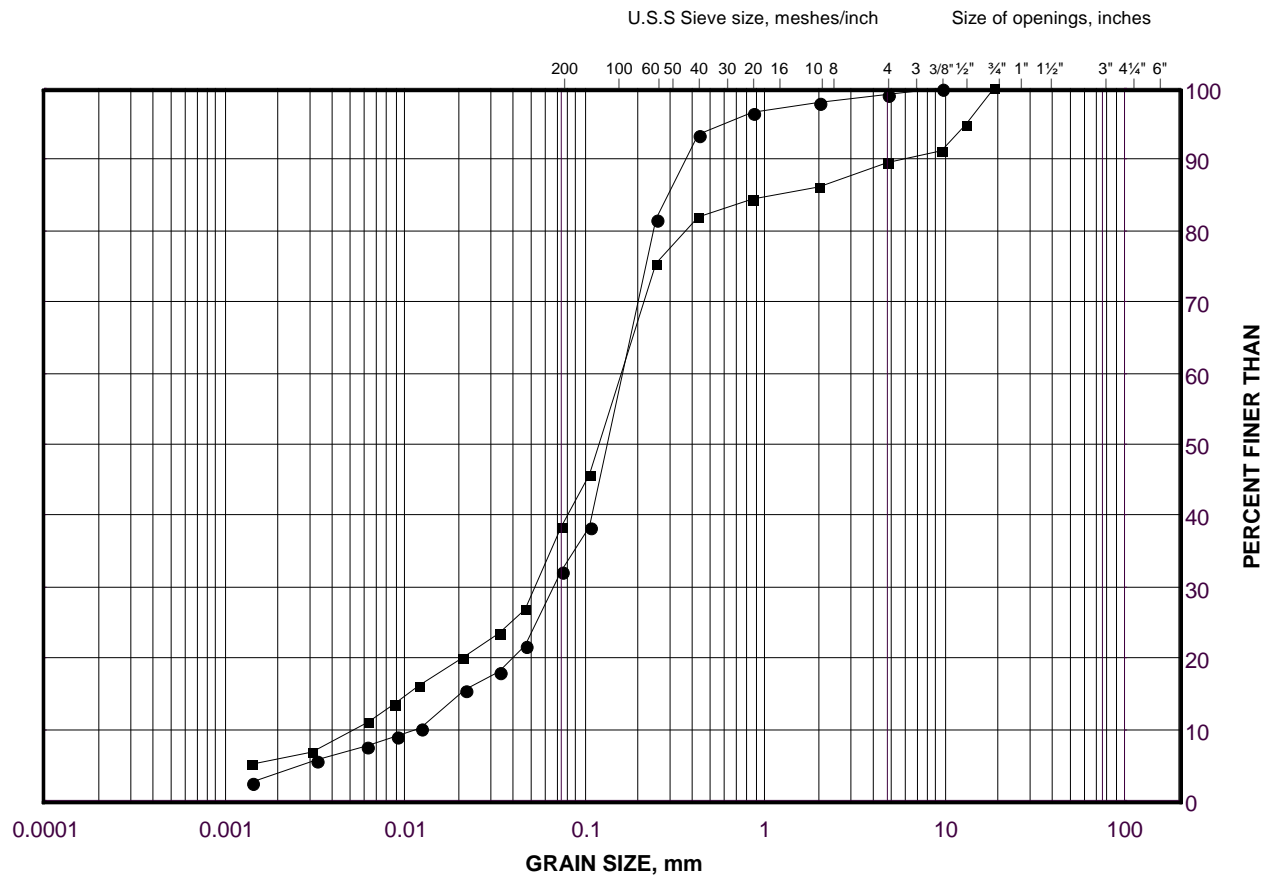
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silty Sand Till to Sand and Silt Till

FIGURE C2-3



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD2-2	3	257.9
■	HD2-2	5	256.3

Project Number: 08-1111-0022E

Checked By: KJB

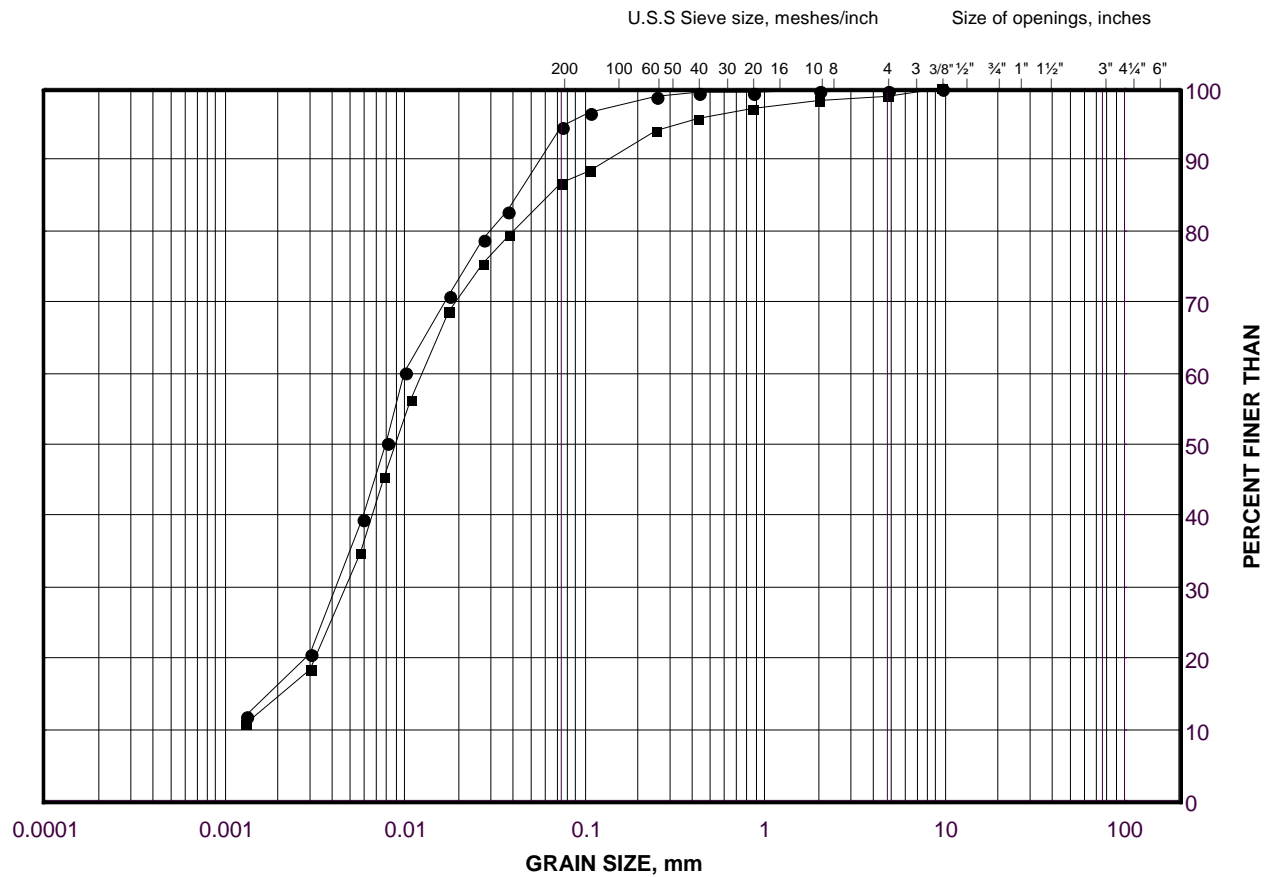
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE C2-4



LEGEND

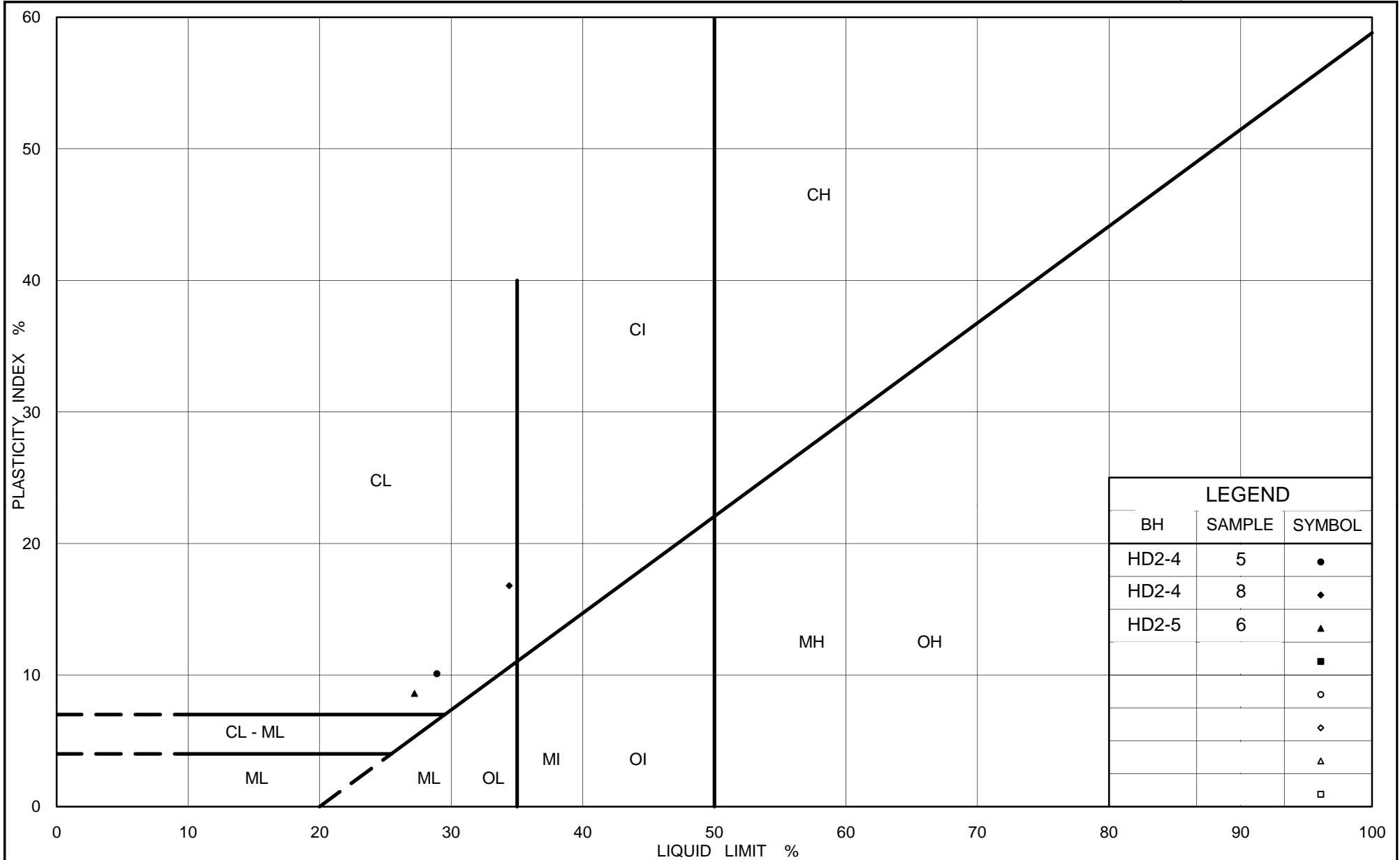
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD2-3	4	256.0
■	HD2-3	6	254.5

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt

Figure No. C2-5

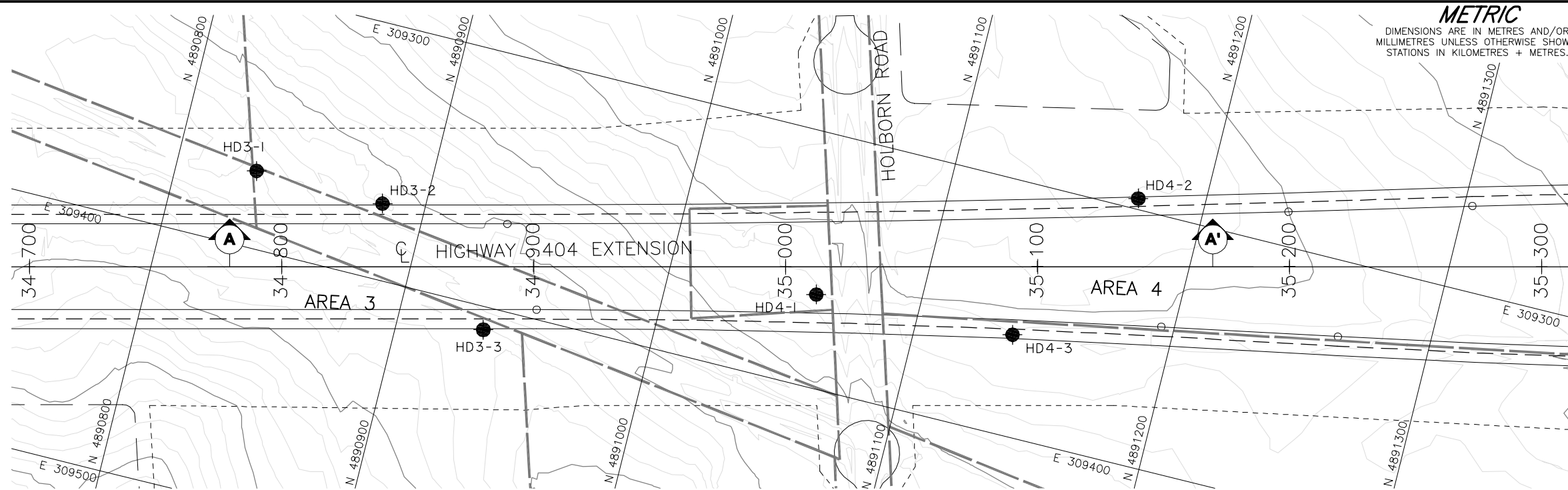
Project No. 08-1111-0022E

Checked By: KJB

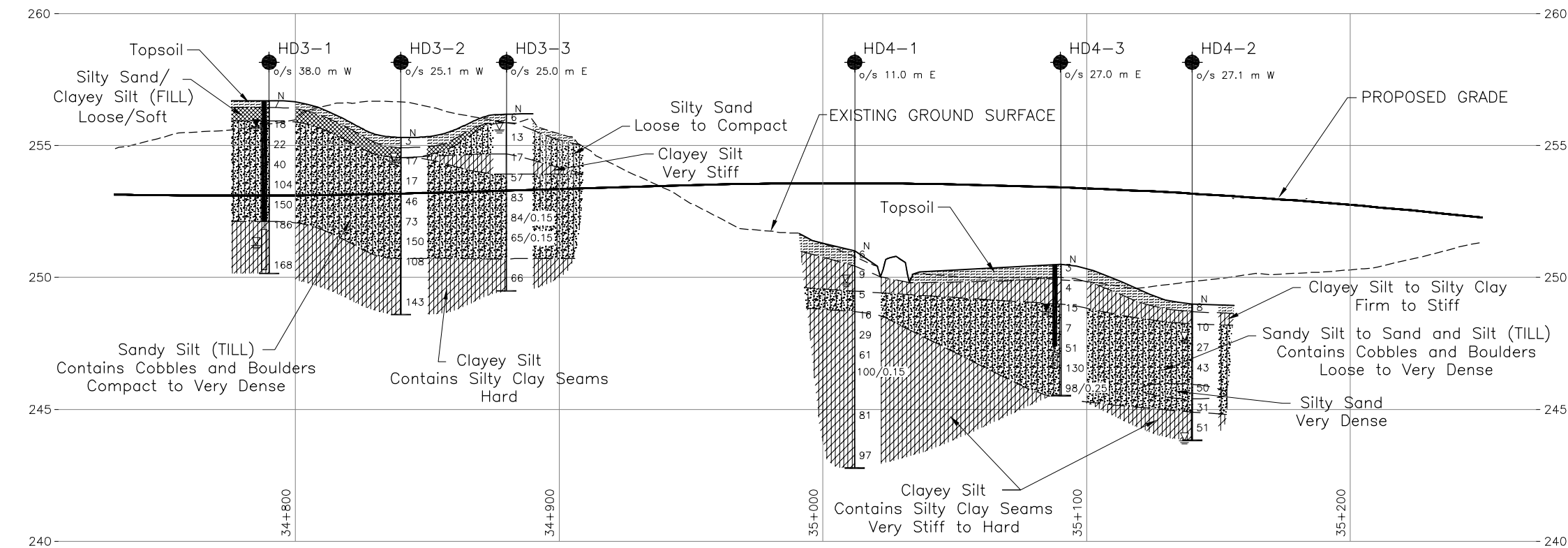
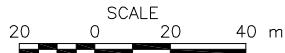


APPENDIX C3

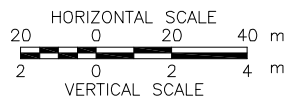
Highway 404 – STA. 34+780 to STA. 34+880 (Deep Cut Area 3)
Drawing, Record of Boreholes and Laboratory Test Results



PLAN



CENTRELINE PROFILE



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

CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STA. 34+780 to STA. 35+150
BOREHOLE LOCATION AND SOIL STRATA



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- 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 June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD3-1	256.7	4890831.6	309369.6
HD3-2	255.3	4890883.2	309370.1
HD3-3	256.2	4890934.1	309409.0
HD4-1	251.0	4891059.0	309363.5
HD4-2	249.0	4891173.8	309295.7
HD4-3	250.5	4891138.4	309360.2

NOTES

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NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C3

PROJECT _____		RECORD OF BOREHOLE No HD3-1		1 OF 1 METRIC	
_____ 2005-07-00		LOCATION _____ N 4890831.6 ; E 309369.6		ORIGINATED BY <u>CR</u>	
DIST _____ HWY <u>404</u>		BOREHOLE TYPE <u>108 mm O.D. Solid Stem Auger</u>		COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>March 24, 2009</u>		CHECKED BY <u>TB/KJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
								20	40	60	80	100	W _p	W	W _L					
256.7	GROUND SURFACE																			
0.0	TOPSOIL		1A	SS	7															
0.3	Silty sand, trace clay, trace gravel (FILL) Loose Brown Moist Sandy SILT, trace clay, trace gravel, containing cobbles and boulders, rootlets present to a depth of 1.4 m, containing interlayers of clayey silt and oxidation staining (TILL) Compact to very dense Brown Moist		1B																	
255.9			2	SS	18															
0.8			3	SS	22															
			4	SS	40															
			5	SS	104															
			6	SS	150															
252.1																				
4.6	CLAYEY SILT, some sand, containing seams of silty clay Hard Grey Moist		7	SS	186															
250.2			8	SS	168															
6.6	END OF BOREHOLE																			
	NOTES: 1. Water level in open borehole at a depth of 5.5 m below ground surface (Elev. 251.2 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.8 m below ground surface (Elev. 255.9 m) on April 2, 2009. 3. Water level in piezometer at a depth of 1.0 m below ground surface (Elev. 255.7 m) on June 12, 2009.																			

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

PROJECT _____		RECORD OF BOREHOLE No HD3-2				1 OF 1 METRIC											
2005-07-00		LOCATION N 4890883.2 ; E 309370.1				ORIGINATED BY CR											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE March 24, 2009				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									
255.3	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL		1A	SS	3		255										
254.9			1B														
254.5	Clayey silt, trace sand, trace gravel, containing organics and rootlets (FILL) Soft Brown Wet		2	SS	17		254										
0.8	Sandy SILT, trace clay, trace gravel, containing cobbles and boulders and layers of clayey silt, containing oxidation staining to a depth of 4.6 m (TILL) Compact to very dense Brown Moist		3	SS	17		253										1 12 74 13
			4	SS	46												
			5	SS	73		252										
			6	SS	150												
250.7							251										
4.6	CLAYEY SILT, some sand, containing seams of silty clay Hard Grey Moist		7	SS	108		250										1 20 61 18
248.6			8	SS	143		249										
6.7	END OF BOREHOLE																
NOTES: 1. Water level in open borehole at a depth of 0.9 m below ground surface (Elev. 254.4 m) upon completion of drilling.																	

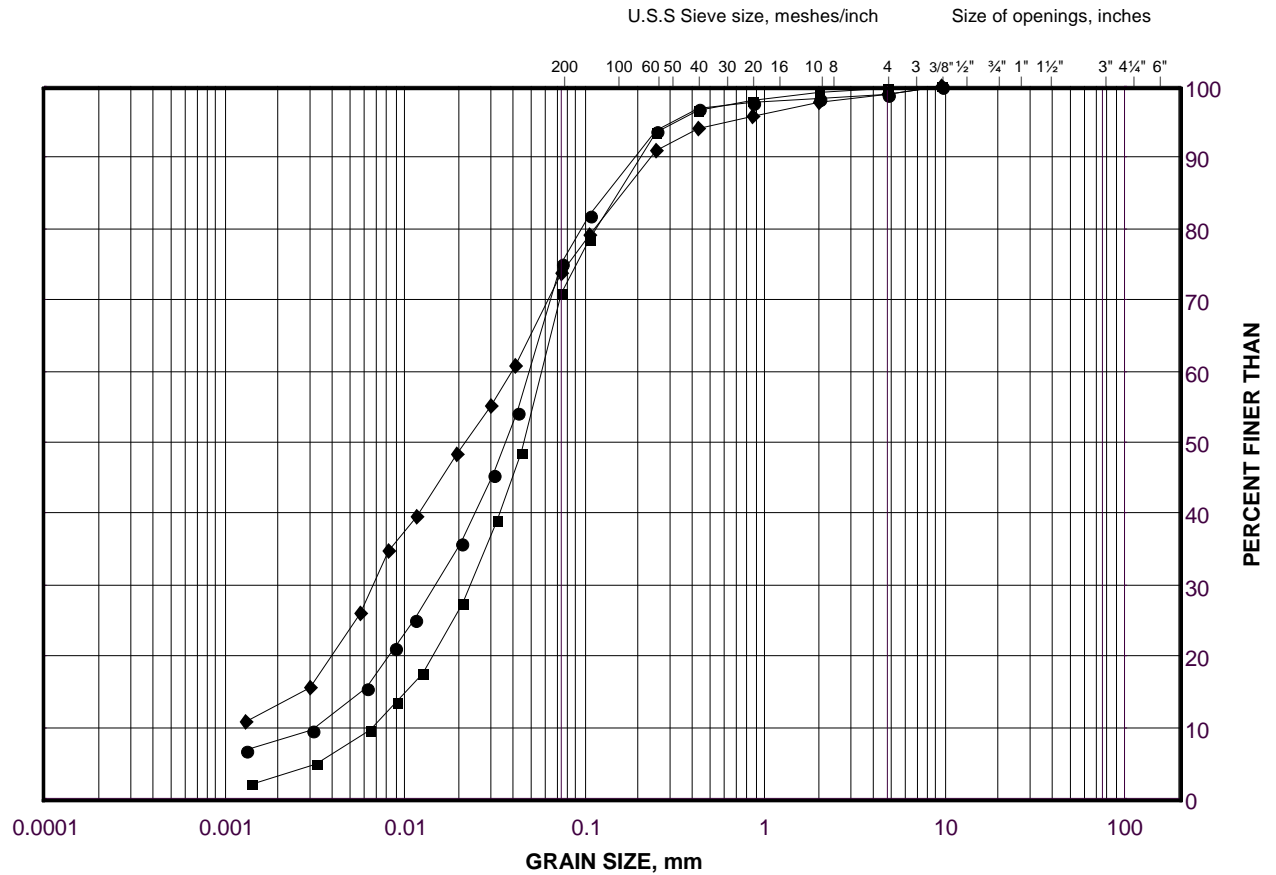
PROJECT _____		RECORD OF BOREHOLE No HD3-3		1 OF 1 METRIC	
2005-07-00		LOCATION N 4890934.1 ; E 309409.0		ORIGINATED BY CR	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE March 24, 2009		CHECKED BY TB/KJB	

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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	w _p	w	w _L						
256.2	GROUND SURFACE																				
0.0 255.9	TOPSOIL		1A	SS	6																
0.3	Silty SAND, trace clay, trace gravel Loose to compact Brown Wet		1B																		
			2	SS	13																
254.7																					
1.5	CLAYEY SILT, trace sand Very stiff Brown Moist		3	SS	17																
253.9																					
2.3	Sandy SILT, trace to some clay, trace gravel, containing cobbles and boulders (TILL) Very dense Brown Moist		4	SS	57																
			5	SS	83																
			6	SS	84/0.15																
			7	SS	65/0.15																
250.7																					
5.5	CLAYEY SILT, some sand, containing seams of silty clay Hard Grey Moist		8	SS	66																
249.5																					
6.7	END OF BOREHOLE																				
NOTES: 1. Water level in open borehole at a depth of 0.6 m below ground surface (Elev. 255.6 m) upon completion of drilling.																					

GRAIN SIZE DISTRIBUTION

Sandy Silt Till

FIGURE C3-1



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD3-3	4	253.6
■	HD3-1	4	254.1
◆	HD3-1	6	252.6

Project Number: 08-1111-0022E

Checked By: KJB

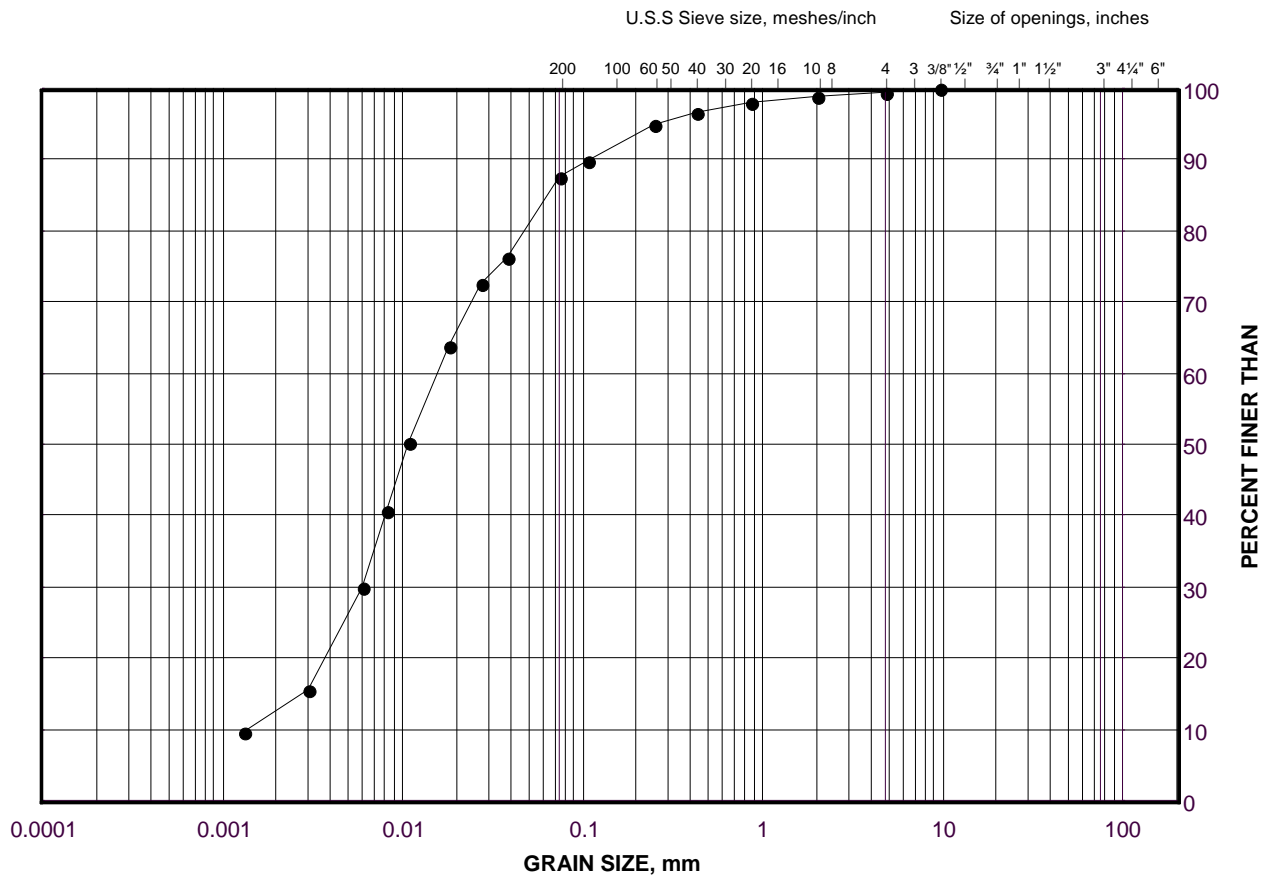
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Sandy Silt Till (Clayey Silt Interlayer)

FIGURE C3-2



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD3-2	3	253.5

Project Number: 08-1111-0022E

Checked By: KJB

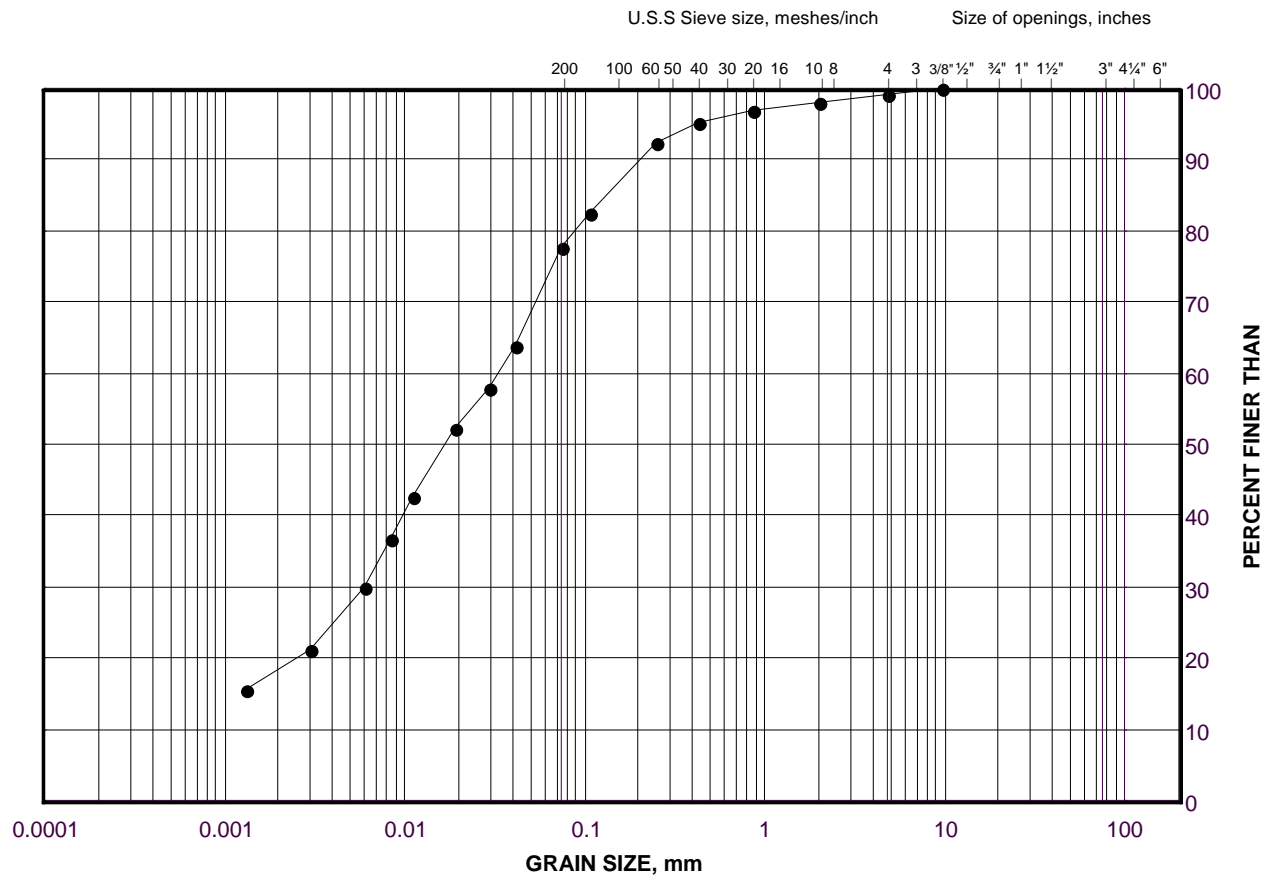
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE C3-3



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

LEGEND

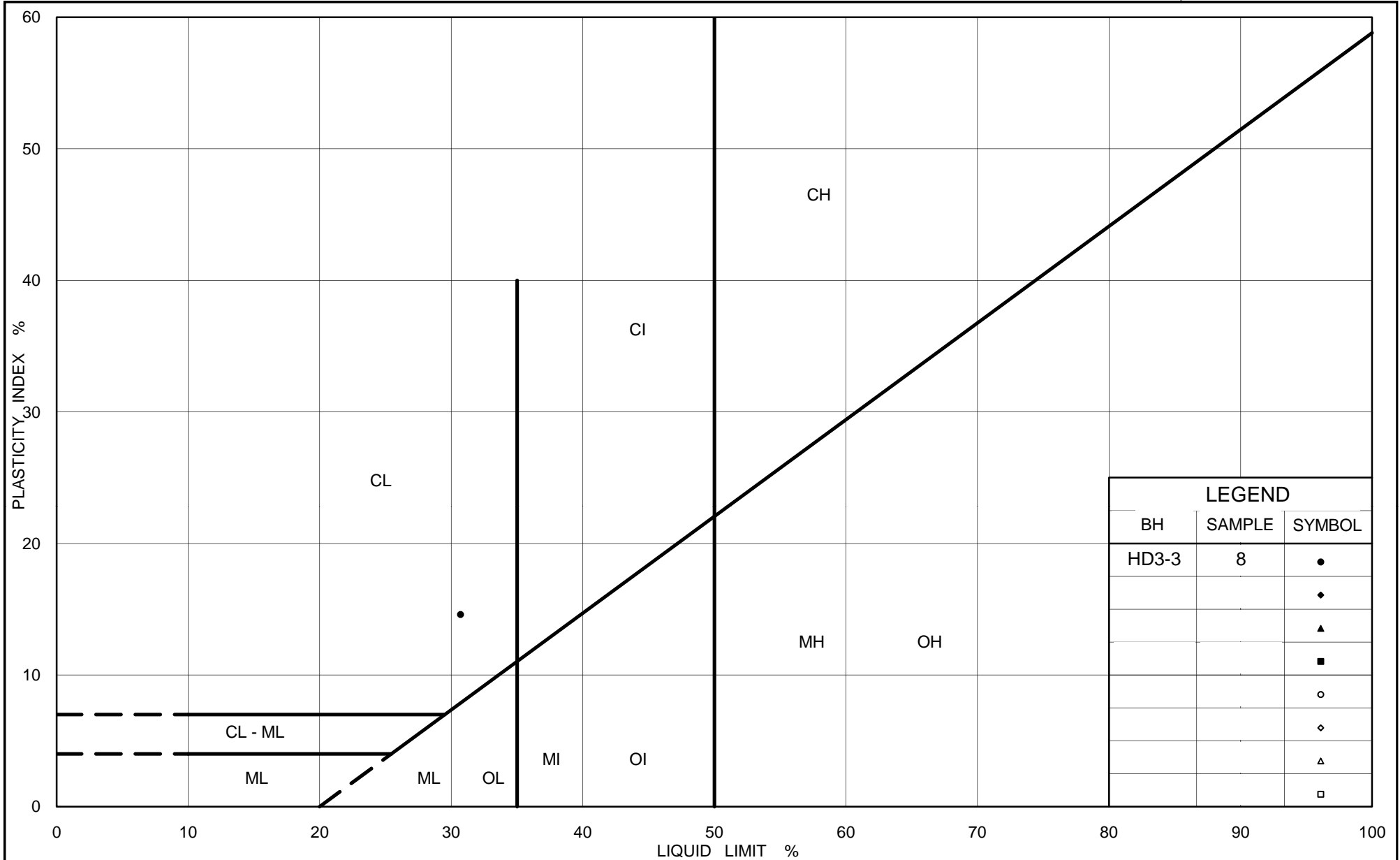
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD3-2	7	250.4

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



LEGEND		
BH	SAMPLE	SYMBOL
HD3-3	8	•
		◆
		▲
		■
		○
		◇
		△
		□



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PLASTICITY CHART

Clayey Silt

Figure No. C3-4

Project No. 08-1111-0022E

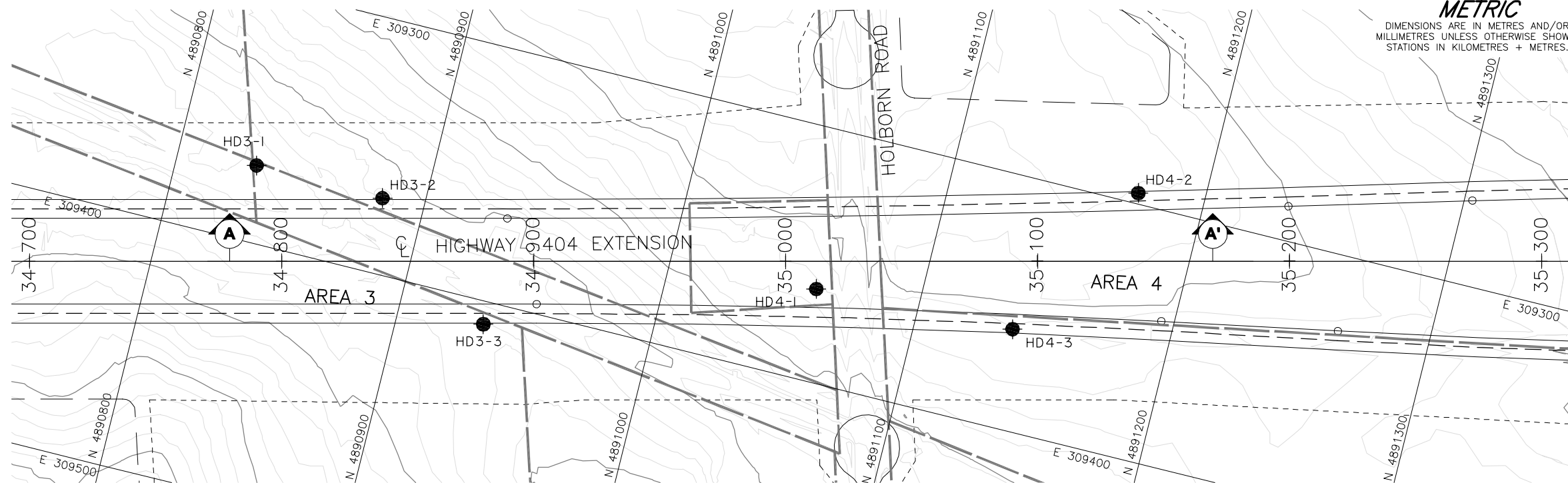
Checked By: KJB



APPENDIX C4

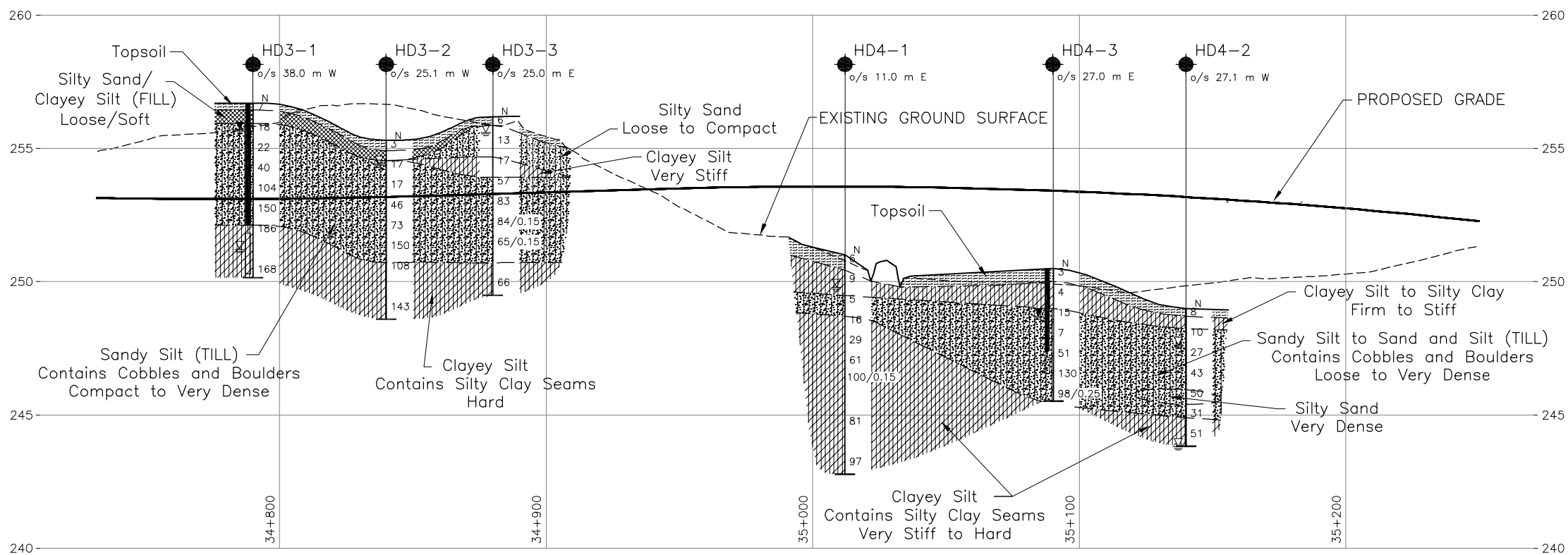
Highway 404 – STA. 35+000 to STA. 35+150 (High Fill Area 4)
Drawing, Record of Boreholes and Laboratory Test Results

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



PLAN

SCALE
20 0 20 40 m



CENTRELINE PROFILE

HORIZONTAL SCALE
20 0 20 40 m
VERTICAL SCALE
2 0 2 4 m

CONT No.
WP No. 2005-07-00



HIGHWAY 404 EXTENSION
STA. 34+780 to STA. 35+150
BOREHOLE LOCATION AND SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- ⊥ 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 June 12, 2009
- ≡ WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD3-1	256.7	4890831.6	309369.6
HD3-2	255.3	4890883.2	309370.1
HD3-3	256.2	4890934.1	309409.0
HD4-1	251.0	4891059.0	309363.5
HD4-2	249.0	4891173.8	309295.7
HD4-3	250.5	4891138.4	309360.2

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 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 provided in digital format by AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00_ct-xprofile.dwg", received April 21, 2009.

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C4

PROJECT _____		RECORD OF BOREHOLE No HD4-1		1 OF 1 METRIC	
2005-07-00		LOCATION N 4891059.0 ; E 309363.5		ORIGINATED BY CR	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE March 25, 2009		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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	20	40	60		80	100			
251.0	GROUND SURFACE																				
0.0	TOPSOIL		1	SS	6																
250.4			2	SS	9																
0.6	CLAYEY SILT, some sand, trace gravel, trace organics and rootlets Stiff Brown Wet																				
249.5			3	SS	5																
1.5	SAND and SILT, trace clay, trace gravel, containing cobbles and oxidation staining (TILL) Loose Brown Wet																				
248.7			4	SS	16																
2.3	CLAYEY SILT, some sand, trace gravel, containing interlayers of sandy silt and oxidation staining, containing cobbles Very stiff to hard Brown Moist		5	SS	29																
			6	SS	61																
			7	SS	100/0.15																
245.5																					
5.5	Containing silty clay seams below 5.5 m		8	SS	81																
242.8			9	SS	97																
8.2	END OF BOREHOLE																				
	NOTES: 1. Water level in open borehole at a depth of 1.2 m below ground surface (Elev. 249.8 m) upon completion of drilling.																				

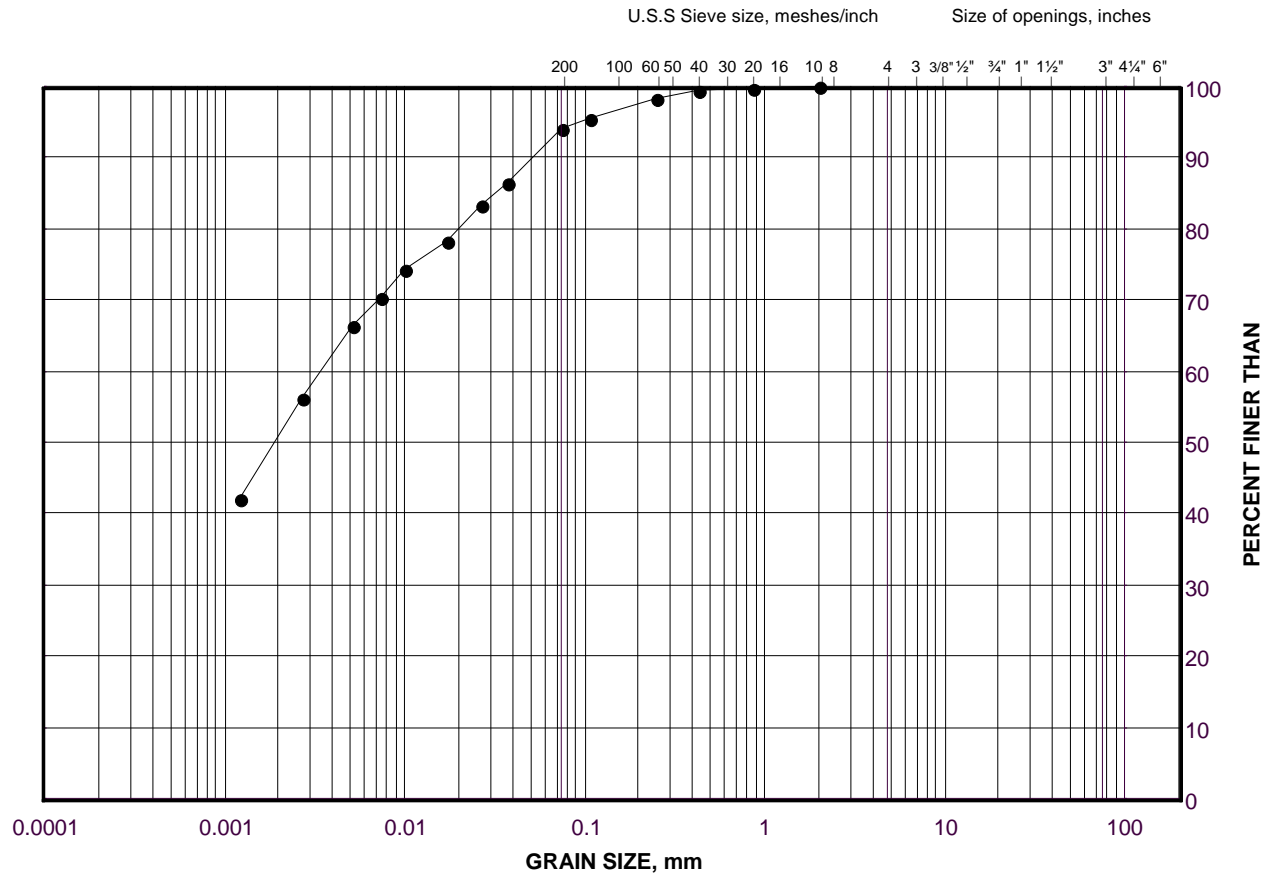
PROJECT _____		RECORD OF BOREHOLE No HD4-2				1 OF 1 METRIC								
2005-07-00		LOCATION N 4891173.8 ; E 309295.7				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE June 8, 2009				CHECKED BY KJB								
SOIL PROFILE			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						
249.0	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	TOPSOIL to CLAYEY SILT, some sand, trace gravel, containing organics and rootlets (Reworked)		1A	SS	8									
0.3	Stiff		1B	SS										
248.2	Dark brown Moist		2	SS	10									
0.8	CLAYEY SILT, trace to some sand, trace gravel													
	Stiff													
	Brown Moist		3	SS	27									
	Sandy SILT to SAND and SILT, trace clay, trace gravel, containing cobbles and boulders, containing clayey silt interlayers (TILL)													
	Compact to dense													
246.0	Brown Moist													
3.1	Silty SAND, trace clay		5	SS	50									
245.4	Dense													
3.6	Brown Moist													
244.9	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders (TILL)		6A	SS	31									
4.1	Dense													
	Brown Moist		6B	SS										
243.8	CLAYEY SILT, trace to some sand, containing oxidation staining		7	SS	51									
5.2	Hard													
	Brown Moist													
	END OF BOREHOLE													
NOTES: 1. Water level in open borehole at a depth of 5.2 m below ground surface (Elev. 243.8 m) upon completion of drilling. 2. Water level in open borehole at a depth of 1.4 m below ground surface (Elev. 247.6 m) on June 9, 2009.														

PROJECT _____		RECORD OF BOREHOLE No HD4-3				1 OF 1 METRIC								
2005-07-00		LOCATION N 4891138.4 ; E 309360.2				ORIGINATED BY CR								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE March 25, 2009				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						
250.5	GROUND SURFACE													
0.0	TOPSOIL		1A	SS	3									
250.0			1B											
0.5	SILTY CLAY, trace to some sand, trace gravel, trace rootlets Firm Brown Wet		2	SS	4									0 6 44 50
249.0														
1.5	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders and oxidation staining (TILL) Loose to very dense Brown Moist to wet		3	SS	15									8 35 46 11
			4	SS	7									
			5	SS	51									11 34 49 6
			6	SS	130									
			7	SS	98/0.25									
245.5	END OF BOREHOLE													
5.0	NOTES: 1. Water level in open borehole at a depth of 1.2 m below ground surface (Elev. 249.3 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.3 m below ground surface (Elev. 250.2 m) on April 2, 2009. 3. Water level in piezometer at a depth of 1.2 m below ground surface (Elev. 249.3 m) on May 20, 2009. 4. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 248.7 m) on June 12, 2009.													

GRAIN SIZE DISTRIBUTION

Silty Clay

FIGURE C4-1



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

LEGEND

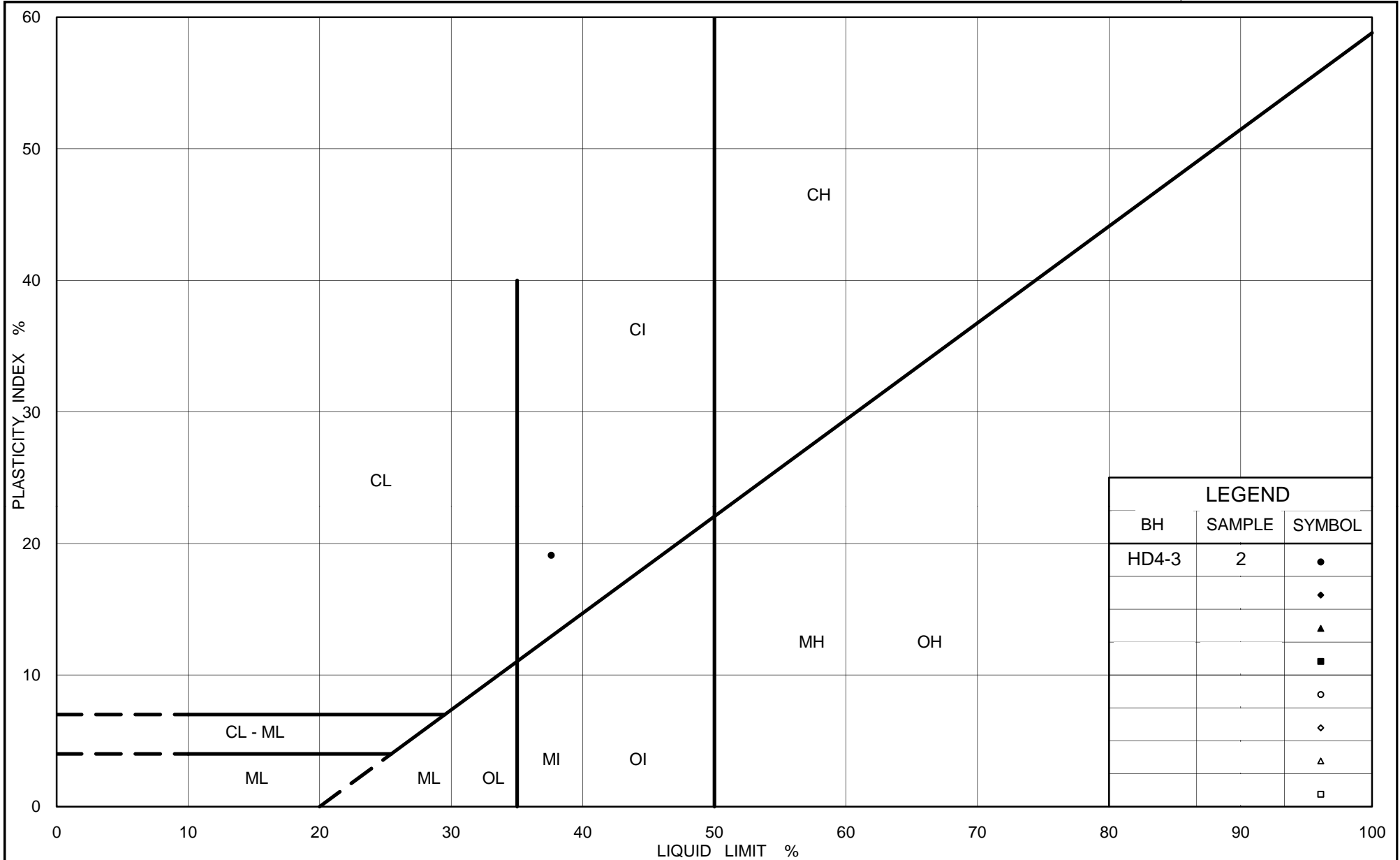
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD4-3	2	249.4

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Silty Clay

Figure No. C4-2

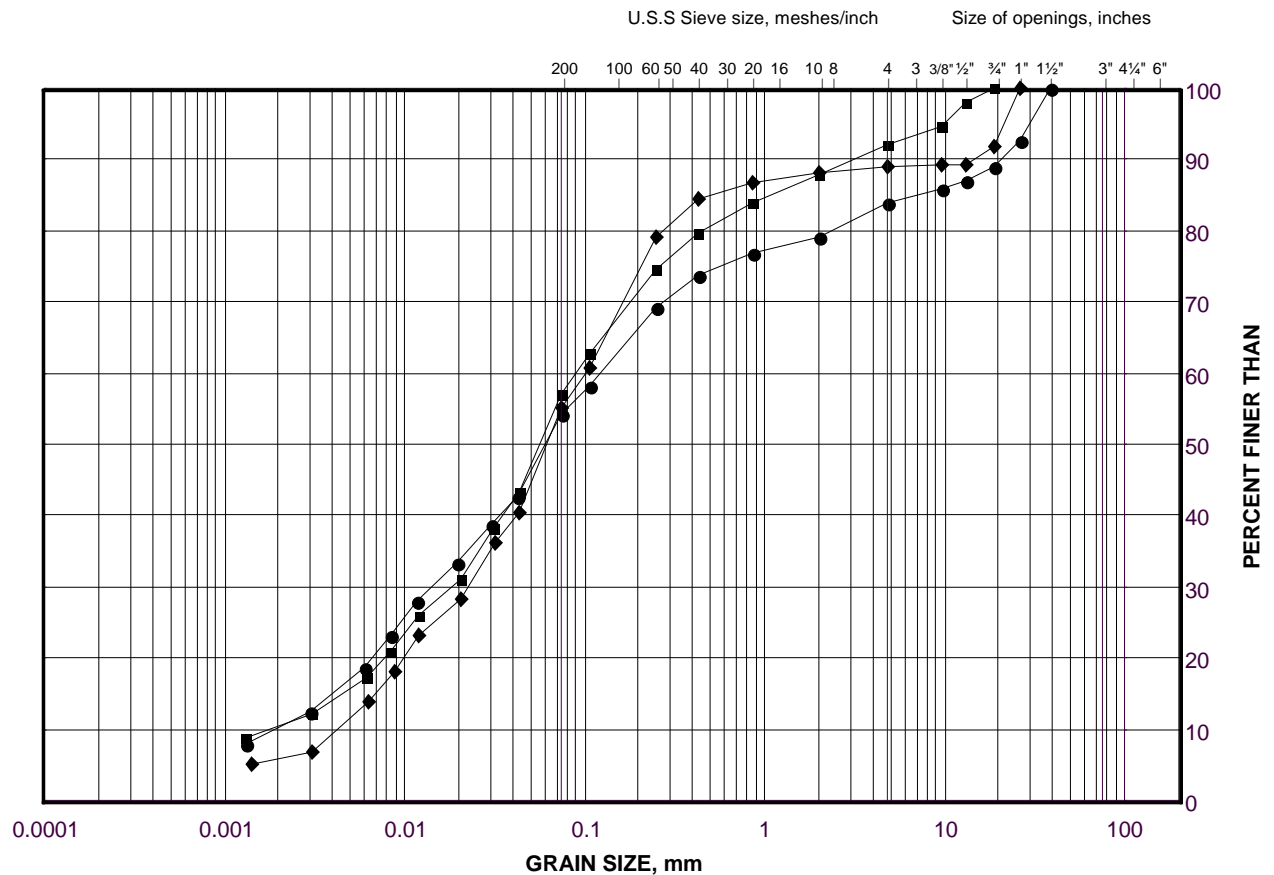
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Sandy Silt to Sand and Silt Till

FIGURE C4-3



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

LEGEND

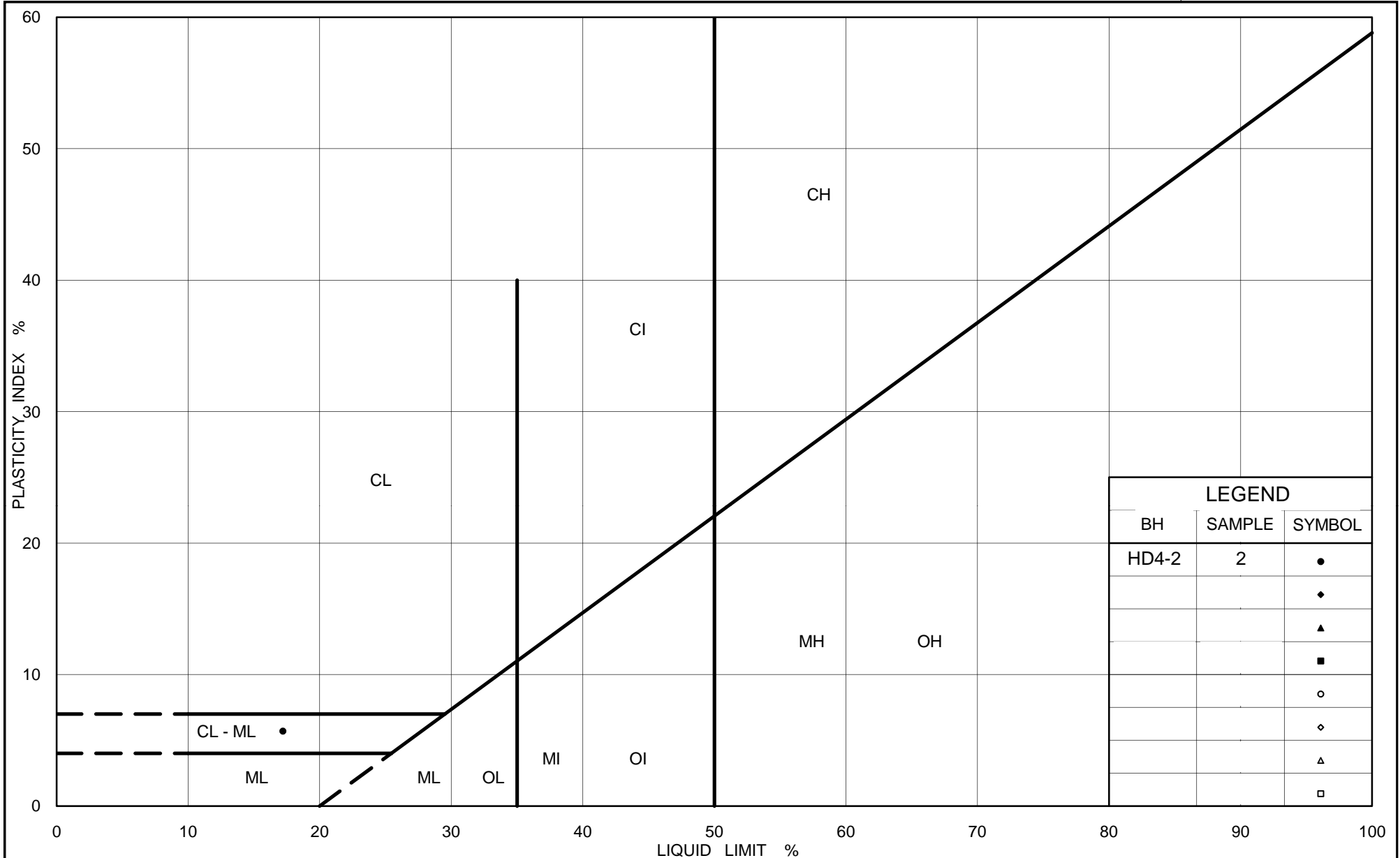
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD4-2	2	247.9
■	HD4-3	3	248.7
◆	HD4-3	5	247.1

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

Ontario

PLASTICITY CHART Sandy Silt Till (Clayey Silt Interlayer)

Figure No. C4-4

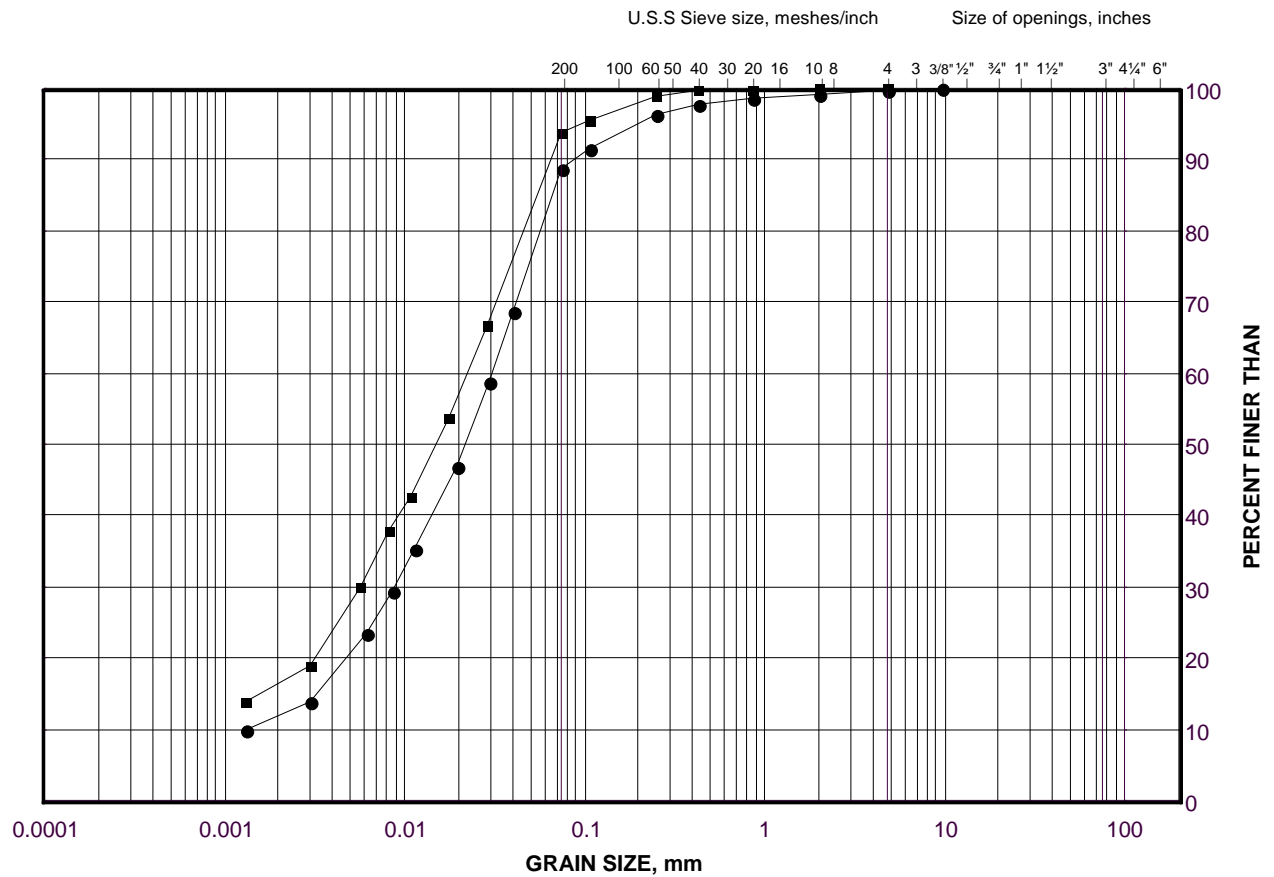
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE C4-5



LEGEND

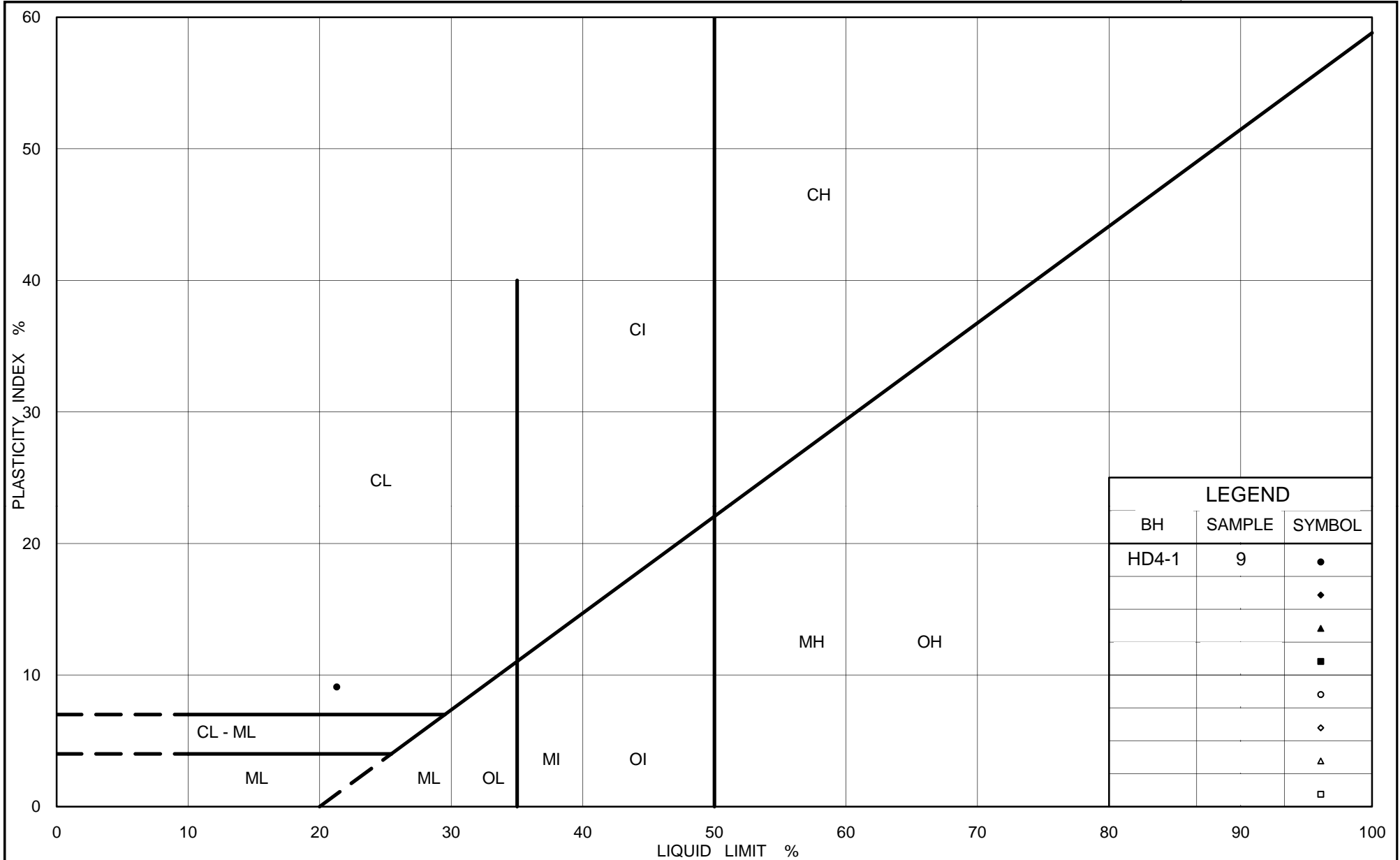
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD4-1	4	248.4
■	HD4-1	6	246.9

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt

Figure No. C4-6

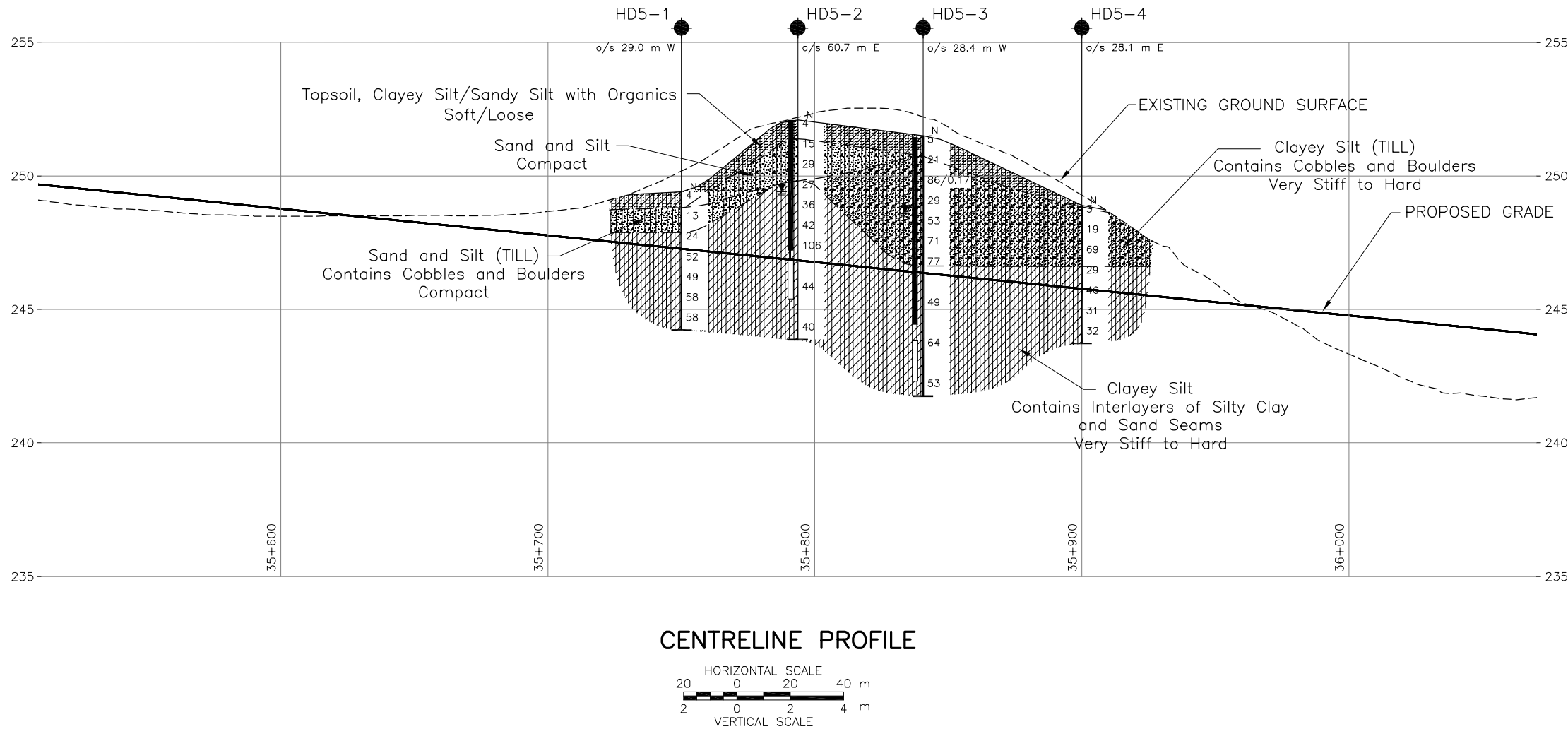
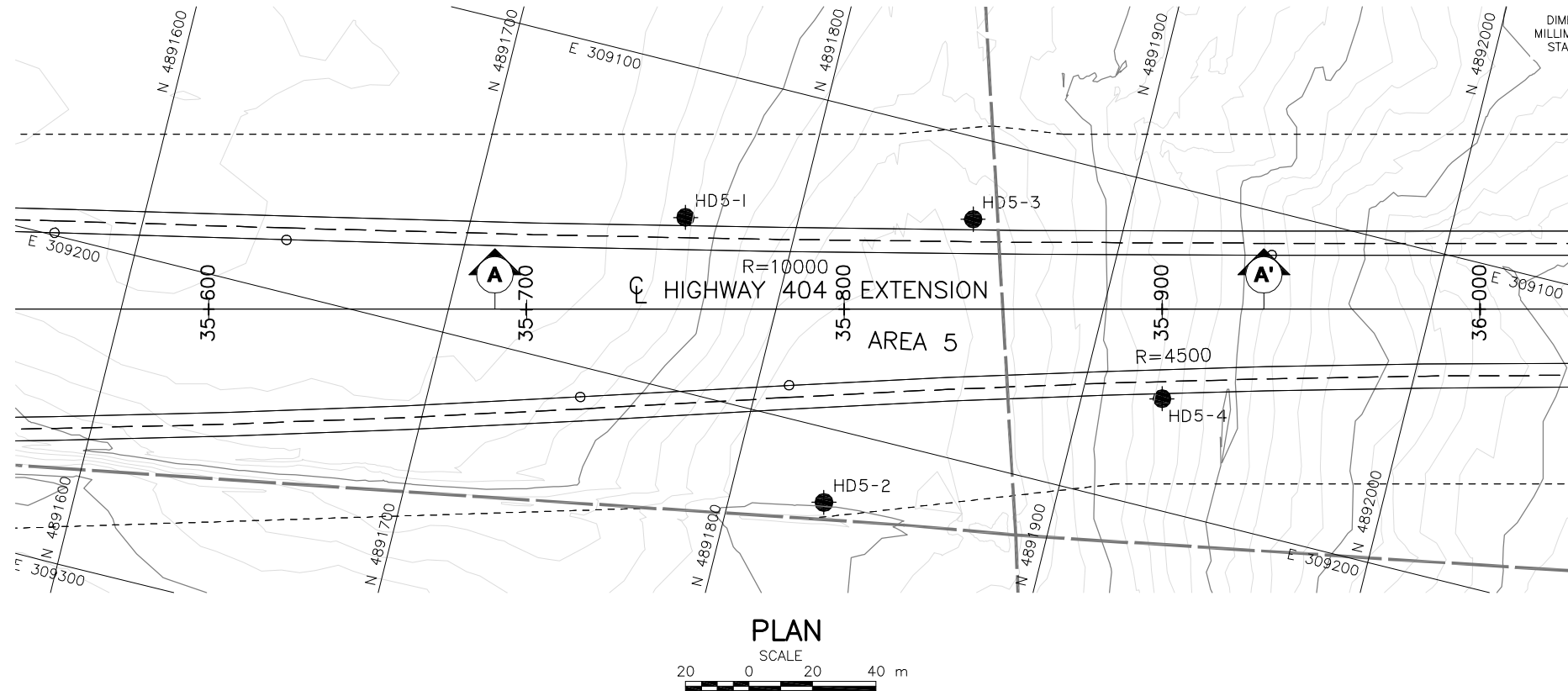
Project No. 08-1111-0022E

Checked By: KJB



APPENDIX C5

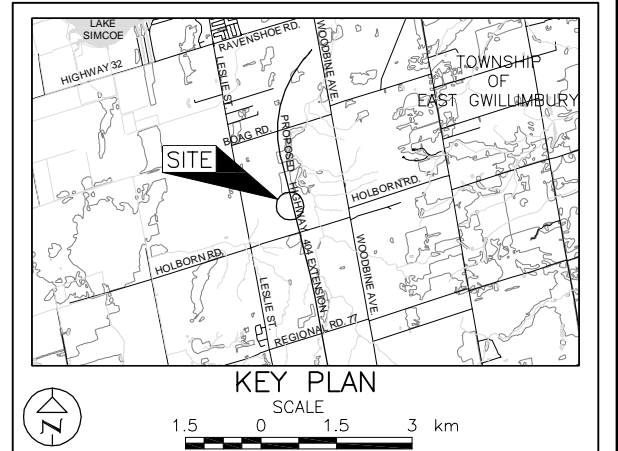
Highway 404 – STA. 35+750 to STA. 35+900 (Deep Cut Area 5)
Drawing, Record of Boreholes and Laboratory Test Results



CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STA. 35+750 to STA. 35+900
BOREHOLE LOCATION AND SOIL STRATA

SHEET



LEGEND

- Borehole - Current Investigation
- 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 June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD5-1	249.4	4891765.3	309146.5
HD5-2	252.1	4891829.3	309223.0
HD5-3	251.5	4891853.3	309125.2
HD5-4	248.9	4891924.6	309165.6

NOTES

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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 AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00-ct-xprofile.dwg", received April 21, 2009.

NO.	DATE	BY	REVISION
Geores No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C5

PROJECT _____		RECORD OF BOREHOLE No HD5-1				1 OF 1 METRIC											
2005-07-00		LOCATION N 4891765.3 ; E 309146.5				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE June 9, 2009				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									WATER CONTENT (%)
249.4	GROUND SURFACE																
0.0	CLAYEY SILT with organics, some sand, containing rootlets (Reworked)		1A	SS	4												
248.8	Soft to firm Dark brown Moist		1B														
0.6			2	SS	13												
247.9	SAND and SILT, some gravel, trace to some clay, containing oxidation staining, cobbles and boulders (TILL)		3	SS	24												
1.5	Compact Moist		4	SS	52												
	CLAYEY SILT, trace to some sand, containing interlayers of silty clay, containing oxidation staining to a depth of 3.05 m		5	SS	49												
	Very stiff to hard Brown to grey Moist		6	SS	58												
		7	SS	58													
244.2	END OF BOREHOLE																
5.2	NOTES: 1. Borehole open and dry upon completion of drilling.																

PROJECT _____		RECORD OF BOREHOLE No HD5-2				1 OF 1 METRIC										
2005-07-00		LOCATION N 4891829.3 ; E 309223.0				ORIGINATED BY TB										
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC										
DATUM Geodetic		DATE June 9, 2009				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								
252.1	GROUND SURFACE															
0.0	TOPSOIL															
251.3	Sandy SILT with organics, trace clay, contains rootlets Very loose to loose Dark brown Moist		1	SS	4											
0.8			2	SS	15											0 35 57 8
	SAND and SILT, trace clay, contains wet sand seams Compact Brown Moist		3	SS	29											
249.8																
2.3	CLAYEY SILT, some sand, trace gravel, containing interlayers of silty clay and seams of fine sand, containing oxidation staining to a depth of 3.81 m Very stiff to hard Brown Moist		4	SS	27											
			5	SS	36											
			6	SS	42											0 1 50 49
	Becoming grey below a depth of 4.2 m		7	SS	106											
			8	SS	44											
243.9	END OF BOREHOLE		9	SS	40											
8.2	NOTES: 1. Water level in piezometer at a depth of 2.7 m below ground surface (Elev. 249.4 m) on June 12, 2009.															

PROJECT _____		RECORD OF BOREHOLE No HD5-3		1 OF 1 METRIC	
2005-07-00		LOCATION N 4891853.3 ; E 309125.2		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE June 8, 2009		CHECKED BY 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/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
251.5	GROUND SURFACE																
0.0	TOPSOIL		1A	SS	5												
0.3	Sandy SILT with organics, trace clay, contains rootlets		1B	SS													
250.7	Loose Brown Moist		2	SS	21												
0.8	CLAYEY SILT, some sand, trace to some gravel, containing interlayers of sandy silt, containing cobbles, boulders and oxidation staining (TILL) Very stiff to hard Brown Moist		3	SS	86/0.17												
			4	SS	29												
			5	SS	53												
			6	SS	71												
			7	SS	77												
246.6	CLAYEY SILT, trace to some sand, containing interlayers of silty clay Hard Grey Moist Containing seams of wet sand below a depth of 6 m		8	SS	49												
4.9			9	SS	64												
			10	SS	53												
241.8	END OF BOREHOLE																
9.8	NOTES: 1. Water level in open borehole at a depth of 5.2 m below ground surface (Elev. 246.3 m) upon completion of drilling. 2. Water level in piezometer at a depth of 2.9 m below ground surface (Elev. 248.6 m) on June 12, 2009.																

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

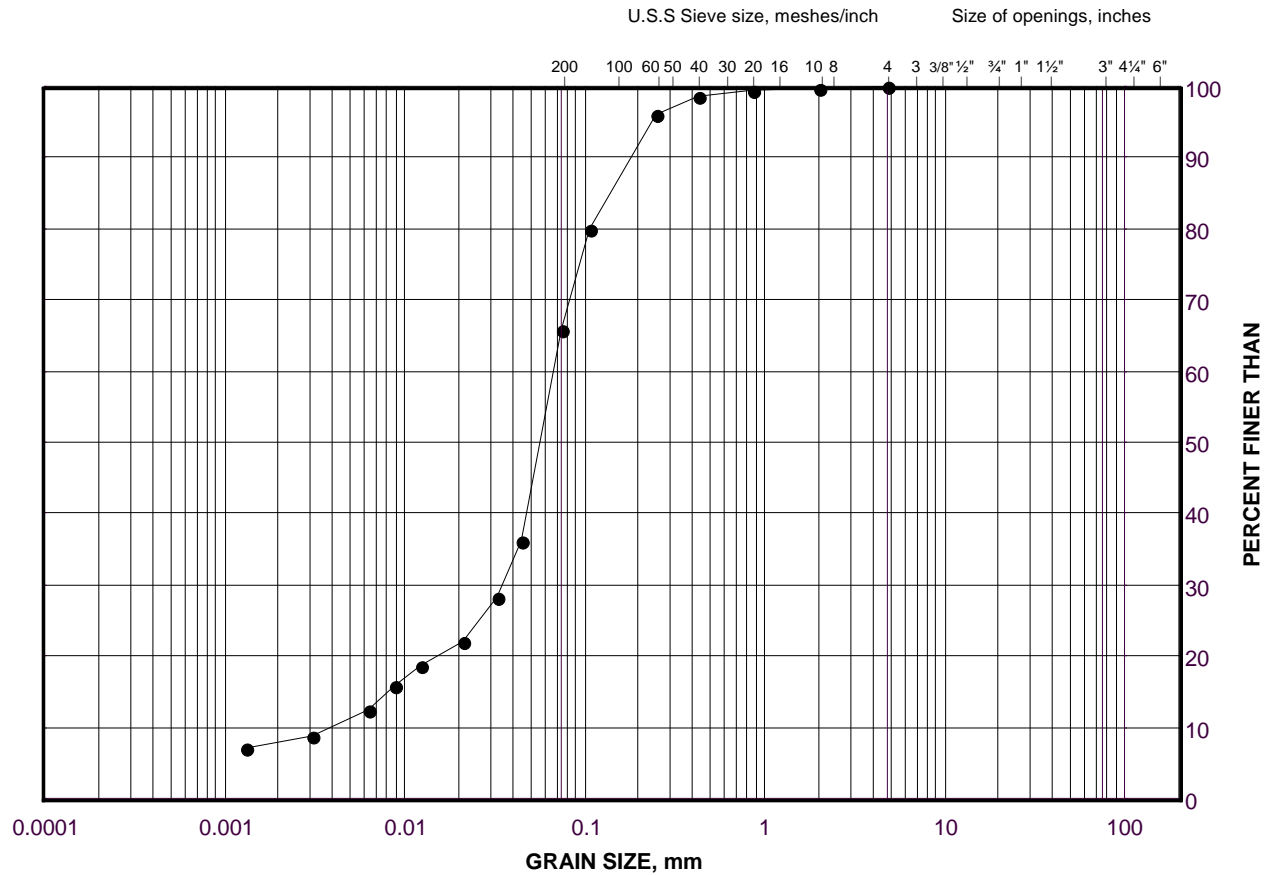
PROJECT _____		RECORD OF BOREHOLE No HD5-4		1 OF 1 METRIC	
2005-07-00		LOCATION N 4891924.6 ;E 309165.6		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE June 2, 2009		CHECKED BY KJB	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE LIQUID CONTENT LIMIT			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 (%)							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20	40	60	80	100	W _p	W					
248.9	GROUND SURFACE																			
0.0	TOPSOIL																			
0.2	CLAYEY SILT, some sand, trace gravel, containing cobbles, boulders and oxidation staining (TILL) Soft to hard Brown Moist		1	SS	3									○						
			2	SS	19															
			3	SS	69									○						
246.6																				
2.3	CLAYEY SILT, trace to some sand, containing interlayers of silty clay and sand seams Very stiff to hard Brown to grey Moist		4	SS	29															
			5	SS	46									○	—					
			6	SS	31															
			7	SS	32															
243.7	END OF BOREHOLE																			
5.2	NOTES: 1. Borehole open and dry upon completion of drilling.																			

GRAIN SIZE DISTRIBUTION

Sand and Silt

FIGURE C5-1



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD5-2	2	251.0

Project Number: 08-1111-0022E

Checked By: KJB

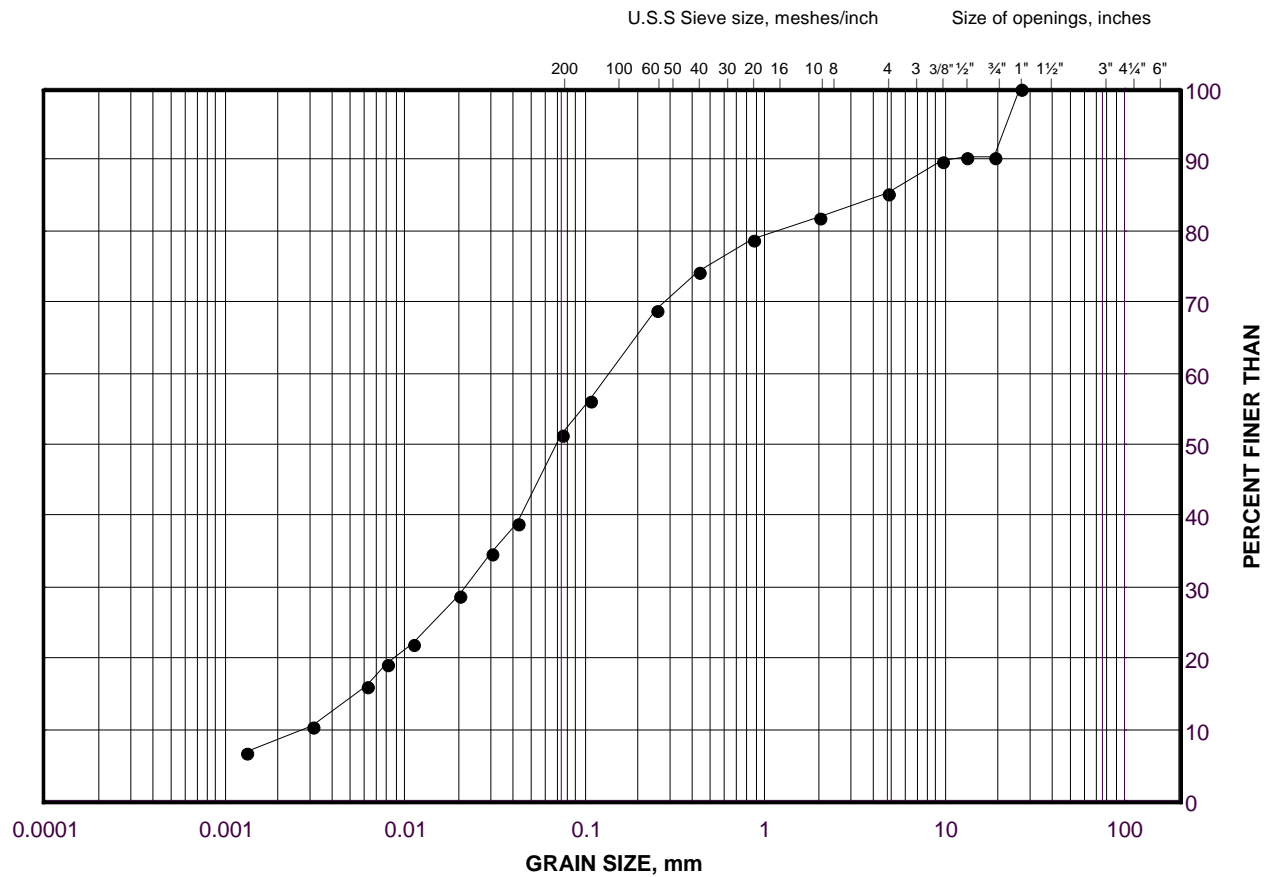
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Sand and Silt Till

FIGURE C5-2



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD5-1	2	248.3

Project Number: 08-1111-0022E

Checked By: KJB

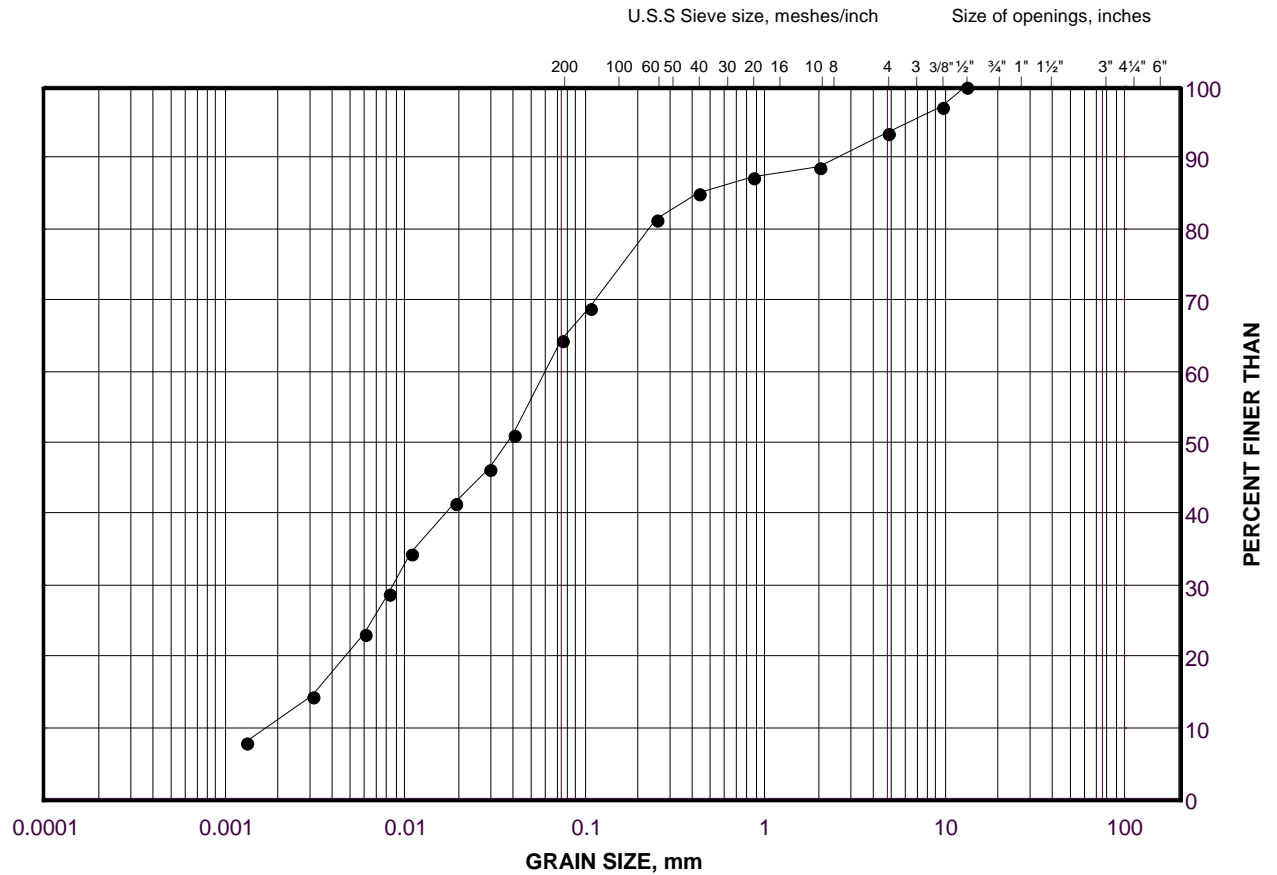
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE C5-3



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

LEGEND

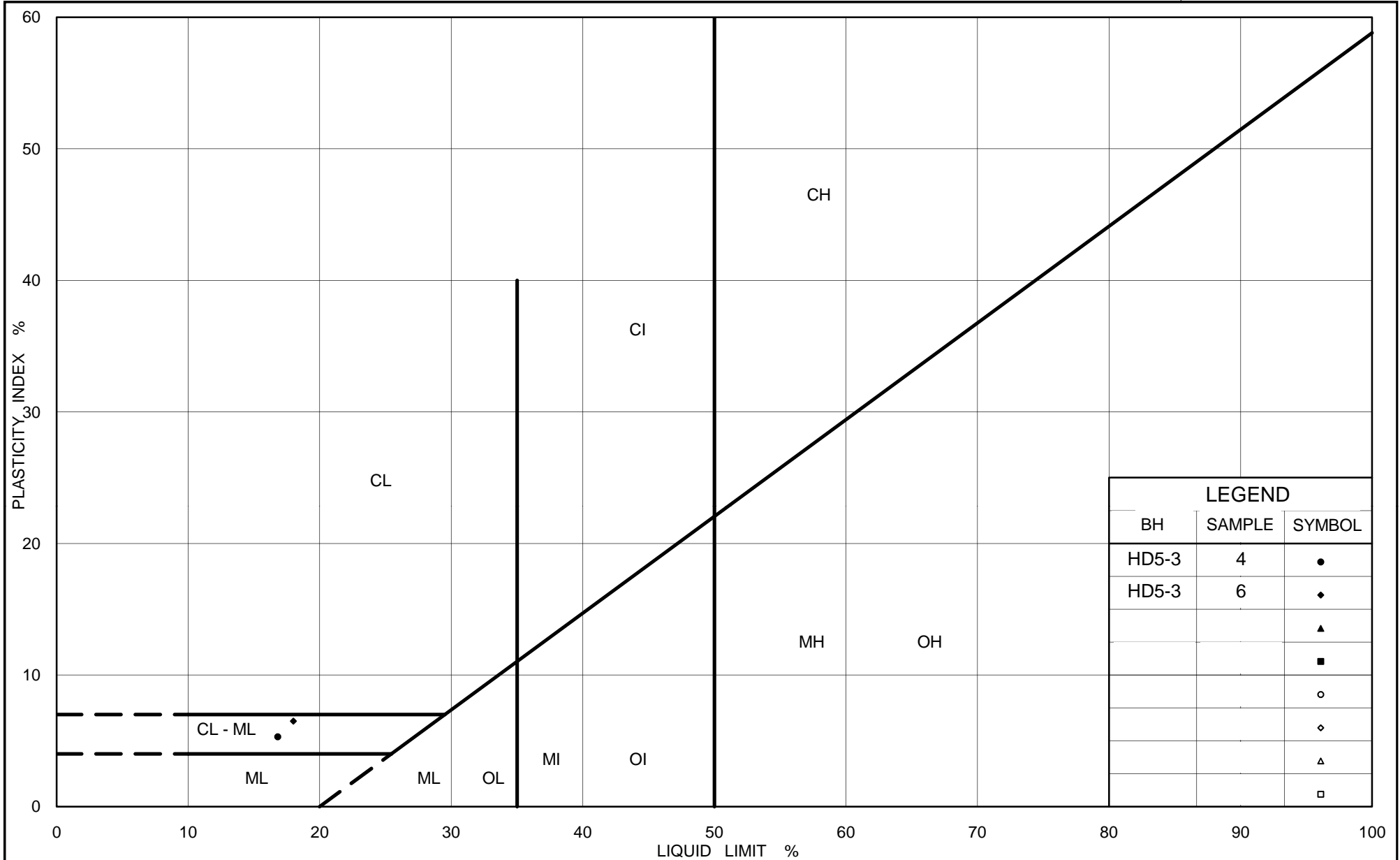
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD5-3	4	248.9

Project Number: 08-1111-0022E

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Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt Till

Figure No. C5-4

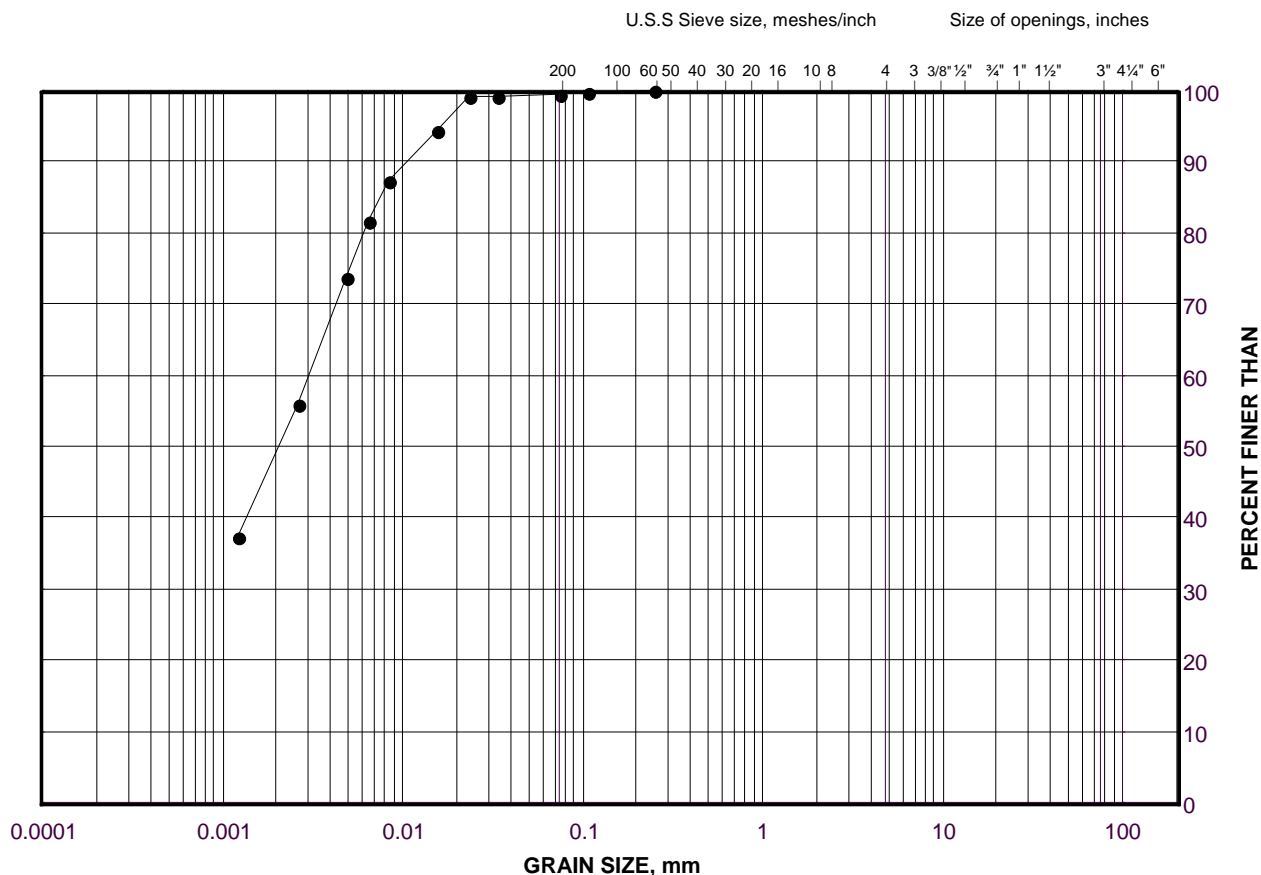
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt (Contains Silty Clay Interlayers)

FIGURE C5-5



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

LEGEND

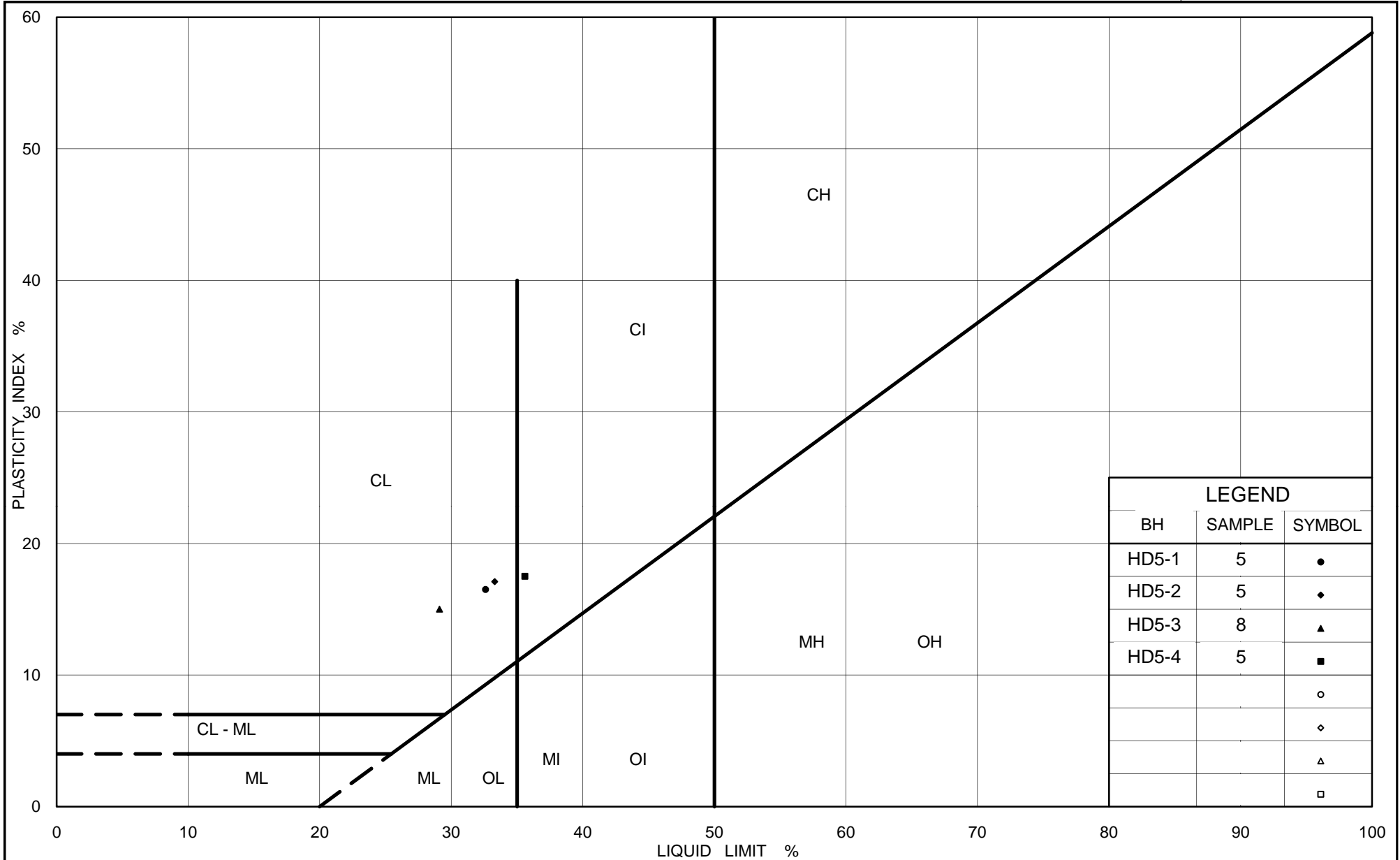
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD5-2	5	248.7

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt

Figure No. C5-6

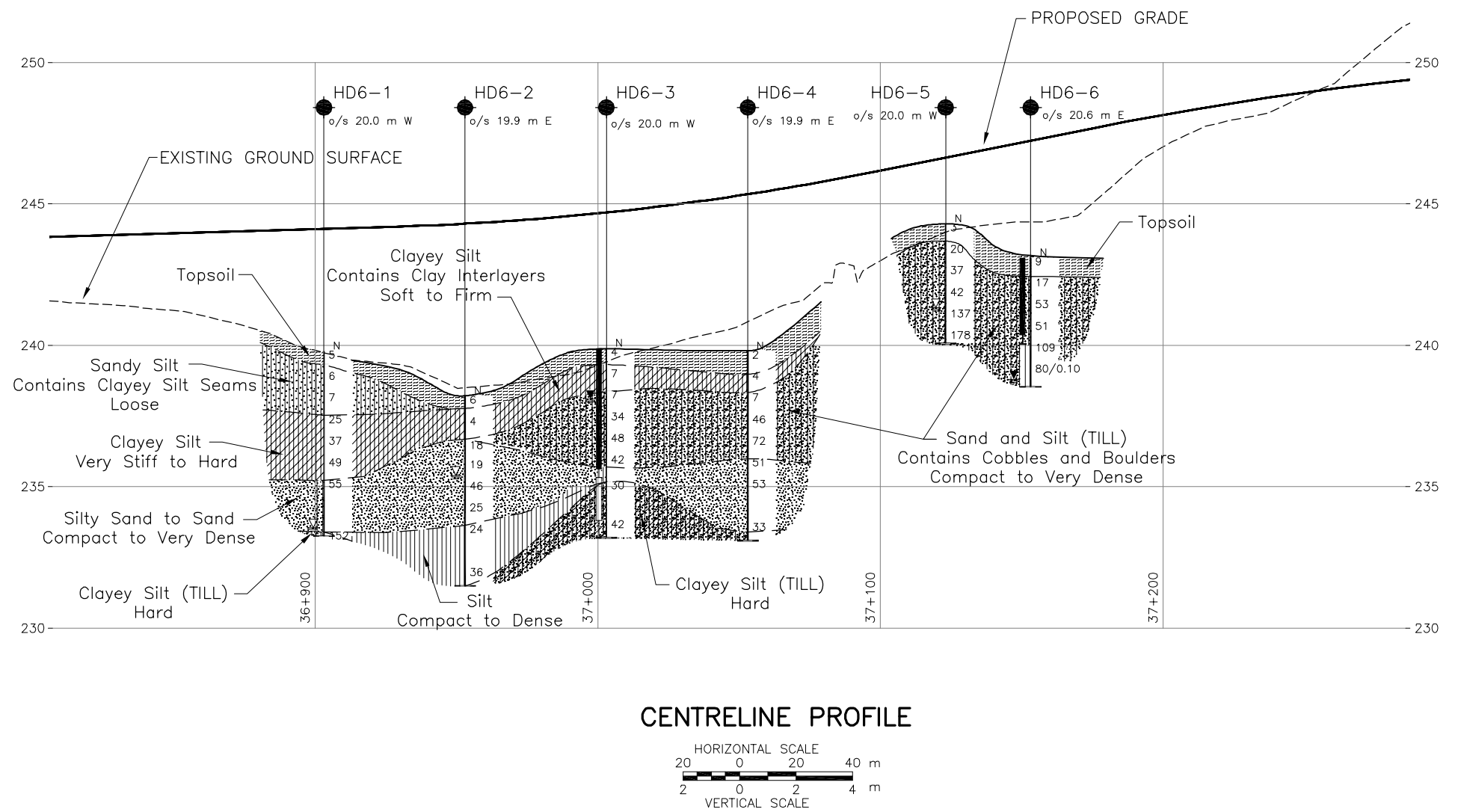
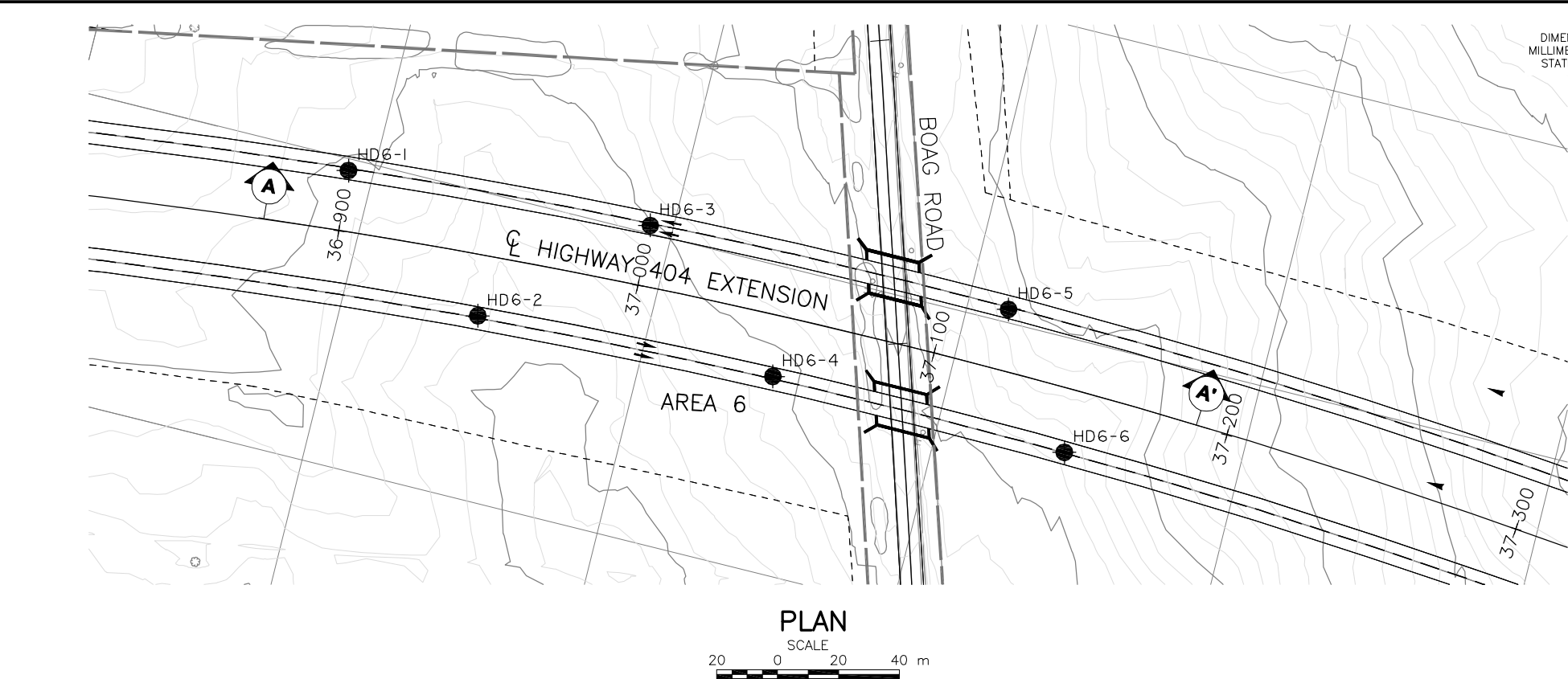
Project No. 08-1111-0022E

Checked By: KJB



APPENDIX C6

Highway 404 – STA. 36+870 to STA. 37+150 (High Fill Area 6)
Drawing, Record of Boreholes and Laboratory Test Results



CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STA. 36+870 to STA. 37+150
BOREHOLE LOCATION AND SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

KEY PLAN
SCALE
0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- 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 June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD6-1	239.8	4892891.8	308903.8
HD6-2	238.2	4892944.6	308939.9
HD6-3	239.9	4892992.5	308897.4
HD6-4	239.8	4893043.6	308935.8
HD6-5	244.3	4893113.5	308895.7
HD6-6	243.1	4893142.7	308936.9

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 provided in digital format by AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00-ct-xprofile.dwg", received April 21, 2009.

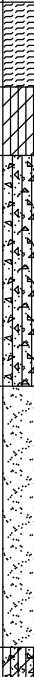
NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C6

PROJECT _____		RECORD OF BOREHOLE No HD6-1				1 OF 1 METRIC								
2005-07-00		LOCATION N 4892891.8 ; E 308903.8				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE February 24, 2009				CHECKED BY TT/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						
239.8	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	TOPSOIL		1A	SS	5									
239.3	Sandy SILT, trace clay and gravel, containing clayey silt seams, trace organics to a depth of 0.8 m Loose Light brown Moist		1B											
0.5			2	SS	6									
			3	SS	7									
237.5	CLAYEY SILT, trace sand Very stiff to hard Brown Moist		4	SS	25									
2.3			5	SS	37									
			6	SS	49									
235.2	Silty SAND, trace clay Very dense Brown Wet		7	SS	55									
4.6														
233.4	CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Wet END OF BOREHOLE		8	SS	152/0.28									
6.6														
NOTES: 1. Water level in open borehole at a depth of 6.3 m below ground surface (Elev. 233.5 m) upon completion of drilling.														



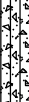
PROJECT _____		RECORD OF BOREHOLE No HD6-2				1 OF 1 METRIC											
2005-07-00		LOCATION N 4892944.6 ; E 308939.9				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 24, 2009				CHECKED BY TT/KJB											
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									
238.2 0.0	GROUND SURFACE TOPSOIL		1A	SS	6												
237.7 0.5	CLAYEY SILT, some sand, trace gravel, trace organics and rootlets to a depth of 0.8 m Firm Brown Moist		1B														
236.7 1.5	SAND, some silt Compact to dense Brown Moist		2	SS	4												
			3	SS	18												
			4	SS	19												
			5	SS	46												
			6	SS	25												
233.6 4.6	SILT, some sand, trace clay Compact to dense Brown Wet		7	SS	24												
231.5 6.7	END OF BOREHOLE NOTES: 1. Water level in open borehole at a depth of 2.8 m below ground surface (Elev. 235.4 m) upon completion of drilling.		8	SS	36												

PROJECT _____		RECORD OF BOREHOLE No HD6-3				1 OF 1 METRIC											
2005-07-00		LOCATION N 4892992.5 ; E 308897.4				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 24, 2009				CHECKED BY TT/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									
239.9	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL Soft		1	SS	4												
239.3																	
0.6	CLAYEY SILT, some sand, trace gravel Firm Brown Moist		2	SS	7												
238.4																	
1.5	SAND and SILT, trace to some clay, trace gravel, containing cobbles and boulders (TILL) Loose to dense Brown Moist to wet		3	SS	7												
			4	SS	34												
			5	SS	48												
			6	SS	42												
235.7																	
4.2	Silty SAND, trace clay Dense Brown Wet																
235.2																	
4.7	CLAYEY SILT, trace sand, trace gravel (TILL) Hard Grey Moist		7	SS	30												
			8	SS	42												
233.2																	
6.7	END OF BOREHOLE																
NOTE: 1. Water level in open borehole at a depth of 6.0 m below ground surface (Elev. 233.9 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 238.1 m) on February 26, 2009. 3. Water level in piezometer at a depth of 1.3 m below ground surface (Elev. 238.6 m) on March 12, 2009. 4. Water level in piezometer at a depth of 1.1 m below ground surface (Elev. 238.8 m) on April 2, 2009. 5. Water level in piezometer at a depth of 1.3 m below ground surface (Elev. 238.6 m) on May 20, 2009. 6. Water level in piezometer at a depth of 1.8 m below ground surface (Elev. 238.1 m) on June 12, 2009.																	

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PROJECT _____		RECORD OF BOREHOLE No HD6-4				1 OF 1 METRIC										
2005-07-00		LOCATION N 4893043.6 ;E 308935.8				ORIGINATED BY TB										
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC										
DATUM Geodetic		DATE February 24, 2009				CHECKED BY TT/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								
239.8 0.0	GROUND SURFACE TOPSOIL Soft		1	SS	2											
239.0 0.8	CLAYEY SILT, some sand, trace gravel, contains interlayers of clay Soft to firm Brown Moist		2	SS	4											
238.3 1.5	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders (TILL) Loose to very dense Brown Moist		3	SS	7											
			4	SS	46											
			5	SS	72											
236.0 3.8	SAND, trace to some silt, trace clay Dense to very dense Brown Moist		6	SS	51											
			7	SS	53											
233.4 6.7	Becoming wet below a depth of 6.1 m CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Moist END OF BOREHOLE		8	SS	33											
NOTES:																
1. Borehole open and dry upon completion of drilling.																

PROJECT _____		RECORD OF BOREHOLE No HD6-5		1 OF 1 METRIC	
2005-07-00		LOCATION N 4893113.5 ; E 308895.7		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE February 19, 2009		CHECKED BY TT/KJB	

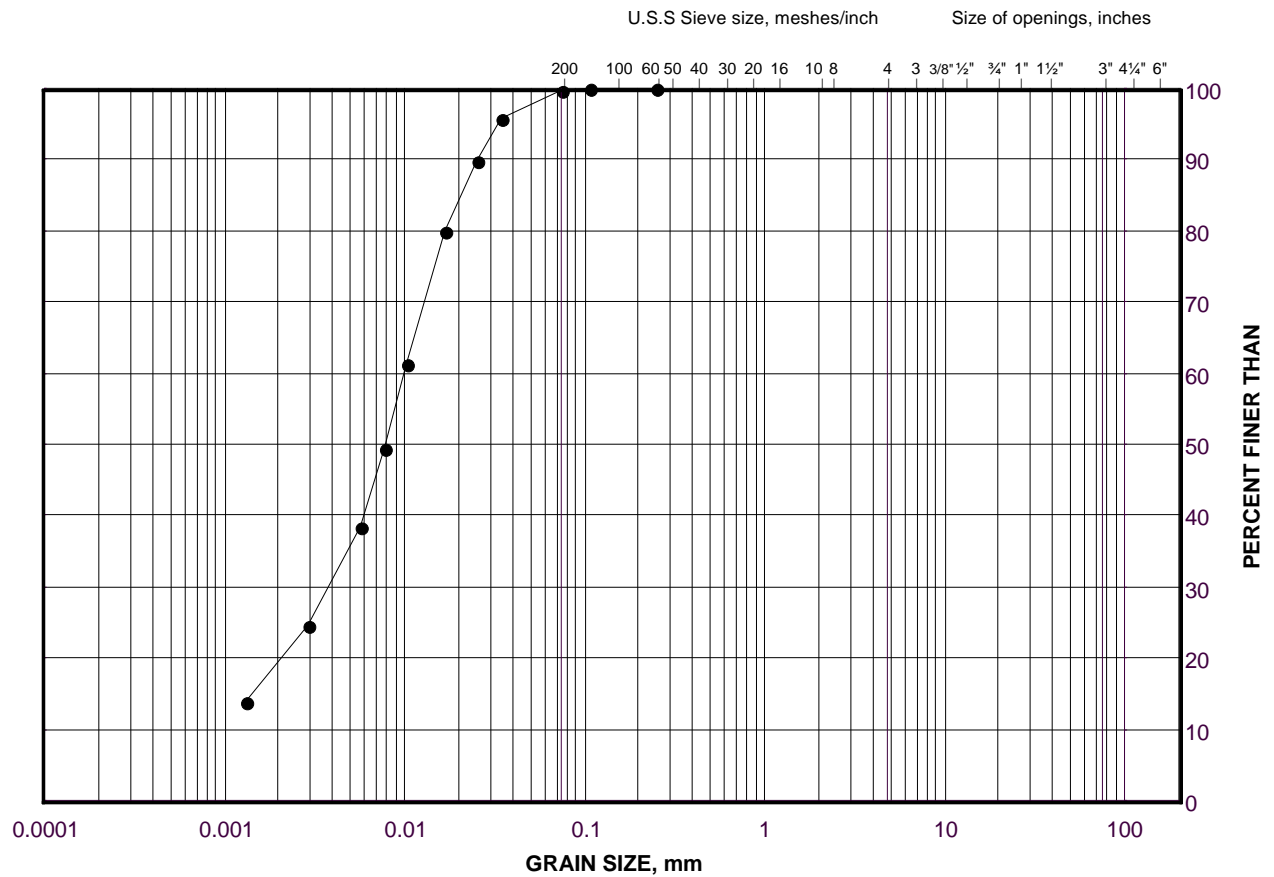
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL				
								20	40	60	80	100	20	40	60		80	100	10	20	30			
244.3	GROUND SURFACE																							
0.0	TOPSOIL		1	SS	3																			
243.7	SAND and SILT, some gravel, trace clay, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		2	SS	20																			
0.6			3	SS	37																			
			4	SS	42																			
			5	SS	137																			
			6	SS	100/0.13																			
240.1	END OF BOREHOLE																							
4.2	NOTES: 1. Water level in open borehole at 3.0 m below ground surface (Elev. 241.3 m) upon completion of drilling.																							

PROJECT _____		RECORD OF BOREHOLE No HD6-6				1 OF 1 METRIC											
2005-07-00		LOCATION N 4893142.7 ; E 308936.9				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE February 18, 2009				CHECKED BY TT/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									
243.1 0.0	GROUND SURFACE TOPSOIL		1	SS	9												
242.4 0.7	SAND and SILT, trace to some clay, trace gravel, containing cobbles and boulders and interlayers of clayey silt (TILL) Compact to very dense Brown Moist		2	SS	17												
			3	SS	53												
			4	SS	51												
			5	SS	109												
			6	SS	80/0.10												
238.5 4.6		END OF BOREHOLE															
NOTES:																	
1. Borehole dry upon completion of drilling.																	
2. Water level in piezometer at a depth of 4.4 m below ground surface (Elev. 238.7 m) on February 26, 2009.																	
3. Water level in piezometer at a depth of 3.9 m below ground surface (Elev. 239.2 m) on March 12, 2009.																	
4. Water level in piezometer at a depth of 2.6 m below ground surface (Elev. 240.5 m) on April 2, 2009.																	
5. Water level in piezometer at a depth of 3.1 m below ground surface (Elev. 240.0 m) on May 20, 2009.																	
6. Water level in piezometer at a depth of 4.3 m below ground surface (Elev. 238.8m) on June 12, 2009.																	

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE C6-1



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

LEGEND

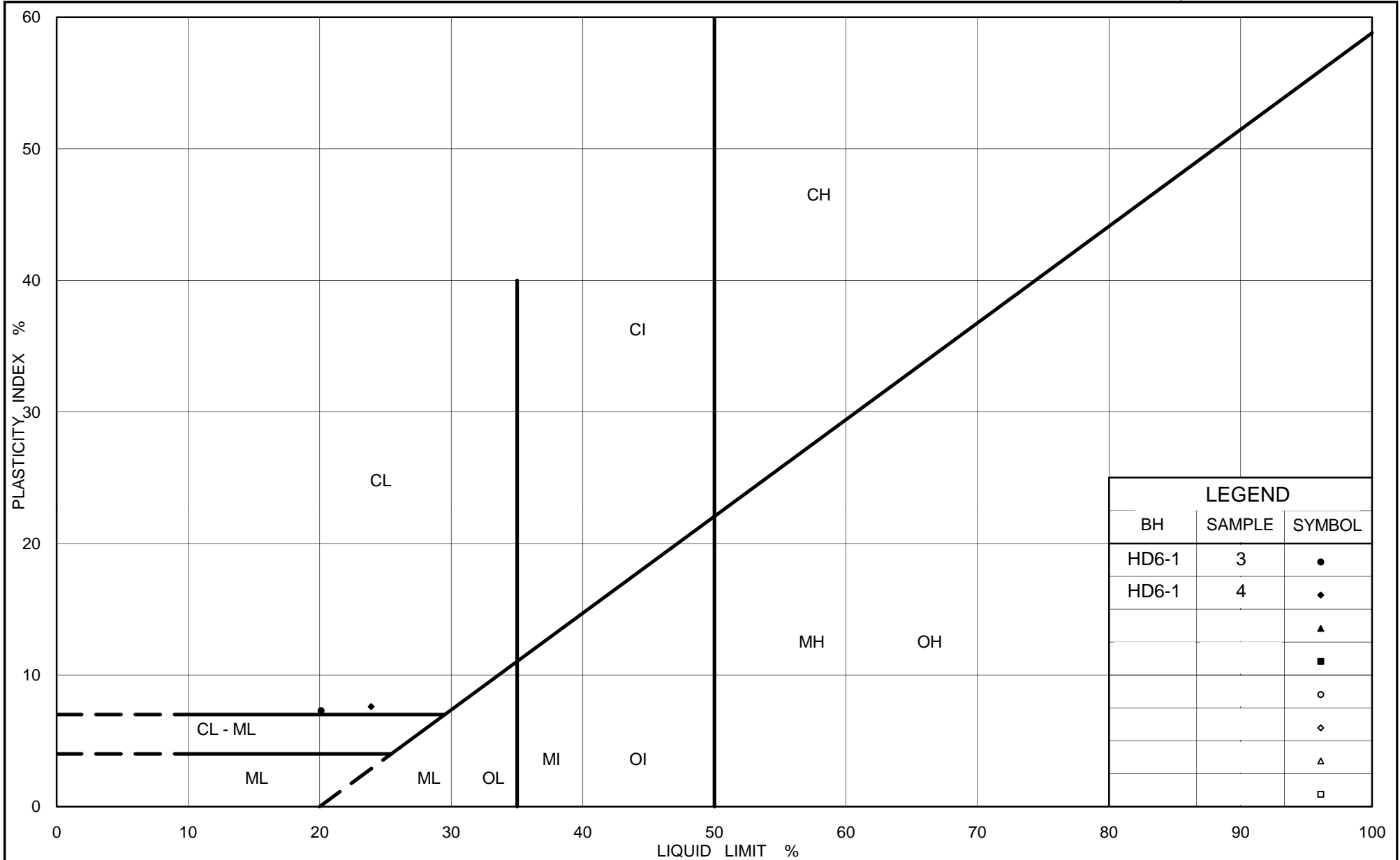
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD6-1	4	237.3

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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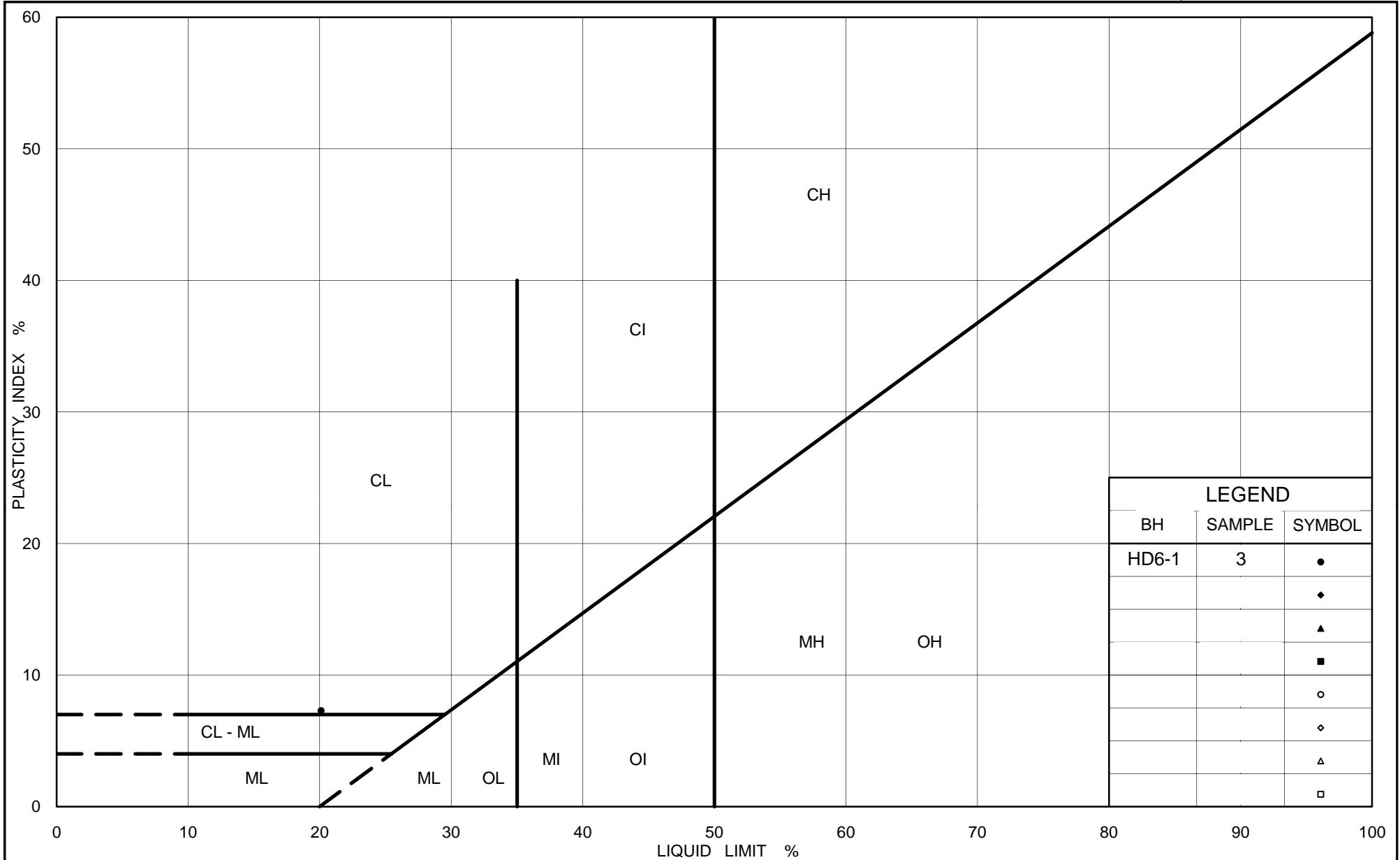
PLASTICITY CHART

Clayey Silt

Figure No. C6-2

Project No. 08-1111-0022E

Checked By: KJB



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Ontario

PLASTICITY CHART Sandy Silt (Clayey Silt Interlayer)

Figure No. C6-3

Project No. 08-1111-0022E

Checked By: KJB

Sand and Silt Till

U.S.S Sieve size, meshes/inch

Size of openings, inches

PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Percent Finer Than (%) - Square Markers	Percent Finer Than (%) - Circular Markers
0.075	5	5
0.15	10	8
0.3	15	12
0.6	20	15
1.2	25	18
2.5	30	20
5.0	35	22
7.5	40	25
15	45	30
30	50	35
60	55	40
120	60	45
250	65	50
500	70	55
1000	75	60
2000	80	65
4000	85	70
8000	90	75
16000	95	80
32000	100	85
64000	100	85
128000	100	85
256000	100	85
512000	100	85
1024000	100	85
2048000	100	85
4096000	100	85
8192000	100	85
16384000	100	85
32768000	100	85
65536000	100	85
131072000	100	85
262144000	100	85
524288000	100	85
1048576000	100	85
2097152000	100	85
4194304000	100	85
8388608000	100	85
16777216000	100	85
33554432000	100	85
67108864000	100	85
134217728000	100	85
268435456000	100	85
536870912000	100	85
1073741824000	100	85
2147483648000	100	85
4294967296000	100	85
8589934592000	100	85
17179869184000	100	85
34359738368000	100	85
68719476736000	100	85
137438953472000	100	85
274877906944000	100	85
549755813888000	100	85
1099511627776000	100	85
2199023255552000	100	85
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8796093022208000	100	85
17592186044416000	100	85
35184372088832000	100	85
70368744177664000	100	85
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562949953421312000	100	85
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1180591620717411303424000	100	85
2361183241434822606848000	100	85
4722366482869645213696000	100	85
9444732965739290427392000	100	85
18889465931478580854784000	100	85
37778931862957161709568000	100	85
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SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

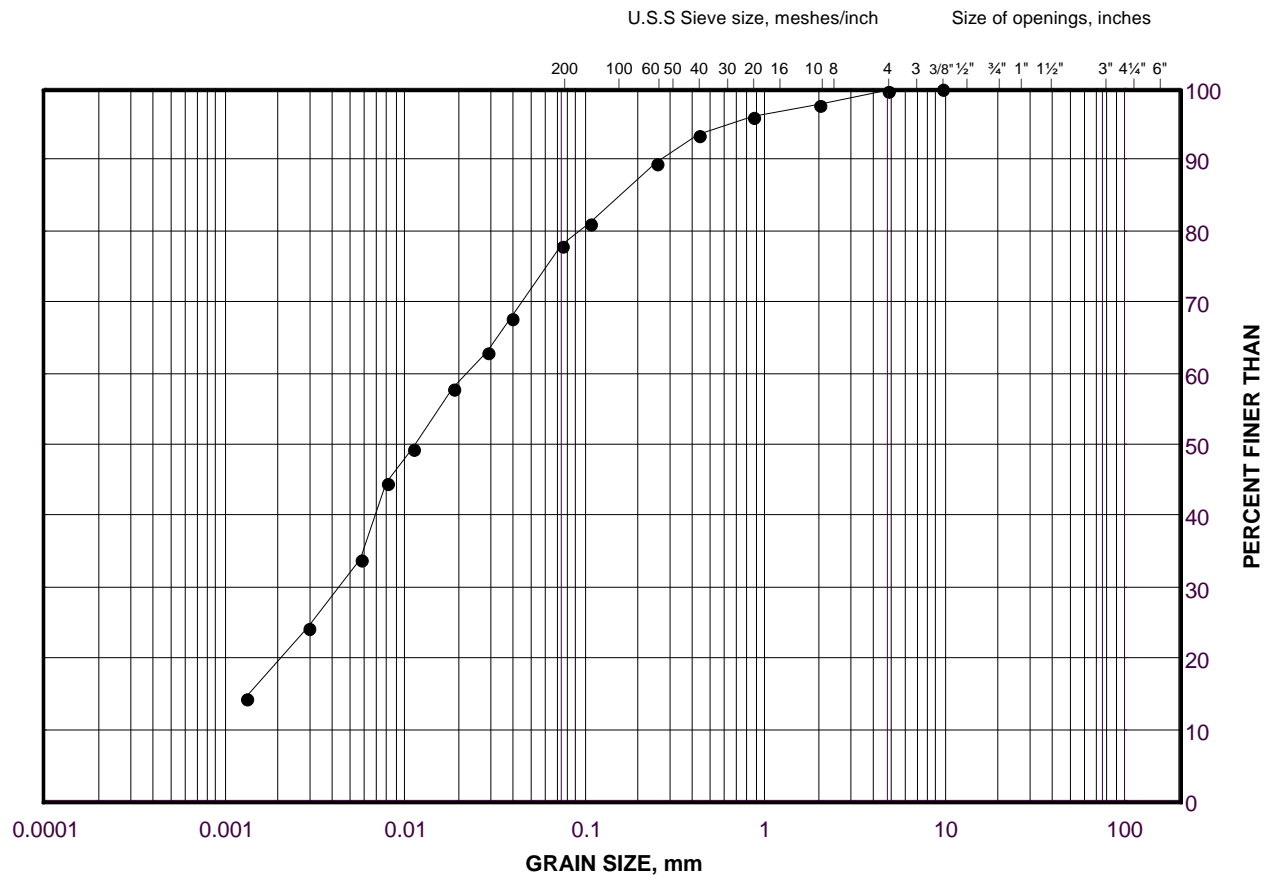
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD6-5	2	243.2
■	HD6-3	5	236.5

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Sand and Silt Till (Clayey Silt Interlayer)

FIGURE C6-5



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD6-6	4	240.5

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 15-Jan-10

Sand

U.S.S Sieve size, meshes/inch

Size of openings, inches

PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Percent Finer Than (%) - Circular Markers	Percent Finer Than (%) - Square Markers
0.001	0	0
0.002	0	0
0.004	0	0
0.006	0	0
0.008	0	0
0.01	0	0
0.015	0	0
0.02	0	0
0.03	0	0
0.04	0	0
0.05	0	0
0.06	0	0
0.07	0	0
0.08	0	0
0.09	0	0
0.1	10	10
0.15	30	20
0.2	60	50
0.3	85	70
0.4	90	75
0.5	95	80
0.7	98	90
1.0	100	95
2.0	100	100
4.0	100	100
6.0	100	100
10.0	100	100
20.0	100	100
40.0	100	100
60.0	100	100
100.0	100	100

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

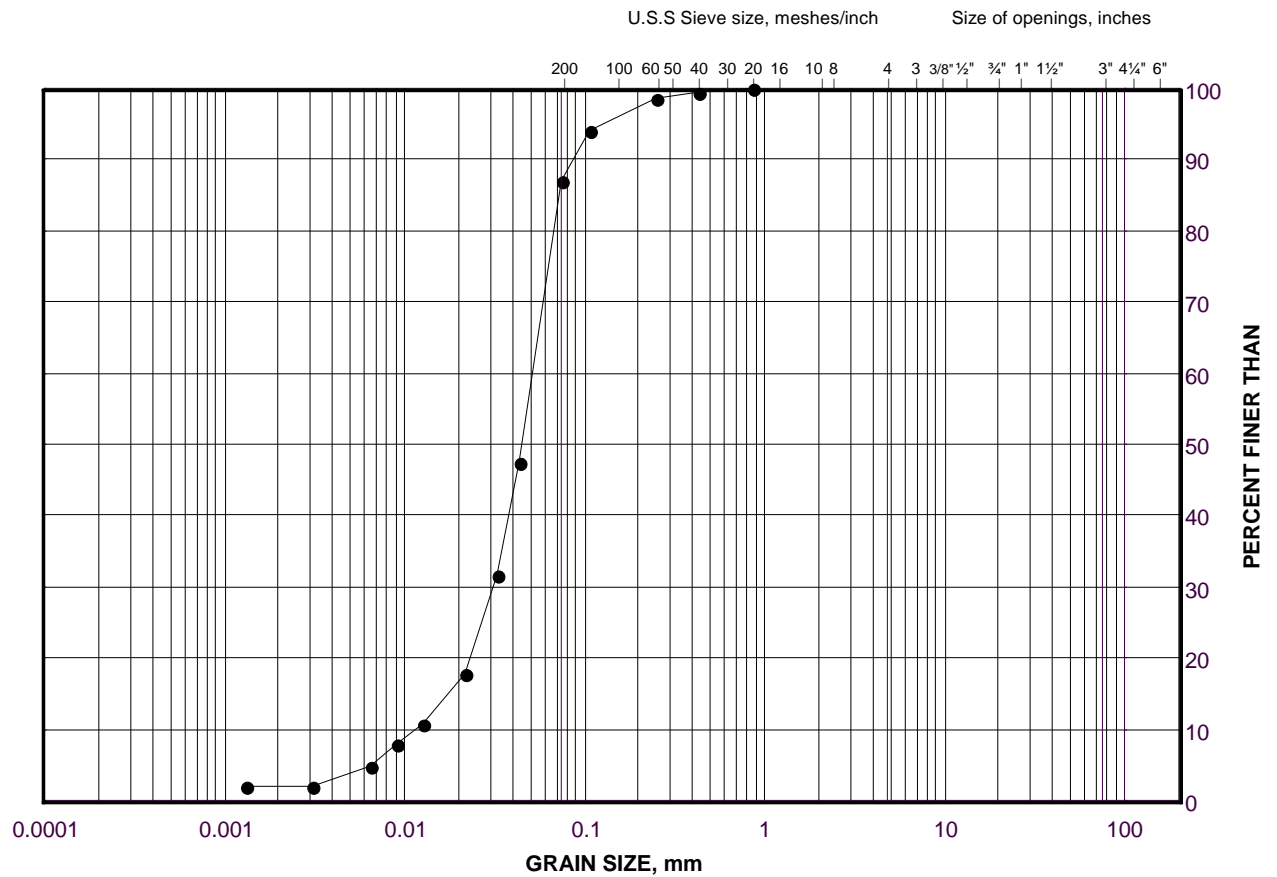
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD6-2	4	235.6
■	HD6-4	7	234.9

Date: 14-Jan-09

GRAIN SIZE DISTRIBUTION

Silt

FIGURE C6-7



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

LEGEND

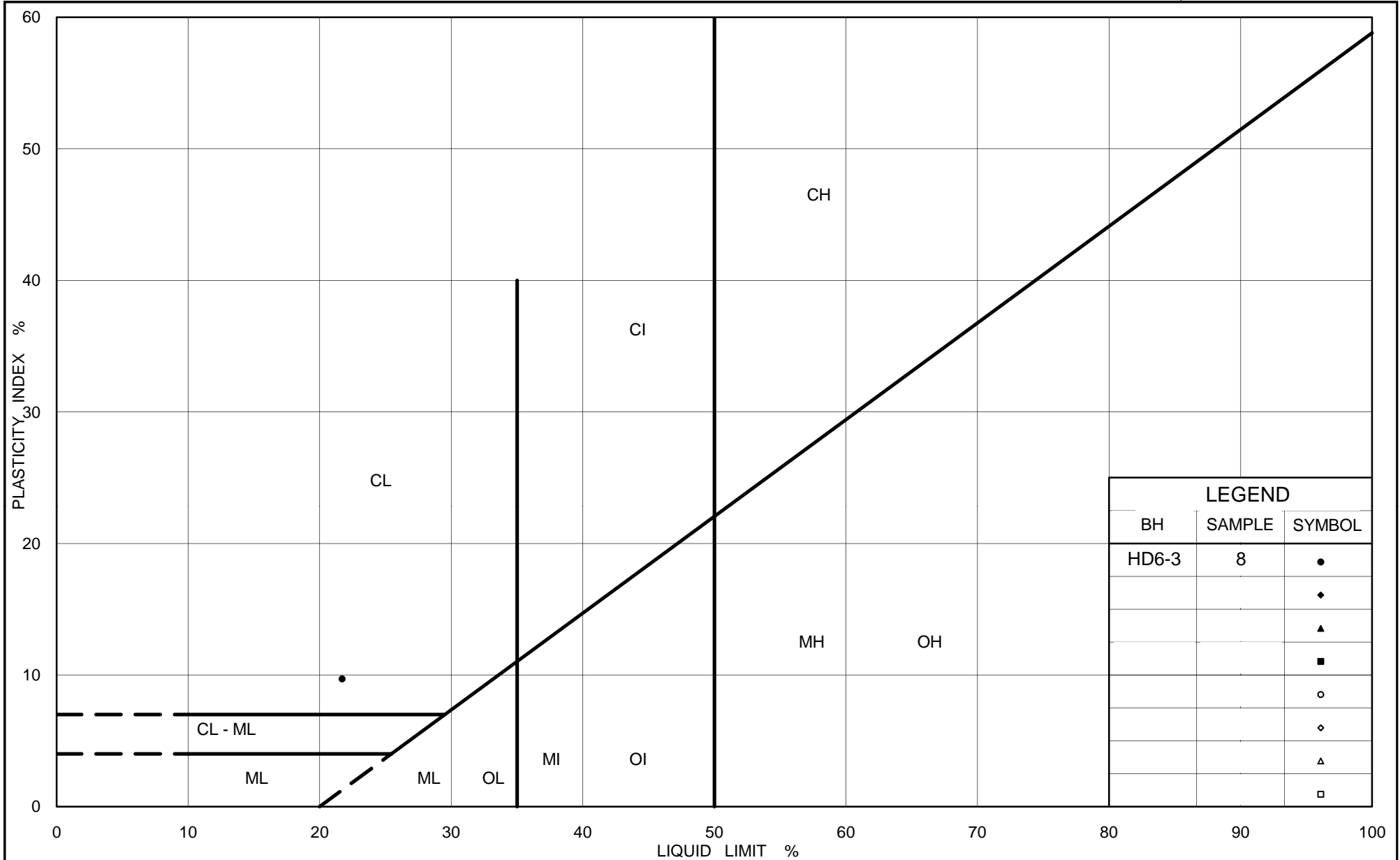
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD6-2	7	233.3

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Till

Figure No. C6-8

Project No. 08-1111-0022E

Checked By: KJB

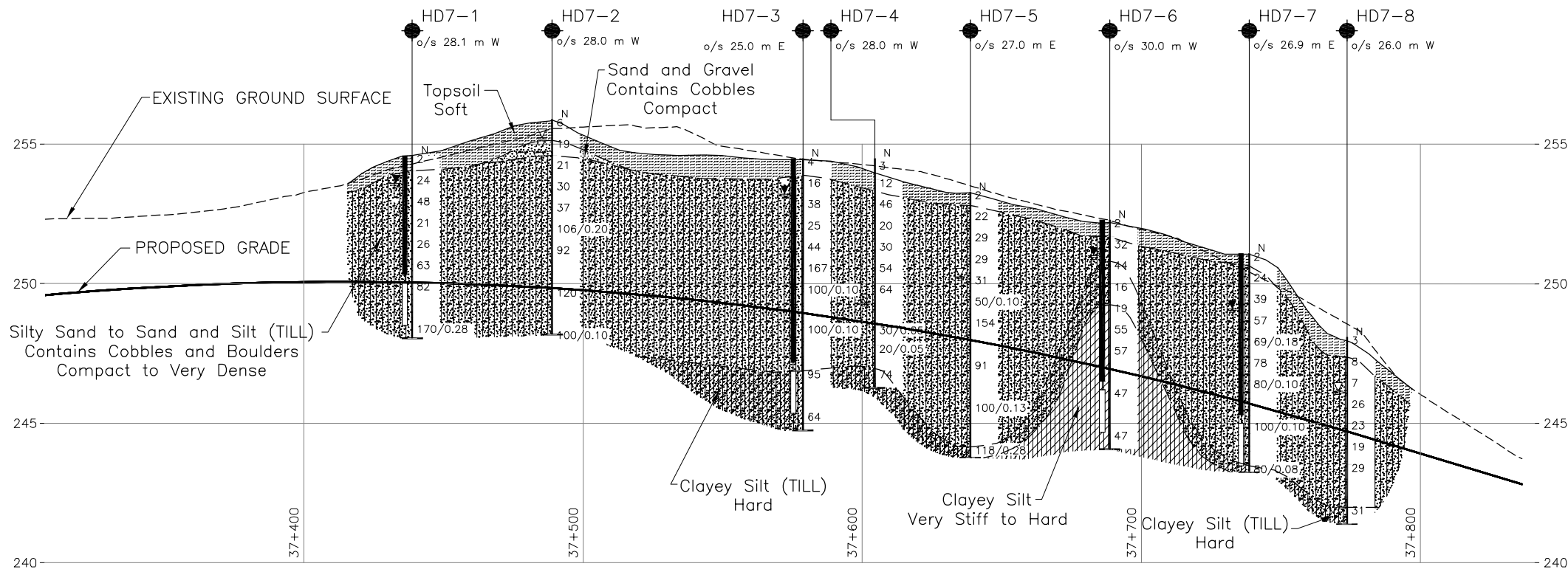
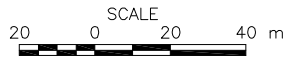


APPENDIX C7

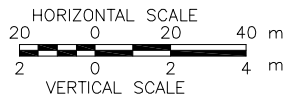
Highway 404 – STA. 37+400 to STA. 37+760 (Deep Cut Area 7)
Drawing, Record of Boreholes and Laboratory Test Results



PLAN



CENTRELINE PROFILE



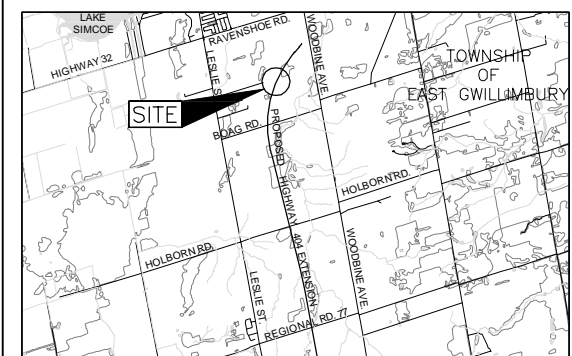
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 2005-07-00

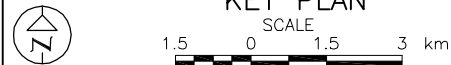
HIGHWAY 404 EXTENSION
STA. 37+400 to STA. 37+760
BOREHOLE LOCATION AND SOIL STRATA



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

- Borehole - Current Investigation
- 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 June 12, 2009
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD7-1	254.6	4893421.2	308913.2
HD7-2	255.9	4893471.2	308921.5
HD7-3	254.5	4893549.4	308989.9
HD7-4	254.5	4893570.4	308941.4
HD7-5	253.3	4893606.5	309006.4
HD7-6	252.3	4893665.4	308962.7
HD7-7	251.1	4893701.8	309032.3
HD7-8	248.1	4893750.7	308991.9

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.

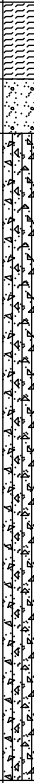
The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS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

REFERENCE

Base plans provided in digital format by AECOM, drawing file no. "x-design 2.dwg", received, November, 04, 2008 and drawing file no. "2538-199-00-ct-xprofile.dwg", received April 21, 2009.

NO.	DATE	BY	REVISION
Geores No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C7

PROJECT _____		RECORD OF BOREHOLE No HD7-1				1 OF 1 METRIC											
2005-07-00		LOCATION N 4893421.2 ; E 308913.2				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE March 16, 2009				CHECKED BY AM/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									
254.6	GROUND SURFACE																
0.0	TOPSOIL Soft		1	SS	2												
254.0																	
0.6	SAND and SILT, trace to some gravel, trace to some clay, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		2	SS	24												
			3	SS	48												
			4	SS	21												
			5	SS	26												
			6	SS	63												
	Containing silty clay seams below a depth of 4.6 m		7	SS	82												
248.1	Becoming grey below a depth of 6.2 m		8	SS	170/0.28												
6.6	END OF BOREHOLE																
NOTES: 1. Water level in open borehole at a depth of 1.8 m below ground surface (Elev. 252.8 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.0 m below ground surface (Elev. 253.6 m) on March 19, 2009. 3. Water level in piezometer at ground surface on April 2, 2009. 4. Water level in piezometer at a depth of 1.0 m below ground surface (Elev. 253.6 m) on June 12, 2009.																	

PROJECT _____			RECORD OF BOREHOLE No HD7-2				1 OF 1 METRIC									
2005-07-00			LOCATION N 4893471.2 ; E 308921.5				ORIGINATED BY TB									
DIST _____ HWY 404			BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC									
DATUM Geodetic			DATE March 16, 2009				CHECKED BY AM/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								
255.9 0.0	GROUND SURFACE TOPSOIL Firm		1	SS	6	▽										
255.1 0.8	SAND and GRAVEL, trace silt, containing cobbles Compact Brown Wet		2	SS	19		255					○				
254.6 1.3	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		3	SS	21		254					○				
			4	SS	30		253									
			5	SS	37		252									
			6	SS	106/0.20		251									
			7	SS	92		250									
			8	SS	120		249					○				
248.2 7.7	END OF BOREHOLE		9	SS	100/0.10											
NOTES: 1. Groundwater seepage noted at a depth of 0.8 m below ground surface (Elev. 255.1 m) during drilling operations. 2. Water level in open borehole at a depth of 0.7 m below ground surface (Elev. 255.2 m) upon completion of drilling.																

PROJECT _____		RECORD OF BOREHOLE No HD7-3		1 OF 1 METRIC	
2005-07-00		LOCATION N 4893549.4 ; E 308989.9		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger		COMPILED BY SC	
DATUM Geodetic		DATE March 16, 2009		CHECKED BY AM/KJB	

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W	W _L					
254.5	GROUND SURFACE																			
0.0	TOPSOIL Soft		1	SS	4															
253.9	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		2	SS	16															
0.6			3	SS	38															
			4	SS	25															
			5	SS	44															
			6	SS	167															
			7	SS	100/0.10															
			8	SS	100/0.10															
246.9	CLAYEY SILT, some sand, trace gravel, contains sandy silt seams (TILL) Hard Grey Moist		9	SS	95															
7.6																				
			10	SS	64															
244.8	END OF BOREHOLE																			
9.8	NOTES: 1. Water level in open borehole at a depth of 1.0 m below ground surface (Elev. 253.5 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.4 m below ground surface (Elev. 253.1 m) on March 19, 2009. 3. Water level in piezometer at a depth of 0.4 m below ground surface (Elev. 254.1 m) on April 2, 2009. 4. Water level in piezometer at a depth of 1.3 m below ground surface (Elev. 253.2 m) on June 12, 2009.																			

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

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

PROJECT _____		RECORD OF BOREHOLE No HD7-5				1 OF 1 METRIC														
2005-07-00		LOCATION N 4893606.5 ; E 309006.4				ORIGINATED BY TB														
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC														
DATUM Geodetic		DATE March 17, 2009				CHECKED BY AM/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										WATER CONTENT (%)		
								20	40	60	80	100						20	40	60
253.3	GROUND SURFACE																			
0.0	TOPSOIL Soft		1	SS	2															
252.8																				
0.5	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		2	SS	22															
			3	SS	29															
			4	SS	29															
			5	SS	31															
	Cobble/boulder inferred at a depth of 3.8 m (Elev. 249.5 m)		6	SS	50/0.10															
			7	SS	154															
	Becoming grey below a depth of 6.1 m		8	SS	91															
			9	SS	100/0.13															
244.2																				
243.8	CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Moist		10	SS	118/0.23															
9.5	END OF BOREHOLE																			
NOTES: 1. Ground water seepage noted at a depth of 2.4 m below ground surface (Elev. 250.9 m) during drilling operations.. 2. Water level in open borehole at a depth of 3.1 m below ground surface (Elev. 250.2 m) upon completion of drilling.																				

MIS-MTO 001 08-1111-0022.GPJ GAL-MISS.GDT 8/9/10 DD/SAC

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

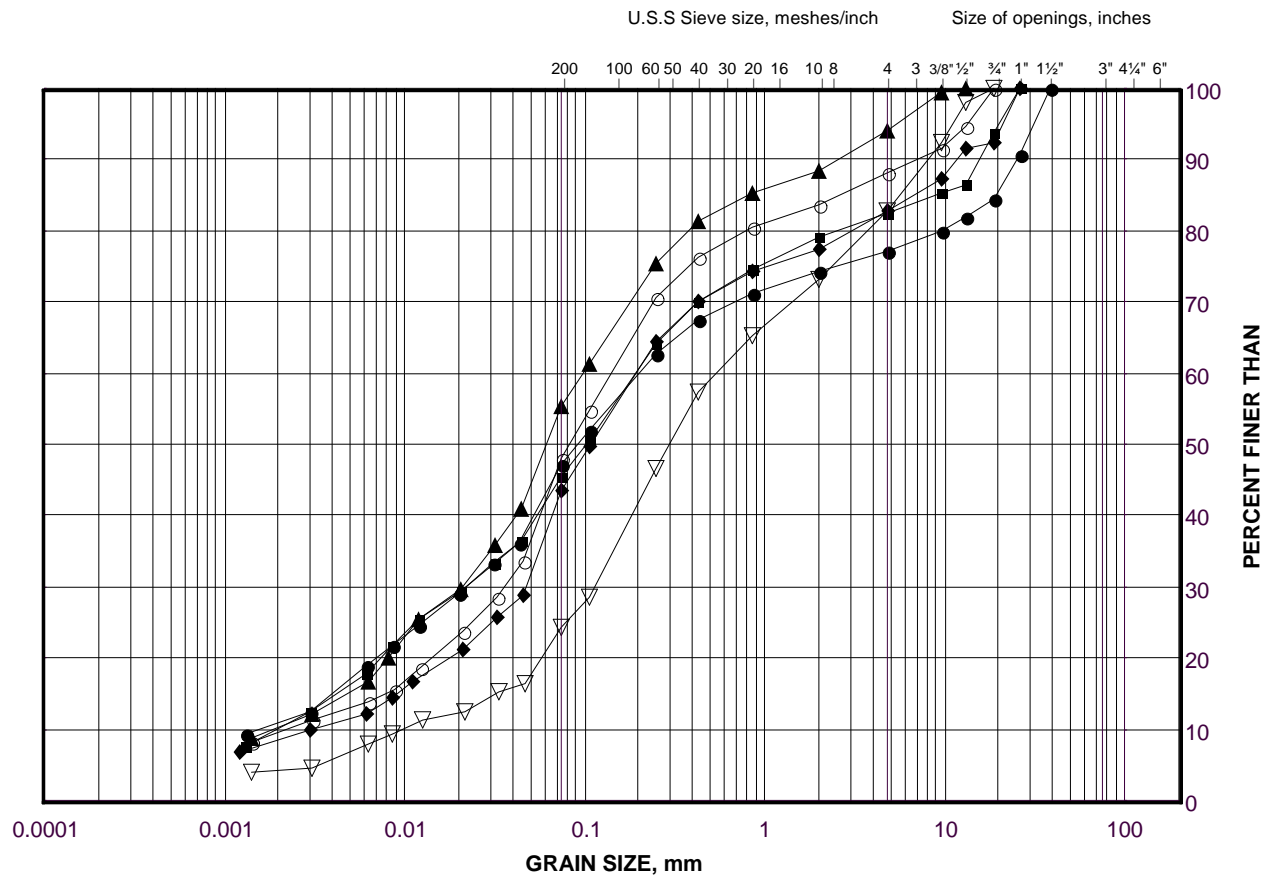
PROJECT _____		RECORD OF BOREHOLE No HD7-7				1 OF 1 METRIC										
2005-07-00		LOCATION N 4893701.8 ; E 309032.3				ORIGINATED BY TB										
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC										
DATUM Geodetic		DATE March 18, 2009				CHECKED BY AM/KJB										
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				WATER CONTENT (%)				
251.1	GROUND SURFACE						20 40 60 80 100									
0.0	TOPSOIL Soft		1	SS	2											
250.6																
0.5	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders (TILL) Compact to very dense Brown Moist		2	SS	24											23 30 36 11
			3	SS	39											
			4	SS	57											
			5	SS	69/0.18											
	Cobble/boulder inferred at a depth of 3.1 m (Elev. 248.0 m)		6	SS	78											6 39 45 10
			7	SS	80/0.10											
	Cobble/boulder inferred at a depth of 4.6 m (Elev. 246.5 m)		8	SS	100/0.10											
243.5			9	SS	80/0.08											
7.9	CLAYEY SILT, some sand, trace gravel, containing cobbles and boulders (TILL) Hard Grey Moist END OF BOREHOLE															
NOTES: 1. Water level in open borehole at a depth of 7.9 m below ground surface (Elev. 243.2 m) upon completion of drilling. 2. Water level in piezometer at a depth of 2.4 m below ground surface (Elev. 248.7 m) on March 19, 2009. 3. Water level in piezometer at a depth of 0.8 m below ground surface (Elev. 250.3 m) on April 2, 2009. 4. Water level in piezometer at a depth of 2.0 m below ground surface (Elev. 249.1 m) on June 12, 2009.																

PROJECT _____			RECORD OF BOREHOLE No HD7-8				1 OF 1 METRIC								
2005-07-00			LOCATION N 4893750.7 ; E 308991.9				ORIGINATED BY TB								
DIST _____ HWY 404			BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic			DATE March 18, 2009				CHECKED BY AM/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			WATER CONTENT (%)				
248.1	GROUND SURFACE														
0.0	TOPSOIL Soft		1	SS	3										
247.3															
0.8	SAND and SILT, trace to some clay and gravel, containing cobbles and boulders (TILL) Loose to compact Brown Moist		2	SS	8										
			3	SS	7										
			4	SS	26										
			5	SS	23										
			6	SS	19										
243.5															
4.6	Silty SAND, some gravel, trace clay, containing cobbles and boulders (TILL) Compact Brown Wet		7	SS	29										
242.0															
6.1	CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Moist		8	SS	31										
241.4															
6.7	END OF BOREHOLE														
NOTES: 1. Water level in open borehole at a depth of 2.0 m below ground surface (Elev. 246.1 m) upon completion of drilling.															

GRAIN SIZE DISTRIBUTION

Silty Sand to Sand and Silt Till

FIGURE C7-1A



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD7-7	2	250.0
■	HD7-8	3	246.3
◆	HD7-5	4	250.7
▲	HD7-7	6	247.0
▽	HD7-8	7	243.2
○	HD7-5	8	246.9

Project Number: 08-1111-022E

Checked By: KJB

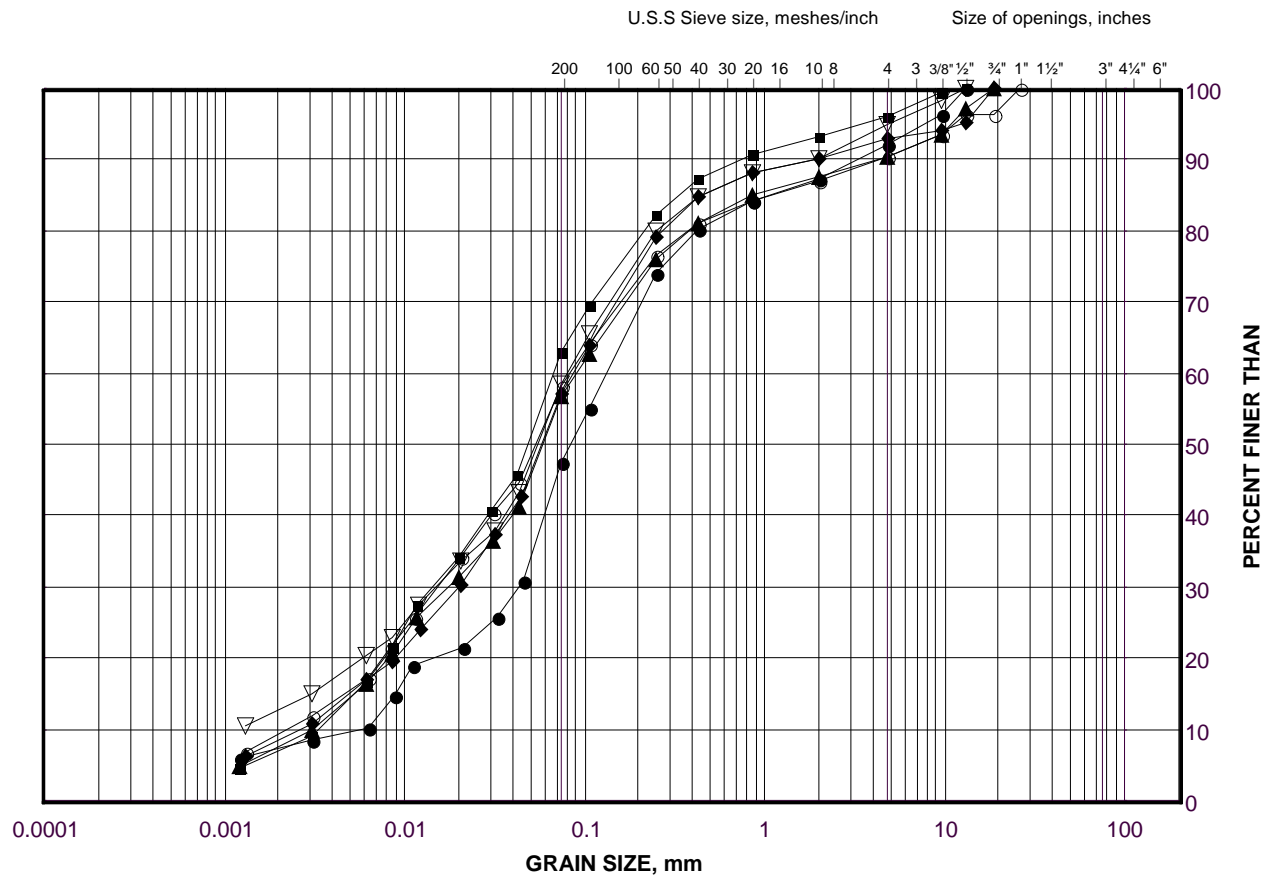
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Silty Sand to Sand and Silt Till

FIGURE C7-1B



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD7-4	2	253.4
■	HD7-2	3	254.1
◆	HD7-3	4	251.9
▲	HD7-1	5	251.2
▽	HD7-4	6	250.4
○	HD7-2	6	251.9

Project Number: 08-1111-0022E

Checked By: KJB

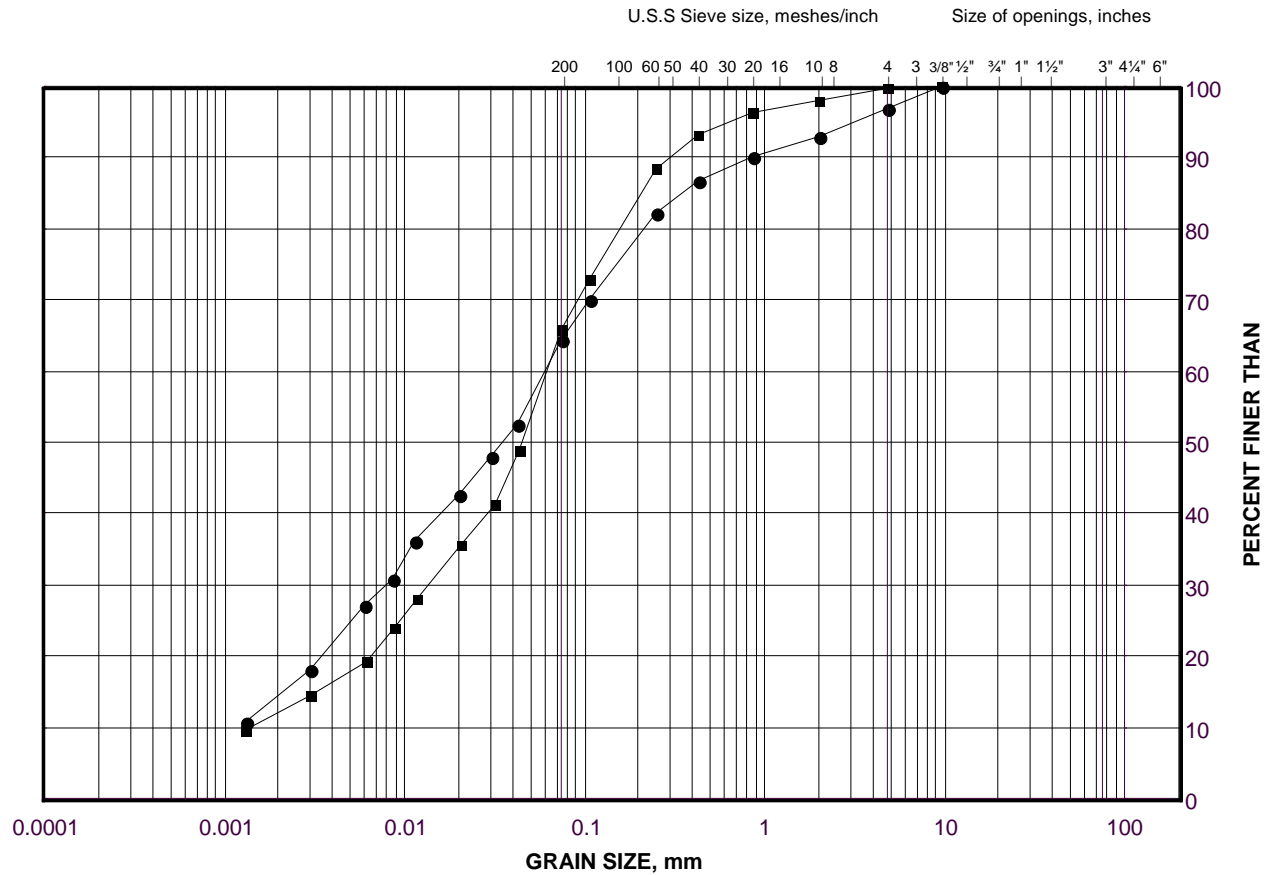
Golder Associates

Date: 14-Jan-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE C7-2



LEGEND

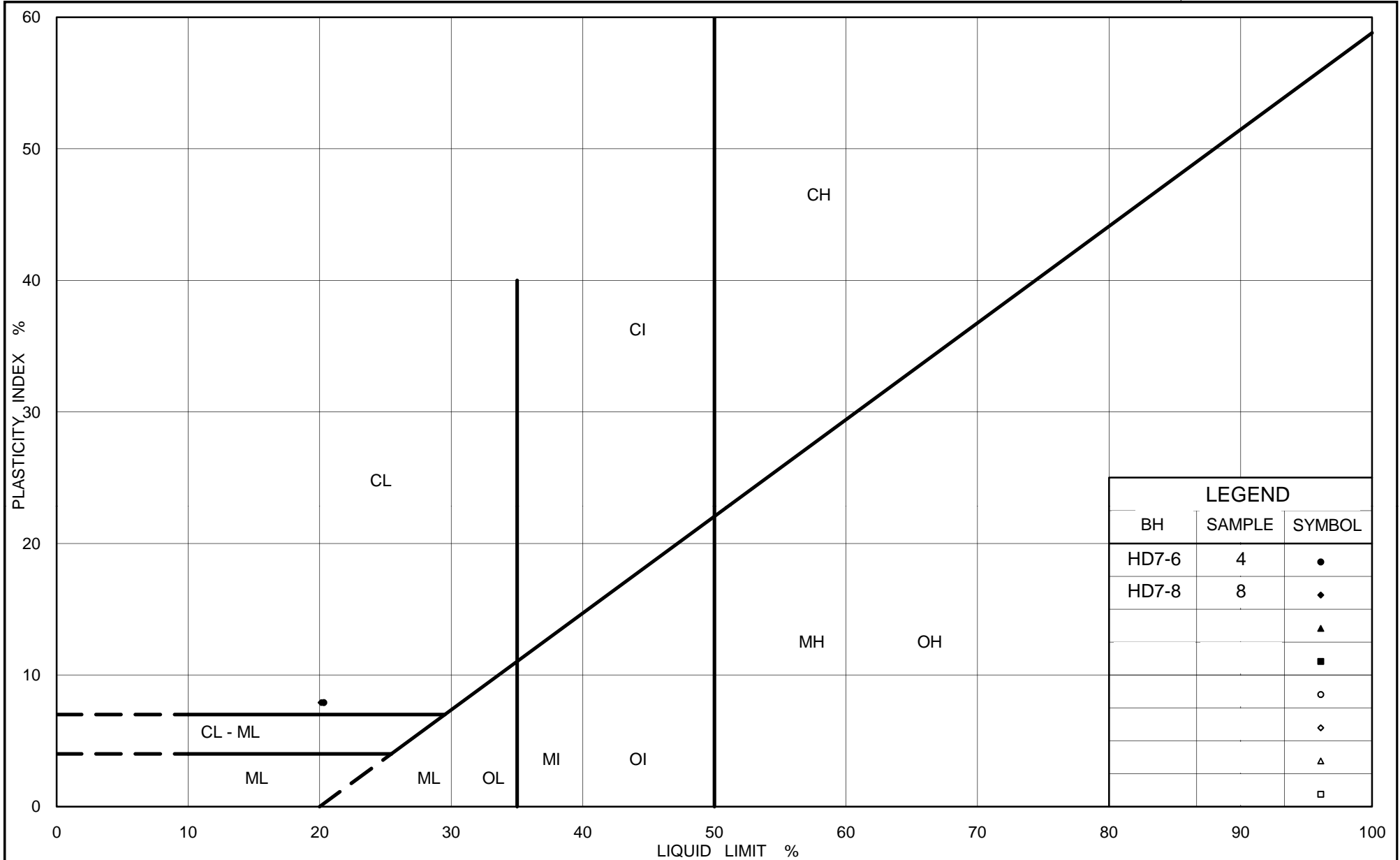
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD7-6	3	250.5
■	HD7-3	9	246.6

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Till

Figure No. C7-3

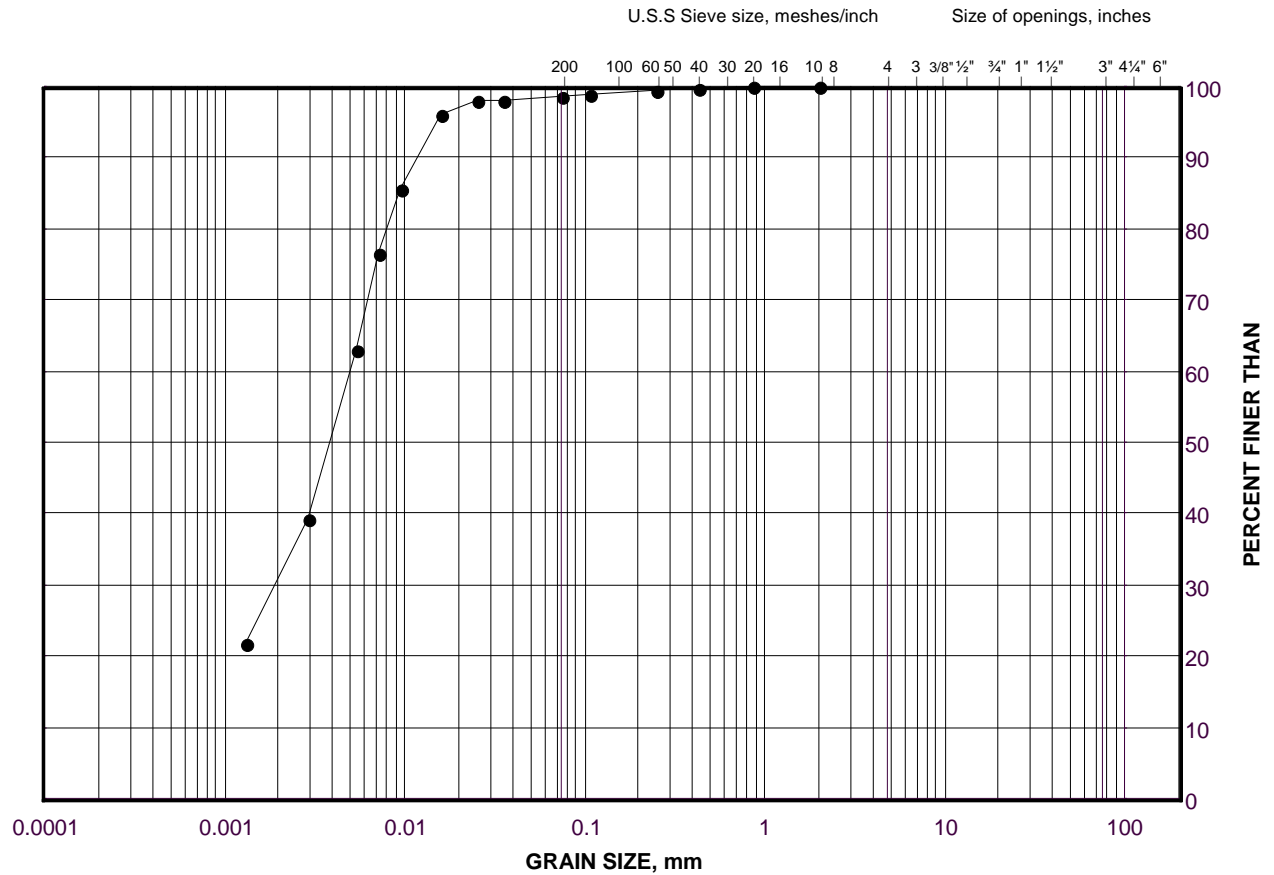
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt

FIGURE C7-4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD7-6	8	245.9

Project Number: 08-1111-0022E

Checked By : KJB

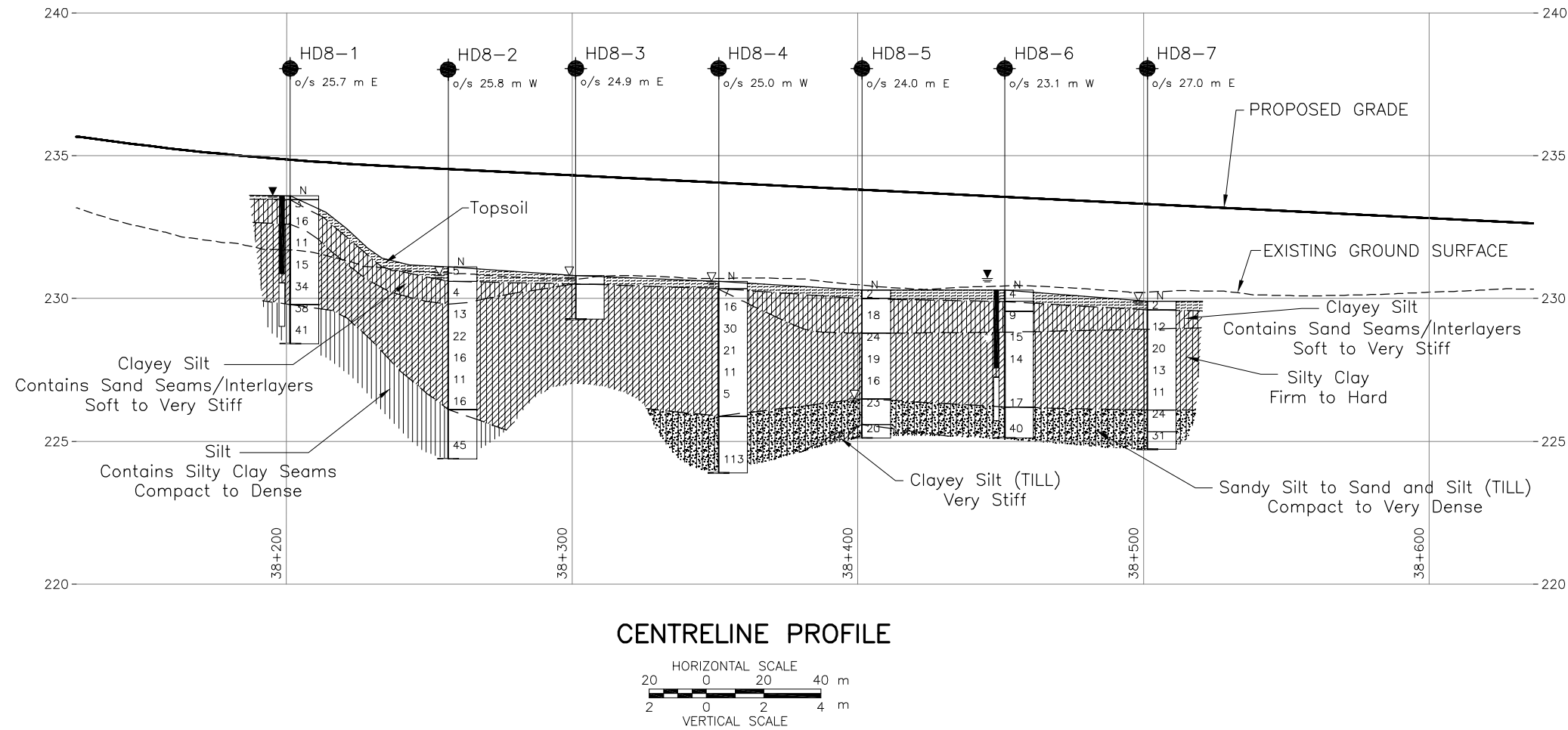
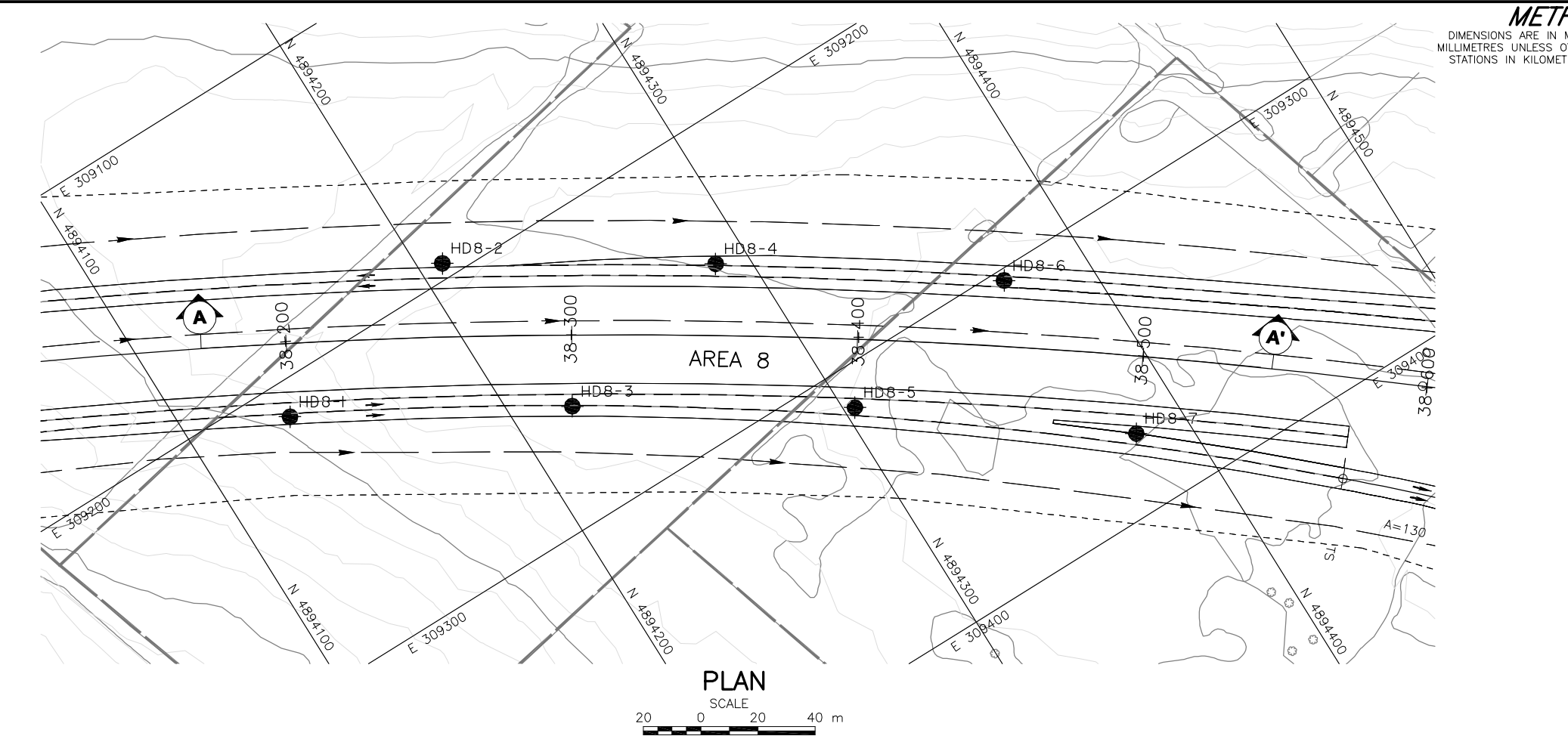
Golder Associates

Date: 14-Jan-10



APPENDIX C8

Highway 404 – STA. 38+200 to STA. 38+500 (High Fill Area 8)
Drawing, Record of Boreholes and Laboratory Test Results



CONT No. WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STA. 38+200 to STA. 38+500
BOREHOLE LOCATION AND SOIL STRATA



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
SCALE: 0 to 3 km

- LEGEND**
- Borehole - Current Investigation
 - 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 June 12, 2009
 - WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HD8-1	233.6	4894134.3	309212.1
HD8-2	231.1	4894207.9	309194.7
HD8-3	230.8	4894220.0	309261.2
HD8-4	230.6	4894289.0	309245.5
HD8-5	230.3	4894303.7	309313.9
HD8-6	230.3	4894371.6	309303.8
HD8-7	229.9	4894382.5	309373.7

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

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NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: 9/8/2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. C8

PROJECT _____		RECORD OF BOREHOLE No HD8-1				1 OF 1 METRIC								
2005-07-00		LOCATION N 4894134.3 ; E 309212.1				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE March 18, 2009				CHECKED BY AM/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						
233.6	GROUND SURFACE													
0.0	TOPSOIL													
0.2	CLAYEY SILT, trace to some sand, trace organics		1	SS	3									
232.8	Soft Brown Moist		2	SS	16								42	
0.8	SILTY CLAY, trace to some sand, trace gravel		3	SS	11									
	Very stiff to hard		4	SS	15									
	Brown Moist		5	SS	34									
229.8	SILT, trace sand, containing silty clay seams		6	SS	38									
3.8	Dense Brown Moist to wet		7	SS	41									
228.4	END OF BOREHOLE													
5.2	NOTES:													
	1. Groundwater seepage encountered at a depth of 0.9 m below ground surface (Elev. 232.7 m).													
	2. Water level in open borehole at a depth of 4.0 m below ground surface (Elev. 229.6 m) upon completion of drilling.													
	3. Water level in piezometer at a depth of 1.1 m below ground surface (Elev. 232.5 m) on March 19, 2009.													
	4. Water level in piezometer at a depth of 0.4 m above ground surface (Elev. 233.2) on April 2, 2009.													
	5. Water level in piezometer at ground surface on June 12, 2009.													

PROJECT _____		RECORD OF BOREHOLE No HD8-2				1 OF 1 METRIC												
2005-07-00		LOCATION N 4894207.9 ; E 309194.7				ORIGINATED BY TB												
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC												
DATUM Geodetic		DATE March 18, 2009				CHECKED BY AM/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										WATER CONTENT (%)
231.1	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL Firm		1	SS	5	▽	231										63.8	
230.6							230											
0.5	CLAYEY SILT, trace to some sand, trace gravel, trace organics Soft to firm Brown Moist		2	SS	4		229											
229.7							229											
1.4	SILTY CLAY, trace to some sand, trace gravel Stiff to very stiff Brown Moist		3	SS	13		228											
			4	SS	22		227											
			5	SS	16		226											
			6	SS	11		225											
226.1			7A	SS	16													
5.0	SILT, trace to some clay, trace sand, containing silty clay seams Compact to dense Grey Moist																	
	Becoming wet below a depth of 6.1 m		8	SS	45												0 1 93 6	
224.4																		
6.7	END OF BOREHOLE																	
NOTES: 1. Water level in open borehole at a depth of 0.3 m below ground surface (Elev. 230.8 m) upon completion of drilling.																		

PROJECT _____		RECORD OF BOREHOLE No HD8-3		1 OF 1 METRIC	
2005-07-00		LOCATION N 4894220.0 ;E 309261.2		ORIGINATED BY TB	
DIST _____ HWY 404		BOREHOLE TYPE Hand Auger		COMPILED BY SC	
DATUM Geodetic		DATE June 2, 2009		CHECKED BY KJB	

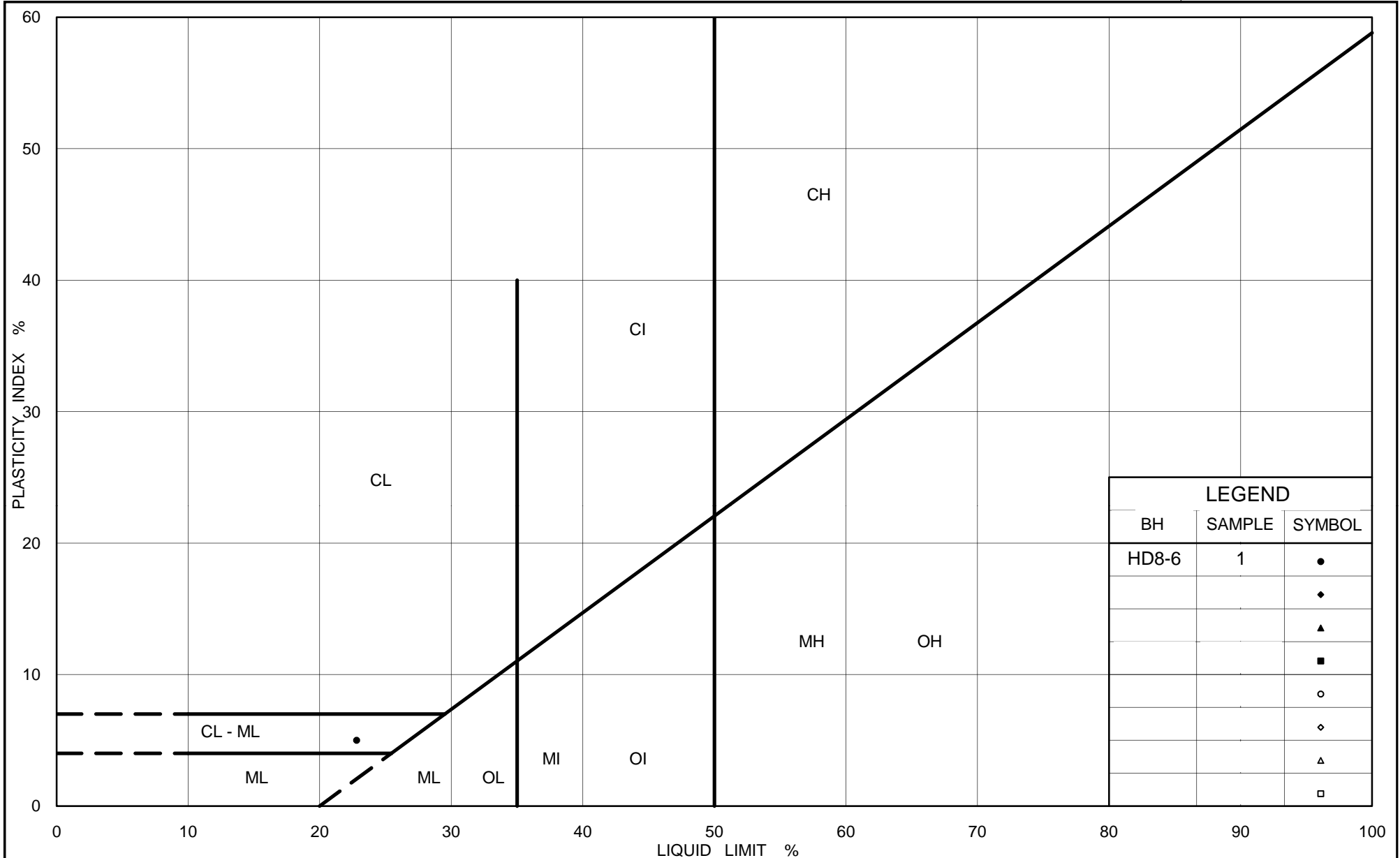
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED	+	FIELD VANE	×	REMOULDED	w _p	w	w _L		
230.8	GROUND SURFACE																
0.0 230.5	TOPSOIL																
0.3	SILTY CLAY, trace sand Grey Moist		1	AS	-												
229.3	END OF BOREHOLE HAND AUGER REFUSAL																
1.5	NOTES: 1. Water level in open borehole at ground surface (Elev. 230.8 m) upon completion of drilling. 2. Hole drilled using a hand auger.																

PROJECT _____		RECORD OF BOREHOLE No HD8-4				1 OF 1 METRIC											
2005-07-00		LOCATION N 4894289.0 ; E 309245.5				ORIGINATED BY TB											
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC											
DATUM Geodetic		DATE March 19, 2009				CHECKED BY AM/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									
230.6	GROUND SURFACE																
0.0	TOPSOIL																
0.3	SILTY CLAY, trace to some sand, trace gravel Firm to very stiff Brown Moist		1	SS	7												
			2	SS	16												
			3	SS	30												
	Becoming grey below a depth of 2.3 m		4	SS	21												
			5	SS	11												
			6	SS	5												
225.9	SAND and SILT, trace clay, trace gravel (TILL) Very dense Grey Moist		7	TO	PH												
4.7																	
			8	SS	113												
223.9	END OF BOREHOLE																
6.7	NOTES: 1. Water level in open borehole at ground surface upon completion of drilling. 2. Attempted to push a Shelby Tube at 4.6 m depth but effective refusal was achieved in Sand and Silt (till) at 4.7 m depth.																

PROJECT _____		RECORD OF BOREHOLE No HD8-5				1 OF 1 METRIC								
2005-07-00		LOCATION N 4894303.7 ; E 309313.9				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE March 19, 2009				CHECKED BY AM/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						
230.3	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	TOPSOIL													
0.3	CLAYEY SILT, some sand, trace gravel Soft to very stiff Brown Moist		1	SS	2		230							
			2	SS	18		229							
228.8	SILTY CLAY, trace sand, trace gravel Very stiff Brown Moist Becoming grey below a depth of 2.3 m.		3	SS	24		228							
			4	SS	19		227							
			5	SS	16		226							
226.5	SAND and SILT, trace clay, trace gravel (TILL) Compact Grey Moist		6	SS	23		225							
225.6	CLAYEY SILT, trace to some sand, trace gravel (TILL) Very stiff Grey Moist		7	SS	20		224							
225.1	END OF BOREHOLE													
5.2	NOTES: 1. Water level in open borehole at a depth of 3.8 m below ground surface (Elev. 226.5 m) upon completion of drilling.													

PROJECT _____		RECORD OF BOREHOLE No HD8-6				1 OF 1 METRIC					
2005-07-00		LOCATION N 4894371.6 ; E 309303.8				ORIGINATED BY TB					
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC					
DATUM Geodetic		DATE March 19, 2009				CHECKED BY AM/KJB					
SOIL PROFILE			SAMPLES			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						
230.3	GROUND SURFACE										
0.0	TOPSOIL		1	SS	4						
229.9											
0.4	CLAYEY SILT, some sand, trace gravel, contains sand interlayers Soft to stiff Brown Moist		2	SS	9						
228.8											
1.5	SILTY CLAY, trace to some sand, trace gravel Stiff Brown Moist		3	SS	15						
	Becoming grey below a depth of 2.3 m		4	SS	14						
			5	TO	PH						
226.2											
4.1	SAND and SILT, trace clay, trace gravel (TILL) Compact to dense Grey Moist		6	SS	17						
225.1			7	SS	40						
5.2	END OF BOREHOLE										
NOTES: 1. Groundwater seepage noted at a depth of 0.6 m (Elev. 229.7 m). 2. Water level in open borehole at a depth of 1.9 m below ground surface (Elev. 228.4 m) upon completion of drilling. 3. Water level in piezometer at 0.7 m above ground surface (Elev. 231.0 m) on April 2, 2009. 4. Water level in piezometer at 0.2 m above ground surface (Elev. 230.5 m) on June 2, 2009. 5. Water level in piezometer at 0.4 m above ground surface (Elev. 230.7 m) on June 12, 2009.											

PROJECT _____		RECORD OF BOREHOLE No HD8-7				1 OF 1 METRIC										
2005-07-00		LOCATION N 4894382.5 ;E 309373.7				ORIGINATED BY TB										
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC										
DATUM Geodetic		DATE March 19, 2009				CHECKED BY AM/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								
229.9	GROUND SURFACE															
0.0	TOPSOIL		1	SS	2											
0.3	CLAYEY SILT, some sand, trace gravel, containing silty sand seams, containing rootlets															
228.9	Soft to stiff		2	SS	12											
1.0	Brown Moist															
	SILTY CLAY, some sand, trace gravel		3	SS	20											
	Stiff to very stiff		4	SS	13											
	Brown Moist															
	Becoming grey below a depth of 3.0 m		5	SS	11											
226.1																
3.8	Sandy SILT, trace to some clay and gravel (TILL)		6	SS	24											
	Compact Grey Wet		7	SS	31											
224.7																
5.2	END OF BOREHOLE															
NOTES:																
1. Water level at ground surface upon completion of drilling.																
2. Water level in open borehole at a depth of 0.8 m below ground surface (Elev. 229.1 m) by end of day March 19, 2009.																



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PLASTICITY CHART Clayey Silt (Contains Sand Interlayers)

Figure No. C8-1

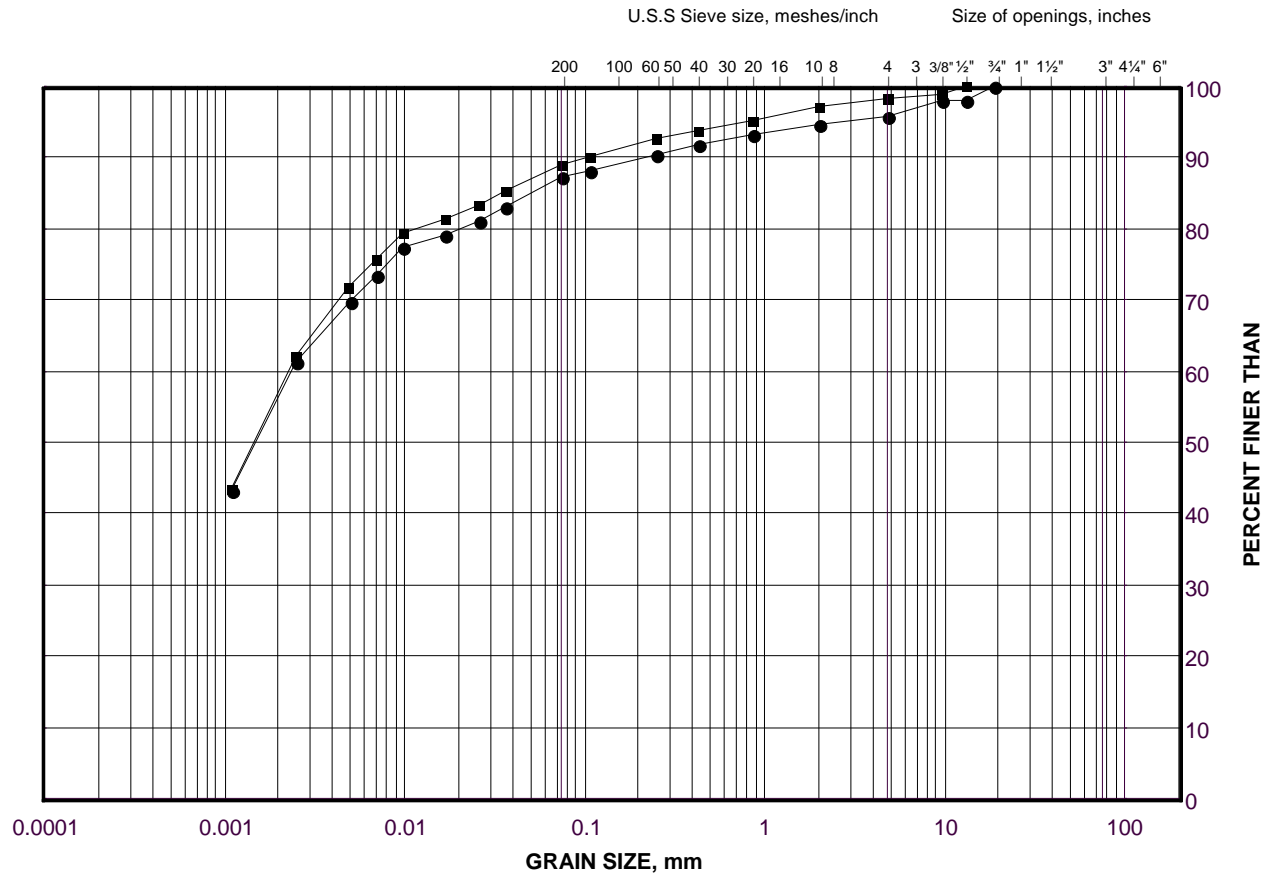
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silty Clay

FIGURE C8-2



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

LEGEND

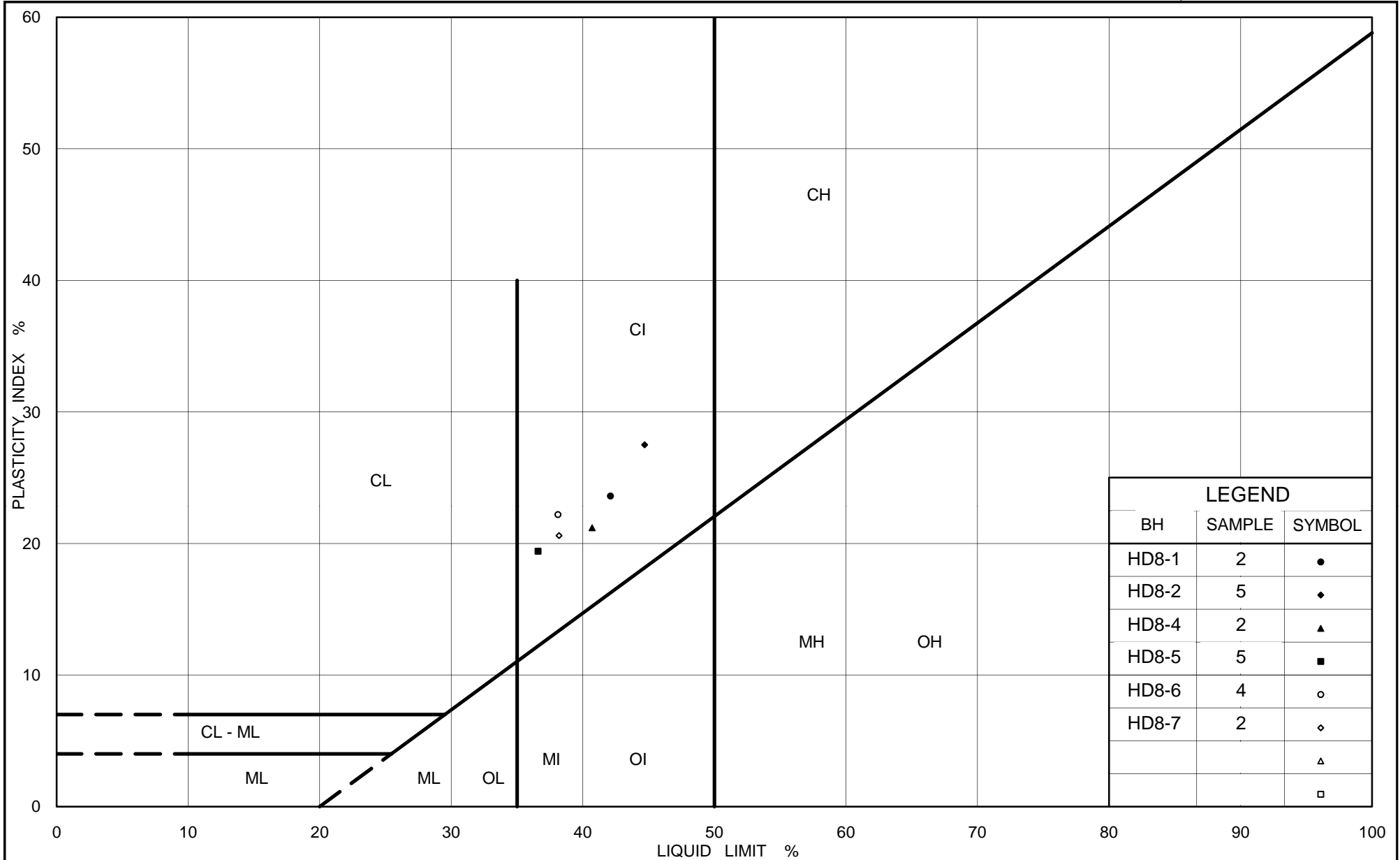
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	HD8-4	2	229.5
■	HD8-6	4	227.7

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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PLASTICITY CHART Silty Clay

Figure No. C8-3

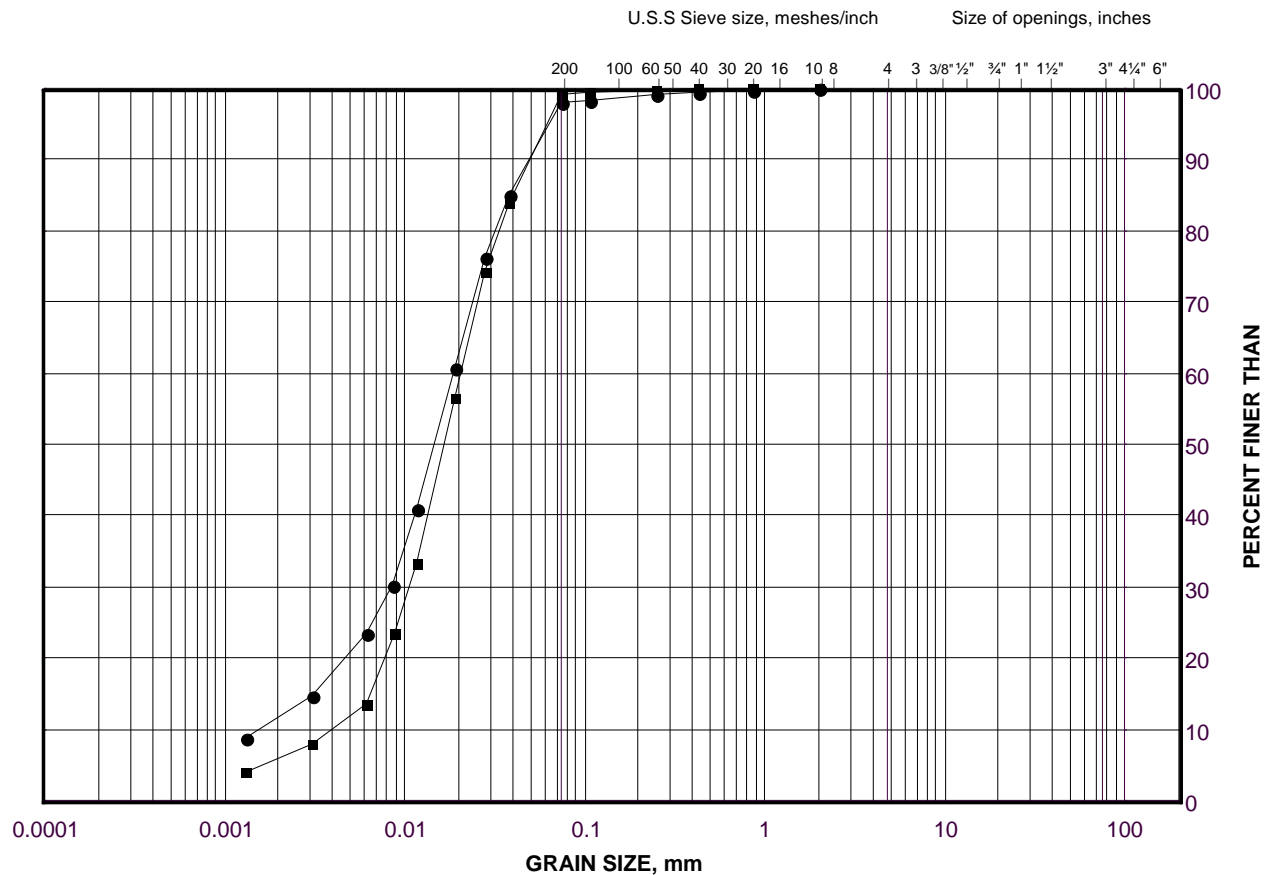
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silt

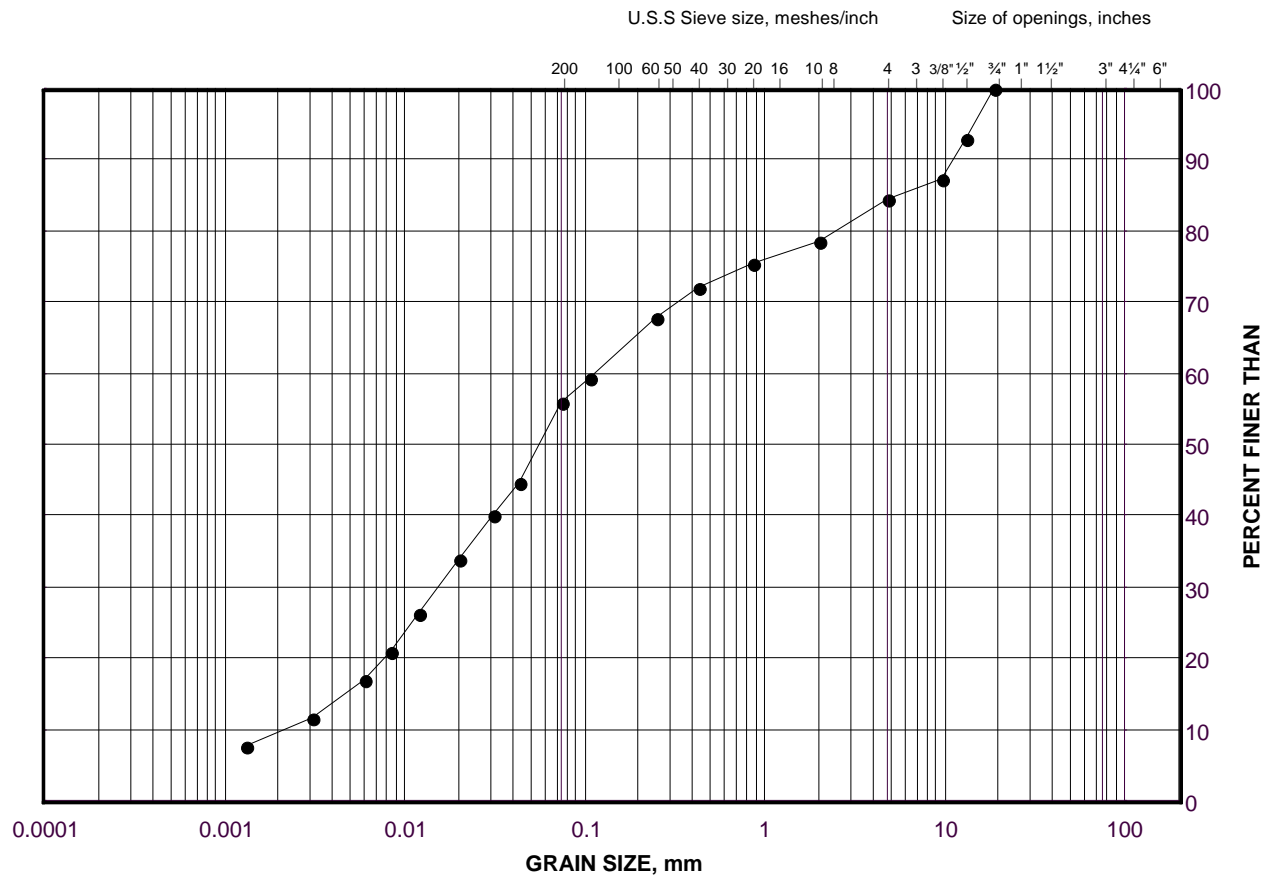
FIGURE C8-4



GRAIN SIZE DISTRIBUTION

Sandy Silt Till

FIGURE C8-5



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

LEGEND

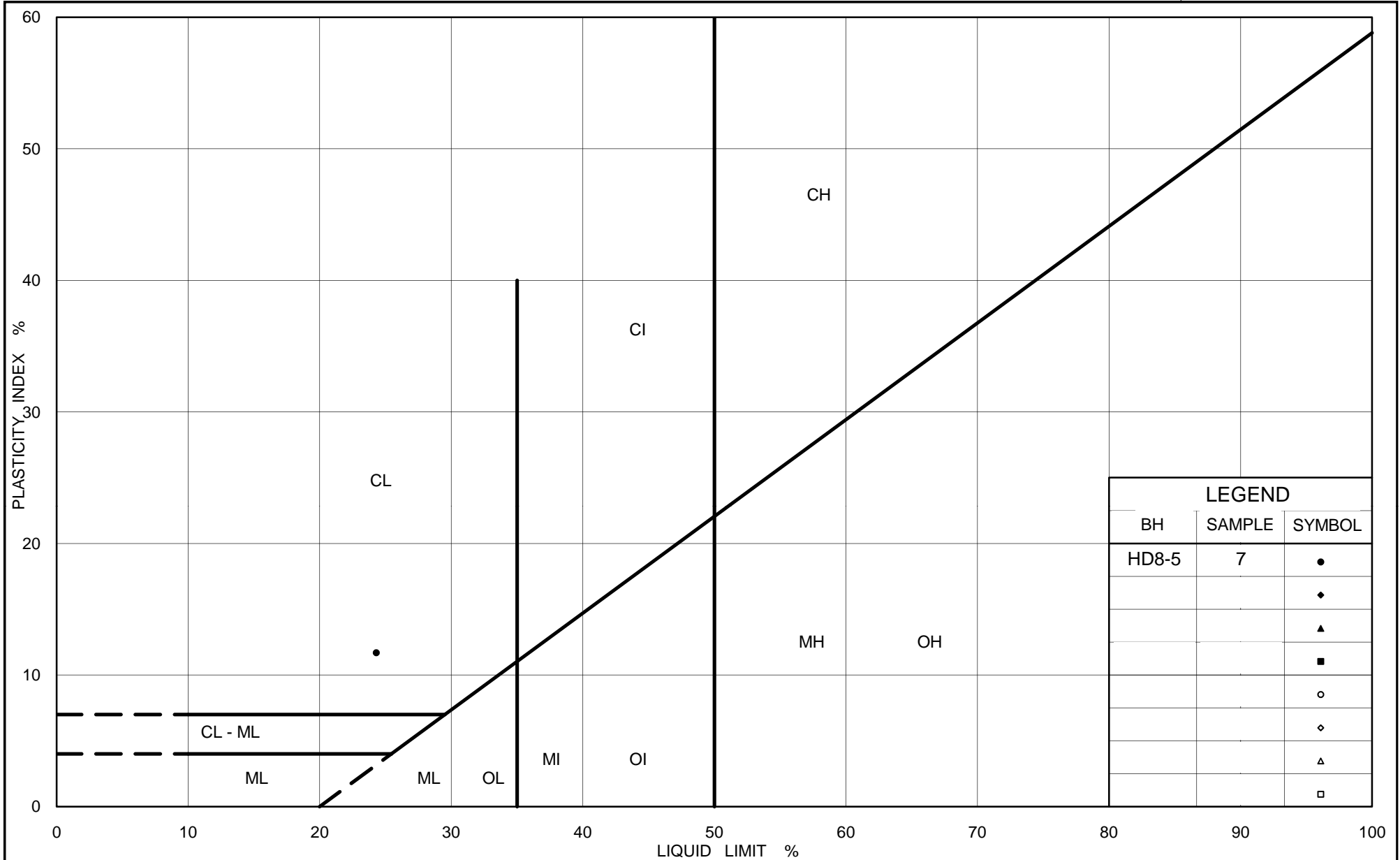
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	HD8-7	7	225.0

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 14-Jan-10



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PLASTICITY CHART

Clayey Silt Till

Figure No. C8-6

Project No. 08-1111-0022E

Checked By: KJB



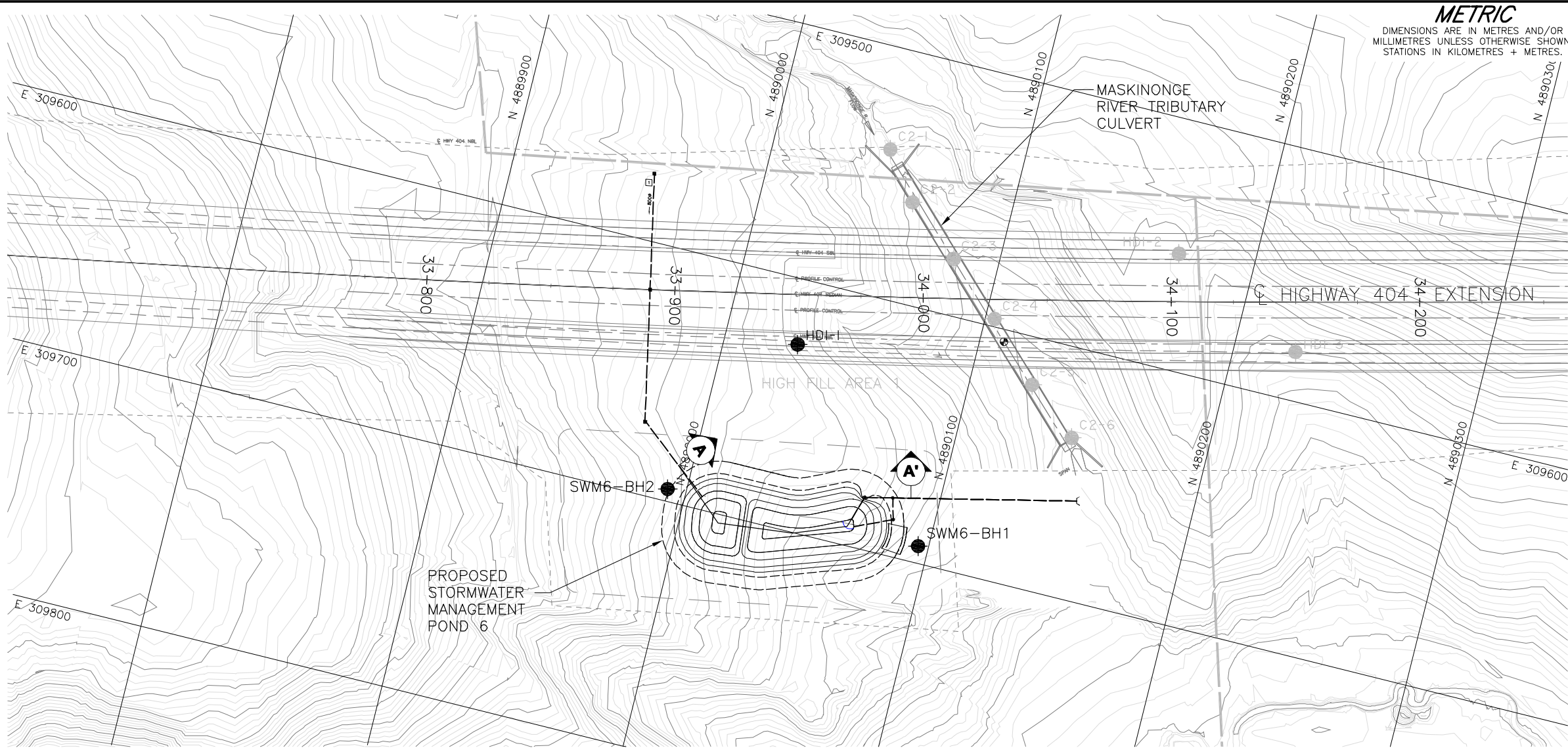
APPENDIX D

Highway 404 - Stormwater Management Ponds

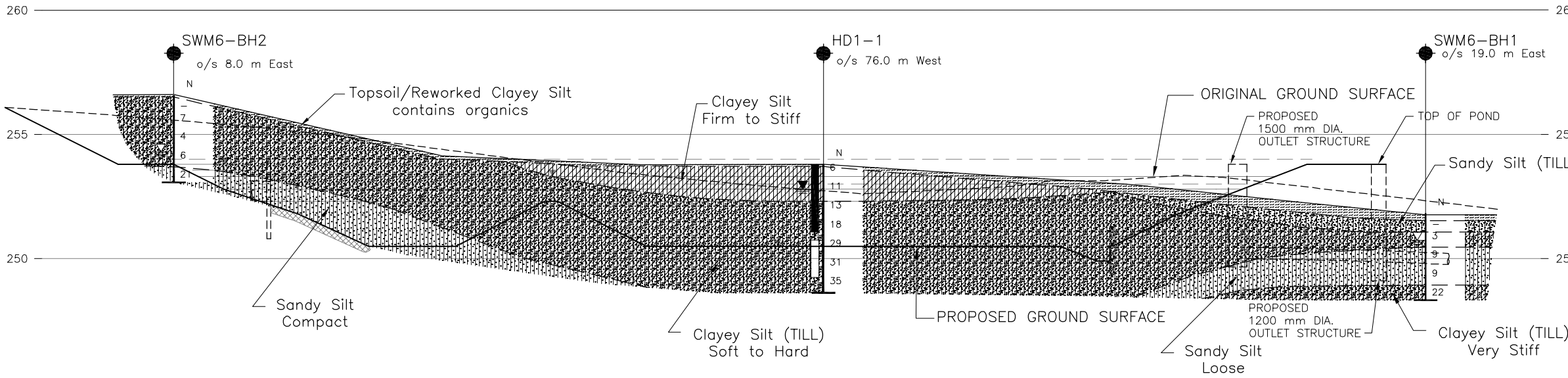


APPENDIX D1

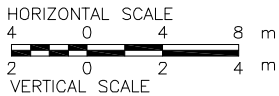
Highway 404 - Stormwater Management Pond 6 Drawing, Record of Boreholes and Laboratory Test Results



PLAN



CROSS-SECTION A-A'



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

CONT No.
WP No. 2005-07-00

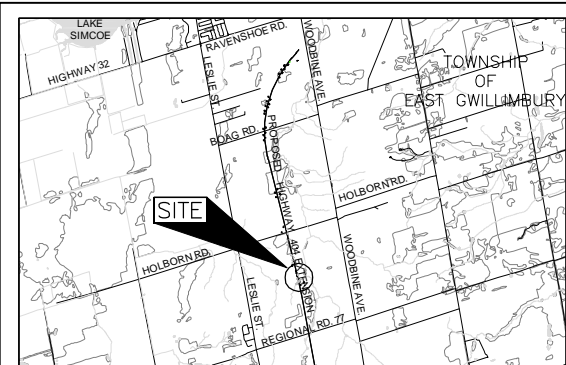


HIGHWAY 404 EXTENSION
STORMWATER MANAGEMENT POND 6
BOREHOLE LOCATION AND SOIL STRATA

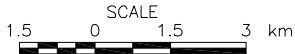
SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN



LEGEND

- Borehole - Current Investigation
- ⊥ 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 June 12, 2009
- ≡ WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
SWM6-BH1	251.8	4890095.9	309693.1
SWM6-BH2	256.6	4889992.5	309695.2
HD1-1	253.8	4890029.2	309626.0

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 provided in digital format by AECOM, drawing files "76808.dwg" and "76809.dwg", received, November, 16, 2009 and drawing file "2538-199-00_00-ST-1001-To Golder-091126.dwg", received November 26, 2009.

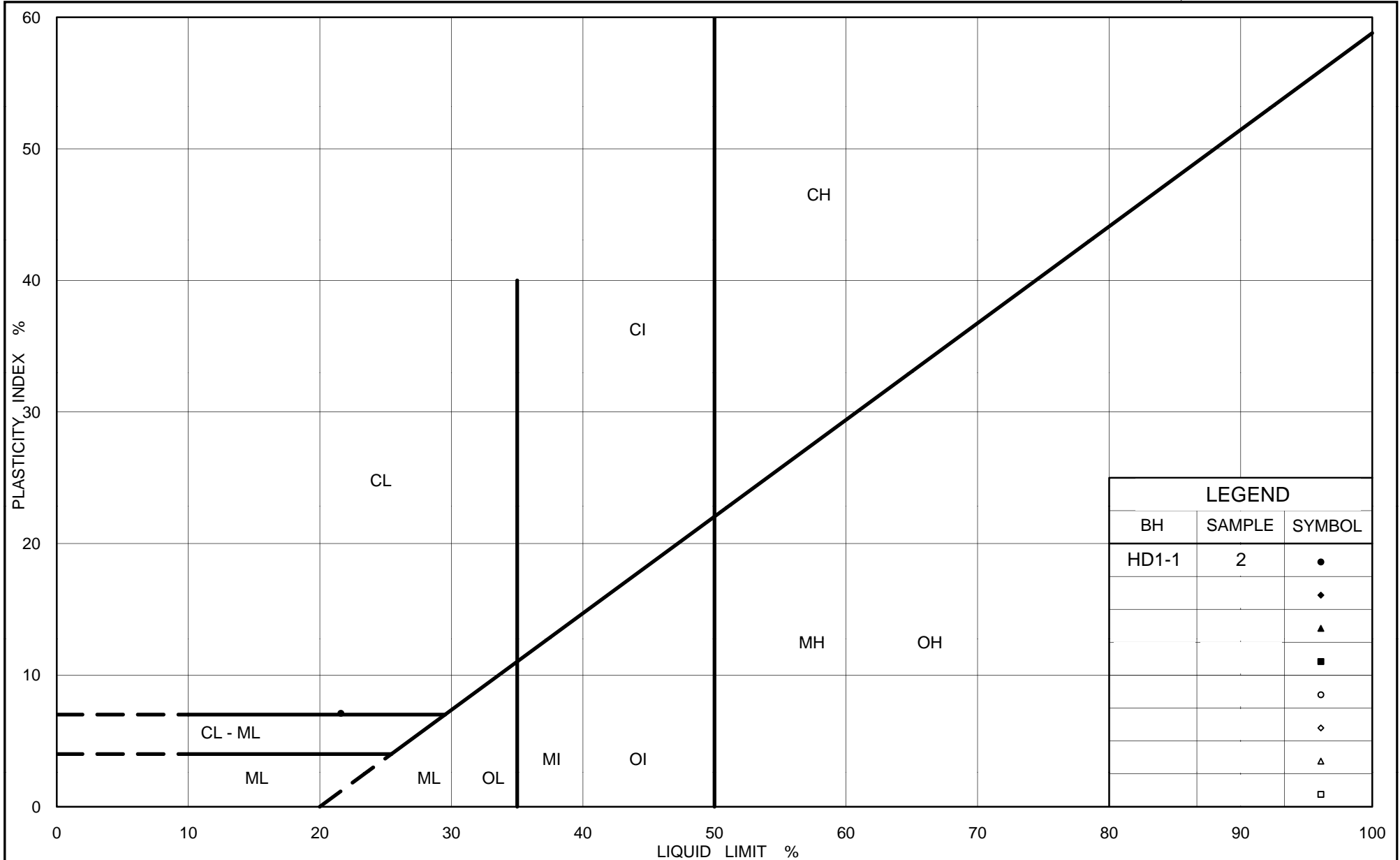
NO.	DATE	BY	REVISION
Geores No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. D1

PROJECT		08-1111-0022		RECORD OF BOREHOLE No SWM6-BH1				1 OF 1 METRIC									
G.W.P.		2005-07-00		LOCATION		N 4890095.9 ; E 309693.1		ORIGINATED BY		NS							
DIST		HWY 404		BOREHOLE TYPE		108 mm Dia. Solid Stem Augers		COMPILED BY		SC							
DATUM		Geodetic		DATE		June 3, 2009		CHECKED BY		XW/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									
251.8	GROUND SURFACE																
0.0	TOPSOIL																
251.5																	
0.3	Sandy SILT, some clay, trace gravel (TILL)		1	AS	-	▽	251										
251.1	Brown Moist		2	SS	3		250										
0.8	CLAYEY SILT, trace to some sand and gravel, containing silty clay interlayers and oxidation staining (TILL)		3	SS	9												
250.5	Soft Brown Moist																
1.4	Sandy SILT, trace clay		4	SS	9		249										
248.9	Loose Brown Moist																
2.9	CLAYEY SILT, trace to some sand and gravel, containing silty clay interlayers and oxidation staining (TILL)		5	SS	22												8 7 54 31
248.3	Very stiff Brown Wet																
3.5	END OF BOREHOLE																
NOTES:																	
1. Water level in open borehole at a depth of 1.1 m below ground surface (Elev. 250.7 m) upon completion of drilling.																	

PROJECT <u>08-1111-0022</u>		RECORD OF BOREHOLE No SWM6-BH2		1 OF 1 METRIC	
G.W.P. <u>2005-07-00</u>		LOCATION <u>N 4889992.5 ; E 309695.2</u>		ORIGINATED BY <u>NS</u>	
DIST <u> </u> HWY <u>404</u>		BOREHOLE TYPE <u>108 mm Dia. Solid Stem Augers</u>		COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>June 3, 2009</u>		CHECKED BY <u>XW/KJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		GR	SA	SI	CL
								○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	REMOULDED	WATER CONTENT (%)						
256.6	GROUND SURFACE						20	40	60	80	100									
0.0	TOPSOIL																			
256.3																				
0.3	CLAYEY SILT, trace sand, trace gravel, containing oxidation staining (TILL) Firm Brown Moist		1	AS	-									○						
			2	SS	7															
			3	SS	4									○						
			4	SS	6															
253.7																				
2.9	Sandy SILT, trace clay Compact Brown Moist		5	SS	21									○						
253.1																				
3.5	END OF BOREHOLE																			
	NOTES: 1. Water level in open borehole at a depth of 2.3 m below ground surface (Elev. 254.3 m) upon completion of drilling.																			

PROJECT _____		RECORD OF BOREHOLE No HD1-1				1 OF 1 METRIC							
2005-07-00		LOCATION N 4890029.2 ; E 309626.0				ORIGINATED BY TB							
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC							
DATUM Geodetic		DATE June 5, 2009				CHECKED BY 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			
253.8	GROUND SURFACE												
0.1	CLAYEY SILT with organics, some sand, containing rootlets (Reworked) Dark brown Moist		1	SS	6								
	CLAYEY SILT, trace to some sand, containing oxidation staining Firm to stiff Brown Moist		2	SS	11								
252.3													
1.5	CLAYEY SILT, trace to some sand, trace gravel, containing oxidation staining (TILL) Stiff to hard Brown Moist		3	SS	13								
			4	SS	18								
			5	SS	29								
			6	SS	31								
			7	SS	35								
248.6	END OF BOREHOLE												
5.2	NOTES: 1. Water level in open borehole at a depth of 5.2 m below ground surface (Elev. 248.6 m) upon completion of drilling. 2. Water level in piezometer at a depth of 1.0 m below ground surface (Elev. 252.8 m) on June 12, 2009.												



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PLASTICITY CHART

Clayey Silt

Figure No. D1-1

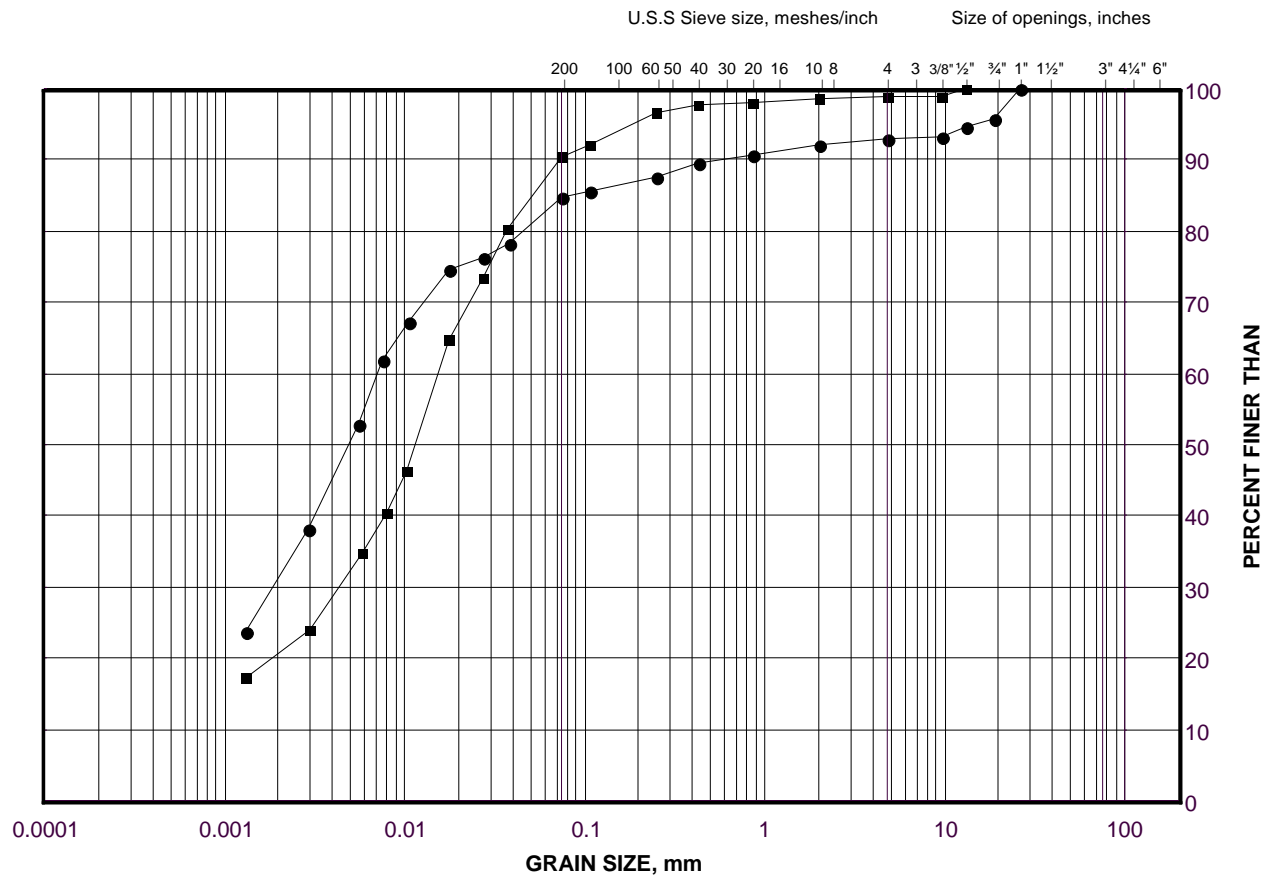
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D1-2



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

LEGEND

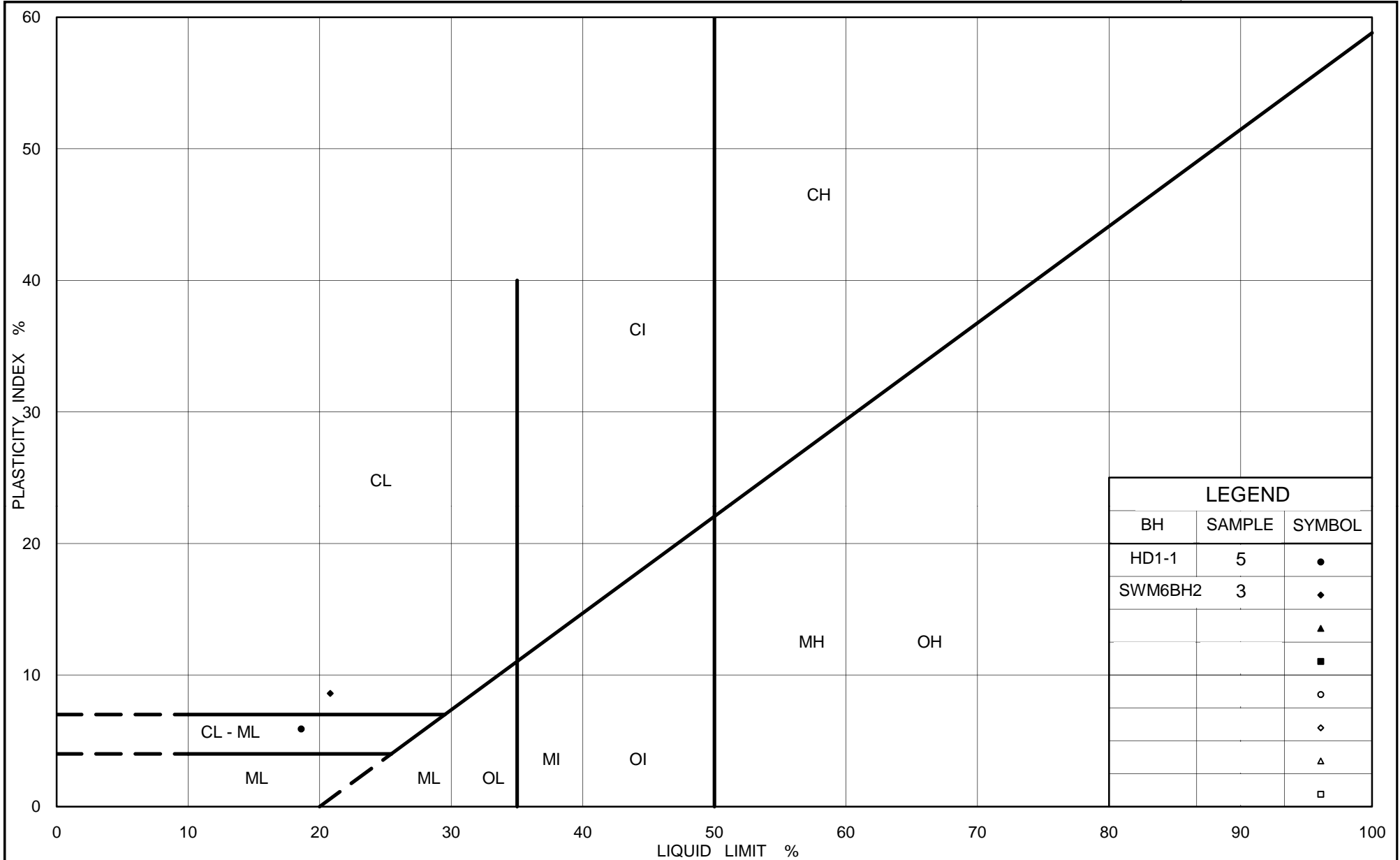
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	SWM6-BH1	5	248.5
■	HD1-1	5	250.4

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 15-Mar-10



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PLASTICITY CHART

Clayey Silt Till

Figure No. D1-3

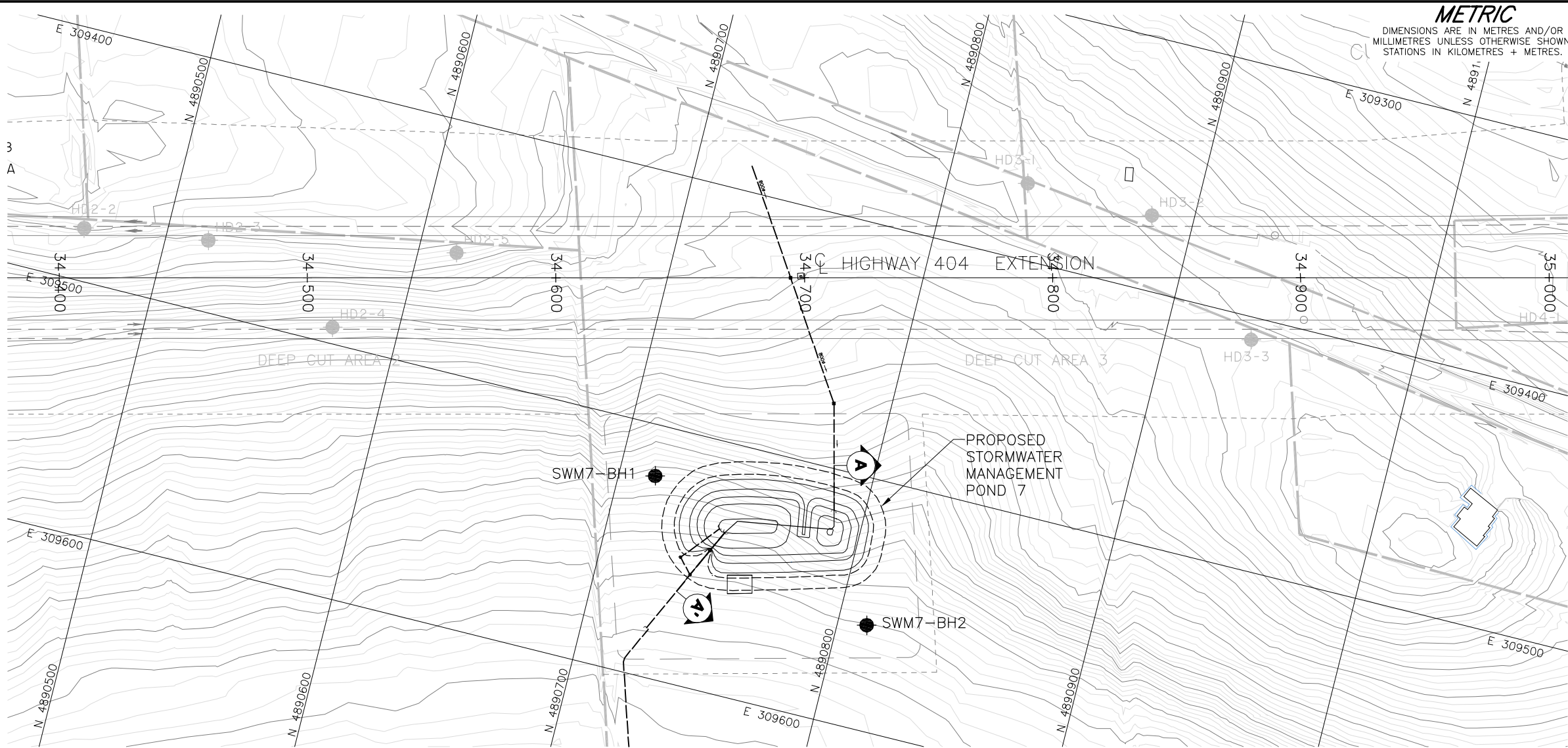
Project No. 08-1111-0022E

Checked By: KJB

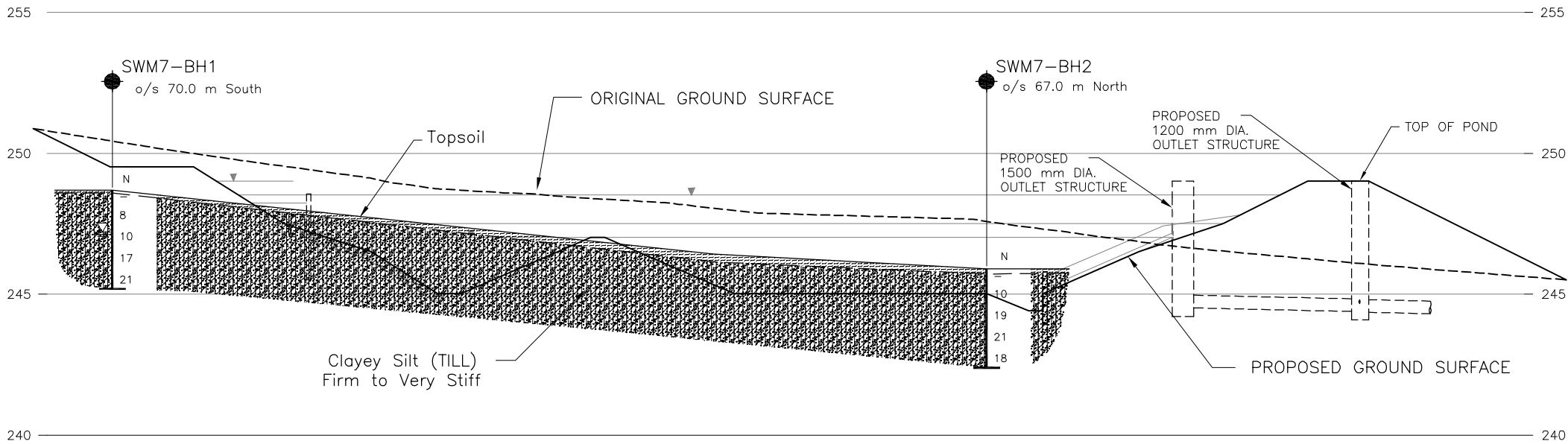


APPENDIX D2

Highway 404 - Stormwater Management Pond 7 Drawing, Record of Boreholes and Laboratory Test Results



PLAN
SCALE
20 0 20 40 m



CROSS-SECTION A-A'

HORIZONTAL SCALE
4 0 4 8 m
2 0 2 4 m
VERTICAL SCALE

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

CONT No.
WP No. 2005-07-00

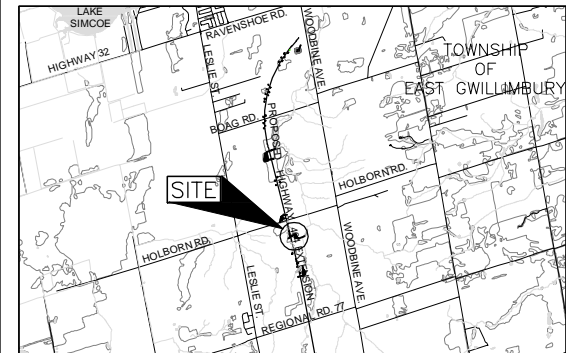


HIGHWAY 404 EXTENSION
STORMWATER MANAGEMENT POND 7
BOREHOLE LOCATION AND SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

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

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
SWM7-BH1	248.8	4890714.5	309520.4
SWM7-BH2	246.0	4890811.6	309558.0

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 provided in digital format by AECOM, drawing files "76808.dwg" and "76809.dwg", received, November, 16, 2009 and drawing file "2538-199-00_00-ST-1001-To Golder-091126.dwg", received November 26, 2009.

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC	CHKD. KJB	APPD. JMAC	DWG. D2

PROJECT <u>08-1111-0022</u>		RECORD OF BOREHOLE No SWM7-BH1		1 OF 1 METRIC	
G.W.P. <u>2005-07-00</u>		LOCATION <u>N 4890714.5 ; E 309520.4</u>		ORIGINATED BY <u>NS</u>	
DIST <u> </u> HWY <u>404</u>		BOREHOLE TYPE <u>108 mm Dia. Solid Stem Augers</u>		COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>March 23, 2009</u>		CHECKED BY <u>XW/KJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL
								20	40	60	80	100	W _p	W	W _L					
248.8	GROUND SURFACE																			
0.0	TOPSOIL																			
0.1	CLAYEY SILT with sand, trace gravel (TILL) Firm to very stiff Brown Moist		1	AS	-								○				1	21 52 26		
			2	SS	8															
			3	SS	10								○	—						
			4	SS	17															
			5	SS	21								○							
245.3	END OF BOREHOLE																			
3.5	NOTES: 1. Water level in open borehole at a depth of 1.5 m below ground surface (Elev. 247.3 m) upon completion of drilling.																			

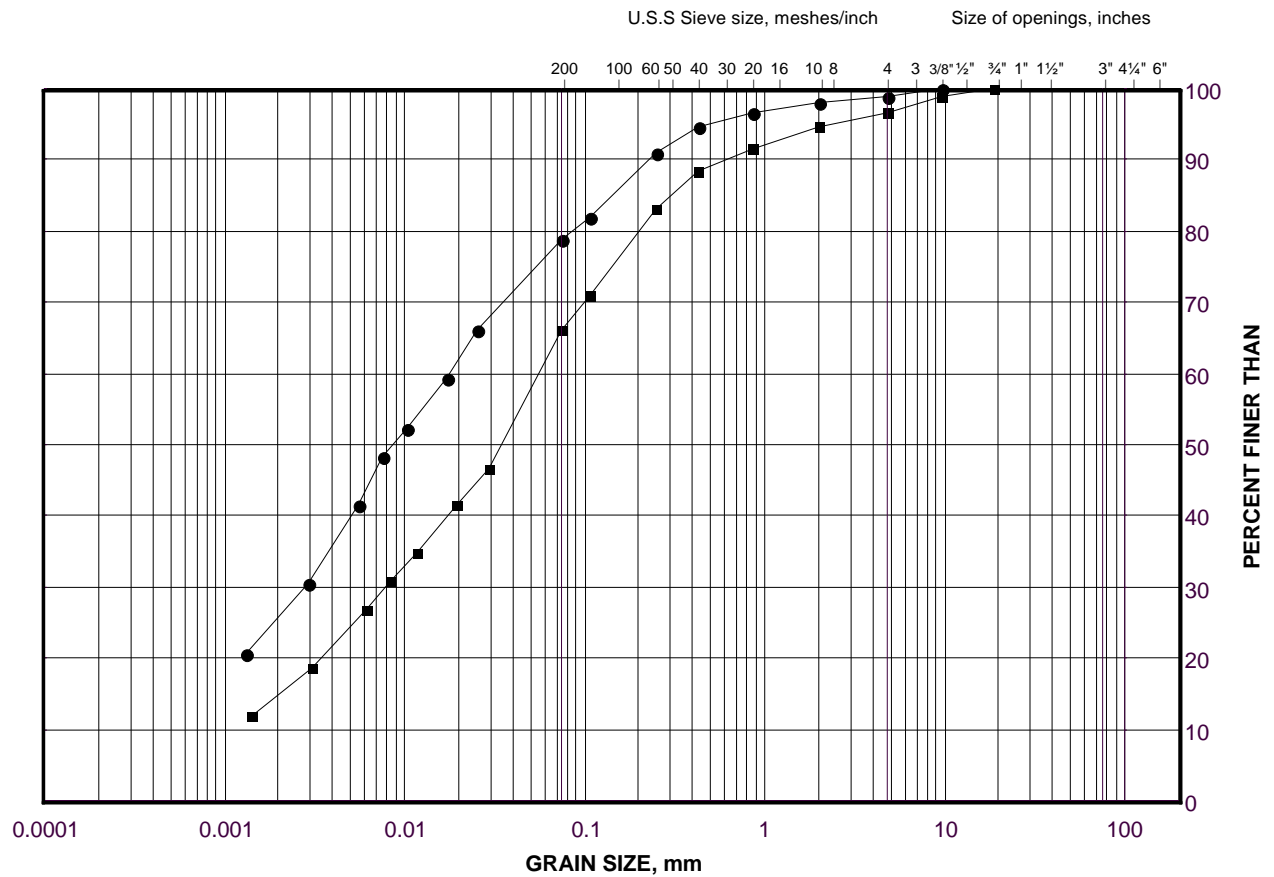
PROJECT <u>08-1111-0022</u>		RECORD OF BOREHOLE No SWM7-BH2		1 OF 1 METRIC	
G.W.P. <u>2005-07-00</u>		LOCATION <u>N 4890811.6 ;E 309558.0</u>		ORIGINATED BY <u>NS</u>	
DIST <u> </u> HWY <u>404</u>		BOREHOLE TYPE <u>108 mm Dia. Solid Stem Augers</u>		COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>March 23, 2009</u>		CHECKED BY <u>XW/KJB</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE LIQUID 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 (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED		w _p w w _L				
246.0	GROUND SURFACE						20	40	60	80	100			
0.0	TOPSOIL													
0.2	CLAYEY SILT with sand, trace gravel (TILL) Stiff to very stiff Brown Moist		1	AS	-									
			2	SS	10									
			3	SS	19									
			4	SS	21									
			5	SS	18									
242.5	END OF BOREHOLE													
3.5	NOTES: 1. Borehole open and dry upon completion of drilling.													

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D2-1



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

LEGEND

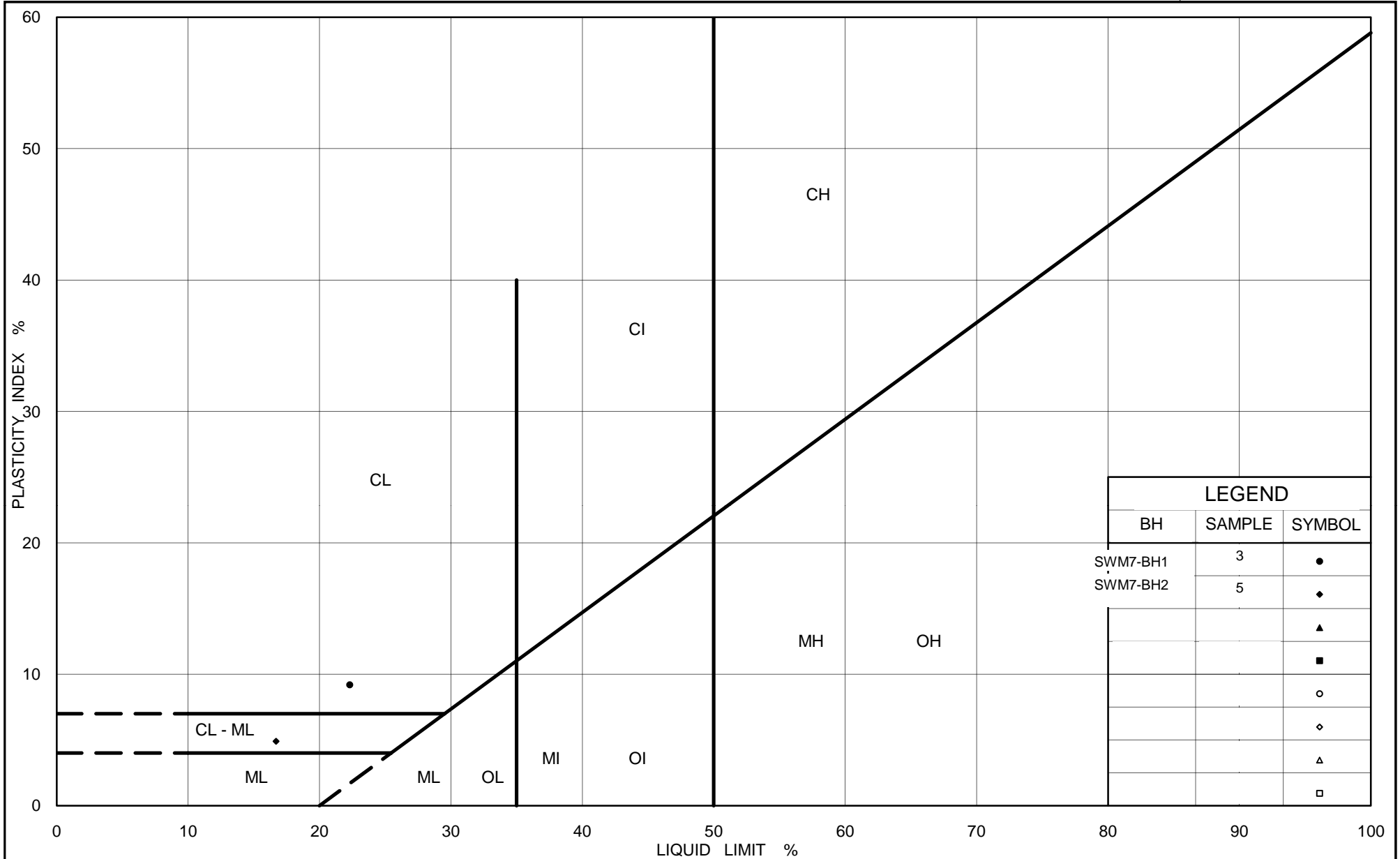
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	SWM7-BH1	1	248.4
■	SWM7-BH2	4	243.5

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 15-Mar-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Till

Figure No. D2-2

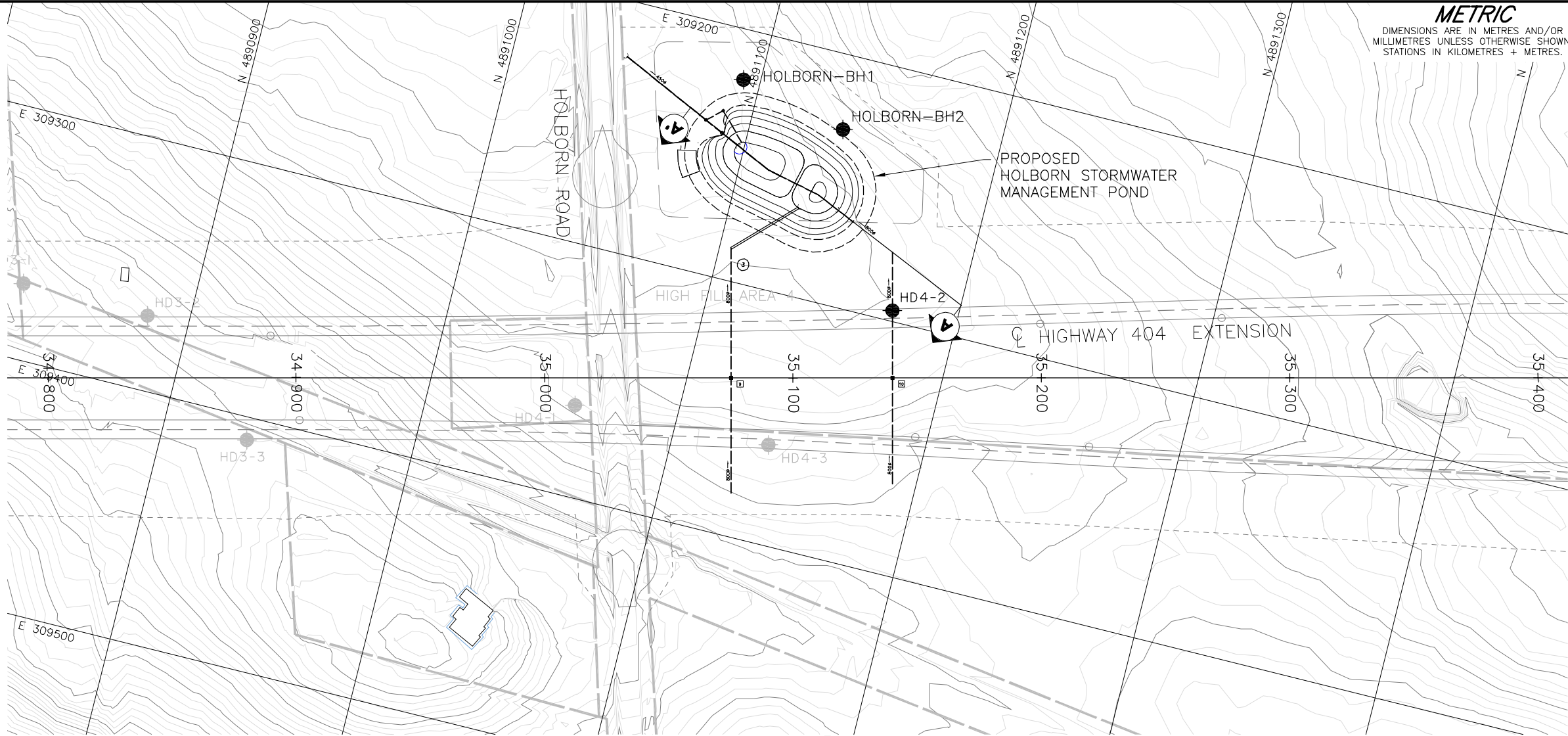
Project No. 08-1111-0022E

Checked By: KJB

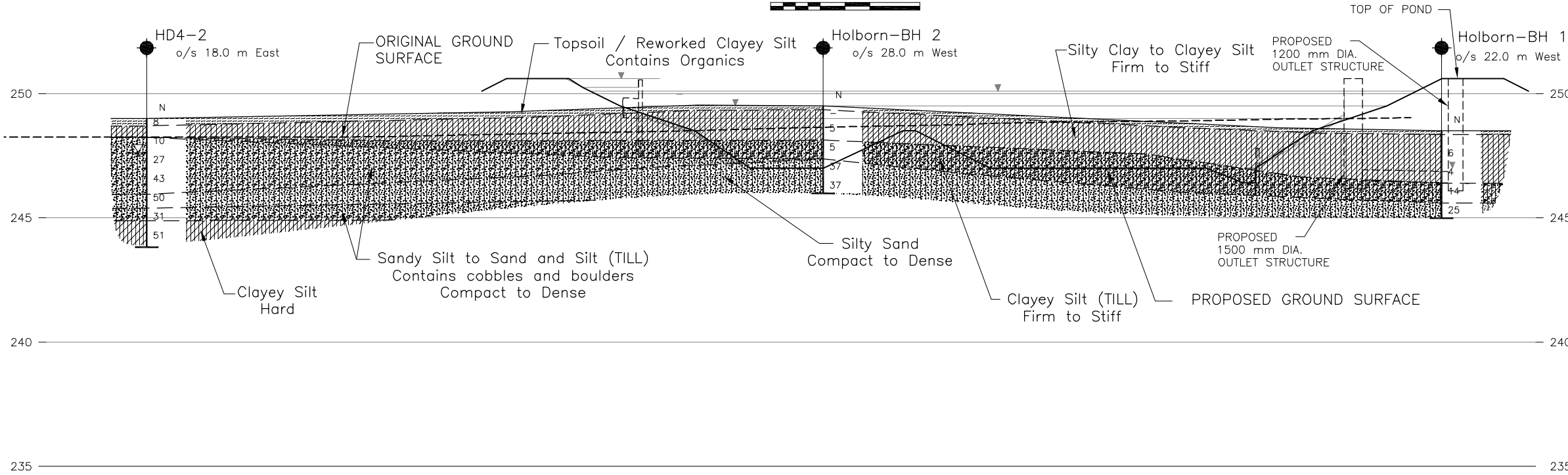


APPENDIX D3

Highway 404 - Holborn Stormwater Management Pond Drawing, Record of Boreholes and Laboratory Test Results



PLAN
SCALE
20 0 20 40 m



CROSS-SECTION A-A'
HORIZONTAL SCALE
4 0 4 8 m
VERTICAL SCALE
2 0 2 4 m

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

CONT No.
WP No. 2005-07-00



HIGHWAY 404 EXTENSION
HOLBORN STORMWATER MANAGEMENT POND
BOREHOLE LOCATION AND SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

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

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
HOLBORN-BH1	248.5	4891093.1	309220.0
HOLBORN-BH2	249.5	4891136.8	309229.7
HD4-2	249.0	4891173.8	309295.7

NOTES

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REFERENCE

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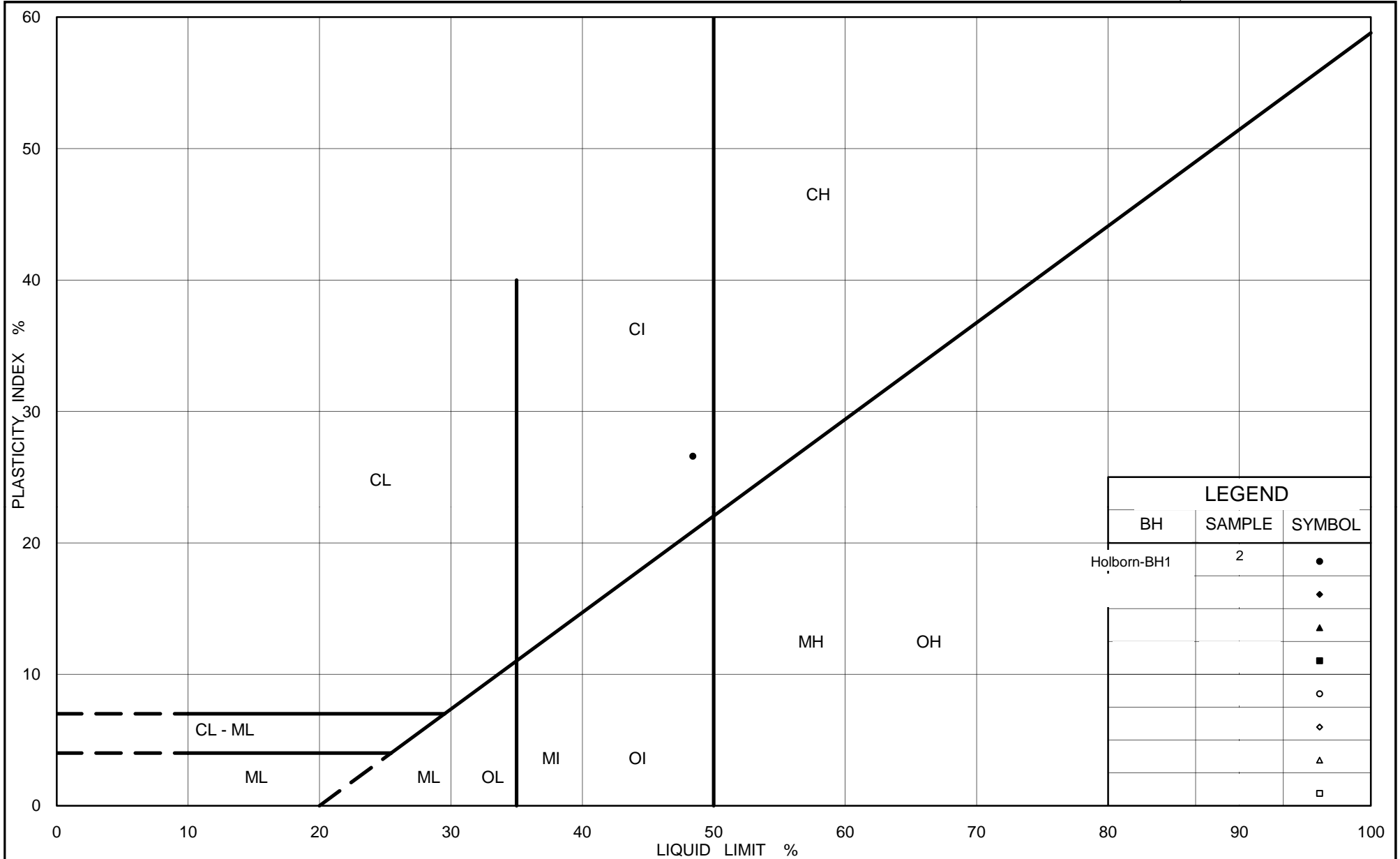
NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. D3

PROJECT		RECORD OF BOREHOLE				No Holborn - BH1		1 OF 1		METRIC							
G.W.P. 08-1111-0022		LOCATION		N 4891093.1 ; E 309220.0		ORIGINATED BY		NS									
DIST		HWY 404		BOREHOLE TYPE		108 mm Dia. Solid Stem Augers		COMPILED BY		SC							
DATUM Geodetic		DATE		June 5, 2009		CHECKED BY		XW/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									
248.5	GROUND SURFACE																
0.0	TOPSOIL																
0.2	SILTY CLAY, some sand, trace gravel, containing organics to 1.4 m and oxidation staining Firm Brown Moist		1	SS	6												
			2	SS	4												
246.4																	
2.1	CLAYEY SILT with sand, trace gravel (TILL) Stiff Brown Moist		3	SS	14												
245.6																	
2.9	Silty SAND, trace clay, trace gravel Compact Brown Moist		4	SS	25												
245.0																	
3.5	END OF BOREHOLE																
NOTES:																	
1. Borehole open and dry upon completion of drilling.																	

PROJECT <u>08-1111-0022</u>		RECORD OF BOREHOLE No Holborn - BH2				1 OF 1 METRIC	
G.W.P. <u>2005-07-00</u>		LOCATION <u>N 4891136.8 ;E 309229.7</u>				ORIGINATED BY <u>NS</u>	
DIST <u> </u> HWY <u>404</u>		BOREHOLE TYPE <u>108 mm Dia. Solid Stem Augers</u>				COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>June 5, 2009</u>				CHECKED BY <u>XW/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									
249.5	GROUND SURFACE																
0.0	TOPSOIL																
0.2	SILTY CLAY, some sand, trace gravel, containing clay interlayers and oxidation staining Firm Brown Wet to moist		1	AS	-												
248.1			2	SS	5												
1.4	CLAYEY SILT, some sand, trace gravel (TILL) Firm Brown Moist		3	SS	5												
247.4																	
2.1	Silty SAND, trace clay, trace gravel Dense Brown Moist		4	SS	37												
246.0			5	SS	37												
3.5	END OF BOREHOLE																
	NOTES: 1. Borehole open and dry upon completion of drilling.																

PROJECT _____		RECORD OF BOREHOLE No HD4-2				1 OF 1 METRIC								
2005-07-00		LOCATION N 4891173.8 ; E 309295.7				ORIGINATED BY TB								
DIST _____ HWY 404		BOREHOLE TYPE 108 mm O.D. Solid Stem Auger				COMPILED BY SC								
DATUM Geodetic		DATE June 8, 2009				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						
249.0	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	TOPSOIL to CLAYEY SILT, some sand, trace gravel, containing organics and rootlets (Reworked)		1A	SS	8									
0.3	Stiff		1B											
248.2	Dark brown Moist		2	SS	10									
0.8	CLAYEY SILT, trace to some sand, trace gravel													
	Stiff													
	Brown Moist		3	SS	27									
	Sandy SILT to SAND and SILT, trace clay, trace gravel, containing cobbles and boulders, containing clayey silt interlayers (TILL)													
	Compact to dense													
246.0	Brown Moist													
3.1	Silty SAND, trace clay		5	SS	50									
245.4	Dense													
3.6	Brown Moist													
244.9	SAND and SILT, trace clay, trace gravel, containing cobbles and boulders (TILL)		6A	SS	31									
4.1	Dense													
	Brown Moist		6B											
243.8	CLAYEY SILT, trace to some sand, containing oxidation staining		7	SS	51									
5.2	Hard													
	Brown Moist													
	END OF BOREHOLE													
NOTES: 1. Water level in open borehole at a depth of 5.2 m below ground surface (Elev. 243.8 m) upon completion of drilling. 2. Water level in open borehole at a depth of 1.4 m below ground surface (Elev. 247.6 m) on June 9, 2009.														



Ministry of Transportation

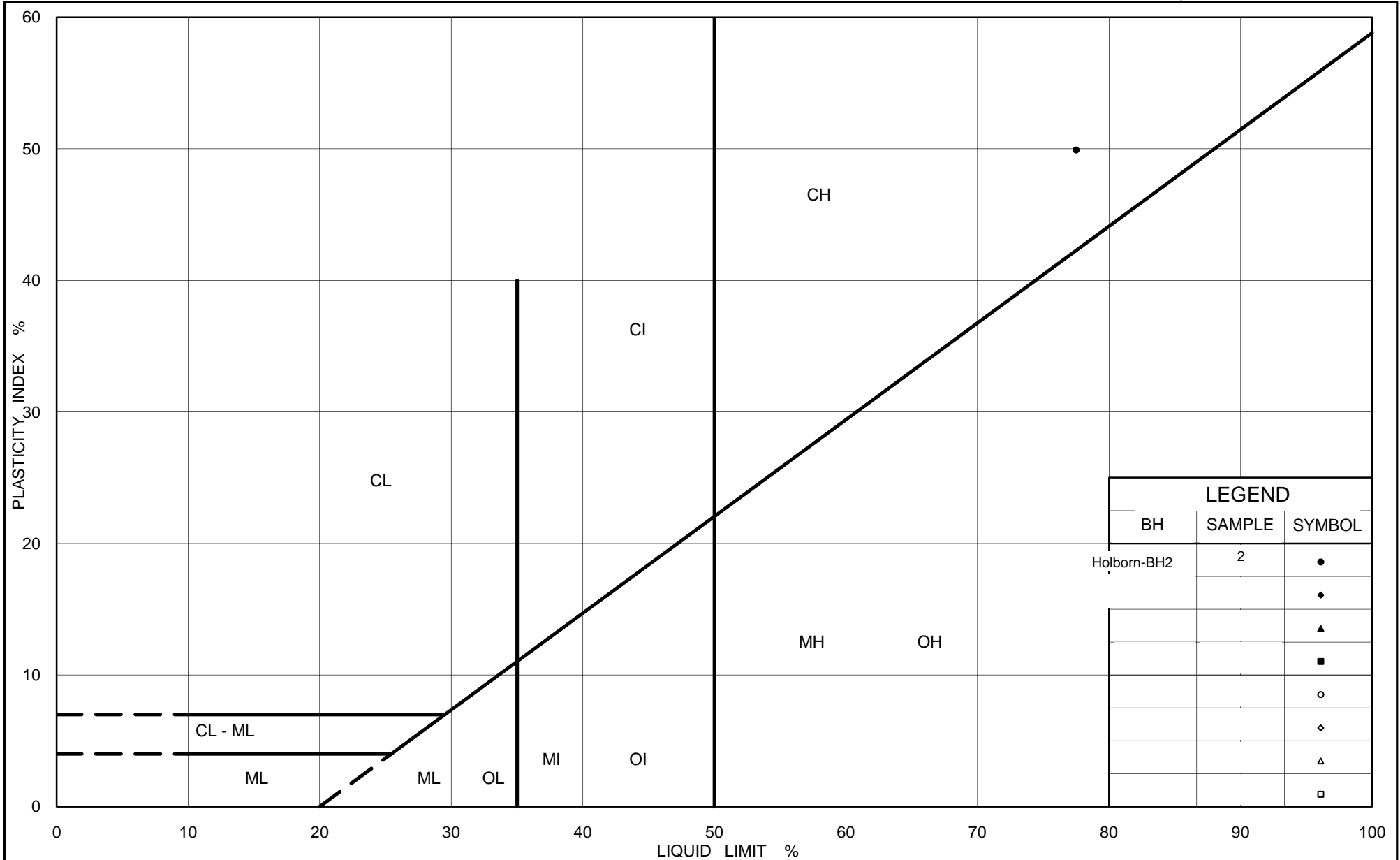
Ontario

PLASTICITY CHART Silty Clay

Figure No. D3-1

Project No. 08-1111-0022E

Checked By: KJB



Ministry of Transportation

PLASTICITY CHART

Silty Clay (Clay Interlayer)

Ontario

Figure No. D3-2

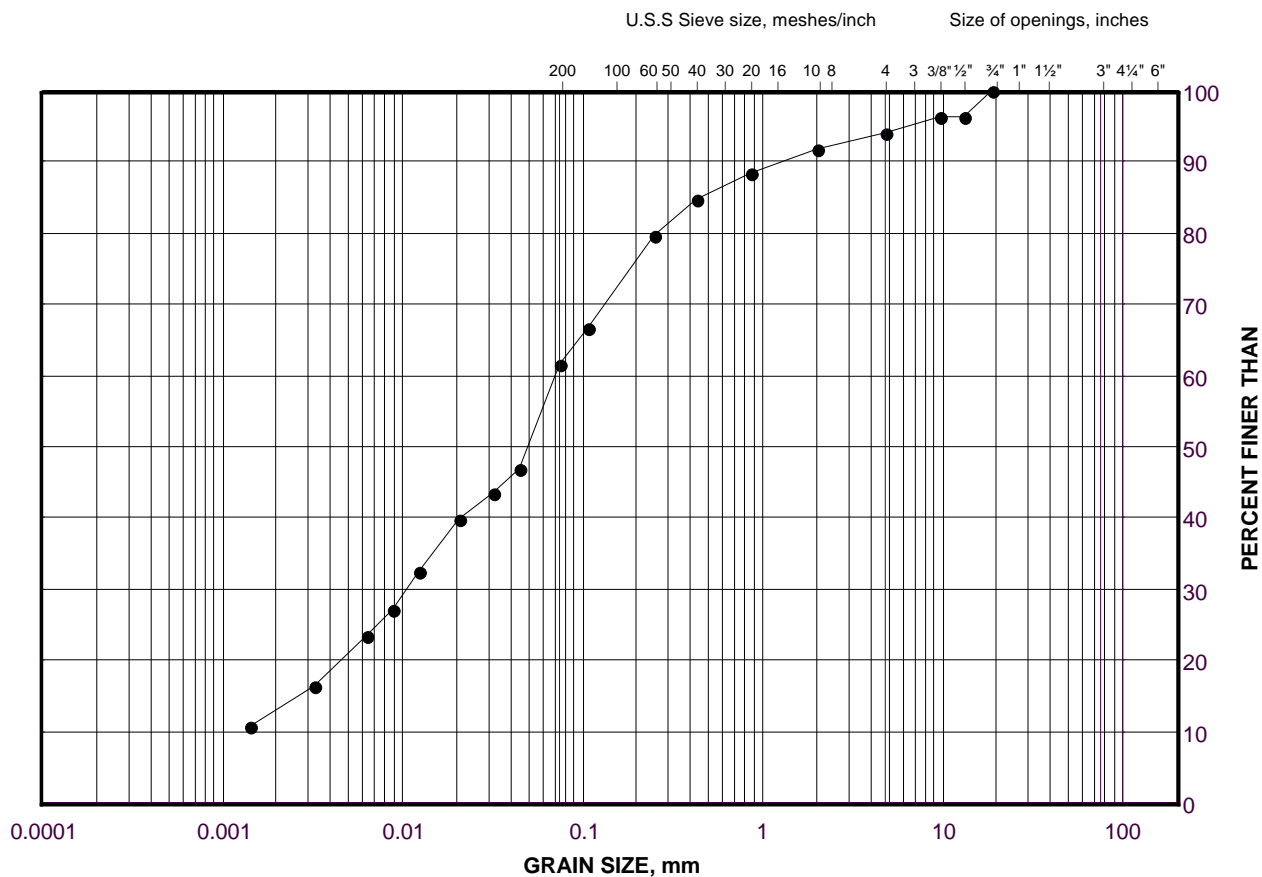
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D3-3



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	Holborn-BH1	3	246

Project Number: 08-1111-0022E

Checked By: KJB

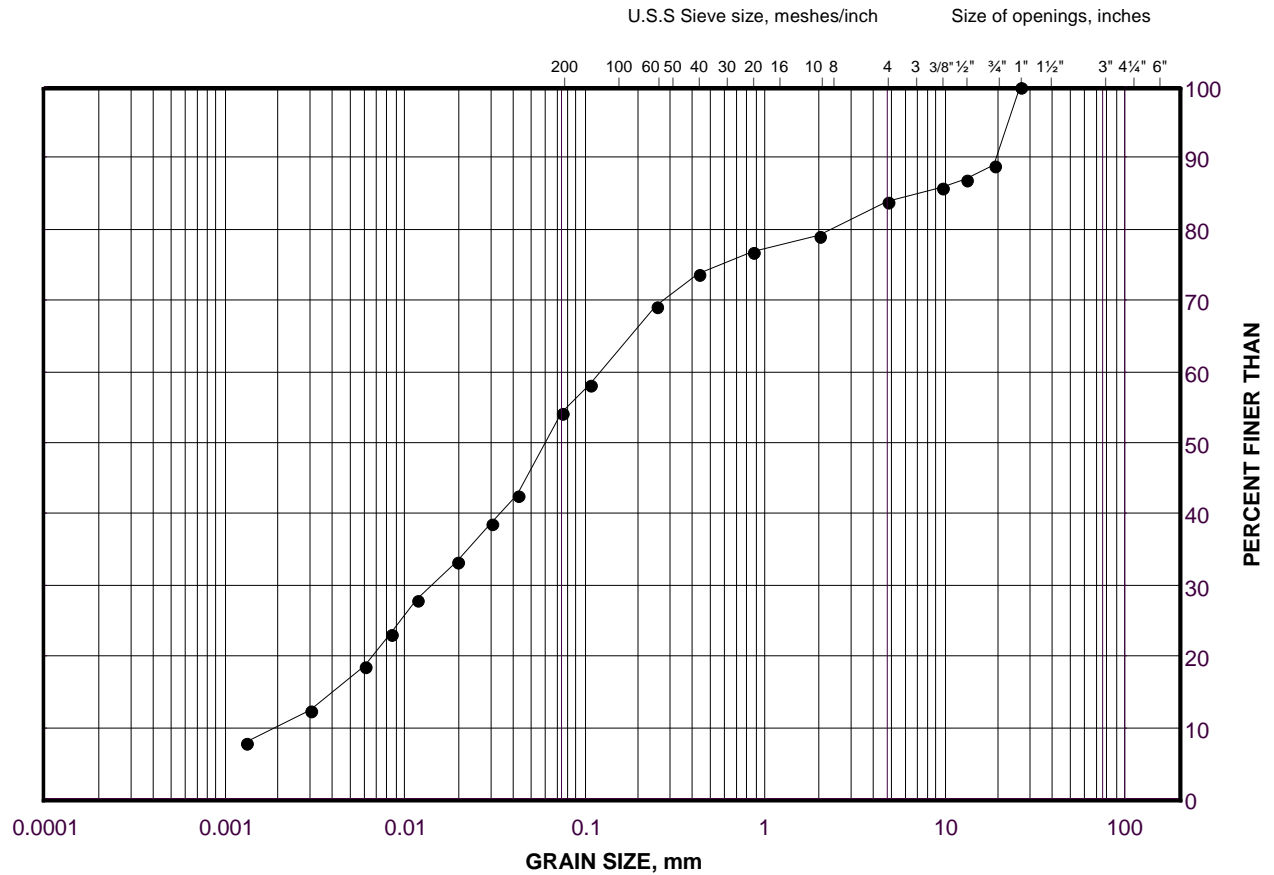
Golder Associates

Date: 17-Mar-10

GRAIN SIZE DISTRIBUTION

Sandy Silt Till

FIGURE D3-4



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

LEGEND

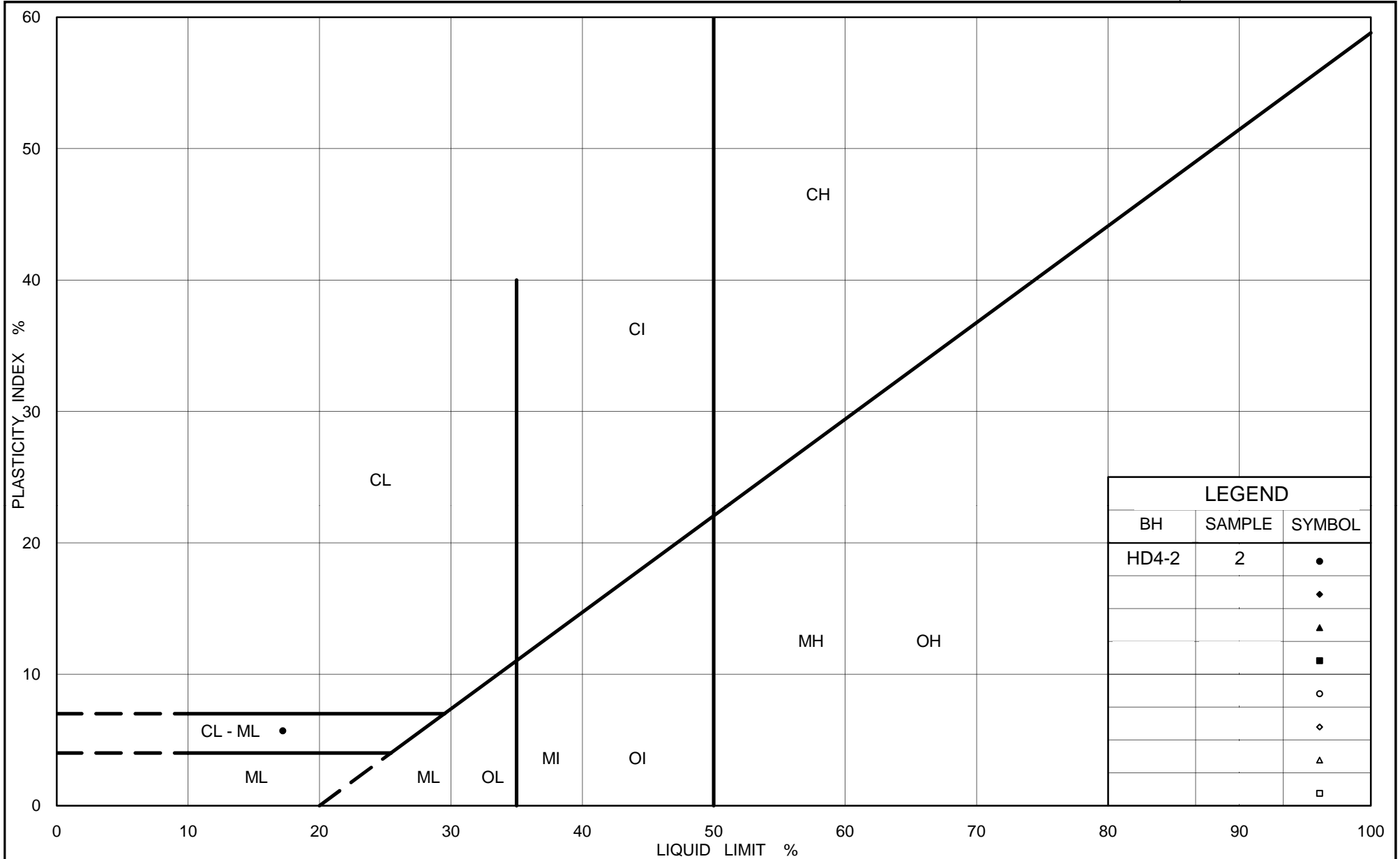
SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
•	HD4-2	2	247.9

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 17-Mar-10



Ministry of Transportation

Ontario

PLASTICITY CHART Sandy Silt Till (Clayey Silt Interlayer)

Figure No. D3-5

Project No. 08-1111-0022E

Checked By: KJB



APPENDIX D4

Highway 404 Stormwater Management Pond 8 Drawing, Record of Boreholes and Laboratory Test Results

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

CONT No.
WP No. 2005-07-00

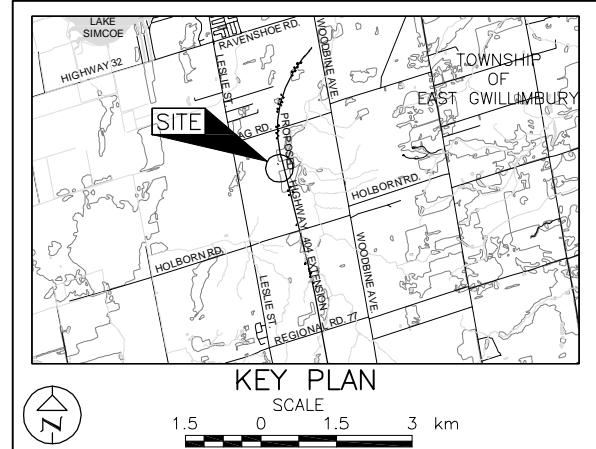



HIGHWAY 404 EXTENSION
STORMWATER MANAGEMENT POND 8
BOREHOLE LOCATION

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND				
 Borehole – Current Investigation				
No.	ELEVATION	CO-ORDINATES		
		NORTHING	EASTING	
SWM8-BH1	244.5	4892252.8	308869.5	
SWM8-BH2	243.6	4892383.7	308940.0	
SWM8-BH3	243.1	4892320.8	308942.0	
SWM8-BH4	238.7	4892485.0	309121.0	

NOTES

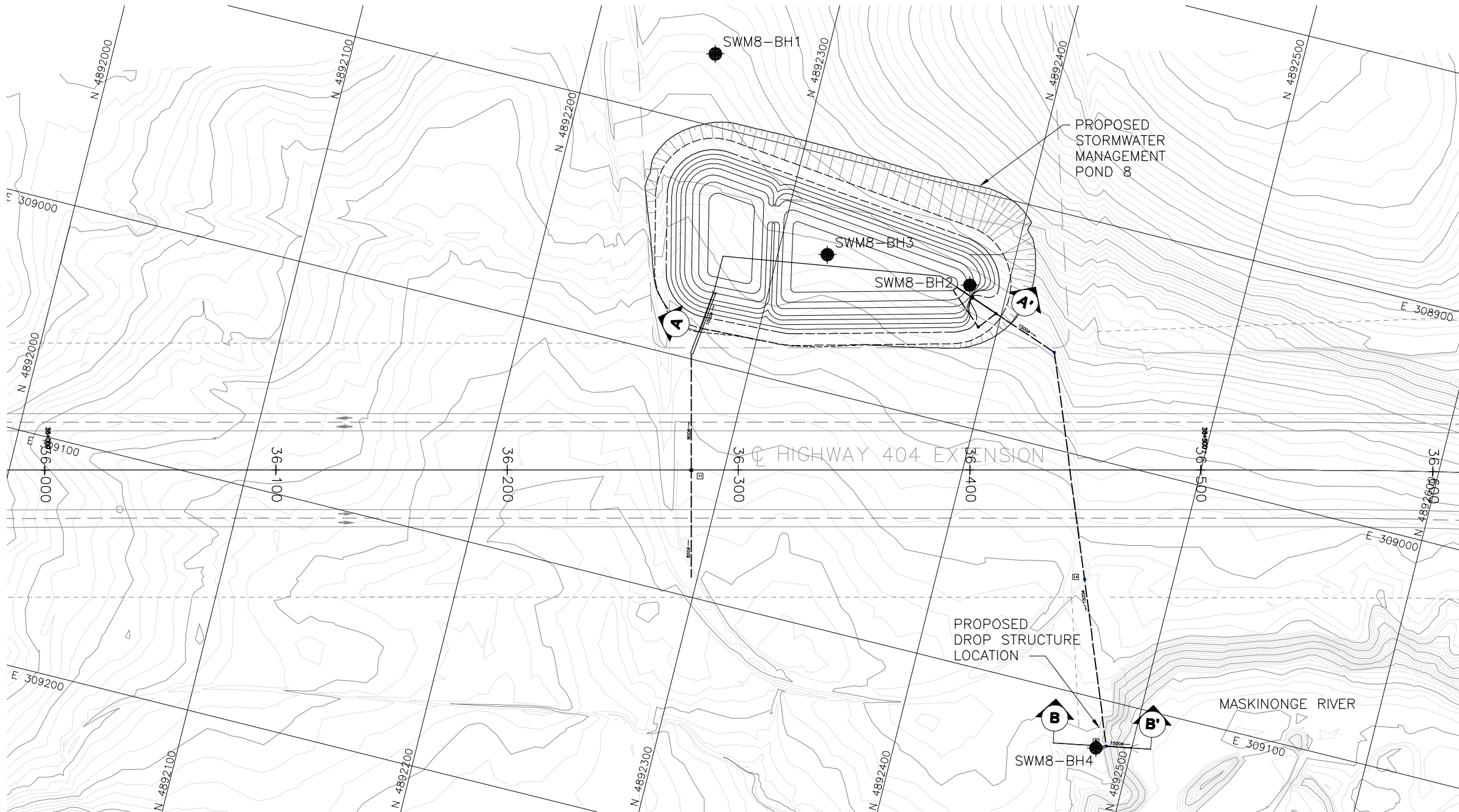
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NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. D4-1

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

CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STORMWATER MANAGEMENT POND 8
SOIL STRATA

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
SCALE
1.5 0 1.5 3 km

LEGEND

- Borehole - Current Investigation
- 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 11, 2010
- WL upon completion of drilling

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
SWM8-BH1	244.5	4892252.8	308869.5
SWM8-BH2	243.6	4892383.7	308940.0
SWM8-BH3	243.1	4892320.8	308942.0
SWM8-BH4	238.7	4892485.0	309121.0

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.

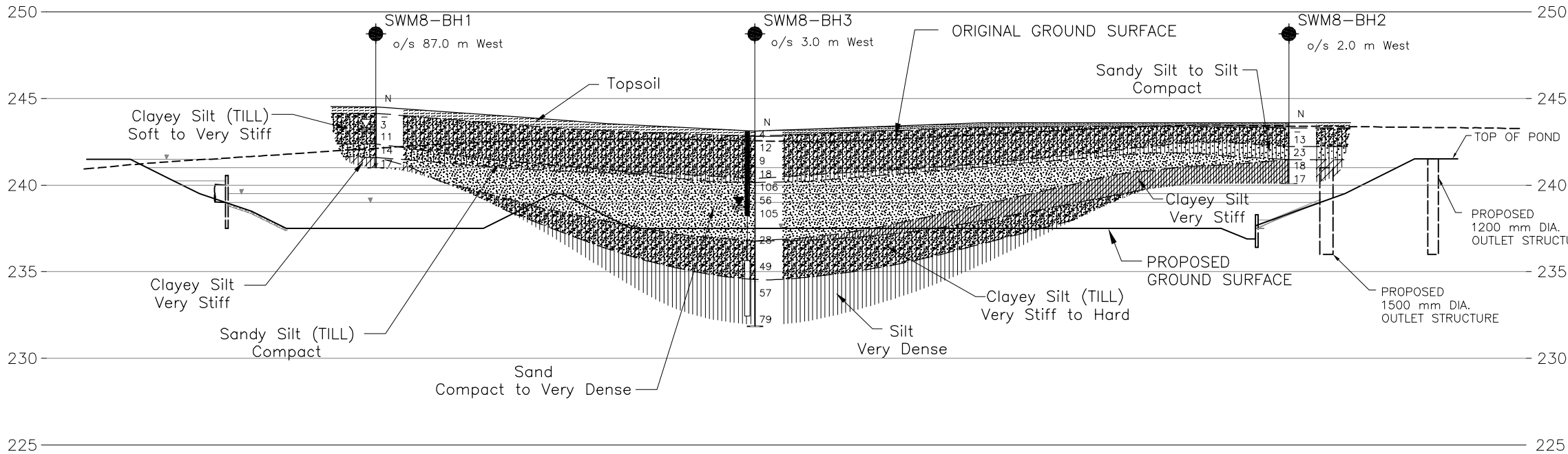
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REFERENCE

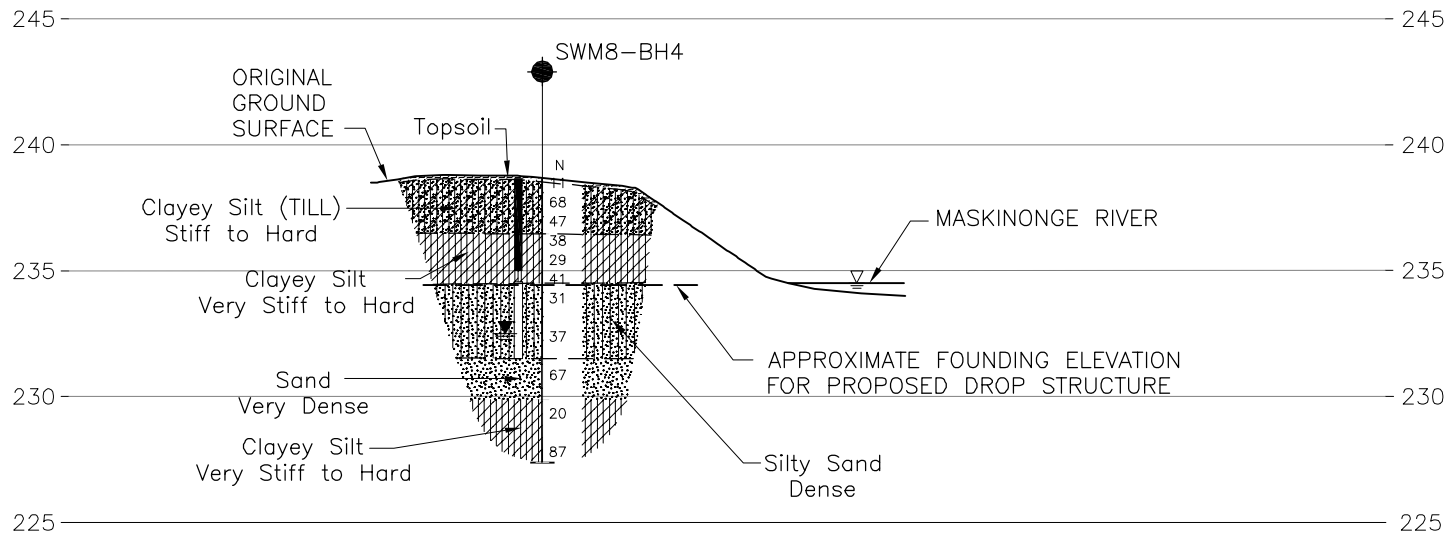
Base plans provided in digital format by AECOM, drawing files "76808.dwg" and "76809.dwg", received, November, 16, 2009 and drawing file "2538-199-00_00-ST-1001-To Golder-091126.dwg", received November 26, 2009.

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404	PROJECT NO. 08-1111-0022		DIST.
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. D4-2



CROSS-SECTION A-A'

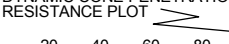
HORIZONTAL SCALE
6 0 6 12 m
3 0 3 6 m
VERTICAL SCALE



CROSS-SECTION B-B'

HORIZONTAL SCALE
6 0 6 12 m
3 0 3 6 m
VERTICAL SCALE

PROJECT		08-1111-0022		RECORD OF BOREHOLE No SWM8-BH1		1 OF 1 METRIC											
G.W.P.		2005-07-00		LOCATION		N 4892252.8 ; E 308869.5											
DIST		HWY 404		BOREHOLE TYPE		108 mm Dia. Solid Stem Augers											
DATUM		Geodetic		DATE		June 15, 2009											
						ORIGINATED BY NS											
						COMPILED BY SC											
						CHECKED BY XW/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									
244.5	GROUND SURFACE																
0.0	TOPSOIL																
244.1																	
0.4	CLAYEY SILT, trace sand, trace gravel (TILL) Soft to stiff Brown Moist to wet		1	AS	-		244										
			2	SS	3												
							243										
			3	SS	11												
242.4																	
2.1	Sandy SILT, trace clay, trace gravel (TILL) Compact Brown Wet		4	SS	14		242										
241.6																	
2.9	CLAYEY SILT, trace sand, containing silty clay interlayers Very stiff Brown Moist		5	SS	17		241										
241.0																	
3.5	END OF BOREHOLE																
NOTES: 1. Water level in open borehole at a depth of 1.2 m below ground surface (Elev. 243.3 m) upon completion of drilling.																	

PROJECT 08-1111-0022			RECORD OF BOREHOLE No SWM8-BH2			1 OF 1 METRIC						
G.W.P. 2005-07-00			LOCATION N 4892383.7 ; E 308940.0			ORIGINATED BY NS						
DIST HWY 404			BOREHOLE TYPE 108 mm Dia. Solid Stem Augers			COMPILED BY SC						
DATUM Geodetic			DATE June 15, 2009			CHECKED BY XW/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							
243.6	GROUND SURFACE											
0.0	TOPSOIL											
243.3												
0.3	CLAYEY SILT, trace sand, trace gravel, containing oxidation staining (TILL) Stiff Brown Moist		1	AS	-		243					
			2	SS	13							
242.2												
1.4	SILT, some clay, trace sand Compact Brown Moist		3	SS	23		242					
241.5												
2.1	CLAYEY SILT, trace sand, containing silty clay interlayers Very stiff Brown Moist		4	SS	18		241					
240.1			5	SS	17							
3.5	END OF BOREHOLE											
	NOTES: 1. Borehole open and dry upon completion of drilling.											

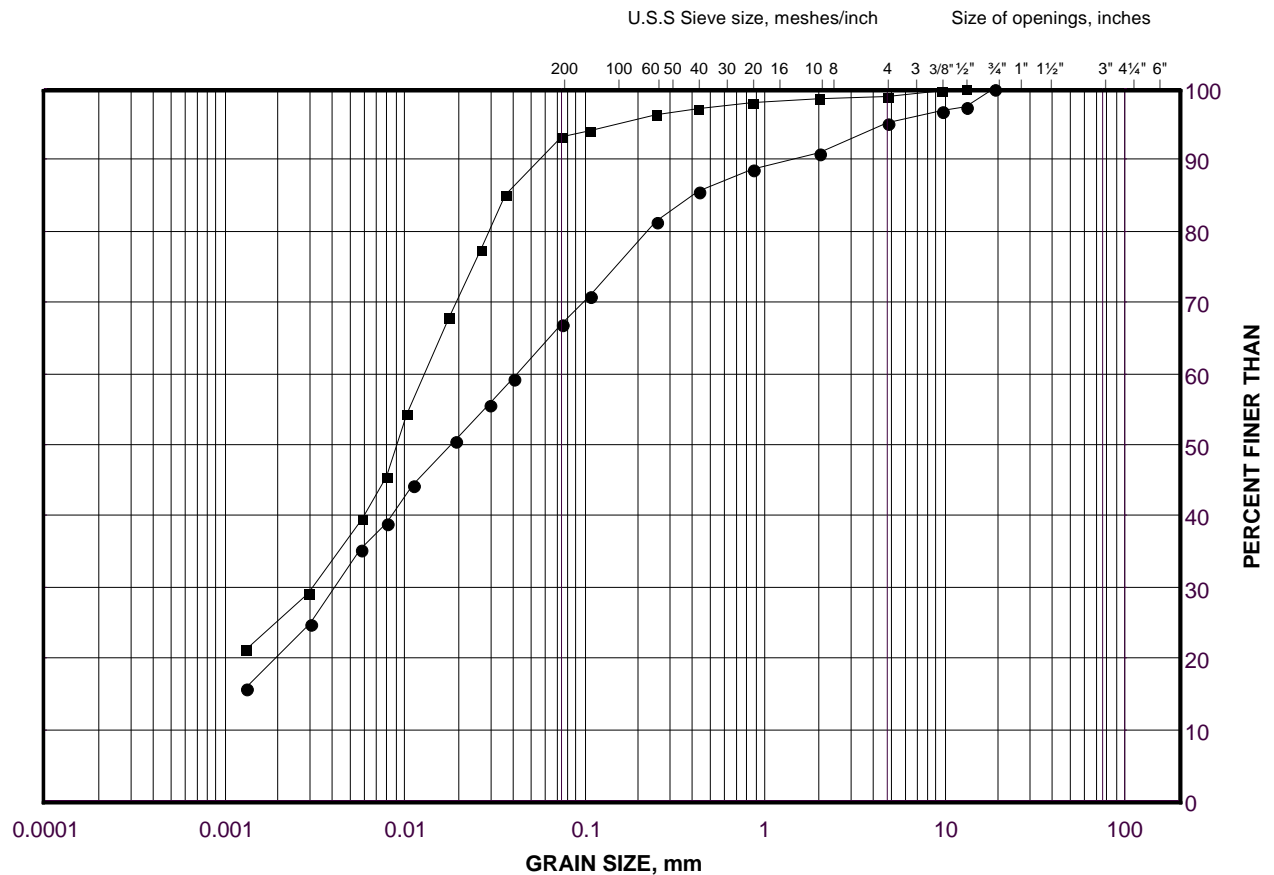
PROJECT		08-1111-0022		RECORD OF BOREHOLE No SWM8-BH3		1 OF 1 METRIC							
G.W.P.		2005-07-00		LOCATION		N 4892320.8 ; E 308942.0							
DIST		HWY 404		BOREHOLE TYPE		108 mm Dia. Solid Stem Augers							
DATUM		Geodetic		DATE		February 9, 2010							
						ORIGINATED BY TB							
						COMPILED BY SC							
						CHECKED BY KJB							
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)			
243.1	GROUND SURFACE												
0.0	TOPSOIL		1A	SS	4		243						
0.3	CLAYEY SILT with sand, trace gravel, containing oxidation staining and silty sand and silty clay interlayers (TILL) Firm to very stiff Brown Moist		1B	SS									
			2	SS	12		242						
			3	SS	9		241						
			4A	SS	18								
240.4	Sandy SILT, trace clay Compact Brown Moist		4B	SS			240						
3.0	SAND, trace to some silt, trace clay, trace gravel Compact to very dense Brown Moist		5	SS	106								
			6	SS	56		239						
			7	SS	105		238						
			8A	SS	28		237						
236.8	CLAYEY SILT, trace to some sand, trace gravel, containing silty sand interlayers (TILL) Very stiff to hard Grey Moist		8B	SS			236						
6.4			9	SS	49		235						
234.4	SILT, some clay, some sand, containing wet silty sand interlayers and silty clay seams Very dense Grey Moist		10	SS	57		234						
8.7			11	SS	79		233						
231.8	END OF BOREHOLE						232						
11.3	NOTES: 1. Piezometer dry immediately after installation. 2. Water level in piezometer at a depth of 4.3 m below ground surface (Elev. 238.8 m) on March 11, 2010.												

PROJECT 08-1111-0022			RECORD OF BOREHOLE No SWM8-BH4			1 OF 1 METRIC											
G.W.P. 2005-07-00			LOCATION N 4892485.0 ; E 309121.0			ORIGINATED BY TB											
DIST HWY 404			BOREHOLE TYPE 108 mm Dia. Solid Stem Augers			COMPILED BY SC											
DATUM Geodetic			DATE February 9, 2010			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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%) W _p — W — W _L			γ	GR SA SI CL
238.7	GROUND SURFACE							20 40 60 80 100									
0.0	TOPSOIL							20 40 60 80 100									
0.2	CLAYEY SILT with sand, trace to some gravel, containing cobbles and boulders (TILL) Stiff to hard Brown Moist		1A 1B	SS	11		238										
			2	SS	68												
			3	SS	47		237										8 27 48 17
236.5	CLAYEY SILT, trace to some sand, containing oxidation staining and silty clay interlayers Very stiff to hard Brown Moist		4	SS	38		236										
2.2			5	SS	29												
			6A 6B	SS	41		235										
234.5	Silty SAND, trace to some gravel, trace clay, containing oxidation staining Dense Brown Wet		7	SS	31		234										0 66 32 2
4.2			8	SS	37		233										
							232										19 51 29 1
231.5	SAND, trace to some silt, trace gravel Very dense Brown Wet		9	SS	67		231										
7.2							230										
229.9	CLAYEY SILT, some sand, trace gravel, containing silty sand and silty clay interlayers Very stiff to hard Grey Moist		10	SS	20		229										2 13 42 43
8.8							228										
			11	SS	87												
227.4	END OF BOREHOLE																
11.3	NOTES: 1. Water level in piezometer at a depth of 6.7 m below ground surface (Elev. 232.0 m) upon completion of drilling. 2. Water level in piezometer at a depth of 6.2 m below ground surface (Elev. 232.5 m) on March 11, 2010.																

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D4-1



LEGEND

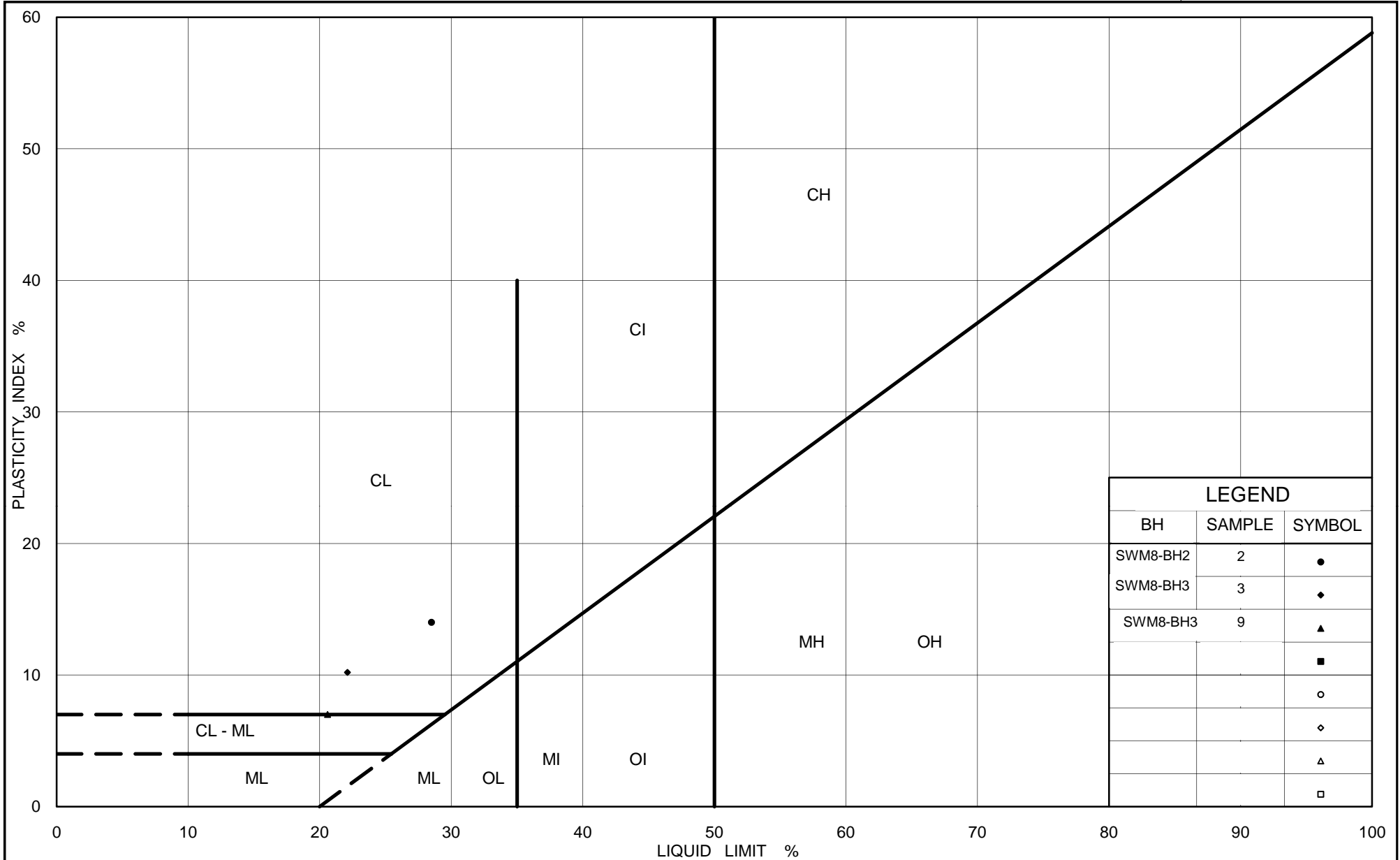
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	SWM8BH3	3	241.3
■	SWM8BH3	9	235.2

Project Number: 08-1111-0022 E

Checked By: KJB

Golder Associates

Date: 17-Mar-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Till

Figure No. D4-2

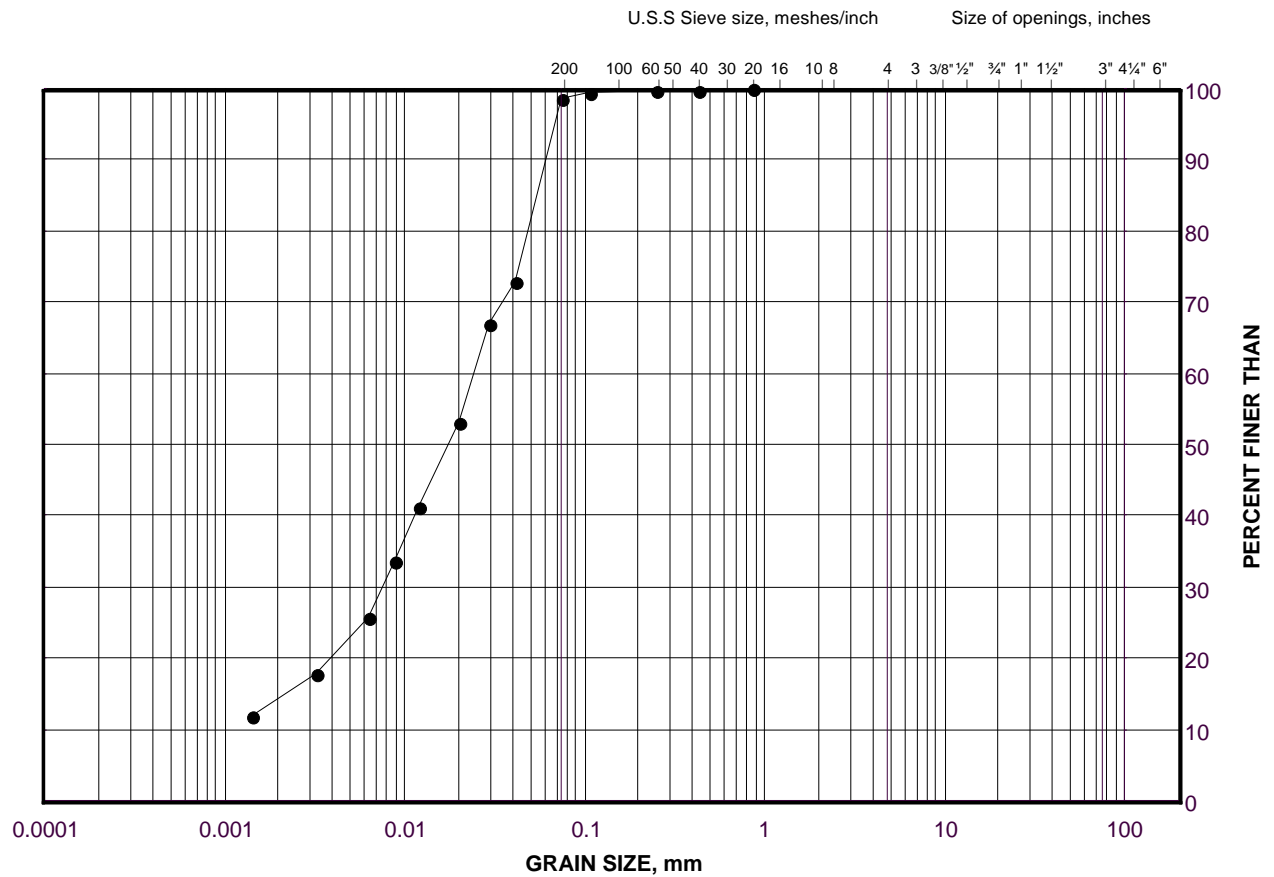
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silt

FIGURE D4-3



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM8-BH2	3	241.8

Project Number: 08-1111-0022E

Checked By: _____

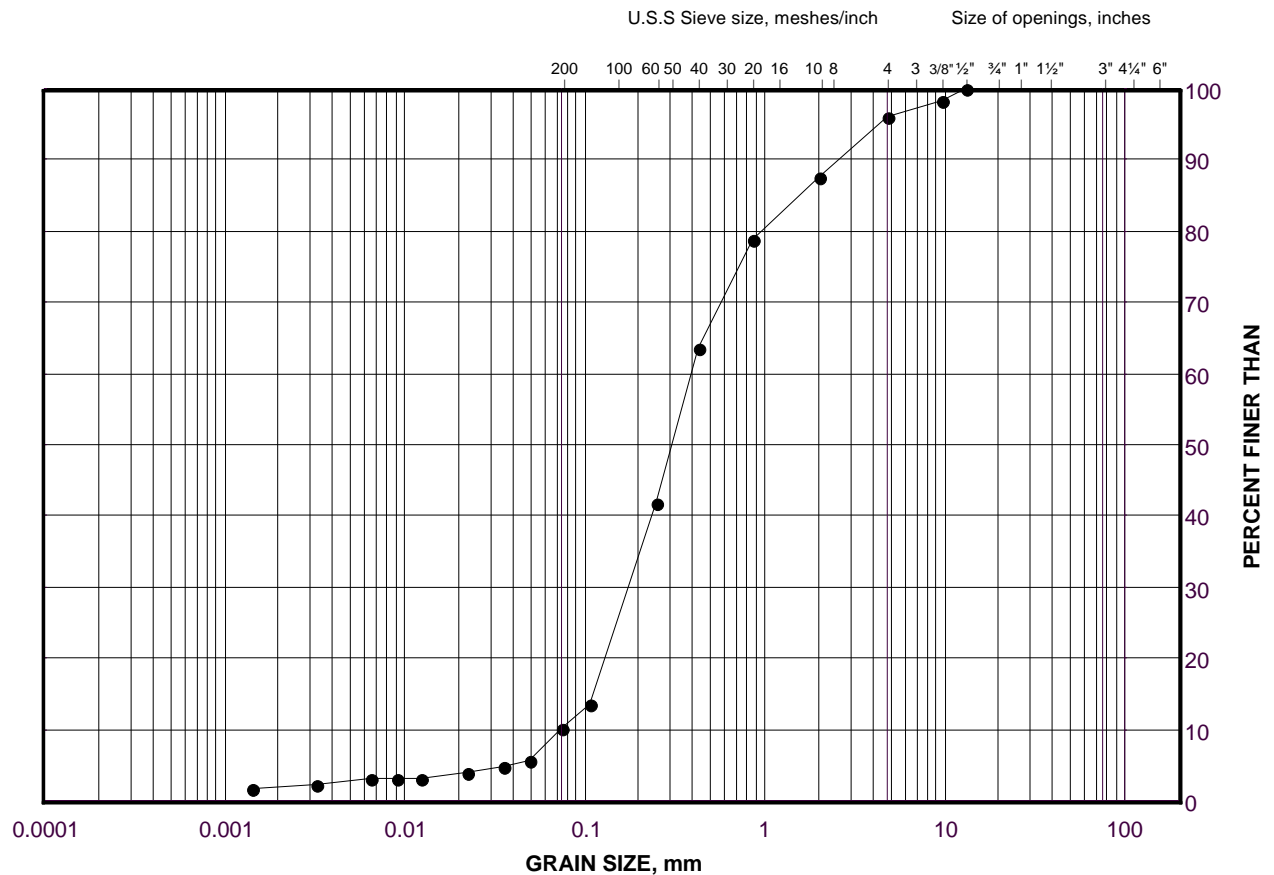
Golder Associates

Date: 23-Mar-10

GRAIN SIZE DISTRIBUTION

Sand

FIGURE D4-4



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM8-BH3	7	238.2

Project Number: 08-1111-0022

Checked By: KJB

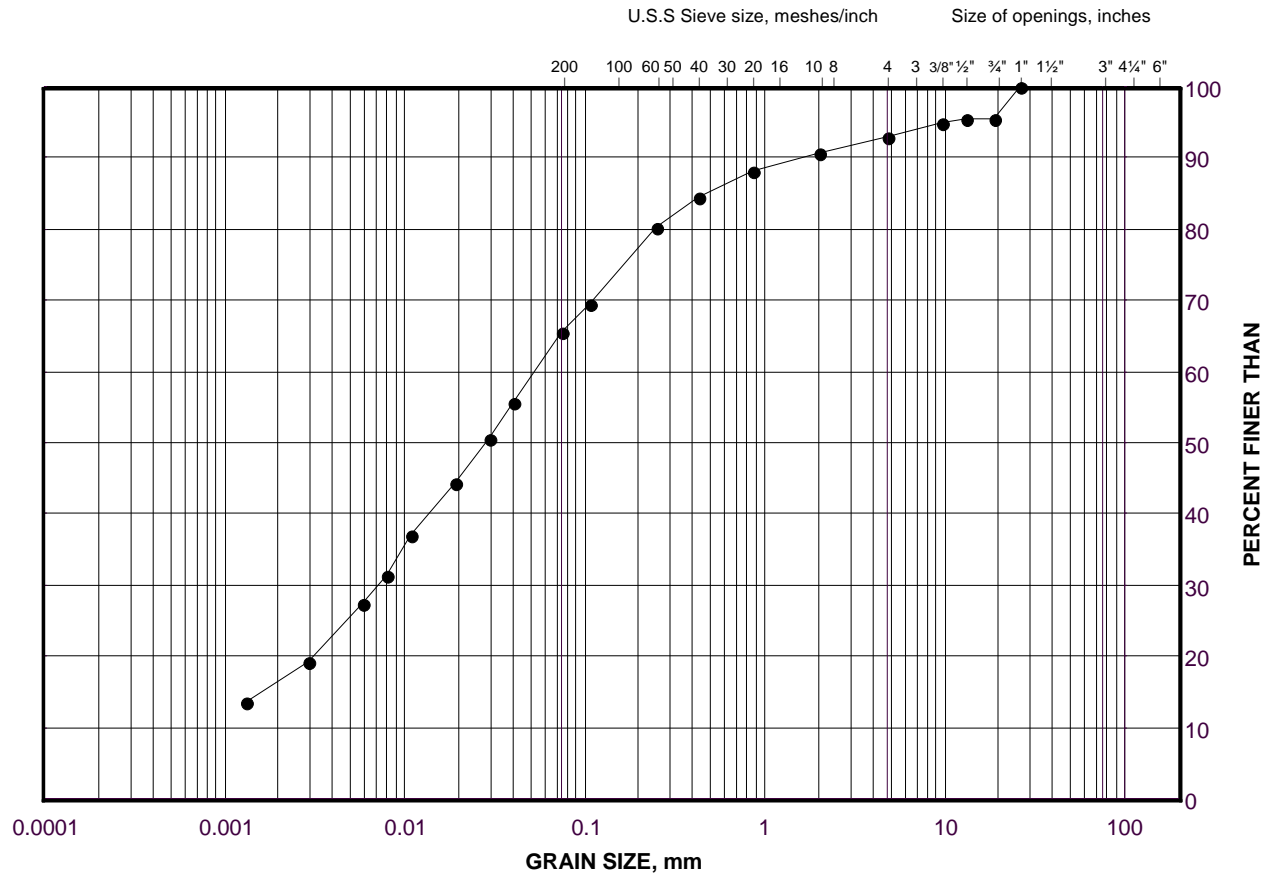
Golder Associates

Date: 17-Mar-10

GRAIN SIZE DISTRIBUTION

Clayey Silt Till

FIGURE D4-5



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

LEGEND

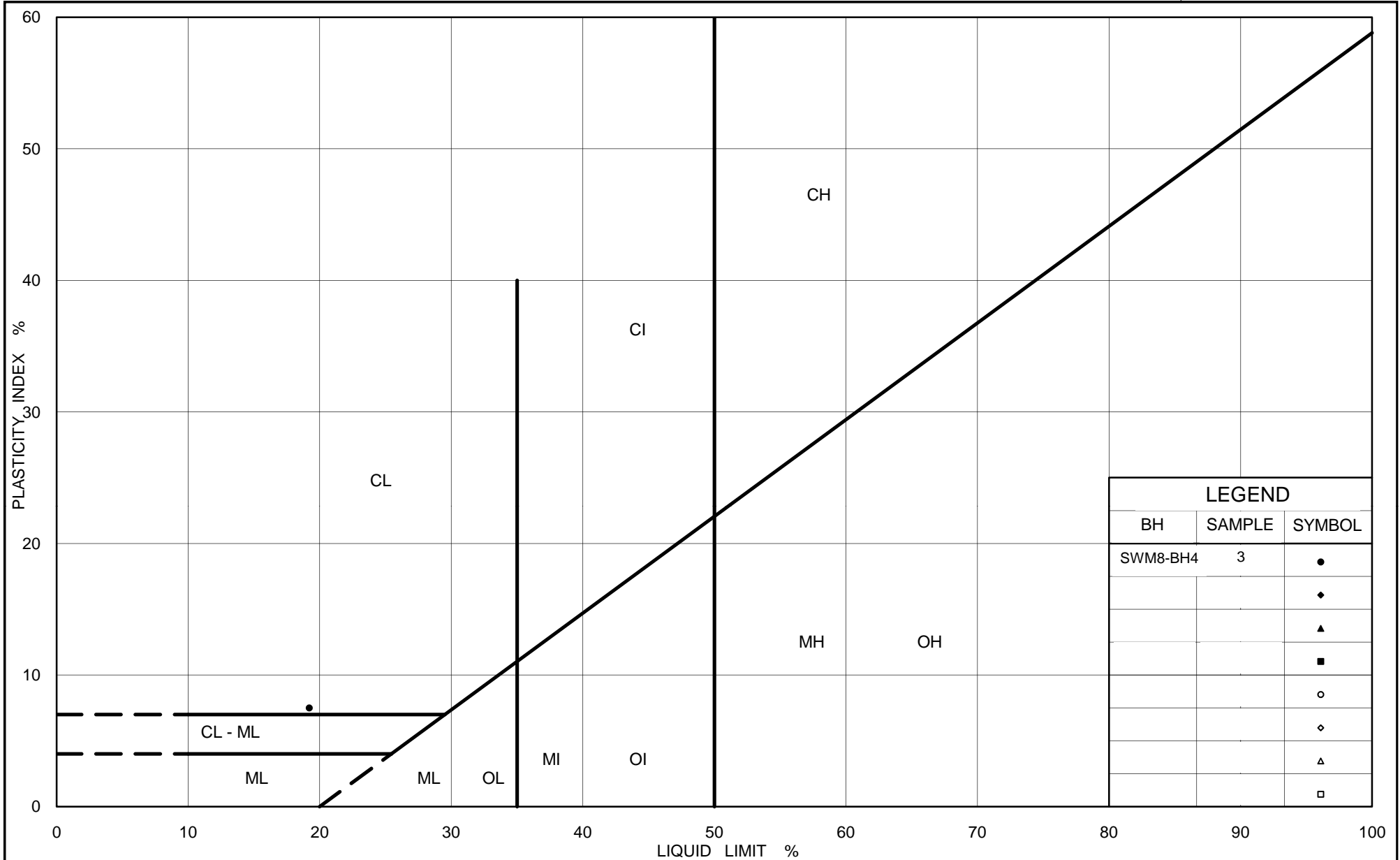
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM8-BH4	3	236.9

Project Number: 08-1111-0022 E

Checked By: KJB

Golder Associates

Date: 17-Mar-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt Till

Figure No. D4-6

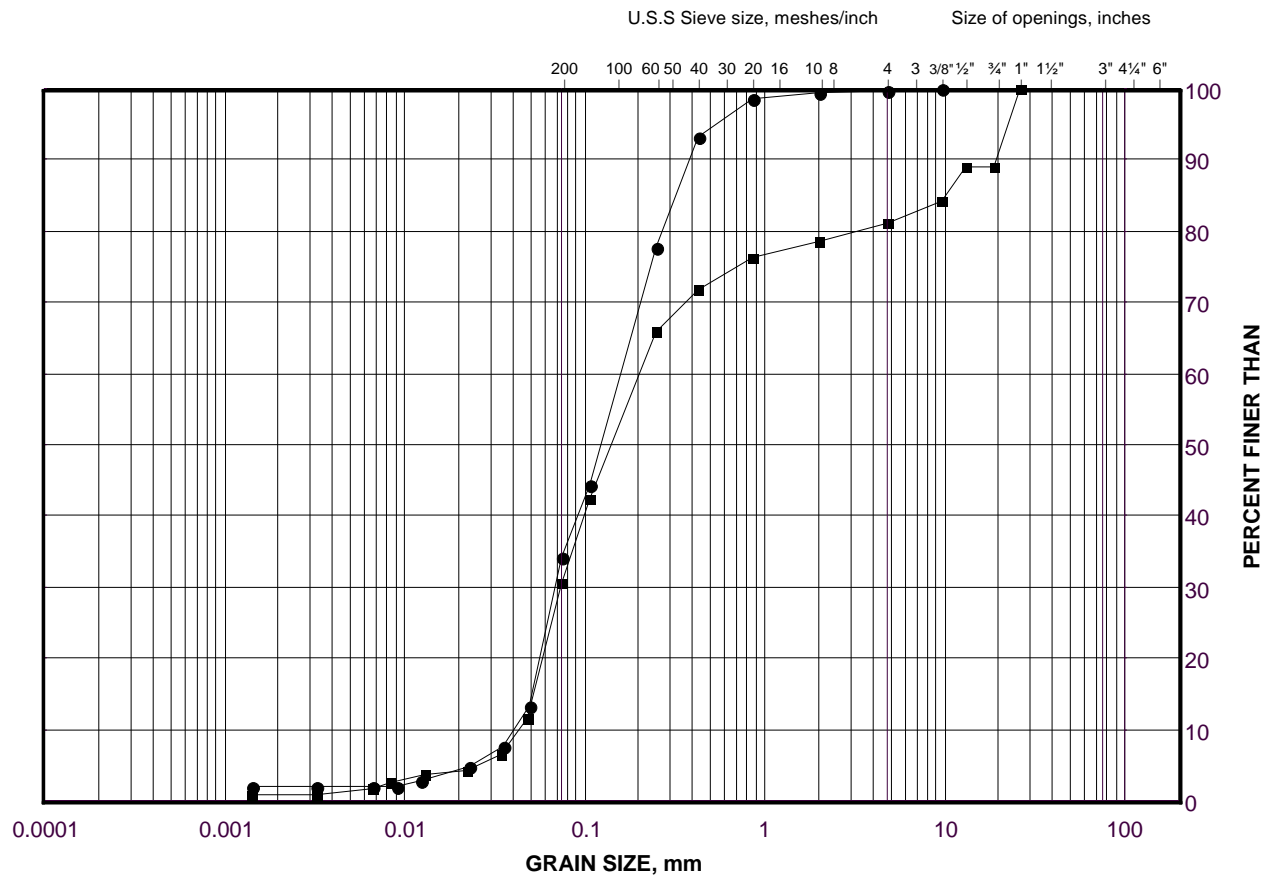
Project No. 08-1111-0022E

Checked By: KJB

GRAIN SIZE DISTRIBUTION

Silty Sand

FIGURE D4-7



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	SWM8BH4	6B	234.4
■	SWM8BH4	8	232.3

Project Number: 08-1111-0022 E

Checked By: KJB

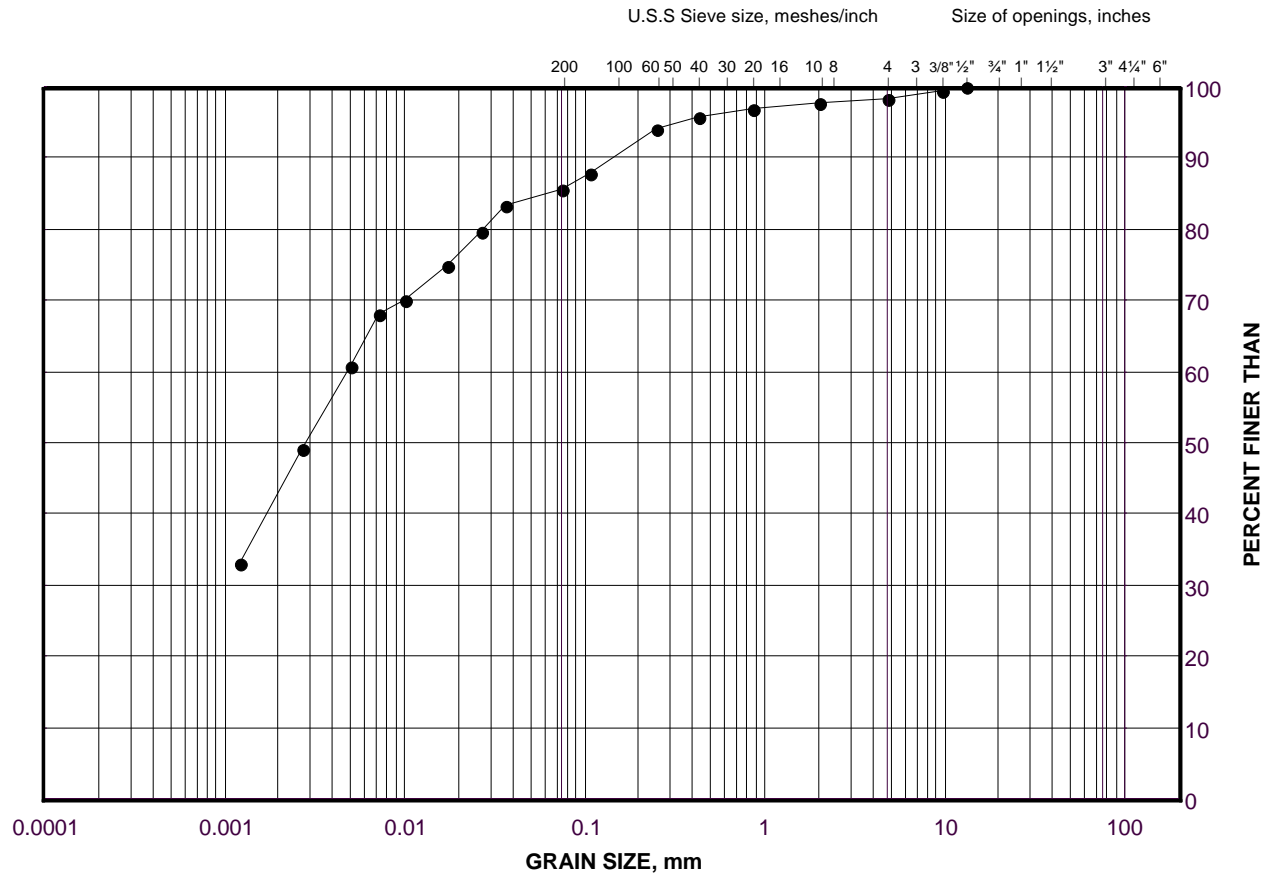
Golder Associates

Date: 17-Mar-10

GRAIN SIZE DISTRIBUTION

Clayey Silt (Lower Stratum)

FIGURE D4-8



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

LEGEND

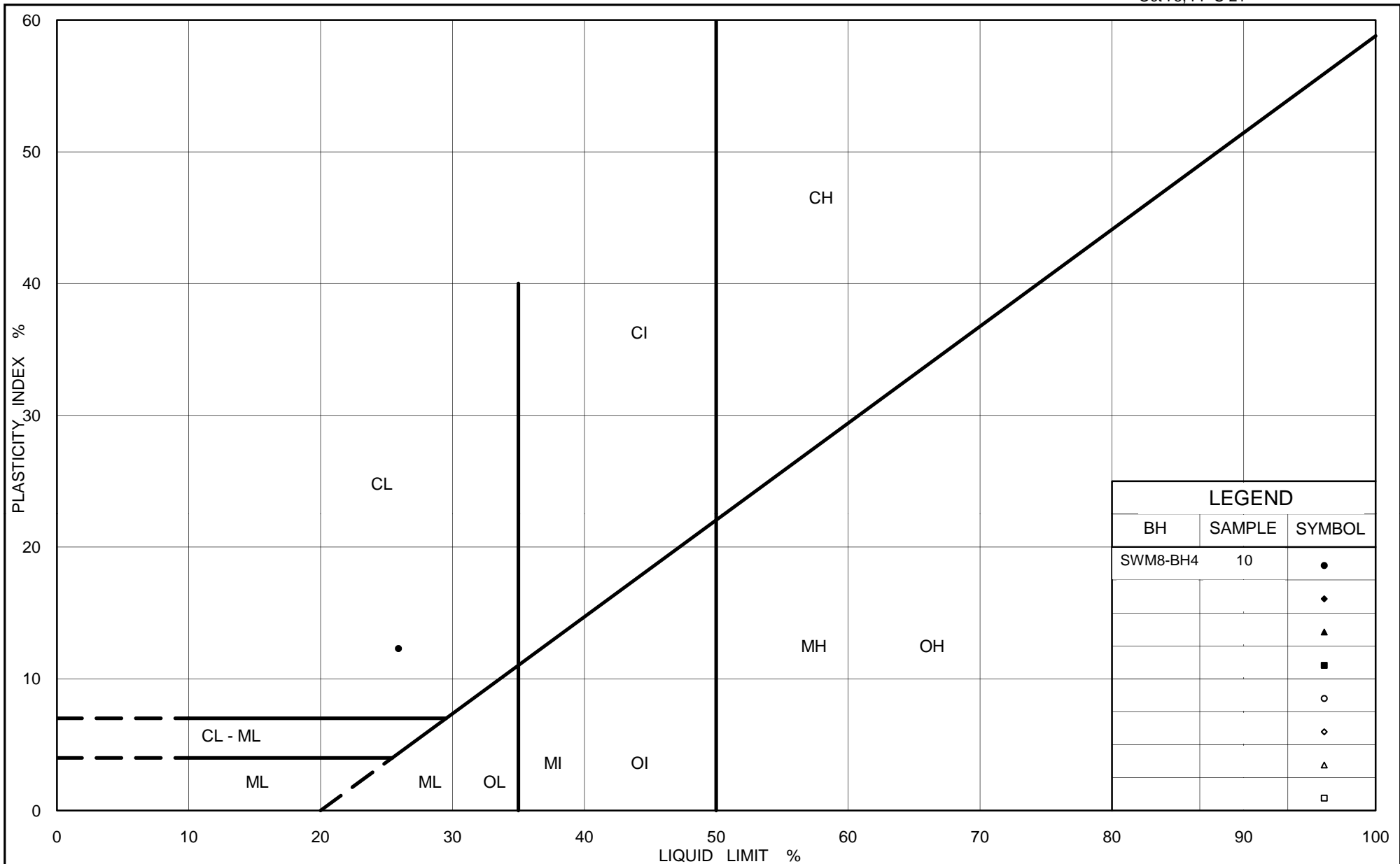
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM8-BH4	10	229.3

Project Number: 08-1111-0022 E

Checked By: KJB

Golder Associates

Date: 17-Mar-10



Ministry of Transportation

Ontario

PLASTICITY CHART

Clayey Silt (Lower Stratum)

Figure No. D4-9

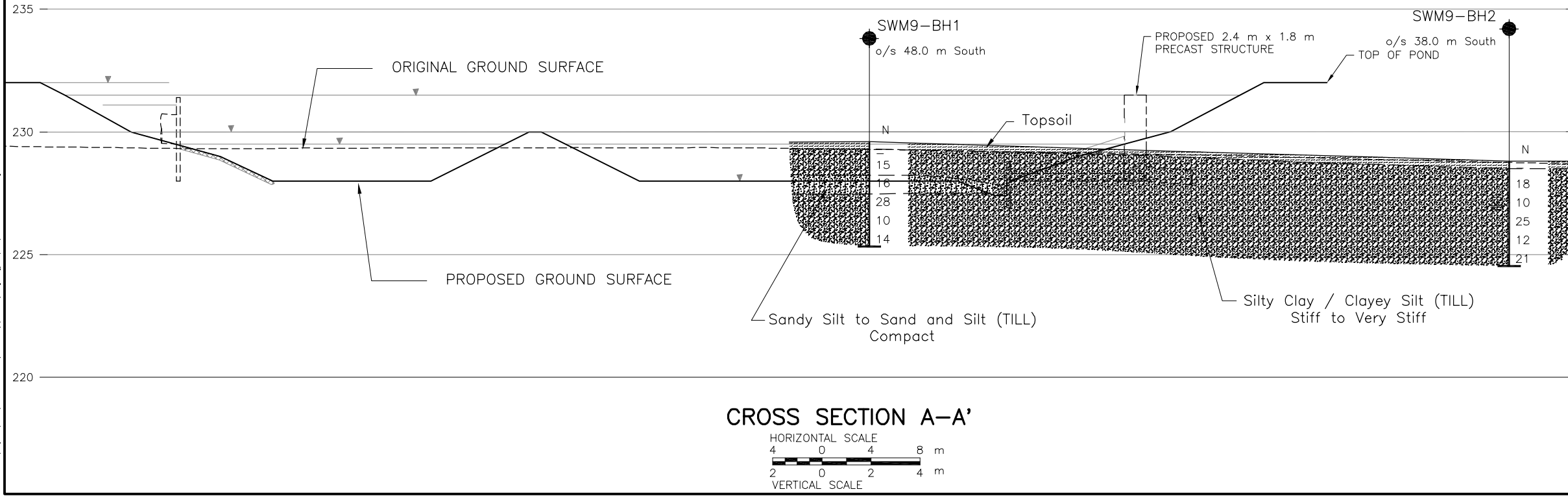
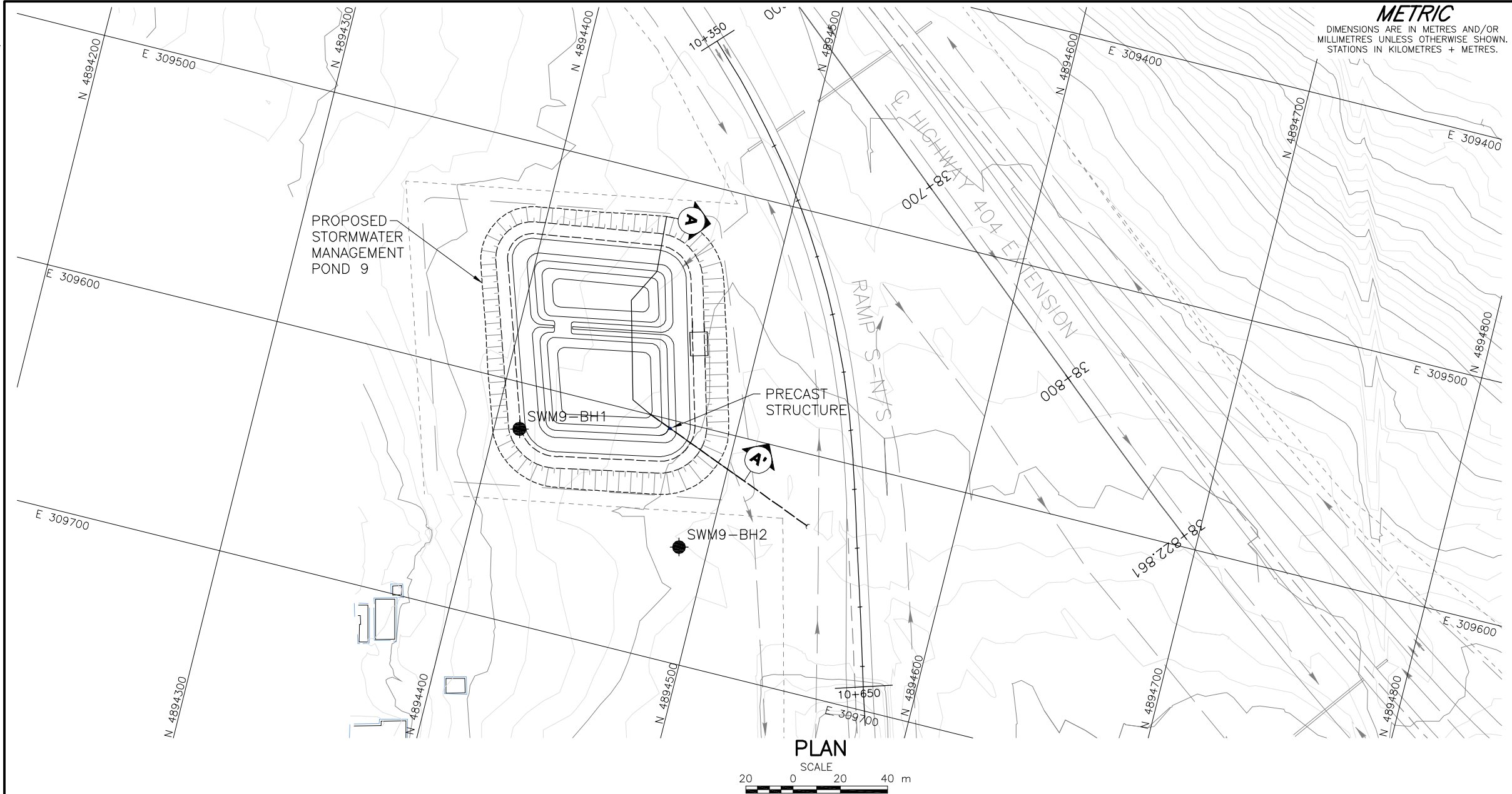
Project No. 08-1111-0022E

Checked By: KJB



APPENDIX D5

Highway 404 Stormwater Management Pond 9 Drawing, Record of Boreholes and Laboratory Test Results

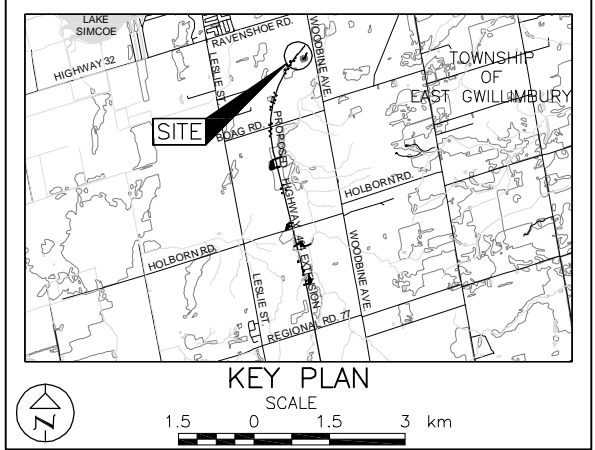


METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 2005-07-00

HIGHWAY 404 EXTENSION
STORMWATER MANAGEMENT POND 9
BOREHOLE LOCATION AND SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



LEGEND			
	Borehole - Current Investigation		
N	Standard Penetration Test Value		
16	Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)		
	WL upon completion of drilling		
No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
SWM9-BH1	229.6	4894410.5	309619.3
SWM9-BH2	228.8	4894488.0	309651.5

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 provided in digital format by AECOM, drawing files "76808.dwg" and "76809.dwg", received, November, 16, 2009 and drawing file "2538-199-00_00-ST-1001-To Golder-091126.dwg", received November 26, 2009.

NO.	DATE	BY	REVISION
Geocres No. 31D-499			
HWY. 404		PROJECT NO. 08-1111-0022	
SUBM'D.	CHKD. TB	DATE: Sep 2010	SITE:
DRAWN: JFC/RJ	CHKD. KJB	APPD. JMAC	DWG. D5

PROJECT		RECORD OF BOREHOLE				No SWM9-BH1		1 OF 1		METRIC							
G.W.P.		LOCATION		ORIGINATED BY		NS											
DIST		HWY		BOREHOLE TYPE		COMPILED BY		SC									
DATUM		DATE		March 13, 2009		CHECKED BY		XW/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									
229.6	GROUND SURFACE																
0.0	TOPSOIL																
229.3																	
0.3	SILTY CLAY to CLAYEY SILT, trace sand, trace gravel (TILL) Stiff Light brown Moist		1	AS	-												
228.2			2	SS	15												
1.4	Sandy SILT to SAND and SILT, some clay, trace gravel (TILL) Compact Brown Moist		3	SS	16												
227.5																	
2.1	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to very stiff Light brown to grey Moist to wet		4	SS	28												
			5	SS	10												
			6	SS	14												
225.3	END OF BOREHOLE																
4.3	NOTES: 1. Borehole open and dry upon completion of drilling.																

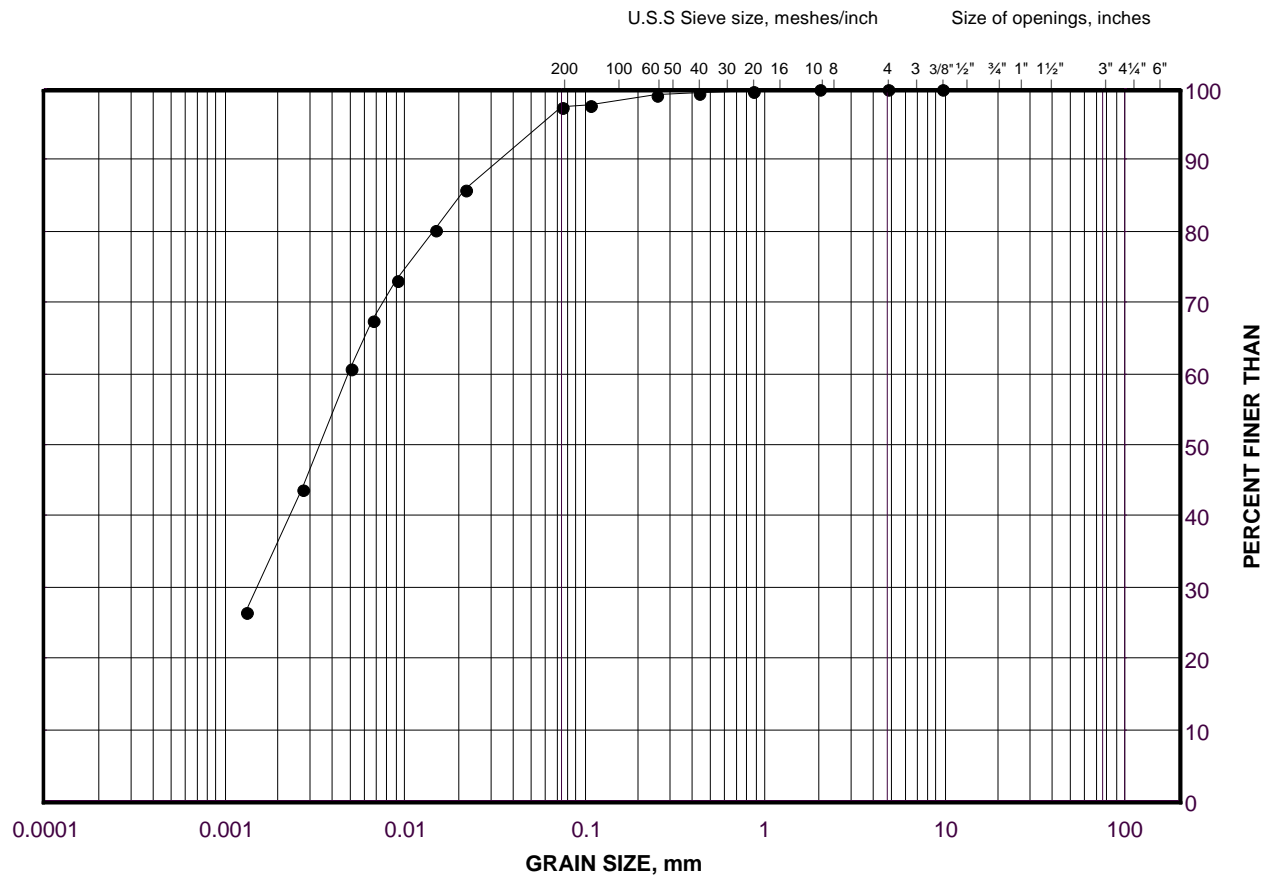
PROJECT <u>08-1111-0022</u>		RECORD OF BOREHOLE No SWM9-BH2		1 OF 1 METRIC	
G.W.P. <u>2005-07-00</u>		LOCATION <u>N 4894488.0 ; E 309651.5</u>		ORIGINATED BY <u>NS</u>	
DIST <u> </u> HWY <u>404</u>		BOREHOLE TYPE <u>108 mm Dia. Solid Stem Augers</u>		COMPILED BY <u>SC</u>	
DATUM <u>Geodetic</u>		DATE <u>March 12, 2009</u>		CHECKED BY <u>XW/KJB</u>	

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					WATER CONTENT (%)				
								20 40 60 80 100					w _p w w _L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED									
228.8	GROUND SURFACE																
0.0	TOPSOIL																
0.3	SILTY CLAY to CLAYEY SILT, trace sand, trace gravel (TILL) Stiff to very stiff Light brown Moist		1	AS	-	▽	228										
			2	SS	18												
			3	SS	10												
			4	SS	25												
			5	SS	12												
			6	SS	21												
224.5	END OF BOREHOLE																
4.3	NOTES: 1. Water level in open borehole at a depth of 1.8 m below ground surface (Elev. 227.0 m) upon completion of drilling.																

GRAIN SIZE DISTRIBUTION

Silty Clay to Clayey Silt Till

FIGURE D5-1



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM9-BH2	6	224.8

Project Number: 08-1111-0022E

Checked By: KJB

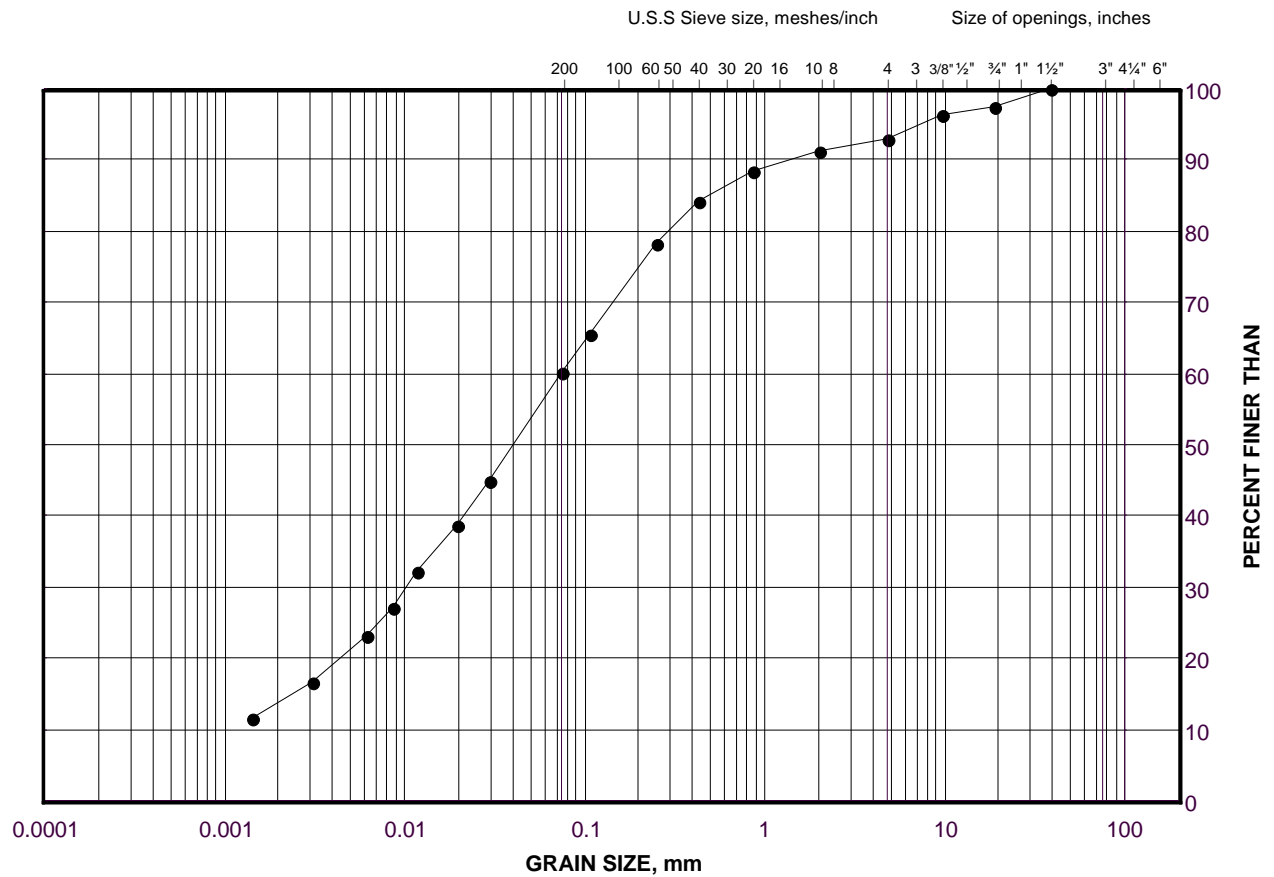
Golder Associates

Date: 17-Mar-10

GRAIN SIZE DISTRIBUTION

Silty Sand to Sand and Silt Till

FIGURE D5-2



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	SWM9-BH1	3	227.9

Project Number: 08-1111-0022E

Checked By: KJB

Golder Associates

Date: 17-Mar-10



APPENDIX E

Groundwater Level, Groundwater and Surface Water Chemistry

Well ID	Ground Surface Elevation (m asl)	Casing Stick Up (m)	12-Mar-09			2-Apr-09			12-Jun-09		
			Depth to Water (m btoc)	Depth to Water (m bgs)	Groundwater Elevation (m asl)	Depth to Water (m btoc)	Depth to Water (m bgs)	Groundwater Elevation (m asl)	Depth to Water (m btoc)	Depth to Water (m bgs)	Groundwater Elevation (m asl)
BR-2	242.27	0.97	2.40	1.43	240.85	2.17	1.20	241.08	3.15	2.18	240.09
BR-3	243.54	1.04	3.14	2.10	241.45	2.85	1.81	241.73	3.26	2.22	241.32
BR-8	241.10	0.93	5.18	4.25	236.85	5.14	4.21	236.89	5.46	4.53	236.57
BR-9	242.82	0.95	5.52	4.57	238.25	5.43	4.48	238.34	5.91	4.96	237.86
C2-1	251.18	0.98	-	-	-	-	-	-	1.25	0.27	250.92
C2-4	249.30	1.05	-	-	-	-	-	-	2.48	1.43	247.87
C2-6	248.02	0.82	-	-	-	-	-	-	3.63	2.81	245.21
HD1-1	253.76	0.87	-	-	-	-	-	-	1.89	1.02	252.75
HD1-2	252.88	1.04	-	-	-	-	-	-	2.11	1.07	251.81
HD2-1B	261.01	1.20	-	-	-	1.88	0.68	260.33	2.48	1.29	259.73
HD2-1A	261.01	0.89	-	-	-	1.69	0.80	260.21	2.68	1.79	259.22
HD2-4	254.32	0.94	-	-	-	1.15	0.21	254.11	Destroyed		
HD3-1	256.72	0.97	-	-	-	1.74	0.78	255.94	1.93	0.96	255.76
HD4-3	250.45	0.92	-	-	-	1.24	0.32	250.14	2.75	1.83	248.63
HD5-2	252.13	0.83	-	-	-	-	-	-	3.52	2.69	249.44
HD5-3	251.48	1.01	-	-	-	-	-	-	3.94	2.93	248.55
HD6-3	239.88	1.24	2.50	1.26	238.62	2.32	1.08	238.80	3.08	1.84	238.04
HD6-6	243.11	1.21	5.15	3.94	239.17	3.85	2.64	240.46	5.58	4.37	238.74
HD7-1	254.58	0.98	-	-	-	0.99	0.02	254.56	1.99	1.01	253.57
HD7-3	254.46	0.87	-	-	-	1.29	0.43	254.03	2.14	1.28	253.18
HD7-6	252.31	1.01	-	-	-	1.16	0.15	252.16	2.35	1.34	250.98
HD7-7	251.07	1.03	-	-	-	1.82	0.79	250.28	3.05	2.02	249.05
HD8-1	233.55	1.36	-	-	-	0.99	-0.38	233.93	1.37	0.01	233.54
HD8-6	230.26	0.81	-	-	-	0.15	-0.66	230.92	0.43	-0.38	230.64

Notes:

- well yet installed

Input BY GAM

Checked SL

Table E-2
Groundwater Quality Summary
Proposed Highway 404 Extension
Queensville Sideroad to Ravenshoe Road

Parameter	Unit	O. Reg. 153/04 Table 2	O. Reg. 169/03 ODWS	BR-3	BR-8	C2-1	HD2-1A	HD5-2	HD7-1	HD3-1
BTEX, Petroleum Hydrocarbons - Fraction F1 to F3										
Benzene	µg/L	5.0	5	IMAC	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	µg/L	24	24	AO	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	µg/L	2.4	2.4	AO	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylenes (Total)	µg/L	300	300	AO	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
C6 - C10 (F1)	µg/L	-	-	-	<100	<100	<100	<100	<100	<100
C6 - C10 (F1 minus BTEX)	µg/L	-	-	-	<100	<100	<100	<100	<100	<100
C>10 - C16 (F2)	µg/L	-	-	-	<100	<100	<100	<100	<100	<100
C6 - C16 (F1 + F2)	µg/L	1000	-	-	<100	<100	<100	<100	<100	<100
C>16 - C34 (F3)	µg/L	1000*	-	-	<100	2100	140	<100	1200	1300
General Chemistry										
Electrical Conductivity	uS/cm	-	-	-	542	473	760	591	744	535
pH	NA	-	6.5-8.5	OG	8.03	8.09	7.95	8.07	8.15	8.1
Total Dissolved Solids	mg/L	-	500	AO	348	302	476	396	478	452
Alkalinity (as CaCO3)	mg/L	-	30-500	OG	182	235	381	250	304	261
Chloride	mg/L	250	250	AO	48.3	1.36	19.3	9.1	39.2	7.42
Nitrate as N	mg/L	10	10	MAC	<0.05	<0.05	<0.05	<0.05	3.61	<0.05
Sulphate	mg/L	-	500	AO	33.3	28.9	24.8	63.6	42.8	85.4
Ammonia as N	mg/L	-	-	-	0.14	0.25	0.12	0.03	0.05	0.04
Calcium	mg/L	-	-	-	57.1	54.7	114	80.5	99.2	112
Magnesium	mg/L	-	-	-	17.9	22.3	19.4	25.2	33.6	27.3
Sodium	mg/L	200	200**	AO	24.7	7.13	21.6	6.53	10.5	9.81
Barium	mg/L	1.0	1.0	MAC	0.1	0.085	0.09	0.082	0.069	0.056
Boron	mg/L	5.0	5.0	IMAC	0.04	0.026	0.015	<0.010	0.013	0.011
Iron	mg/L	-	0.3	AO	1.2	0.297	<0.010	<0.010	<0.010	0.167

Notes:

* - Standard for Hydrocarbon Fractions F3 + F4.

** - The aesthetic objective for sodium in drinking water is 200 mg/L. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L so that this information may be communicated to local physicians for their use with patients on sodium restricted diets.

O.Reg. 153/04, Table 2 - Soil, ground water and sediment standards for full depth generic site condition standards in a potable ground water condition.

O. Reg. 169/03 - Ontario drinking water standards, objectives and guidelines.

MAC - Maximum acceptable concentration

IMAC - Interim maximum acceptable concentration

AO - Aesthetic objective

OG - Operation guidelines

Exceedance of the ODWS**Exceedance of O. Reg. 153 (T2)**

Table E-3
Surface Water Quality Summary
Proposed Highway 404 Extension
Queensville Sideroad to Ravenshoe Road

Parameter	Unit	PWQO	SW1
Electrical Conductivity	uS/cm	-	697
pH	NA	6.5-8.5	7.86
Total Dissolved Solids	mg/L	-	440
Alkalinity (as CaCO ₃)	mg/L	-	358
Chloride	mg/L	-	15.4
Nitrate as N	mg/L	-	<0.05
Sulphate	mg/L	-	20.7
Ammonia as N	mg/L	-	<0.02
Sodium	mg/L	-	4.6
Iron	mg/L	0.3	8.68

Notes:

PWQO - Provincial water quality objectives

Exceedance of the PWQO



Certificate of Analysis

AGAT WORK ORDER: 10T379342

PROJECT NO: 08-1111-0022

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Gregory Meek

O. Reg 153 Petroleum Hydrocarbon F1 - F3 in Water

DATE SAMPLED: Jan 07, 2010

DATE RECEIVED: Jan 08, 2010

DATE REPORTED: Jan 18, 2010

SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BR3 1630746	BR8 1630747	C2-1 1630755	HD2-1A 1630756	HD5-2 1630757	HD7-1 1630765	HD3-1 1630773
Benzene	µg/L	5.0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	µg/L	24	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	µg/L	2.4	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylenes (Total)	µg/L	300	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
C6 - C10 (F1)	µg/L		100	<100	<100	<100	<100	<100	<100	<100
C6 - C10 (F1 minus BTEX)	µg/L		100	<100	<100	<100	<100	<100	<100	<100
C>10 - C16 (F2)	µg/L		100	<100	<100	<100	<100	<100	<100	<100
C6 - C16 (F1 + F2)	µg/L	1000	100	<100	<100	<100	<100	<100	<100	<100
C>16 - C34 (F3)	µg/L		100	<100	2100	140	<100	1200	120	1300

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T2(PGW)

1630746-1630773 The C6-C10 fraction is calculated using Toluene response factor.

The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.

Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.

Total C6-C50 results are corrected for BTEX contributions.

This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.

n-C6 and n-C10 response factors are within 30% of Toluene response factor.

n-C10, n-C16 and n-C34 response factors are within 10% of their average.

C50 response factor is within 70% of n-C10 + n-C16 n-C34 average.

Linearity is within 15%.

Extraction and holding times were met for this sample.

Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

NA = Not Applicable

Certified By:

**AGAT** Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T379342

PROJECT NO: 08-1111-0022

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Gregory Meek

Groundwater General Chemistry

DATE SAMPLED: Jan 07, 2010

DATE RECEIVED: Jan 08, 2010

DATE REPORTED: Jan 18, 2010

SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BR3 1630746	BR8 1630747	C2-1 1630755	HD2-1A 1630756	HD5-2 1630757	HD7-1 1630765	HD3-1 1630773
Electrical Conductivity	uS/cm		2	542	473	760	591	744	671	535
pH	NA		NA	8.03	8.09	7.95	8.07	8.15	8.07	8.10
Total Dissolved Solids	mg/L		20	348	302	476	396	478	488	452
Alkalinity (as CaCO3)	mg/L		5	182	235	381	250	304	295	261
Chloride	mg/L	250	0.10	48.3	1.36	19.3	9.10	39.2	7.42	4.69
Nitrate as N	mg/L	10	0.05	<0.05	<0.05	<0.05	<0.05	3.61	<0.05	0.30
Sulphate	mg/L		0.10	33.3	28.9	24.8	63.6	42.8	85.4	32.6
Ammonia as N	mg/L		0.02	0.14	0.25	0.12	0.03	0.05	0.04	0.95
Calcium	mg/L		0.05	57.1	54.7	114	80.5	99.2	112	91.2
Magnesium	mg/L		0.05	17.9	22.3	19.4	25.2	33.6	27.3	22.2
Sodium	mg/L	200	0.05	24.7	7.13	21.6	6.53	10.5	9.81	6.05
Barium	mg/L	1.0	0.002	0.100	0.085	0.090	0.082	0.069	0.056	0.065
Boron	mg/L	5.0	0.010	0.040	0.026	0.015	<0.010	0.013	0.011	<0.010
Iron	mg/L		0.010	1.20	0.297	<0.010	<0.010	<0.010	0.167	<0.010

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T2(PGW)

Certified By:



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 10T379342

PROJECT NO: 08-1111-0022

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Gregory Meek

Surfacewater General Chemistry

DATE SAMPLED: Jan 07, 2010

DATE RECEIVED: Jan 08, 2010

DATE REPORTED: Jan 18, 2010

SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	SW1 1630745
Electrical Conductivity	uS/cm		2	697
pH	NA	6.5-8.5	NA	7.86
Total Dissolved Solids	mg/L		20	440
Alkalinity (as CaCO ₃)	mg/L		5	358
Chloride	mg/L		0.10	15.4
Nitrate as N	mg/L		0.05	<0.05
Sulphate	mg/L		0.10	20.7
Ammonia as N	mg/L		0.02	<0.02
Sodium	mg/L		0.05	4.60
Iron	mg/L	0.3	0.010	8.68

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO (mg/L)

Certified By:

Elizabeth Potokowska



AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 10T379342

PROJECT NO: 08-1111-0022

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Gregory Meek

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
1630745	SW1	PWQO (mg/L)	Surfacewater General Chemistry	Iron	0.3	8.68
1630746	BR3	O.Reg.169/03	Groundwater General Chemistry	Sodium	20 (200)	24.7
1630755	C2-1	O.Reg.169/03	Groundwater General Chemistry	Sodium	20 (200)	21.6



APPENDIX F

MOE Water Well Records and Locations

TABLE F-1:**SUMMARY OF MOE WATER WELL RECORDS WITHIN 500 m OF THE ALIGNMENT**

	Overburden Drilled	Overburden Dug	Bedrock Drilled
Number	18	16	2
Casing Diameter Range (m)	0.05 – 0.15	0.76 – 1.0	0.15 – 0.18
Depth (m) Range Average	12.2 – 82.6 39.5	3.1– 21.3 9.7	78.3 – 121.0 99.7
Yield (gpm) Range Average	4 - 40 12.2	1 - 20 5.9	10 - 25 17.5
Water Use	Domestic - 12 Commercial – 1 Domestic/Livestock - 1 Not Used - 2 Not Specified – 1 Observation Well - 1	Domestic - 13 Commercial – 0 Domestic/Livestock - 1 Not Used - 1 Not Specified – 1 Observation Well - 0	Domestic - 2 Commercial – 0 Domestic/Livestock - 0 Not Used - 0 Not Specified – 0 Observation Well - 0

Note:

- Based on MOE Water Well Record database (Electronic License, December 3, 2008).
- A casing diameter and depth was not specified for eight of the wells, therefore included under drilled overburden wells for lack of any other information.

Entered By: GAM

Checked By: SL

TABLE F-2:
MOE WATER WELL RECORDS
(From Golder Database, November 2008 and MOE Update, December 3, 2008)

LABLE	CON	LOT	DATE	EASTING	NORTHING	ELEV (ft ASL)	WATER FOUND (ft BGS)	TYPE	DIA (in)	SCREEN (TOP) (ft BGS)	Length (ft)	SWL (ft)	RATE (IGM)	TIME (min)	PL (ft)	TYPE	USE	METHOD	DRLR	OWNER	DESCRIPTION
327	03	020	Apr/55	625271	4888915	857	36	Fr	2	36	4	12	5	180		WS	DO	JT	2310	MOE# 6900327	TPSL 0003 BRWN CLAY STNS 0036 MSND GRVL 0040
347	03	025	May/60	624634	4890747	820	35	Fr	30			10	2			WS	DO	BR	4102	MOE# 6900347	BLUE CLAY 0035
348	03	025	Sep/67	624640	4890526	813	18	Fr	30			10	4			WS	DO	BR	4102	MOE# 6900348	BRWN CLAY GRVL 0018 BRWN CLAY MSND 0020 BLUE CLAY 0035
359	03	030	Feb/67	624538	4892867	770	22	Fr	30			8	1			WS	DO	BR	3109	MOE# 6900359	TPSL 0002 CLAY MSND 0020 MSND 0028
360	03	031	Feb/59	623826	4892726	803	152	Fr	4	147	5	30	4	300	90	WS	ST,DO	CT	3107	MOE# 6900360	YLLW CLAY STNS 0059 MSND GRVL 0069 BLUE CLAY 0127 QSND 0130 BLUE CLAY 0145 GREY CSND 0152
364	03	033	May/65	624822	4894019	754	28	Fr	30			14	2			WS	ST,DO	BR	3109	MOE# 6900364	TPSL 0002 CLAY 0027 MSND 0034
4756	04	001	Nov/58	624706	4895197	750	8	Fr	36			3	20			WS	DO	BR	4102	MOE# 6904756	BLUE CLAY 0008 GRVL MSND 0013
9019	03	025	Sep/68	624262	4890551	819	25	Fr	30			20				WS		BR	1555	MOE# 6909019	TPSL 0001 BRWN CLAY 0011 STNS MSND 0022 CLAY STNS 0031 MSND STNS 0040
9025	03	030	Aug/68	624322	4892801	775	113	Fr	4	114	4	FLW	6	120		WS	DO	CT	2310	MOE# 6909025	CLAY MSND 0012 CLAY 0050 MSND 0060 CLAY 0080 CLAY STNS 0113 CSND 0118
9303	04	002	May/69	624652	4895491	749	6	Fr	30			8	2	60		WS	DO	BR	1555	MOE# 6909303	MSND 0006 CLAY 0011 GRVL 0012 CLAY 0015
12736	03	030	May/75	624239	4892703	772	16	Fr	30			11				WS	DO	BR	3109	MOE# 6912736	TPSL 0002 CLAY SAND 0016 SAND 0020
13141	04	033	Dec/75	624827	4894761	752	14	Fr	30			4				WS	DO	BR	3109	MOE# 6913141	TPSL 0002 BRWN CLAY STNS 0014 GRVL 0015 BRWN CLAY STNS 0032
14140	04	034	Jul/77	624862	4894421	750	7	Fr	30			5				WS	DO	BR	3109	MOE# 6914140	TPSL 0002 BRWN CLAY SLTY 0007 SAND 0012
14630	03	025	May/78	624112	4890521	819	128	Fr	5	127	4	20	12	60		WS	DO	CT	1711	MOE# 6914630	GREY CLAY STNS 0034 GREY CLAY STNS SAND 0107 BLUE CLAY 0128 CSND 0134
14738	03	020	Jun/78	624462	4888571	908	24	Fr	30			17				WS	DO	BR	3109	MOE# 6914738	TPSL 0002 BRWN CLAY STNY 0024 FSND 0031 BLUE CLAY SLTY 0040 FSND 0047
14742	03	020	Sep/78	625212	4888871	858	30	Fr	30			25				WS	DO	BR	3109	MOE# 6914742	TPSL 0002 BRWN CLAY 0027 BLUE CLAY SLTY 0050 BLUE CLAY STNY 0070
15013	03	025	Feb/79	624212	4890671	820	116	Fr	4	117	4	35	10	60		WS	DO	CT	1711	MOE# 6915013	PRDG 0033 GREY CLAY STNS 0095 BLUE CLAY STNS 0116 CSND 0123
15025	03	033	Apr/79	623862	4893621	766	112	Fr	6	112	3	55	5			WS	DO	CT	5459	MOE# 6915025	BLCK TPSL 0001 BRWN SAND CLAY SOFT 0027 BLUE CLAY SOFT 0084 BLUE CLAY STNS 0112 BLUE GRVL 0115
15562	03	020	Jul/80	624512	4888621	930	23	Fr	30			10				WS	DO	BR	3109	MOE# 6915562	TPSL 0001 BRWN CLAY SLTY 0023 FSND 0025 BLUE CLAY STNY 0042
16098	03	020	Apr/81	624512	4888621	930	46	Fr	6	45	3	6	10	60		WS	CO	CT	1350	MOE# 6916098	BRWN FILL TPSL 0003 GREY CLAY 0024 GREY CLAY GRVL 0046 BRWN GRVL SAND 0050
17178	03	020	Aug/84	624950	4888567		48	Fr	6	40	8	30	5	120		WS	DO	RC		MOE# 6917178	BRWN CLAY DNSE 0040 BRWN SAND CLN FSND 0048
17289	03	020	Dec/84	624950	4888567		397	Fr	7			130	10	1200		WS	DO	RC		MOE# 6917289	BLCK TPSL SOFT 0001 BRWN SAND CLAY PCKD 0008 BLUE CLAY DNSE 0060 GREY SAND SOFT 0064 BLUE CLAY DNSE 0102 GREY SILT SOFT 0126 BLUE CLAY DNSE 0305 GREY GRVL CLAY LYRD 0309 GREY CLAY STNS DNSE 0370 GREY GRVL CLAY HARD 0390 GREY GRVL SAND PORS 0397 GREY LMSN
17712	03	032	Nov/85	623972	4893421		25	Fr	30			20				WS	DO	BR		MOE# 6917712	BRWN FILL CLAY STNS 0004 BLCK TPSL SOFT 0005 BRWN CLAY SAND HARD 0025 BLUE CLAY STNS HARD 0043
19429	03	020	Apr/88	625214	4888917	853	259	Fr	6	261	3	98	25	120		WS	DO	RC	3108	MOE# 6919429	BRWN CLAY SNDY 0024 BLUE CLAY GVLY 0105 FSND 0106 BLUE CLAY 0178 BLUE CLAY SAND LYRD 0229 BLUE CLAY GRVL 0258 SAND 0264
20349	03	032	Mar/89	623972	4893421		142	Fr	6			5	20	120		WS	DO	RA		MOE# 6920349	GREY CLAY 0060 GREY CLAY GRVL 0110 GREY SAND 0135 GRVL 0142
21996	03	026	Aug/82	624234	4890638	817	262	Fr	6	258	4	55	20	130		WS	DO	RC		MOE# 6921996	BRWN CLAY STNS PCKD 0017 GREY CLAY STNS PCKD 0043 GREY SAND GRVL LOOS 0045 GREY CLAY STNS PCKD 0062 GREY CLAY STNS SLTY 0135 BRWN GRVL CLAY 0186 GREY CLAY STNS SNDY 0197 GREY CLAY STNS PCKD 0233 BRWN SAND GRVL CLN 0262 GREY CLAY DNSE 0271 BRWN GRVL CLAY
23707	03	025	Sep/96	624246	4890627	813	136	Fr	6	133	3	25	40	60		WS	DO	RA		MOE# 6923707	BRWN CLAY STNS HARD 0025 BRWN CLAY SILT SOFT 0117 BRWN SAND GRVL CGVL 0136
23919	03	020	May/97	624952	4888567				40								NU	CT		MOE# 6923919	BRWN CLAY STNS 0010
24966	03	020	Jul/99	624878	4888737	856	17	Fr	36			1	10	90		WS	DO	CT		MOE# 6924966	NO LOG
25293	03	030	Mar/00	624140	4892610		257	Fr	6			35	25	60	240		DO		1413	MOE# 6925293	BRWN CLAY HARD 0017 BRWN SAND GRVL LOOS 0042 GREY CLAY STNS HARD 0095 GREY SAND SILT CMTD 0103 GREY CLAY STNS HARD 0146 GREY GRVL LOOS 0150 GREY CLAY BLDR HARD 0246 GREY GRVL SILT LOOS 0249 GREY LMSN HARD 0257
25949	03	026	Jul/01	624460	4890989		240	Fr	6	240	3	45	5	480	181		DO		6300	MOE# 6925949	BRWN CLAY 0016 BLUE CLAY HARD 0080 BLUE CLAY GRVL HARD 0112 BLUE CLAY 0229 BLUE SAND CLAY 0236 BLUE CLAY 0240 BLUE SAND CLN 0245 BLUE CLAY 0251
25950	03	026	Aug/01	624460	4890989												NU		6300	MOE# 6925950	
27136	03	025	Jun/03	624543	4890584												NU		4102	MOE# 6927136	
30833	03	031	Sep/06	623766	4892770														5019	MOE# 6930833	
30994	03	030	Oct/06	624276	4892820		56	Fr	6	53	5	15	4	60	56		DO		1413	MOE# 6930994	BRWN CLAY SAND 0017 GREY CLAY 0048 GREY SAND 0058
35810			Sep/06	624624	4890304	0	35	Fr	2	30	710					OW		BR	6607	MOE# 7035810	BRWN SAND CGVL 0005 BRWN SAND 0020 GREY FSND 0040

Note: Co-ordinates referenced to UTM NAD 83

Entered By: GAM
Checked By: SL

Table F-3
Private Wells To Be Monitored During Construction
Highway 404

Property No. / Designation¹	Site No.²	PIN	Address
14	28	03418-0163	1982 Queensville Sideroad East
16	26	03418-0287	1742 Queensville Sideroad
17	-	-	1763 Holborn Road
19	17	03417-0027	1861 Boag Road
-	-	-	1925 Boag Road
-	-	-	1989 Boag Road
20	-	03417-0011	22311 Leslie St.
22	28	03417-0014	22372 Woodbine Avenue East
23	37	03467-0600	2324 Ravenshoe Road
Gas Station	34	03468-0764	22766 Woodbine Avenue

¹ Property designation / number taken from Exhibits 4-1a to 4-1c provided by AECOM at PIC (Feb. 4, 2010)

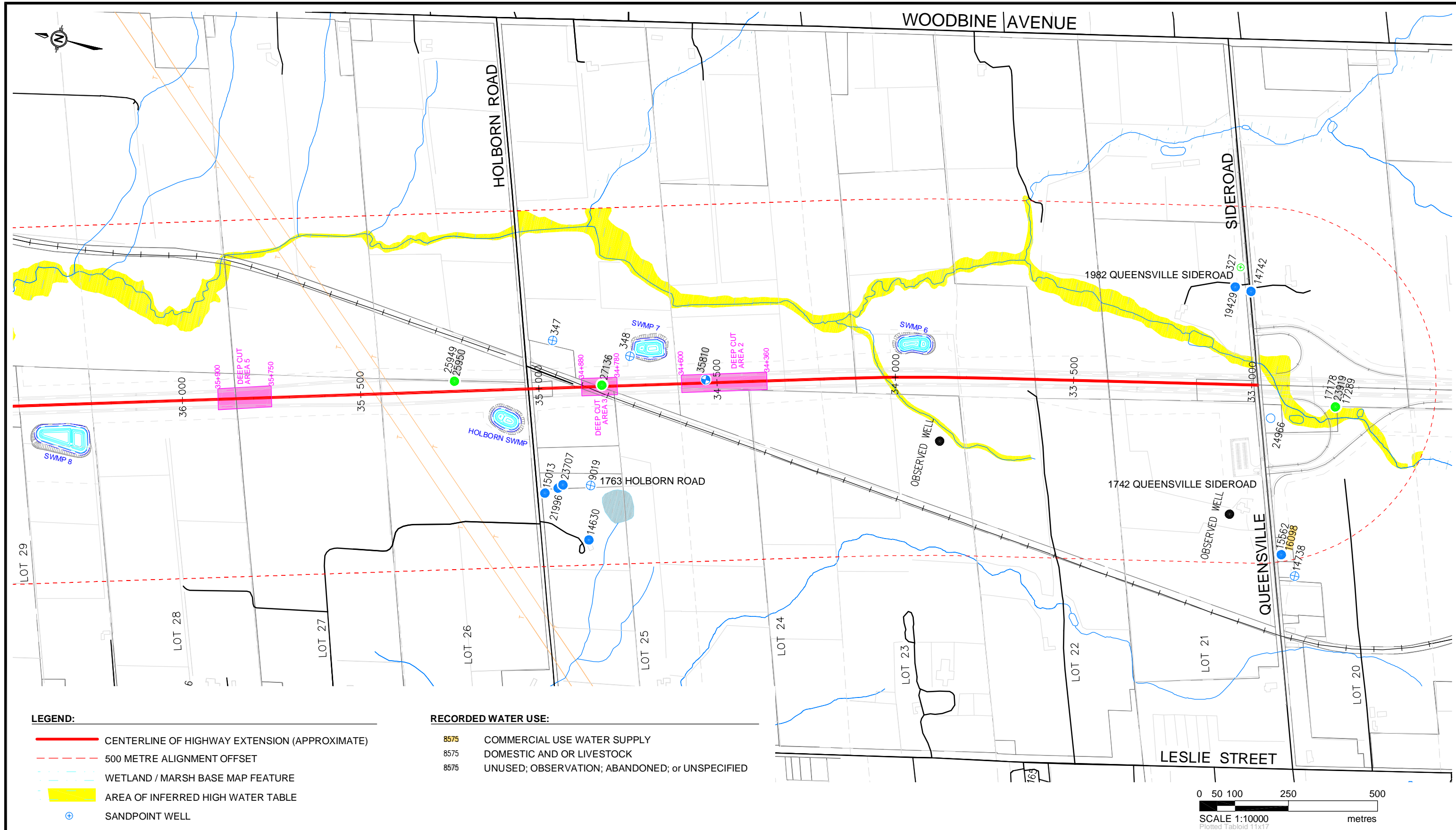
² Site number taken from contact list provided by AECOM at start-up meeting (June 26, 2008)


Table F-4
Proposed New Monitoring Wells (Standpipe Piezometers)
To Be Located Near Potential Dewatering Activity Sites
Highway 404

Potential Dewatering Activity	Approximate Location (MTM NAD83)	
	Northing	Easting
SWM Pond 6	4889946	309677
Holborn SWM Pond	4891045	309198
SWM Pond 8	4892448	308945
Boag Road Overpass – SBL Structure	4893094	308845
Boag Road Overpass – NBL Structure	4893066	308983

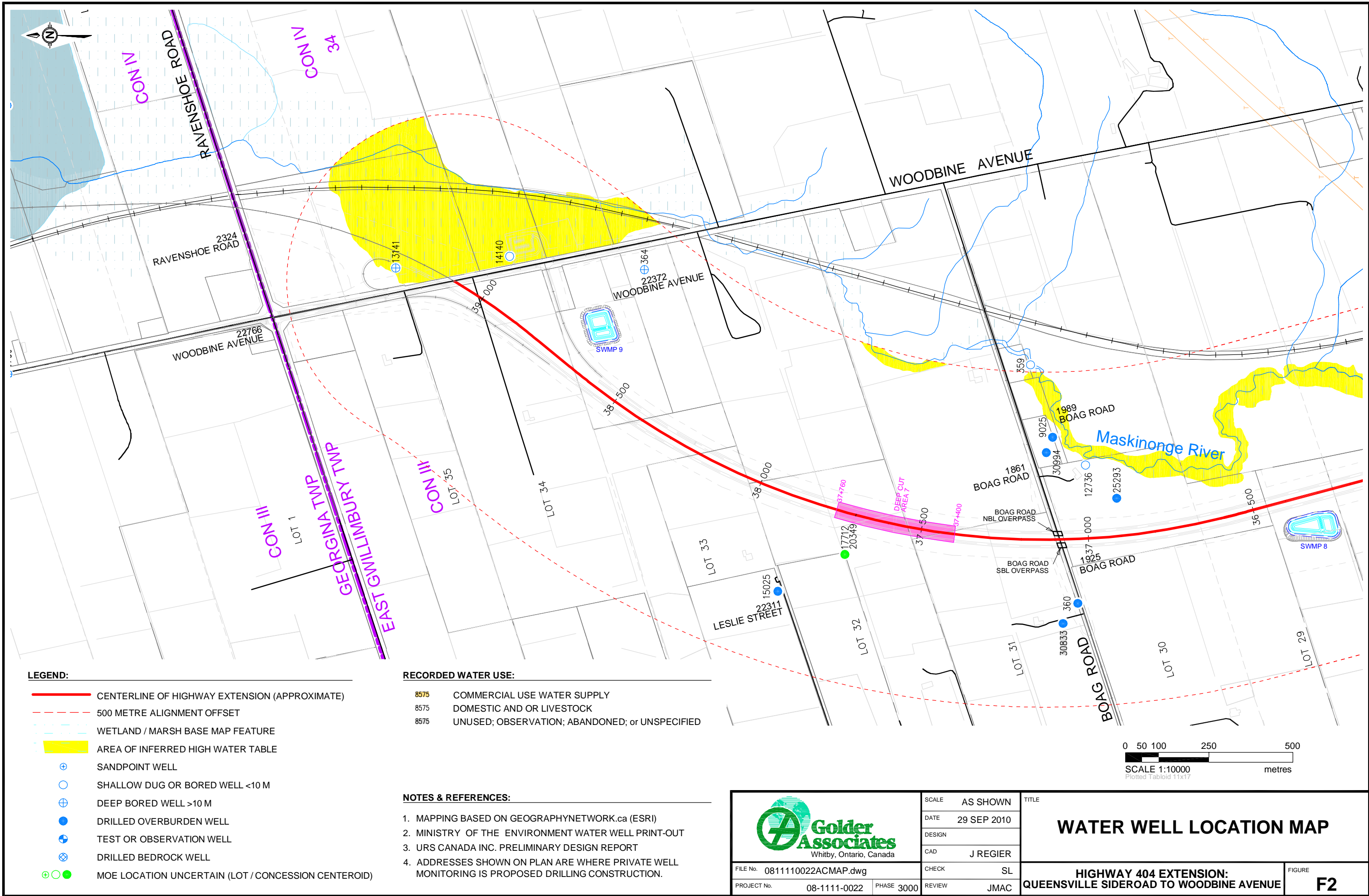
Entered By: KJB


Checked by: SL



 Whitby, Ontario, Canada		SCALE	AS SHOWN	TITLE WATER WELL LOCATION MAP	
		DATE	29 SEP 2010		
		DESIGN			
		CAD	J REGIER	HIGHWAY 404 EXTENSION: QUEENSVILLE SIDEROAD TO RAVENSHOE ROAD	
FILE No. 0811110022ACMAP.dwg		CHECK	SL		
PROJECT No. 08-1111-0022		PHASE	3000	REVIEW	JMAC
					FIGURE F1

PLOT DATE: September 29, 2010
FILENAME: T:\Projects\2008\08-1111-0022 (Hwy 404 Extension)\-AC-\0811110022ACMAP.dwg: [F2]



 Golder Associates Whitby, Ontario, Canada			SCALE	AS SHOWN	TITLE	WATER WELL LOCATION MAP
			DATE	29 SEP 2010		
			DESIGN			
			CAD	J REGIER		
FILE No. 0811110022ACMAP.dwg			CHECK	SL	HIGHWAY 404 EXTENSION: QUEENSVILLE SIDEROAD TO WOODBINE AVENUE	FIGURE F2
PROJECT No. 08-1111-0022	PHASE 3000	REVIEW	JMAC			

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner Irene + Gene Gabrowski Resident —

LOCATION: Lot 29 Concession 30 Municipality York

STREET ADDRESS: 1861 BOAG RD, QUEENSVILLE, ON

TELEPHONE NO: 905-478-1480 FIRE NO: —

DO YOU HAVE A WATER WELL? (YES) NO

ARE YOU CONNECTED TO MUNICIPAL SUPPLY? YES (NO)

WHERE IS YOUR WELL LOCATED? FRONT OF HOUSE

WELL DIAMETER: 36 Inches WELL DEPTH: 26 Feet

WELL TYPE: Hand Dug ✓
Bored —
Drilled —

CASTING TYPE Steel —
Concrete ✓
Culvert —
Stone/Wood —
Cribbed —

PUMP TYPE Submersible ✓ Suction Lift — Jet ✓ Other: —

WELL AGE: 35 Years

DO YOU HAVE A WATER WELL RECORD? YES (NO)

RECORD NO.: —

WELL USAGE Domestic Supply ✓
Livestock —
Irrigation —
Other —

WELL CAPACITY 0-5gpm —
5-10gpm — unknown.
10-20gpm —
>20gpm —

WATER QUALITY Good ✓
Poor —

Mineral —
Salt —
Sulphur —
Gas —
Bacteria —

- add chlorine spring
- UV filter
- water softener

WATER LEVEL

Please state approximate level of water in well below ground, if known

Spring — feet
Summer 12 feet
Fall — feet
Winter — feet

12 feet of water, 14 ft below ground.

DOMESTIC WATER WELL SURVEY FORM
Golder Associates Ltd.
Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

N/A

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? ☒ YES ☐ NO

ADDITIONAL REMARKS:

→ concerned about construction activities - quality,
quantity

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner Norman Blanchard Resident —

LOCATION: Lot 33 Concession 3 Municipality YORK

STREET ADDRESS: 22372 WOODBINE AVE, QUEENSVILLE, ON

TELEPHONE NO: 905-478-4947 FIRE NO: —

DO YOU HAVE A WATER WELL? (YES)/NO

ARE YOU CONNECTED TO MUNICIPAL SUPPLY ? YES (NO)

WHERE IS YOUR WELL LOCATED? In front - 6 feet from house

WELL DIAMETER: 36 Inches

WELL DEPTH: 15 Feet

WELL TYPE: Hand Dug ✓
Bored —
Drilled —

CASTING TYPE: Steel —
Concrete ✓
Culvert —
Stone/Wood —
Cribbed —

PUMP TYPE Submersible — Suction Lift — Jet ✓ Other: —

WELL AGE: 46 Years

DO YOU HAVE A WATER WELL RECORD? YES (NO)

RECORD NO.: —

WELL USAGE Domestic Supply ✓
Livestock —
Irrigation —
Other —

WELL CAPACITY 0-5gpm —
5-10gpm —
10-20gpm —
>20gpm —

NO- unsure.

WATER QUALITY Good ✓
Poor —

Mineral —
Salt —
Sulphur —
Gas —
Bacteria —

WATER LEVEL

Please state approximate level of water in well below ground, if known

Spring — feet
Summer 7.5 feet below ground, 7.5 ft water in well (from bottom)
Fall — feet
Winter — feet

Date: January 14, 2010
08-1111-0022 – Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

N/A

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? YES ☒ NO

ADDITIONAL REMARKS:

→ concerns about quality + quantity.

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner Mike Sokolowski Resident _____

LOCATION: Lot 21 Concession 3 Municipality York

STREET ADDRESS: 1982 QUEENSVILLE SIDEROAD, QUEENSVILLE, ONTARIO

TELEPHONE NO: 416-293-9588 FIRE NO: -

(MIKE)

DO YOU HAVE A WATER WELL? (YES) / NO

ARE YOU CONNECTED TO MUNICIPAL SUPPLY ? YES (NO)

WHERE IS YOUR WELL LOCATED? 30 S OF HOUSE (800ft N. of Queensville)
Rd.

WELL DIAMETER: 6 1/4 Inches

WELL DEPTH: 258 Feet

WELL TYPE: Hand Dug _____
Bored _____
Drilled ✓

CASTING TYPE Steel ✓
Concrete _____
Culvert _____
Stone/Wood _____
Cribbed _____

PUMP TYPE Submersible ✓ Suction Lift _____ Jet _____ Other: _____

WELL AGE: <1 Years

DO YOU HAVE A WATER WELL RECORD? (YES) NO

RECORD NO.: A081416

WELL USAGE Domestic Supply ✓
Livestock _____
Irrigation _____
Other _____

WELL CAPACITY 0-5gpm _____
5-10gpm _____
10-20gpm _____
>20gpm ✓

Tested at
100gpm

WATER QUALITY Good ✓
Poor _____

Mineral _____
Salt _____
Sulphur N/A
Gas _____
Bacteria _____

WATER LEVEL Please state approximate level of water in well below ground, if known

Spring 20 feet
Summer 20 feet
Fall 20 feet
Winter 20 feet

Date: January 14, 2010
08-1111-0022 – Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

N/A.

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? YES ☒ NO

ADDITIONAL REMARKS:

No.

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner B.W. Savage Resident —

LOCATION: Lot 3 Concession 30 Municipality E. Gwillimbury / YORK

STREET ADDRESS: 1925 Boag Rd, Queensville ON

TELEPHONE NO: 905-478-4883 FIRE NO: —

DO YOU HAVE A WATER WELL? YES / NO

ARE YOU CONNECTED TO MUNICIPAL SUPPLY ? YES NO

WHERE IS YOUR WELL LOCATED? WEST SIDE OF HOUSE

WELL DIAMETER: 6 Inches WELL DEPTH: 55 Feet

WELL TYPE: Hand Dug — CASTING TYPE Steel ✓
Bored — Concrete —
Drilled ✓ Culvert —
Stone/Wood —
Cribbed —

PUMP TYPE Submersible ✓ Suction Lift — Jet — Other: —

WELL AGE: 3 Years

DO YOU HAVE A WATER WELL RECORD? YES / NO

RECORD NO.: —

WELL USAGE Domestic Supply ✓ WELL CAPACITY 0-5gpm —
Livestock — 5-10gpm (unknown)
Irrigation — 10-20gpm —
Other — >20gpm —

WATER QUALITY Good ✓ Mineral —
Poor — Salt —
Sulphur — N/A.
Gas —
Bacteria —

WATER LEVEL Please state approximate level of water in well below ground, if known
Spring — feet
Summer — feet unknown
Fall — feet
Winter — feet

Date: January 14, 2010
08-1111-0022 - Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

N/A.

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? YES ☒ NO — NOTED CONCERN ABOUT OPENING SEALED WELL.

ADDITIONAL REMARKS:

NO

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner STU BEATTY Resident N/A - VACANT.

LOCATION: Lot 21 Concession 3 Municipality York

STREET ADDRESS: 1742 QUEENSVILLE SIDEROAD, QUEENSVILLE, ON

TELEPHONE NO: 905-669-5571 FIRE NO: —

DO YOU HAVE A WATER WELL? YES / NO

ARE YOU CONNECTED TO MUNICIPAL SUPPLY ? YES / NO

WHERE IS YOUR WELL LOCATED? _____

WELL DIAMETER: _____ Inches

WELL DEPTH: _____ Feet

WELL TYPE: Hand Dug _____
Bored _____
Drilled _____

CASTING TYPE Steel _____
Concrete _____
Culvert _____
Stone/Wood _____
Cribbed _____

PUMP TYPE Submersible _____ Suction Lift _____ Jet _____ Other: _____

WELL AGE: _____ Years

DO YOU HAVE A WATER WELL RECORD? YES / NO

RECORD NO.: _____

WELL USAGE Domestic Supply _____ WELL CAPACITY 0-5gpm _____
Livestock _____ 5-10gpm _____
Irrigation _____ 10-20gpm _____
Other _____ >20gpm _____

WATER QUALITY Good _____ Mineral _____
Poor _____ Salt _____
Sulphur _____
Gas _____
Bacteria _____

WATER LEVEL Please state approximate level of water in well below ground, if known
Spring _____ feet
Summer _____ feet
Fall _____ feet
Winter _____ feet

VACANT →
OWNED BY
MTO.
(N. SIDE OF
QUEENSVILLE,
FUTURE SITE OF
PARKING LOT)

Date: January 14, 2010
08-1111-0022 – Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM
Golder Associates Ltd.
Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? YES NO

ADDITIONAL REMARKS:

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME: Owner Melrose Investment Inc. Resident N/A

LOCATION: Lot 1 Concession - Municipality YORK

STREET ADDRESS: 1742 BOAG ROAD, QUEENSDALE, ON

TELEPHONE NO: 905-849-1367 FIRE NO: -

DO YOU HAVE A WATER WELL? YES ☒ NO Decommissioned 4 years ago.

ARE YOU CONNECTED TO MUNICIPAL SUPPLY ? YES / NO

WHERE IS YOUR WELL LOCATED? _____

WELL DIAMETER: _____ Inches WELL DEPTH: _____ Feet

WELL TYPE: Hand Dug _____ CASTING TYPE Steel _____
Bored _____ Concrete _____
Drilled _____ Culvert _____
Stone/Wood _____
Cribbed _____

PUMP TYPE Submersible _____ Suction Lift _____ Jet _____ Other: _____

WELL AGE: _____ Years

DO YOU HAVE A WATER WELL RECORD? YES / NO

RECORD NO.: _____

WELL USAGE Domestic Supply _____ WELL CAPACITY 0-5gpm _____
Livestock _____ 5-10gpm _____
Irrigation _____ 10-20gpm _____
Other _____ >20gpm _____

WATER QUALITY Good _____ Mineral _____
Poor _____ Salt _____
Sulphur _____
Gas _____
Bacteria _____

WATER LEVEL Please state approximate level of water in well below ground, if known
Spring _____ feet
Summer _____ feet
Fall _____ feet
Winter _____ feet

Date: January 14, 2010
08-1111-0022 – Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM
Golder Associates Ltd.
Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? YES NO

ADDITIONAL REMARKS:

Date: January 14, 2000
08-1111-0022 - Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM

Golder Associates Ltd.

Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

NAME:

Owner RESIDENT - FRED + DIANE FORTH
~~Resident~~

LOCATION:

Lot _____

Concession _____

Municipality EAST GUILDFORD

STREET ADDRESS:

1989 BOAG ROAD, QUEENSVILLE, ONT

TELEPHONE NO:

905-478-1897

FIRE NO:

?DO YOU HAVE A WATER WELL? (YES) NOARE YOU CONNECTED TO MUNICIPAL SUPPLY? YES / (NO)

WHERE IS YOUR WELL LOCATED?

By HOUSE

WELL DIAMETER:

APPROX3 1/2

Inches

WELL DEPTH:

APPROX25

Feet

WELL TYPE:

Hand Dug ✓

Bored _____

Drilled _____

CASTING TYPE

Steel _____

Concrete ✓

Culvert _____

Stone/Wood _____

Cribbed _____

PUMP TYPE

Submersible _____

Suction Lift ✓

Jet _____

Other: _____

WELL AGE:

APPROX50 Years

DO YOU HAVE A WATER WELL RECORD?

YES (NO)

RECORD NO.: _____

WELL USAGE

Domestic Supply ✓

Livestock _____

Irrigation _____

Other _____

WELL CAPACITY

0-5gpm _____

5-10gpm _____

10-20gpm _____

>20gpm _____

WATER QUALITY

Good ✓

Poor _____

Mineral ✓

Salt _____

Sulphur _____

Gas _____

Bacteria _____

WATER LEVEL

Please state approximate level of water in well below ground, if known

Spring _____ feet

Summer _____ feet

Fall _____ feet

Winter _____ feet

don't knowBut have never had any problem with water.

Date: January 14, 2009
08-1111-0022 - Highway 404 Extension

DOMESTIC WATER WELL SURVEY FORM
Golder Associates Ltd.
Contact: Greg Meek 905-723-2727 ext. 330, Fax: 905-723-2182

Please state any water quantity or quality problems experienced with the well:

none

If selected, would you be willing to participate in a water well (i.e., water level and/or water quality sampling) monitoring program? ☒ YES ☐ NO

as long as it is not a cost.

ADDITIONAL REMARKS:

water has been always good. Never had a
quality or quantity problem at any time.
Very good water.



APPENDIX G

Non-Standard Special Provisions

SUBGRADE INSPECTION AT STORMWATER MANAGEMENT POND CONTAINMENT BERM FILL AREAS - Item No.

Non-Standard Special Provision

Portions of the stormwater management pond containment berms are to be constructed as fill embankments. The fill areas are shown on the Contract drawings at SWM Pond 6, SWM Pond 7, Holborn SWM Pond, SWM Pond 8 and SWM Pond 9.

The measured depth of topsoil or soils containing organics that are to be stripped generally ranges from 0.1 m to 0.3 m at SWM Pond 6, 0.1 m to 0.2 m at SWM Pond 7, 0.2 m to 0.3 m at Holborn SWM Pond, 0.3 m to 0.4 m at SWM Pond 8, and is about 0.3 m at SWM Pond 9. The plan limits of areas to be stripped are provided elsewhere in the Contract.

After stripping, the exposed subgrade soil shall be inspected by the Quality Verification Engineer (QVE) prior to placement of embankment fill, proofrolled to identify soft / loosened areas, and any poorly performing areas should be subexcavated and replaced with suitable backfill.

Basis of Payment

Payment at the lump sum contract price for this tender item shall be full compensation for all labour, equipment and materials for completion of the work.

END OF SECTION

DEWATERING OF EXCAVATION FOR STORMWATER MANAGEMENT POND CONSTRUCTION - Item No.

Non-Standard Special Provision

Scope

Cut Areas – The contractor shall be alerted that the groundwater level at SWM Pond 6, SWM Pond 7, Holborn SWM Pond, SWM Pond 8 and SWM Pond 9 was measured to range from 1 m to 4.3 m below ground surface. It is estimated that the new stormwater management pond grades will be constructed to depths ranging from 1 m to 3.3 m below the groundwater levels measured in the boreholes and piezometers installed in the vicinity of the pond areas in June 2009 and March 2010. The cut slopes consist of water-bearing silty sand to sand and silt till, silt and sand layers, and clayey silt / cohesive deposits containing silty sand interlayers / seams. Dewatering ahead of deep cut excavations will be required and the excavation shall be kept stable during the work. It is considered that a combination of ditches and sub-drains installed progressively as the subgrade is lowered and in advance of the final side-slopes being excavated to the design grade is required to allow the groundwater to drain sufficiently ahead of the permanent excavation. If excavation operations are to progress during wet periods of the year (i.e. Spring and Fall), gravel sheeting may be required to control erosion due to groundwater seepage.

Fill Areas – The contractor shall be alerted that the shallow groundwater level at SWM Pond 6, SWM Pond 7, Holborn SWM Pond, SWM Pond 8 and SWM Pond 9 was measured to range from 1 m to 4.3 m below ground surface in June 2009 and March 2010. It is estimated that stripping up to 0.4 m below existing ground surface may be required to remove topsoil / surficial organics at the pond containment berm fill areas as indicated elsewhere in the Contract. Temporary dewatering may be required and the temporary excavation shall be kept stable during the work in order to allow for stripping and compaction of suitable backfill soils in the dry. It is considered that any groundwater seepage into excavated areas of subgrade preparation can be handled by diversion channels, perimeter ditches / trenches and pumping using sump pumps.

Basis of Payment

Payment at the contract price for the above tender item shall be full compensation for all labour, equipment and materials required to do the work.

END OF SECTION

CLAY LINER FOR STORMWATER MANAGEMENT PONDS - Item No.

Non-Standard Special Provision

The Contractor must ensure that a minimum 0.6 m thick clay liner is provided at the stormwater management pond areas shown on the Contract Drawings. The Contractor has the option of constructing the clay liner using suitable earth fill or confirm that sufficient thickness of native soils exist that meet the specifications for clay liner material as described below.

The clay liner material may consist of native or imported clayey silt to silty clay, or clayey silt till to silty clay till and have the following properties:

- Plasticity Index greater than 7 percent (ASTM D422);
- Meet the following gradation requirements (ASTM D 422);
 - 100 percent of the particles passing the 75 mm sieve size;
 - Not less than 50 percent of the particles, by weight, passing the U.S. No. 200 standard sieve (75 µm openings);
 - Not less than 15 percent of the particles, by weight, greater than 0.002 mm size.

If the existing in-situ native soils are being considered for use as clay liner material, the Contractor must excavate test pits or expose areas of the proposed liner material to verify that clayey silt, silty clay, clayey silt till or silty clay till soils (minimum 0.6 m thick) are present within the design elevations shown on the Contract Drawings to the acceptance of the Quality Verification Engineer (QVE). If native cohesive soils are not present within the design clay liner elevations, the existing subgrade will need to be subexcavated to the base of the proposed clay liner elevation and replaced with suitable earth fill meeting the specifications above.

Soil classification tests consisting of Atterberg limits, water content, and grain size distribution including hydrometer tests should be performed by the QVE on the clay liner material at each stormwater management pond area to ensure conformance with the specifications listed above. These tests should be performed at a frequency of one test per 1,000 cubic metres of liner material placed or a minimum of 3 tests per SWM Pond on either the in-situ or imported material to confirm suitability of the material.

Suitable earth fill meeting the clay liner specifications above should be placed in accordance with SP206S03 and be placed in maximum 0.3 m thick lifts and compacted to a minimum 95% Standard Proctor Maximum Dry Density of the material.

The clay liner should be protected from disturbance due to construction procedures, inclement weather conditions, and frost penetration during construction. For this reason, the ballast/cover soil should be placed on top of the clay liner as soon as practicable after liner construction.

Basis of Payment

Payment at the lump sum contract price for this tender item shall be full compensation for all labour, equipment and materials for completion of the work.

END OF SECTION

MONITORING WELLS (STANDPIPE PIEZOMETERS) - Item No.

Non-Standard Special Provision

Scope

Installation, monitoring, and decommissioning of standpipe piezometers is required in conjunction with the Permit to Take Water for the construction of stormwater management ponds and the Boag Road structures. Groundwater levels will be required to be measured periodically in existing monitoring wells and in private water wells on neighbouring properties. The frequency of the monitoring will be specified in the Permit To Take Water but as a minimum will include monitoring pre-construction, during construction at regular intervals and post-construction.

As some existing monitoring wells/piezometers may need to be removed as part of the construction of the stormwater management ponds and bridge structures, the contractor will be responsible for ensuring that a replacement monitoring well is installed and maintained at each of the stormwater management pond and Boag Road structure locations, as necessary. Existing monitoring wells/piezometers may be used for monitoring if they are not damaged or removed by construction.

New standpipe piezometers should intersect the groundwater table and water bearing strata and extend to the lowest excavation elevation at each location. All piezometers should be installed in accordance with Ontario Regulation 903 (as amended) by licensed water well contractors. All new monitoring wells/piezometers installed by the contractor shall be decommissioned at the end of the construction/monitoring period in accordance with Ontario Regulation 903 (as amended) by licensed water well contractors. A well abandonment record shall be prepared and filed with the Ontario Ministry of the Environment by the licensed contractor.

Basis of Payment

Payment at the contract price for the above tender item shall be full compensation for all labour, equipment and materials required to do the work.

END OF SECTION

DECOMMISSIONING EXISTING WELLS (STANDPIPE PIEZOMETERS) - Item No.

Non-Standard Special Provision

Scope

Existing wells / piezometers that are to be removed as part of the construction (and which cannot be used as monitoring wells as part of the Permit to Take Water) shall be decommissioned prior to construction in accordance with Ontario Regulation 903 (as amended) by a licensed water well contractor. A well abandonment record shall be prepared and filed with the Ontario Ministry of the Environment by the licensed contractor.

Basis of Payment

Payment at the contract price for the above tender item shall be full compensation for all labour, equipment and materials required to do the work.

END OF SECTION

n:\active\2008\1111\08-1111-0022 uma hwy 404 ext. regionof york\hydrogeology\final report\appendix g\08-1111-0022e nssp decommissioning existing wells.docx



APPENDIX H

Application for Permit to Take Water

For Office Use Only			
Reference Number	Payment Received	Date (y/m/d)	Initials
	\$		

General Information and Instructions

General:

Information requested in this form is collected under the authority of the *Ontario Water Resources Act*, R.S.O. 1990 (OWRA) and the *Environmental Bill of Rights*, C. 28, Statutes of Ontario, 1993, (EBR) and will be used to evaluate applications for a Permit to Take Water as required by Section 34 (OWRA).

Instructions:

- Applicants are responsible for ensuring that they complete the most recent application form.** When completing this form, please refer to the "Guide to Permit to Take Water Application Form" (referred to as the Guide). Application forms and supporting documentation are available from your local Regional or District Office of the Ministry of the Environment, and in the "Publications" section of the Ministry of the Environment website at <http://www.ene.gov.on.ca/envision/gp/index.htm>.
- Questions regarding completion and submission of this application should be directed to local Regional Office of the Ministry of the Environment. Contact information for these offices is available in the Guide or on the Ministry of the Environment website at <http://www.ene.gov.on.ca/envision/org/op.htm>
- This form must be completed with respect to all the requirements of the Guide for it to be considered an application for approval. **Incomplete applications will be returned to the applicant.**
- A complete application consists of:
 - (1) a completed, signed application form
 - (2) all required supporting information identified in this form and the Guide, and
 - (3) a certified cheque or money order, in Canadian funds, made payable to the **Ontario Minister of Finance** for the application fee when required. Payment may also be made by Visa, MasterCard or American Express,

The Ministry may require additional information during the technical review of any application initially accepted as complete.

- The original application, along with supporting information and the application fee should be sent to:

**Ministry of the Environment,
Attention: Permit to Take Water Director
Director, Environmental Assessment and Approvals Branch,
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario, M4V 1L5**

- Information contained in this application form is not considered confidential and will be made available to the public upon request. Information submitted as supporting information may be claimed as confidential but will be subject to the *Freedom of Information and Protection of Privacy Act* (FOIPPA) and the *EBR*. If you do not claim confidentiality at the time of submitting the information, the Ministry of the Environment may make the information available to the public without further notice to you. If you are identifying confidential material, please indicate why you believe the information is confidential.

1. Permit Administration

Please indicate if this is an application for a:

- ☒ New Permit
☐ Amendment to Permit (attach a photocopy of permit)
☐ Renewal of Permit (attach a photocopy of permit)

2. Classification

Classification	Fee Required	No Fee Required
<input type="checkbox"/> Category 1	<input type="checkbox"/> \$750	<input type="checkbox"/> Reason _____
<input type="checkbox"/> Category 2	<input type="checkbox"/> \$750	<input type="checkbox"/> Reason _____
<input checked="" type="checkbox"/> Category 3	<input checked="" type="checkbox"/> \$3,000	<input type="checkbox"/> Reason _____

3. Applicant Information

Applicant Name (legal name of individual or organization as evidenced by legal documents such as a copy of Driver's Licence or Master Business Licence)		Business Identification Number	
Ministry of Transportation, Nanda Kandiah			
Business Name (the name under which the entity is operating or trading if different from the Applicant Name - also referred to as trade name)			
Applicant Type:		North American Industry Classification System (NAICS) Code	
<input type="checkbox"/> Corporation	<input type="checkbox"/> Federal Government	9	1 2 9 1 0
<input type="checkbox"/> Individual	<input type="checkbox"/> Municipal Government		
<input type="checkbox"/> Partnership	<input checked="" type="checkbox"/> Provincial Government		
<input type="checkbox"/> Sole Proprietor	<input type="checkbox"/> Other (describe):		

4. Applicant Physical Address

Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street)				
Ministry of Transportation, 1201 Wilson Ave, Building D, 4th Floor				
City / Town	County/District	Province/State	Country	Postal Code
Downsview		Ontario	Canada	M3M 1J8
Telephone Number (including area code)	Fax Number (including area code)	E-mail Address		
416-235-5397	416-235-3576	nanda.kandiah@ontario.ca		

5. Applicant Mailing Address

Same as Applicant Physical Address? ☒ Yes ☐ No If no, complete below

Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street/P.O.Box/Rural Route Number)			
City / Town	Province/State	Country	Postal Code

6. Project Technical Information Contact

Same as Applicant? ☐ Yes ☒ No If no, complete below

Name		Company	
Shawn Lytle		Golder Associates Ltd.	
Address information:			
Same as Applicant Mailing Address? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If no, please provide technical information contact mailing address below			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street/P.O.Box/Rural Route Number)			
121 Commerce Park Drive, Unit L			
City / Town	Province/State	Country	Postal Code
Barrie	Ontario	Canada	L4N 8X1
Telephone Number (including area code & extension)	Fax Number (including area code)	E-mail Address	
705-722-4492 (ext) 2223	705-722-3786	slytle@golder.com	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)				
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0	
Source Location Information (if multiple sources are included in application, provide information for each source)				
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) Boag Road Northbound Lanes Overpass				
Lot 31	Concession 3	Part	Reference Plan	
Municipality/Unorganised Township Town of East Gwillimbury		County/District Regional Municipality of York	Original Geographic Township	
Geographic (GPS) Coordinates (to be provided in Datum NAD83)				
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624035	Northing 4892785
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location				
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes If yes, please describe: _____ <input checked="" type="checkbox"/> No				
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes If yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No				
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, what is the distance to the nearest well? _____				
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown				
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite			
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes If yes, please attach approval or Notice of Completion <input type="checkbox"/> No				
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes If yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No				
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.)				

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes If yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes If yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)			
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0
Source Location Information (if multiple sources are included in application, provide information for each source)			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) Boag Road Southbound Lanes Overpass			
Lot 31	Concession 3	Part	Reference Plan
Municipality/Unorganised Township Town of East Gwillimbury	County/District Regional Municipality of York	Original Geographic Township	
Geographic (GPS) Coordinates (to be provided in Datum NAD83)			
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624000 Northing 4892775
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location			
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes If yes, please describe: _____ <input checked="" type="checkbox"/> No			
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes If yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No			
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, what is the distance to the nearest well? _____			
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite		
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes if yes, please attach approval or Notice of Completion <input type="checkbox"/> No			
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes if yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No			
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.) 			

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes if yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes if yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)			
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0
Source Location Information (if multiple sources are included in application, provide information for each source)			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) SWMP Holborn			
Lot 26	Concession 3	Part	Reference Plan
Municipality/Unorganised Township Town of East Gwillimbury		County/District Regional Municipality of York	Original Geographic Township
Geographic (GPS) Coordinates (to be provided in Datum NAD83)			
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624390 Northing 4890825
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location			
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes if yes, please describe: _____ <input checked="" type="checkbox"/> No			
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes if yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No			
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, what is the distance to the nearest well? _____			
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite		
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes if yes, please attach approval or Notice of Completion <input type="checkbox"/> No			
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes if yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No			
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.)			

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes if yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes if yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)			
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0
Source Location Information (if multiple sources are included in application, provide information for each source)			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) SWMP 6			
Lot 23	Concession 3	Part	Reference Plan
Municipality/Unorganised Township Town of East Gwillimbury		County/District Regional Municipality of York	Original Geographic Township
Geographic (GPS) Coordinates (to be provided in Datum NAD83)			
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624860 Northing 4889760
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location			
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes If yes, please describe: _____ <input checked="" type="checkbox"/> No			
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes If yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No			
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If no, what is the distance to the nearest well? _____			
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite		
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes If yes, please attach approval or Notice of Completion <input type="checkbox"/> No			
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes If yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No			
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.) 			

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes If yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes If yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)				
Total Number of Wells	Total Number of Lake Intakes	Total Number of Ponds	Total Number of Watercourse Intakes	
0	0	7	0	
Source Location Information (if multiple sources are included in application, provide information for each source)				
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street)				
SWMP 7				
Lot	Concession	Part	Reference Plan	
25	3			
Municipality/Unorganised Township		County/District	Original Geographic Township	
Town of East Gwillimbury		Regional Municipality of York		
Geographic (GPS) Coordinates (to be provided in Datum NAD83)				
Method of Collection	Accuracy Estimate	UTM Zone	Easting	Northing
Digital Mapping		17	624674	4890480
Is the Applicant the owner of the site where water taking will occur?				
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location				
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ?				
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)?				
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				
Are you aware of any complaints or impacts resulting from water takings at the site?				
<input type="checkbox"/> Yes if yes, please describe: _____ <input checked="" type="checkbox"/> No				
Will water from the site be packaged in a container (bottled water, tanks)?				
<input type="checkbox"/> Yes if yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No				
Are wells located within 500 m of the site where water taking will occur?				
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, what is the distance to the nearest well? _____				
Is municipal water available to all dwellings within 500m of the site where water taking will occur?				
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown				
Estimated start date of water taking	Water taking to extend for a period of:			
May 2011	12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite			
Is activity subject to the <i>Environmental Assessment Act</i> ?				
<input checked="" type="checkbox"/> Yes if yes, please attach approval or Notice of Completion <input type="checkbox"/> No				
If yes, did the project receive any Part II Orders / Bump-Up requests?				
<input type="checkbox"/> Yes if yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No				
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.)				

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year?	
<input type="checkbox"/> Yes if yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)?	
<input type="checkbox"/> Yes if yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)			
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0
Source Location Information (if multiple sources are included in application, provide information for each source)			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) SWMP 8			
Lot 28	Concession 3	Part	Reference Plan
Municipality/Unorganised Township Town of East Gwillimbury	County/District Regional Municipality of York	Original Geographic Township	
Geographic (GPS) Coordinates (to be provided in Datum NAD83)			
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624060 Northing 4892015
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location			
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes if yes, please describe: _____ <input checked="" type="checkbox"/> No			
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes if yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No			
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, what is the distance to the nearest well? _____			
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite		
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes if yes, please attach approval or Notice of Completion <input type="checkbox"/> No			
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes if yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No			
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.)			

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes if yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes if yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	

7. Source Information – Note: Source Information must be provided separately for each source. Please complete and submit multiple copies of this Source Information section (pages 3 and 4 of this form) if your application includes more than one source.

Number of Water Taking Sources Included in this Application (do not include domestic uses that do not require a permit)			
Total Number of Wells 0	Total Number of Lake Intakes 0	Total Number of Ponds 7	Total Number of Watercourse Intakes 0
Source Location Information (if multiple sources are included in application, provide information for each source)			
Civic Address - Street information (street number/name/type/direction/unit/suite/emergency 911 location number and street) SWMP 9			
Lot 33	Concession 3	Part	Reference Plan
Municipality/Unorganised Township Town of East Gwillimbury		County/District Regional Municipality of York	Original Geographic Township
Geographic (GPS) Coordinates (to be provided in Datum NAD83)			
Method of Collection Digital Mapping	Accuracy Estimate	UTM Zone 17	Easting 624655 Northing 4894150
Is the Applicant the owner of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, attach the owner's name, address and a signed letter granting consent for the applicant to access the water taking location			
Is the site where water taking will occur located in an area of development control as defined by the <i>Niagara Escarpment Planning & Development Act</i> ? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Is the site where water taking will occur located on the Oak Ridges Moraine Conservation Area as defined by the Oak Ridges Moraine Conservation Plan (a regulation made under the <i>Oak Ridges Moraine Conservation Act</i>)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
Are you aware of any complaints or impacts resulting from water takings at the site? <input type="checkbox"/> Yes if yes, please describe: _____ <input checked="" type="checkbox"/> No			
Will water from the site be packaged in a container (bottled water, tanks)? <input type="checkbox"/> Yes if yes, what size of containers? <input type="checkbox"/> greater than 20 litres <input type="checkbox"/> 20 litres or less <input checked="" type="checkbox"/> No			
Are wells located within 500 m of the site where water taking will occur? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No if no, what is the distance to the nearest well? _____			
Is municipal water available to all dwellings within 500m of the site where water taking will occur? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
Estimated start date of water taking May 2011	Water taking to extend for a period of: 12 <input type="checkbox"/> days <input type="checkbox"/> weeks <input checked="" type="checkbox"/> months <input type="checkbox"/> years <input type="checkbox"/> indefinite		
Is activity subject to the <i>Environmental Assessment Act</i> ? <input checked="" type="checkbox"/> Yes if yes, please attach approval or Notice of Completion <input type="checkbox"/> No			
If yes, did the project receive any Part II Orders / Bump-Up requests? <input type="checkbox"/> Yes if yes, what was the date of the Minister's Decision? _____ <input type="checkbox"/> Decision pending <input checked="" type="checkbox"/> No			
List any public consultation/notification that has occurred related to the proposed water taking (i.e., public hearings, notification of First Nations, etc.) 			

☐ **Watercourse** - please complete this table if applying to take water from a watercourse (i.e., stream, municipal ditch, open drain, etc.)

Watercourse Name	Tributary to
Does flow in the watercourse stop at any time during the year? <input type="checkbox"/> Yes if yes, during which months? _____ For what period of time? _____ <input type="checkbox"/> No	
Do you move/relocate the water intake (pump)? <input type="checkbox"/> Yes if yes, please provide primary and secondary locations on attached map <input type="checkbox"/> No	


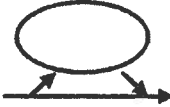
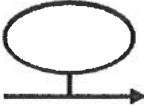

☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier Boag Road NBL				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes if yes, please provide date of construction _____ FUTURE EXCAVATION FOR CONSTRUCTION <input type="checkbox"/> No				
Pond Size				
Average Length 16m	Average Width 5m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
 <input type="checkbox"/> online	 <input type="checkbox"/> by-pass	 <input type="checkbox"/> connected	 <input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater				
<input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel)				
<input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)				
<input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____


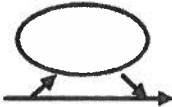
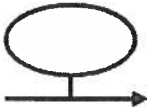

☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened?		
<input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints)		
If 'Driven or Jetted', provide the following:		
Total number of sandpoints/wellpoints: _____		
Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well?		
<input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done?		
<input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier				
Boag Road SBL				
Was the pond constructed (man made)?				
<input checked="" type="checkbox"/> Yes if yes, please provide date of construction FUTURE EXCAVATION FOR CONSTRUCTION <input type="checkbox"/> No				
Pond Size				
Average Length	Average Width	Average Depth of Water	Maximum Depth of Water	Approximate Volume of Pond
16m	5m	Dry	Dry	Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
				
<input type="checkbox"/> online	<input type="checkbox"/> by-pass	<input type="checkbox"/> connected	<input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater <input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel) <input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse) <input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____


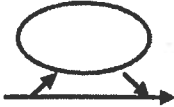
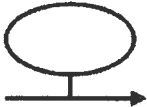

☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier SWMP 6				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes if yes, please provide date of construction <u>FUTURE EXCAVATION FOR CONSTRUCTION</u> <input type="checkbox"/> No				
Pond Size				
Average Length 100m	Average Width 50m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
				
<input type="checkbox"/> online	<input type="checkbox"/> by-pass	<input type="checkbox"/> connected	<input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater <input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel) <input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse) <input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.) If "flowing water", 1. Does water flow into the pond (inflow)? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, is there a structure to regulate the inflow? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe: _____ 2. Does water flow out of the pond (outflow)? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, is there a control structure to regulate the outflow? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, describe: _____				





☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier SWMP 7				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes if yes, please provide date of construction <u>FUTURE EXCAVATION FOR CONSTRUCTION</u> <input type="checkbox"/> No				
Pond Size				
Average Length 90m	Average Width 50m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
 <input type="checkbox"/> online	 <input type="checkbox"/> by-pass	 <input type="checkbox"/> connected	 <input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater				
<input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel)				
<input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)				
<input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____





☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier SWMP 8				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes if yes, please provide date of construction FUTURE EXCAVATION FOR CONSTRUCTION <input type="checkbox"/> No				
Pond Size				
Average Length 150m	Average Width 80m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
 <input type="checkbox"/> online	 <input type="checkbox"/> by-pass	 <input type="checkbox"/> connected	 <input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater				
<input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel)				
<input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)				
<input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____





☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes If yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes If yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes If yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier SWMP 9				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes If yes, please provide date of construction FUTURE EXCAVATION FOR CONSTRUCTION <input type="checkbox"/> No				
Pond Size				
Average Length 100m	Average Width 80m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
 <input type="checkbox"/> online	 <input type="checkbox"/> by-pass	 <input type="checkbox"/> connected	 <input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input type="checkbox"/> Seepage / springs / groundwater				
<input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel)				
<input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)				
<input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____





☐ **Well** - please complete this table if applying to take water from a well (includes sumps for mines and quarries)

Well Name / Identifier	Water Well Record Number	If not available, provide name of property owner at time of well construction
Has the well been deepened? <input type="checkbox"/> Yes if yes, what was the date of deepening? _____ <input type="checkbox"/> No		
Type of Well: <input type="checkbox"/> Drilled <input type="checkbox"/> Bored <input type="checkbox"/> Dug <input type="checkbox"/> Driven or Jetted (sandpoints/wellpoints) If 'Driven or Jetted', provide the following: Total number of sandpoints/wellpoints: _____ Number of interconnected sandpoint/wellpoint systems: _____		
Can you measure the depth to water in this well? <input type="checkbox"/> Yes if yes, what is the depth to static water level? _____ Date Measured: _____ <input type="checkbox"/> No		
Has a pumping test been done? <input type="checkbox"/> Yes if yes, please attach report <input type="checkbox"/> No		

☐ **Lake** - please complete this table if applying to take water from a lake

Lake Name

☒ **Pond/Reservoir** - please complete this table if applying to take water from a pond/reservoir

Pond Name / Identifier SWMP Holborn				
Was the pond constructed (man made)? <input checked="" type="checkbox"/> Yes if yes, please provide date of construction <u>FUTURE EXCAVATION FOR CONSTRUCTION</u> <input type="checkbox"/> No				
Pond Size				
Average Length 80m	Average Width 50m	Average Depth of Water Dry	Maximum Depth of Water Dry	Approximate Volume of Pond Dry
Pond Type				
Select the diagram that most accurately resembles your pond:				
 <input type="checkbox"/> online	 <input type="checkbox"/> by-pass	 <input type="checkbox"/> connected	 <input checked="" type="checkbox"/> dugout	
Source of pond water (select all that apply)				
<input checked="" type="checkbox"/> Seepage / springs / groundwater				
<input checked="" type="checkbox"/> Surface water runoff (including tile drains, does not include watercourse or open channel)				
<input type="checkbox"/> Pumped water (if water is pumped into a pond, complete section information for source from which water is pumped - i.e., well, lake or watercourse)				
<input type="checkbox"/> Flowing water (watercourse, open drains, ditches, etc.)				
If "flowing water",				
1. Does water flow into the pond (inflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a structure to regulate the inflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____
2. Does water flow out of the pond (outflow)?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	
If yes, is there a control structure to regulate the outflow?		<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, describe: _____

<p>Is this application for water taking to extend for a period of less than one year?</p> <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>If no, this application may be subject to posting and/or public consultation requirements under the Environmental Bill of Rights. For more information, please refer to the Guide.</p>	
<p>Is this application for agricultural use or aquaculture?</p> <p><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p> <p>If no, this application may be subject to posting and/or public consultation requirements under the Environmental Bill of Rights. For more information, please refer to the Guide.</p>	

Purpose Options for Water Taking	
	Purpose
Agriculture	irrigation of (includes frost protection): field and pasture crops; fruit orchard; market garden/flowers; nursery; sod farm; tender fruits; tobacco, other (must specify)
Commercial	aquaculture, bottled water, golf course irrigation, mall/business; snowmaking, other (must specify)
Construction	Dredging, road building, other (must specify)
Dewatering	pits and quarries; construction; other (must specify)
Industrial	aggregate washing, brewing/soft drinks, cooling water, food processing, manufacturing; pipeline testing; power generation; other (must specify)
Institutional	school, hospital, other (must specify)
Recreation	aesthetic, fish pond, wetland, other (must specify)
Remediation	groundwater; other (must specify)
Water Supply	campground, communal, municipal, other (must specify)
Miscellaneous	dam/reservoir, heat pump, wildlife conservation, pumping test, other (must specify)

[illegible]

10. Attachments

The following must be attached for all applications (Category 1, 2 and 3) to be complete:

- ☒ **Map Requirements**
On a 1:10 000 OBM (Ontario Base Map) (1:50 000 only acceptable in locations where 1:10 000 is not obtainable), mark and label:
 - all existing and proposed water taking locations with sources corresponding with source name
 - all of the following features within 500m of each source: existing wells (indicate use of existing well, springs, watercourses, wetlands, water bodies, property lines, locations and name of property owners, nearest road intersection, dwellings.
- ☒ Describe **in detail** how, where and when all water is obtained, stored, transferred, used and returned to the environment (if applicable). Details must include the source of all water takings (and corresponding source name if applicable), purpose of the water taking, period of water taking, and maximum quantity requested (see Guide for further instruction).
Note: If your application is subject to posting on the Environmental Bill of Rights (EBR) Registry, this description will be used to create the Proposal Notice. The ministry may change the wording as required, to meet the EBR posting requirements.
- ☒ Describe how water taking needs (rates, amounts and time periods) were determined. Provide all relevant information and calculations to demonstrate the water takings requested are warranted. Calculation worksheets are available. Refer to Appendix E of the Guide.
- ☒ Attach completed water conservation Schedule 1.

The following must be attached for all Category 2 applications:

- ☐ Completed Schedule 2 and/or Schedule 3 signed by a Qualified Person.

The following must be attached for all Category 3 applications:

- ☒ Study Summary Letter Dated June 17, 2010

11. Statement/Signature of Applicant

I, the undersigned, hereby declare that to the best of my knowledge:

- The information contained herein and the information submitted in support of this application is complete and accurate in every way and I am aware of the penalties against providing false information.
- The Project Technical Information Contact identified in Section 6 if this form is authorized to act on my behalf for the purpose of obtaining this approval.

Print Name	Signature	Date (yyyy/mm/dd)

Application for Permit to Take Water

Ce formulaire est disponible en français

For Office Use Only			
Reference Number	Payment Received	Date (y/m/d)	Initials
	\$		

12. Payment Information

Application Category		Amount Enclosed	
<input type="checkbox"/> Category 1 (\$750)	<input type="checkbox"/> Category 2 (\$750)	<input checked="" type="checkbox"/> Category 3 (\$3000)	\$ <input type="checkbox"/> no fee required
Method of Payment			
<input type="checkbox"/> Certified Cheque <input type="checkbox"/> Money Order <input type="checkbox"/> VISA <input type="checkbox"/> MasterCard <input type="checkbox"/> American Express			
Credit Card Information (if paying by VISA, MasterCard or American Express)*			
Name on Card (please print)	Credit Card Number	Expiry Date (yy/mm)	
Cardholder Signature		Date (y/m/d)	

*NOTE: credit card accepted for payments UNDER \$10,000.00 only.

APPENDIX E

Schedule for Water Conservation Measures

Schedule 1 – Implementation of Water Conservation in accordance with Best Management Practices and Standards for the Relevant Sector

General Information and Instructions

Section 1: General Information

Information on this Schedule is collected under the authority of the *Ontario Water Resources Act, R.S.O. 1990 (OWRA)*, and the new *Environmental Bill of Rights, C. 28. Statutes of Ontario, 1993*, and will be used to evaluate applications for a Permit to Take Water as required by Section 34 (OWRA).

Instructions:

1. This Schedule forms part of the Permit to Take Water application form and is subject to all provisions and instructions where applicable.
2. All questions of Section 2 of this Schedule must be answered for this Schedule to be considered complete.

Purpose:

The purpose of this Schedule is to allow persons applying for a permit required by the Ministry to document in the application all water conservation measures and practices that are currently being undertaken or that is anticipated to be undertaken for the duration of the permit.

Persons applying for a permit are encouraged to take all reasonable and practical measures to conserve water and to be up to date with sector-specific best management practices and standards for water conservation (i.e. whether you are currently implementing or anticipate implementing water conservation best water management standards and practices relevant to your sector).

Various sector associations publish information on best practices that may be useful in determining practices and standards for water conservation. Examples of these sector-specific associations include the following:

- **Municipal Sector** – Ontario Water Works Association
- **Agricultural Sector** – Ontario Ministry of Agriculture (Fact Sheets and Guides on Best Management Practices containing information on efficient irrigation systems, staggering irrigation schedules and preparing Environmental Farm Plans)
- **Other Sectors** – For information on up-to-date best management practices and measures for water conservation, contact your relevant sector association.

Section 2: Water Conservation Best Management Practices and Standards

Use this section of the Schedule to indicate what conservation measures and practices you are currently implementing or anticipate implementing. Where relevant, additional information can be attached as an appendix to this Schedule.

State your goals for reducing the use, loss or waste of water or for increasing the efficiency of water use (e.g., litres per day per unit of production or litres per day per capita for the residential sector).

Schedule 1 continued

Check off which of the following water conservation best management measures and practices that you have implemented or will implement for the duration of the permit:

	Implemented	To be Implemented
Water Use Audit	<input type="checkbox"/> N/A	<input type="checkbox"/>
Universal metering of all users (municipalities)	<input type="checkbox"/> N/A	<input type="checkbox"/>
Water Efficient Fixtures/Equipment/Technology	<input type="checkbox"/> N/A	<input type="checkbox"/>
Develop and Implement an Overall Water Conservation and Efficiency Program	<input type="checkbox"/> N/A	<input type="checkbox"/>
Leak Detection/Loss Prevention/Control Program	<input type="checkbox"/> N/A	<input type="checkbox"/>
Public/Employee Information/Education/Outreach	<input type="checkbox"/> N/A	<input type="checkbox"/>
Landscaping techniques/Site and Urban Design Principles	<input type="checkbox"/> N/A	<input type="checkbox"/>
Water Efficient production processes/practices (e.g. re-use of water)	<input type="checkbox"/> N/A	<input type="checkbox"/>
Economic Incentives/Cost-Share/Full Costing recovery/tax credits/rebate programs	<input type="checkbox"/> N/A	<input type="checkbox"/>

Other (please specify): N/A

Of the measures and practices checked off above, provide specific details of the best management practices applied or to be applied including equipment (e.g. pump specification), processes, such as water used for industrial production and/or irrigation system(s), current and proposed technology, approach, processes and procedures:

N/A

For the above measures and practices, list information relevant for your sector and/or other sources of information used in determining water conservation and efficiency management practices and measures: N/A

List dates of when the best management measures and practices were or will be applied for the duration of the permit: N/A

Identify any approval or certification that you have received for implementing water conservation and efficiency best management practices, e.g. Environmental Farm Plan, Audubon Cooperative Sanctuary Program for Golf Courses: N/A

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