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**Geotechnical Investigation
Proposed QEW Utility Crossing
for Horizon Utility & Cogeco Cable
Fifty Road, Stoney Creek, Ontario**

Prepared for:

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HAGE00304213A (Revised)
September 17, 2008

Table of Contents

1. Introduction	2
2. Site Description	3
3. Investigation Program	3
3.1 Fieldwork	3
3.2 Laboratory Testing	3
4. Subsurface Conditions	6
4.1 Subsoil Conditions	6
4.1.1 Topsoil/pavement structure	6
4.1.2 Clayey Silt Till	6
4.2 Groundwater Conditions	7
5. Discussions and Recommendations	8
5.1 Engineering Evaluation of Subsurface Conditions	8
5.2 Comments on Horizontal Directional Drilling	8
5.3 Excavation	9
5.4 Backfilling Operations	9
5.5 Ground Movement Monitoring	10
5.5.1 Surface Monitoring Points	10
5.5.2 Data Collection and Data Transfer	10
5.5.3 Criteria for Assessment	11
6. General Comments	12

Appendix A
Borehole Location Plan
Note of Sample Description
Borehole Logs

Appendix B
Results of Grain Size Analysis (Figures 1- 5)
Atterberg Limits (Figure 6)

1. Introduction

Trow Associates Inc. (Trow) was retained by Horizon Utilities & Cogeco Cables to conduct a geotechnical investigation for the proposed QEW Utility Crossing in the Town of Stoney Creek, Ontario.

It is understood that the proposed Utility Crossing will be installed by horizontal directional drilling techniques under the QEW. The proposed crossing is located west of Fifty Road at the partial cloverleaf interchanges area.

The invert for the proposed crossing, based on our understanding, will be 2 m below the existing road grade at the access ramps area, and 5 m below the existing road grade at the QEW east & west bound lanes. We also understand that the diameter of the proposed bore will range between 0.51 and 0.61 m.

The purpose of this geotechnical investigation was to determine the subsurface soil and groundwater conditions at the site by drilling six (6) boreholes along the proposed crossing alignment to a depth ranging between 4.7 and 6.7 m below the existing grade, and based on this information, to provide an engineering report with geotechnical recommendations pertaining to the proposed construction.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or it may require additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description

The proposed Utility crossing is located underneath the QEW just west of the Fifty Road Bridge, in the Town of Stoney Creek, Ontario.

The area of the investigation was the Ministry of Transportation right of way at the six-ramp partial cloverleaf intersection, and the freeway median area (left shoulder for the QEW west bound). Ground surface at the area between the access ramps is covered with grass and small vegetation, with some shrubs and low bushes scattered around the adjacent bridge abutments. The land use at the surrounding area is predominately commercial at the south side of the QEW, and residential at the north side. The entry point for the proposed crossing is located between the QEW east bound exit and entrance ramps off Fifty Road south bound lanes. The egress point for the proposed crossing is located to the northwest of the MTO right of way on a grassy area near Base Line Road.

3. Investigation Program

3.1 Fieldwork

The fieldwork for this investigation was carried out on June 12 and 13, 2008. In general accordance with the MTO specification, subsurface conditions were explored at six (6) borehole locations (as illustrated on Drawings No.1. Boreholes were advanced to termination depths that ranged between approximately 4.6 m (Borehole No.'s 1, 2, and 5) to 7.6 m (Borehole No.'s 3, 3A and 4) below existing grades.

The fieldwork was supervised by a member of Trow's engineering staff who cleared the underground utilities, obtained the necessary permits, directed the drilling and sampling operations, documented the stratigraphy encountered at the boreholes, and observed the groundwater conditions. Drilling operations was carried out by a local contractor (Determination Drilling & Soil Investigation) in compliance with the conditions of the MTO Encroachment Permit No. EC-2008-20t-99, dated June 03, 2008, and the MTO Temporary Conditions Manual Book 7.

Representative samples of the subsoils were recovered in the boreholes at 0.75 and 1.5 m depth intervals using a split spoon sampler driven in accordance with the standard penetration test procedure. All soil samples were preserved in plastic bags, labeled accordingly and returned to Trow's Hamilton laboratory for visual, textural and olfactory classification. The groundwater conditions in the open boreholes were closely monitored during and upon completion of drilling. In addition, piezometers were installed in Boreholes 3 and 4 for long term monitoring. The water levels in the piezometers were read on June 19, 2008. All boreholes were backfilled upon completion of drilling with a bentonite mix as per MOE regulations, with the exception of the boreholes where piezometers were installed. The locations and ground surface elevations of the boreholes were established in the field by Trow. The ground surface elevations at the borehole locations were reference to benchmark as detailed below:

Tablet in top of south concrete abutment at the southeast corner of the Fifty Road Bridge (over the QEW), 0.82 m from south end of the abutment, and 0.21 m from the west face of the concrete sidewall. The benchmark geodetic elevation is 91.277 m.

3.2 Laboratory Testing

The geotechnical laboratory testing program consisted of the following:

- Natural moisture content determination on all recovered soil samples,
- Unit weight determination on selected cohesive soil samples,
- Undrained shear strength of cohesive samples using pocket penetrometer, and

- Atterberg limits and grain size analysis on selected samples

The results of the moisture content, unit weight and Atterberg Limits tests are summarized on the borehole logs. The results of the grain size analyses and Atterberg Limits tests are shown plotted in Figures 1 to 6 attached in Appendix B.

4. Subsurface Conditions

4.1 Subsoil Conditions

Underneath the surface layer of topsoil or pavement, the boreholes encountered clayey silt till to full depths of exploration. Details of the fieldwork including soil descriptions, inferred stratigraphy, standard penetration 'N' values, and groundwater observations in the boreholes during and following completion of drilling are given on the Log of Borehole sheets, (Drawing Nos. 2 to 7) attached in appendix A..

It should be noted that the boundaries of soil indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change. It should be noted that the "Notes on Sample Description", preceding the borehole logs, forms an integral part of the report and should be read in conjunction with it.

A brief description of the soil units encountered at the borehole locations is presented in the following sections.

4.1.1 Topsoil/pavement structure

A layer of topsoil was encountered at the surface in Boreholes 1, 2, 3, 4 and 5. The thickness of the topsoil layer ranged from 100 to 150 mm.

At Borehole No. 3A a layer of asphaltic concrete was encountered on the surface overlying crushed limestone to a depth of 610 mm below the existing grade.

Topsoil measurements were carried out at the borehole locations only and were observed to be variable across the site. If required, a more detailed analysis (involving closely spaced test pits) should be carried out to accurately quantify the amount of topsoil to be removed.

4.1.2 Clayey Silt Till

Clayey silt till was encountered underlying the topsoil/pavement structure layer in all boreholes. This is a well graded deposits composed of 2 to 7% gravel, 23 to 31% sand, 50 to 62% silt, and 11 to 20% clay size particles. It also contains some cobbles and boulders.

The natural moisture content of the native clayey silt till ranged from 9 to 19%. The liquid limit, plastic limit, and plasticity index of three samples of the till were found to range from 21 to 27%, 15 to 18%, and 6 to 9, respectively. These results are typical of a low plasticity clay or clayey silt.

The SPT 'N' values recorded in the clayey silt till varied from 8 to more than 100 blows per 300 mm, but mostly in the range of 12 to 50 blows, suggesting stiff to hard consistency, with occasional firm zones.

4.2 Groundwater Conditions

Groundwater conditions were assessed in the open boreholes during the course of the fieldwork. Free water was not encountered in any of the boreholes upon completion of drilling. These short term observations may not represent the true groundwater conditions at this site due to the short period of observation and the low permeability of the site soils.

Piezometers were installed in Boreholes 3 and 4, and the water levels in the piezometers were read on June 19, 2008, with the results shown in Table 1 below.

Table 1: Water Level Measurements in the Installed Piezometer

BH No.	Depth of Borehole	Groundwater Depth/Elevation (m)
BH3(P1)	7.6 m	6.24 / 77.6
BH4(P2)	7.6 m	No free water

In the long term, seasonal fluctuations of the groundwater level at the site should also be anticipated.

5. Discussions and Recommendations

5.1 Engineering Evaluation of Subsurface Conditions

The boreholes encountered generally consistent and fairly uniform subsurface conditions. The stratigraphy comprises a thin covering of topsoil underlain by clayey silt till. The till is a well graded deposit of low plasticity and generally stiff to hard consistency. Groundwater level at the time of the investigation was more than 6 m below existing ground surface. These subsurface conditions are generally favorable for the proposed construction.

5.2 Comments on Horizontal Directional Drilling

We understand that it is proposed to install the underground services by horizontal directional drilling. The drill hole diameter is expected to have a maximum diameter of 0.56 m, at invert depths of 2 to 5 m.

The drill hole for the installation of the services is expected to encounter generally stiff to hard clayey silt till. The till has a slight apparent cohesion, and is classified as a firm soil in Terzaghi's Tunnelman's Ground Classification. At the proposed invert depth, the undrained shear strength of the soil is estimated to range from 75 kPa to over 200 kPa. The Stability Factor (i.e., the ratio of overburden pressure at tunnel center line to undrained shear strength) will be less than 2. From past experience, it should be feasible to install the services by horizontal directional drilling in the clayey silt till, and stability at the face and crown of the drill hole should be satisfactory (with a properly designed drilling fluid).

The horizontal directional drilling method uses a drilling fluid for support of the drill hole and to transport the soil cutting. The drilling fluid should be designed by a specialist contractor, based on such factors as the soil type, diameter and depth of drill hole, rate of drilling, etc., and may have to be adjusted as construction proceeds.

The consistency of the clayey silt till ranges from firm to hard, and it also contains some cobbles and boulders. The cutting head used for the horizontal directional drilling must be capable of handling the range of consistency, and the presence of cobbles and boulders, which could be up to 0.3 m or larger. Past experience indicates that boulders size up to about 20 to 30% the drill hole diameter could be pushed to the side or removed by the drilling fluid, but larger boulders must be broken down into smaller pieces before they can be removed. The boulders are much harder than the soil matrix and will cause more wear and tear to the cutting head.

Groundwater table is expected to be below the invert of the drill hole; however, the till could contain sand seams that could be water bearing and could introduce some seepage into the drill hole.

With good construction control and no loss of drilling fluid, the road directly above the center line of the drill hole is expected to experience less than 5 mm settlement.

5.3 Excavation

We do understand that, the entry point for the proposed pipe installation is located on the MTO right of way (the location of Manhole No. 1 as noted on the attached Borehole Location Plan). Consequently, excavation will be required at this location for the Manhole installation. Based on the results of the investigation, the excavation for the most part will generally be carried out within the clayey silt till layer. It should be noted that the conditions can be significantly different from those indicated in the boreholes if there are existing service trenches immediately adjacent to the excavations. If such is the case, more fill material should be anticipated during excavations.

Excavations may be undertaken as “open-cut”, provided they comply with the requirements of the current Occupational Health and Safety Act (OHSA). For guidance, the very stiff silty clay till is considered to be a Type 2 soil and the firm portion of the till is considered as a Type 3 soil. The fill material is also classified as Type 3 soil. According to OSHA regulations, if an excavation contains more than one type of soil, the soil shall be classified as the type with the highest number. The silty clay till should therefore, be classified as Type 3 soil for this site.

The OSHA requires that excavation slopes be cut at predetermined inclinations, based on the soil types. Locally, where loose/soft materials are encountered, or within zones of persistent seepage at depth, it may be necessary to flatten the side slopes further. It is anticipated that excavations can be carried out in open cuts using conventional large backhoe type equipment. Cobbles and boulders could be encountered in the clayey silt till layer and their presence may influence the progress of excavations. Consequently, provisions should be made in the contract documents to cover any delays caused by boulder obstructions. Side slopes of temporary excavations must conform to the most recent Occupational Health and Safety Act (OHSA) and local regulations. For guidance, the very stiff silty clay till is considered to be a Type 2 soil and the stiff portion of the till is considered as a Type 3 soil. The fill material is also classified as Type 3 soil. According to OSHA regulations, if an excavation contains more than one type of soil, the soil shall be classified as the type with the highest number. The silty clay till should therefore, be classified as Type 3 soil for this site.

5.4 Backfilling Operations

Backfill used to satisfy and service trenches, etc., should be compactable fill, i.e. inorganic soil with its moisture content close to its optimum moisture content determined in a standard Proctor test. The excavated native soils are expected to be a cohesive till which is likely to be blocky in nature and would be difficult to compact in confined areas or where large compactors cannot be used. The soil will also require partial drying to reach the optimum moisture. The use of this material should therefore be limited. Imported granular or other non-cohesive soils should be considered.

Backfilling procedures and materials should also meet the provincial and local requirements and specifications.

Any organic, excessively wet, or otherwise deleterious material should not be used for backfilling purposes. Any shortfall of suitable on-site excavated material can be made up with imported and approved materials.

Backfill should be placed in lifts not exceeding 200 mm and compacted to satisfy the local and provincial requirements.

All backfill and compaction operations should be monitored by qualified geotechnical personnel to approve material, to evaluate placement operations, and to verify that the specified degree of compaction is being achieved throughout the fill.

5.5 Ground Movement Monitoring

5.5.1 Surface Monitoring Points

It is recommended that during construction, ground movement monitoring be carried out for the highway and for the ramps, and the method and equipment of construction modified as necessary. The ground movement monitoring program should be carried out in accordance with the MTO requirements and the most recent guideline for tunneling.

The monitoring should consist of surface and deep settlement points along the center line and on either sides of the drill hole. The deep settlement points should be installed below the frost penetration depths. The surface settlement points should be marked on either sides of the proposed pipe alignment at a maximum spacing of 5.0 m O.C. Locations of the surface settlement points are subjected to the MTO approval where traffic disruption might occur.

A condition survey must be carried out before the construction take place, and after the completion of the proposed bore. The survey should document the pavement surface conditions (i.e. cracks, distortion and deviations, heaves, and depressions).

5.5.2 Reading Frequency

An average of at least two readings should be taken to establish the initial conditions. A minimum of three (3) sets of reading should be taken daily during construction and work stoppages. The monitoring should be extended after the construction completion for at least 2 weeks provided that further settlement has stopped.

5.5.3 Data Collection and Data Transfer

A procedure should be established in consultation with the MTO to make sure that the monitoring data will reach all parties as soon as necessary. The consultant and the contractor should interpret monitoring data as needed. The Foundation Engineer will be contacted for technical support in the interpretation of the ground movements and review of the contractor response when review and alert levels are reached.

5.5.4 Criteria for Assessment

An average of 2 initial reading shall be recorded as baseline readings, all the subsequent readings should be compared to the baseline reading. A maximum value of 10 mm relative to the baseline reading shall be considered as a review level, at which, the method, rate and sequence of construction, or ground stabilization measures should be reviewed or modified to mitigate further ground movement.

A maximum value of 15 mm relative to the baseline readings shall be considered as an Alert Level, at which, the contractor shall cease construction operations and secure the site, to mitigate further movements and to assure safety of public and maintain traffic.

6. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation. The results reflect only limited environmental conditions of the site or subsoil.

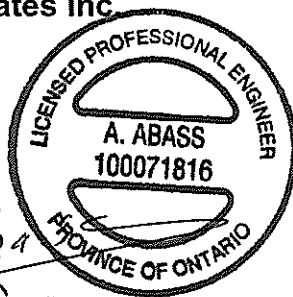
The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigation, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.


Trow Associates Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Trow Associates Inc. will assume no responsibility for interpretation of the recommendations in the report.


We trust this information is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours very truly,

Trow Associates Inc.




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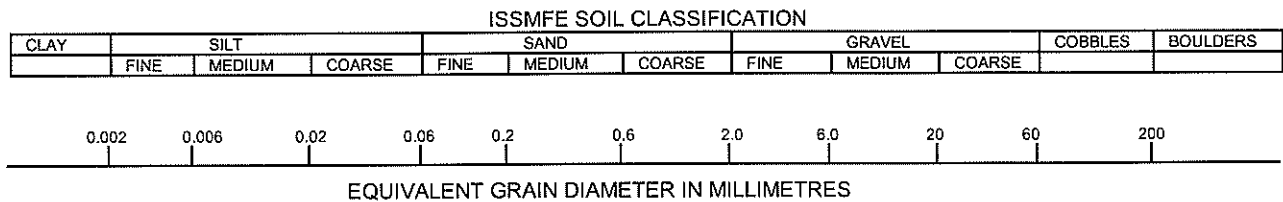



Stephen D. Campbell, P. Geo.
Hamilton Branch Manager

Appendix A:
Drawings 1: Borehole Location Plan
Drawings 2 to 7: Borehole Logs

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by Trow Consulting Engineers Limited also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. **Fill:** Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.
3. **Till:** The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.



Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 1

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/13/2008 - 6/13/2008 CHECKED BY J.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) •		DYNAMIC CONE PENETRATION	PLASTIC LIMIT PL	NATURAL WATER CONTENT w	LIQUID LIMIT LL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						
89.6	Topsoil														
89.0	Clayey Silt Till														
0.2	- brown														
	- fissured														
	- trace of gravel														
	- moist														
	- stiff														
			1	SS	13										
			2	SS	13										
			3	SS	12										
			4	SS	8										
			5	SS	12										
84.6	End of Borehole														
5.0	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 5.0 m 4. Borehole backfilled upon completion of drilling.														

ON MOT BRGE303730_MTO.GPJ ON MOT.GDT 9/10/08

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



Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 2

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/12/2008 - 6/12/2008 CHECKED BY J.N.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) •		PLASTIC LIMIT PL	NATURAL WATER CONTENT W	LIQUID LIMIT LL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		DYNAMIC CONE PENETRATION 20 40 60 80 100	+					
83.7													
83.8	Topsoil												
0.2	Clayey Silt Till - brown - fissured - trace of gravel - sand seams - moist - very stiff to hard		1	SS	19								
			2	SS	24								
			3	SS	34								
			4	SS	55								
			5	SS	50								
78.7	End of Borehole												
5.0	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 5.0 m 4. Borehole backfilled upon completion of drilling.												

+ 3, x 3: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE



Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 3

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/12/2008 - 6/12/2008 CHECKED BY J.N.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) ● DYNAMIC CONE PENETRATION					PLASTIC LIMIT PL	NATURAL WATER CONTENT w	LIQUID LIMIT LL	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
83.6																
80.8	Topsoil															
0.2	Clayey Silt Till - brown - fissured - traces organic at 0.76 m - trace of gravel - sand seams - moist - very stiff to hard		1	SS	16		●					>>(0)	0			
			2	SS	25		●					>>(0)	0			
			3	SS	15		●					>>(0)	0			
			4	SS	17		●					>>(0)	0			
			5	SS	36		●					>>(0)	0			
			6	SS	26		●					>>(0)	0			
			7	SS	19		●					>>(0)	0			
75.5	End of Borehole															
8.1	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 8.1 m. 4. Piezometer was installed.															

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

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Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 3A

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/13/2008 - 6/13/2008 CHECKED BY J.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) • DYNAMIC CONE PENETRATION		PLASTIC LIMIT PL	NATURAL WATER CONTENT w	LIQUID LIMIT LL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
83.8	Asphaltic Concrete													
83.0	Granular Fill													
83.2	- crushed limestone													
0.6	- Grey													
	Clayey Silt Till		1	SS	27									
	- brown		2	SS	49									
	- fissured		3	SS	19									
	- trace organic at 0.76 m		4	SS	18									
	- trace of gravel													
	- sand seams													
	- moist													
	- stiff to hard													
75.7			5	SS	11									
			6	SS	28									
			7	SS	28									
8.1	End of Borehole													
	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 8.1 m 4. Borehole backfilled upon completion of drilling.													

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE

ON MOT BRGE0030730_MTO.GPJ ON MOT.GDT 9/10/08



Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 4

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/12/2008 - 6/12/2008 CHECKED BY J.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) ●			PLASTIC LIMIT PL	NATURAL WATER CONTENT w	LIQUID LIMIT LL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			DYNAMIC CONE PENETRATION								SHEAR STRENGTH kPa			WATER CONTENT (%)
83.0								20	40	60	80	100							
82.9	Topsoil																		
0.2	Clayey Silt Till - brown - fissured - traces organic at 0.76 m - trace of gravel - sand seams - some cobbles and boulders - moist - stiff to hard		1	SS	10		82												
			2	SS	21		81												
			3	SS	53		80												
			4	SS	50/100 mm		79												
			5	SS	17		78												
			6	SS	18		77												
			7	SS	29		76												
74.9	End of Borehole						75												
8.1	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 8.1 m 4. Piezometer was installed.																		

ON MOT BRGE003730, MTO, GPJ ON MOT, GDT 9/10/08

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



Trow Associates Inc.
428 Millen Road
Stoney Creek, ON L8E 3N9

RECORD OF BOREHOLE No 5

SHEET 1 OF 1

METRIC

PROJECT NO. HAGE00304213A LOCATION See Borehole Location Plan ORIGINATED BY P.P.
DIST Central HWY QEW BOREHOLE TYPE CONTINUOUS FLIGHT SOLID STEM AUGERS COMPILED BY A.A.
DATUM GEODETIC DATE 6/13/2008 - 6/13/2008 CHECKED BY J.N.

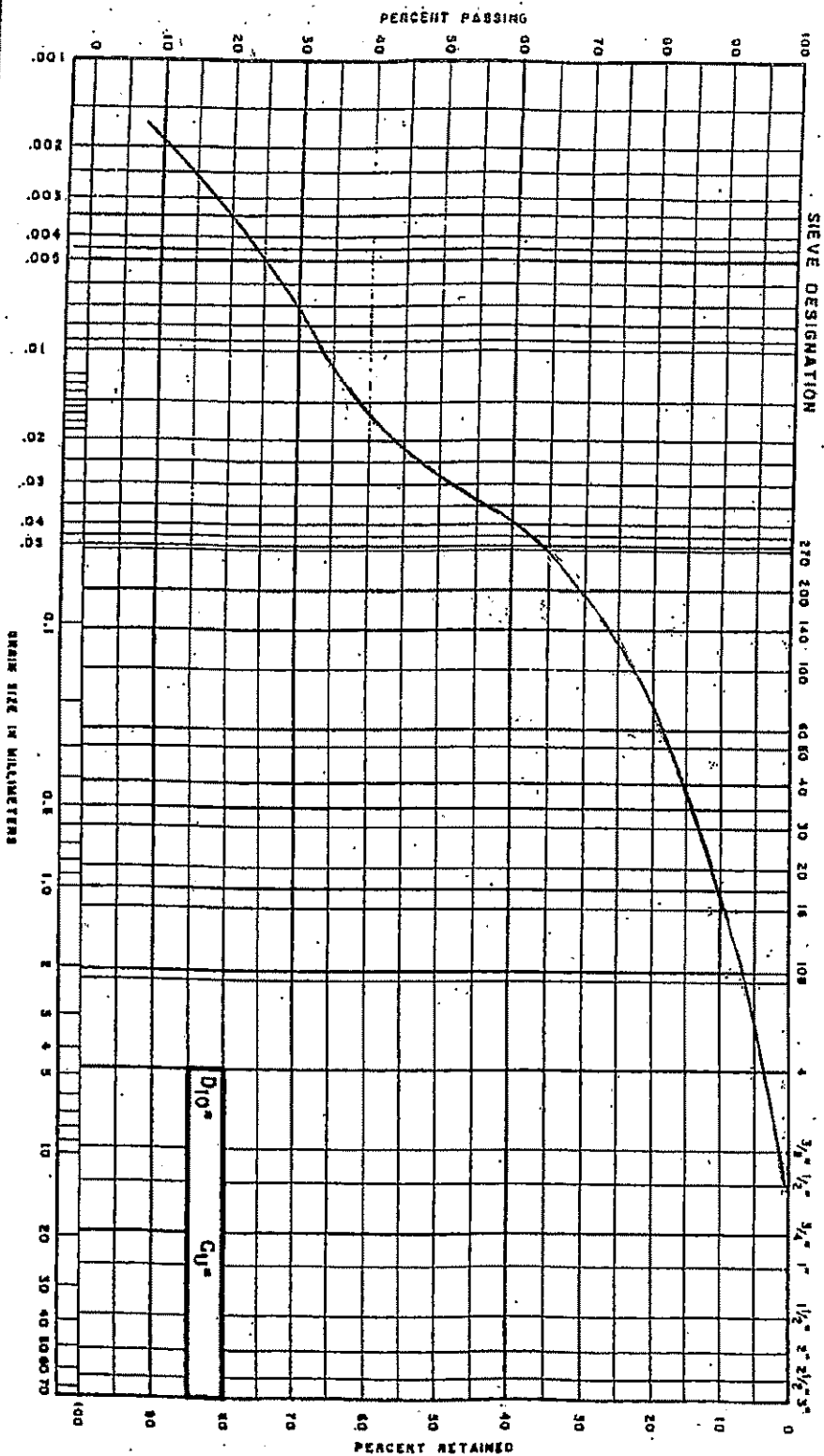
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	SPT TEST (N-Value) • DYNAMIC CONE PENETRATION			PLASTIC LIMIT PL	NATURAL WATER CONTENT w	LIQUID LIMIT LL	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			
82.1	Topsoil														
80.0	Clayey Silt Till														
0.2	- brown - fissured - traces organic at 0.76 m - trace of gravel - sand seams - silt zone at 2.3 m - moist - very stiff to hard		1	SS	18										
			2	SS	26										
			3	SS	28										
			4	SS	29										
			5	SS	21										
77.1	End of Borehole														
5.0	NOTES: 1. This drawing is to be read with the subject report and project number as presented above. 2. Interpretation assistance by Trow is required before use by others. 3. Borehole advanced by solid stem auger equipment to a termination depth of 5.0 m 4. Borehole backfilled upon completion of drilling.														

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

ON MOT BRGE0030730_MTO.GPJ ON MOT.GDT 9/10/08

Cloy & Silt

Sand		Gravel	
Fine	Medium	Coarse	Fine



JOB NO.: HAGE00304213A



Figure 1

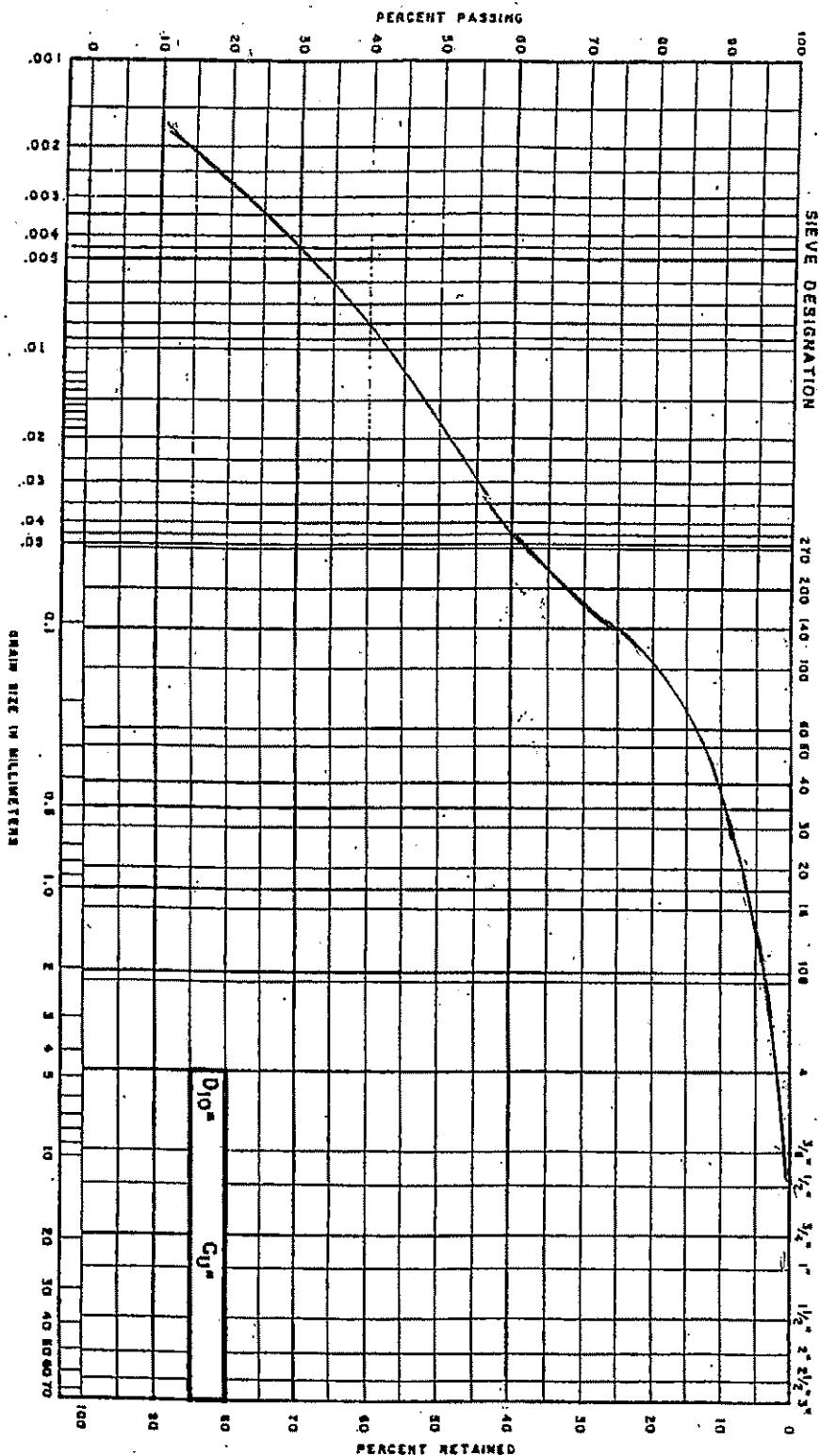
SAMPLE ID: 8-110 BHL @ 2.3 m

DATE SAMPLED: June 13, 2008

Appendix B
Figures 1 – 5: Grain Size Analysis Results
Figure 6: Atterberg Limits

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt		Sand		Gravel	
		Fine	Medium	Coarse	
					Fine Coarse



CLIENT:

JOB NO.: HAGE00304213A

Trow

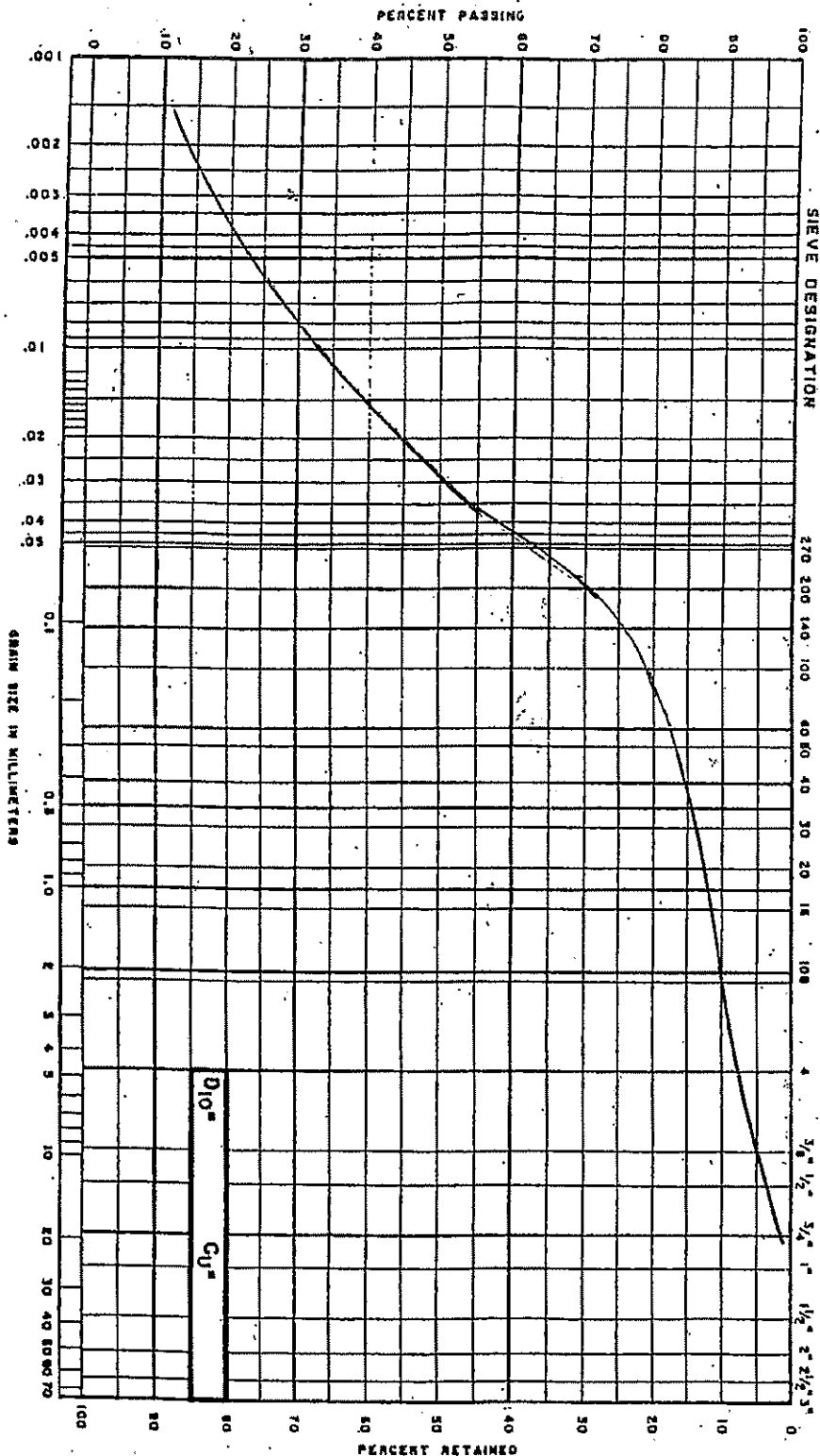
Figure 2

SAMPLE ID: * 8-111 BH2 @ 2.3 m

DATE SAMPLED: June 12, 2008

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt		Sand			Gravel	
		Fine	Medium	Coarse	Fine	Coarse



CLIENT:

JOB NO.: HAGE003004213A

Trow

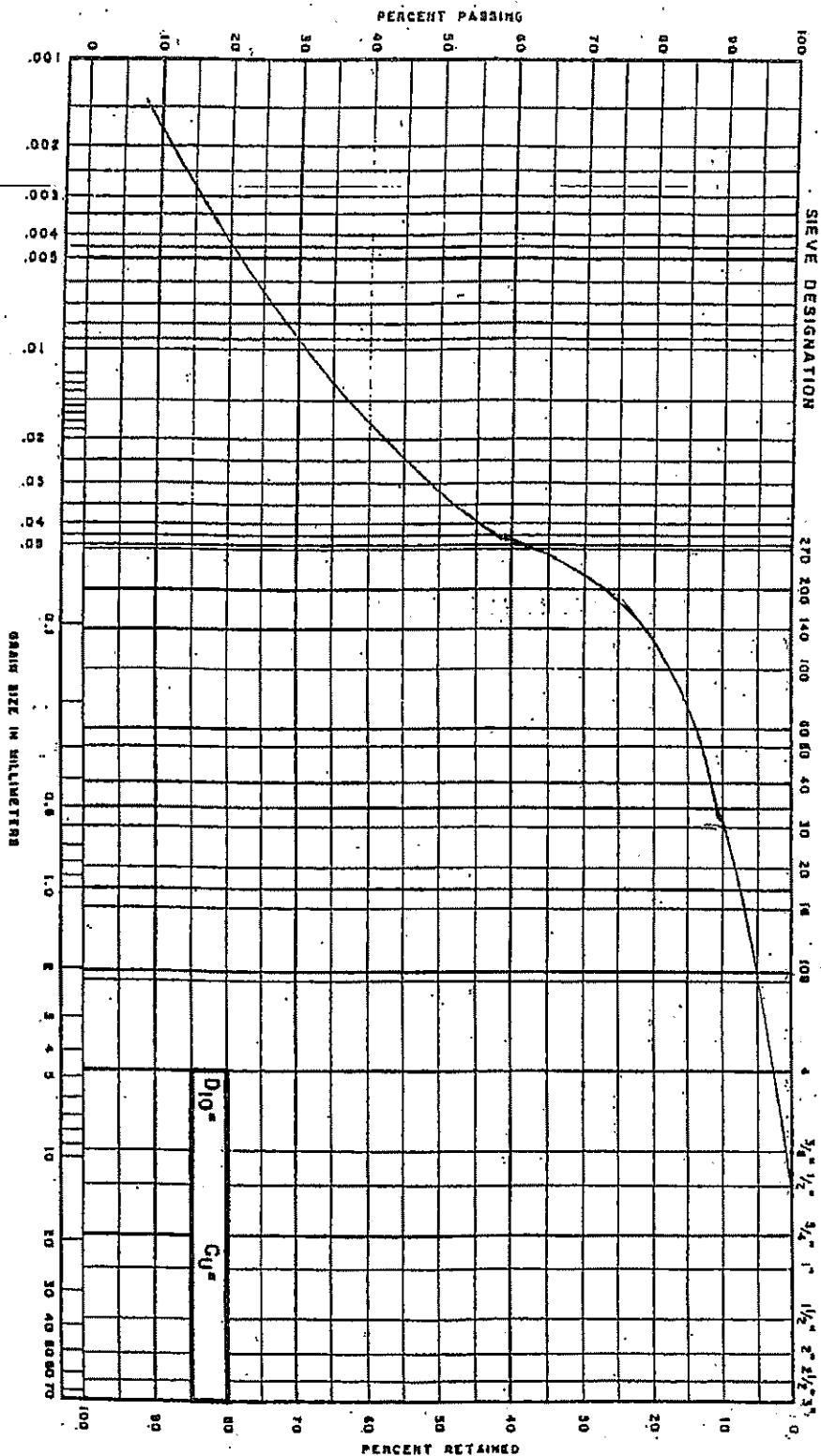
Figure 3

SAMPLE ID: 8-104 BH3 @4.6 m

DATE SAMPLED: June 12, 2000

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt		Sand		Gravel	
		Fine	Medium	Coarse	Fine
					Coarse

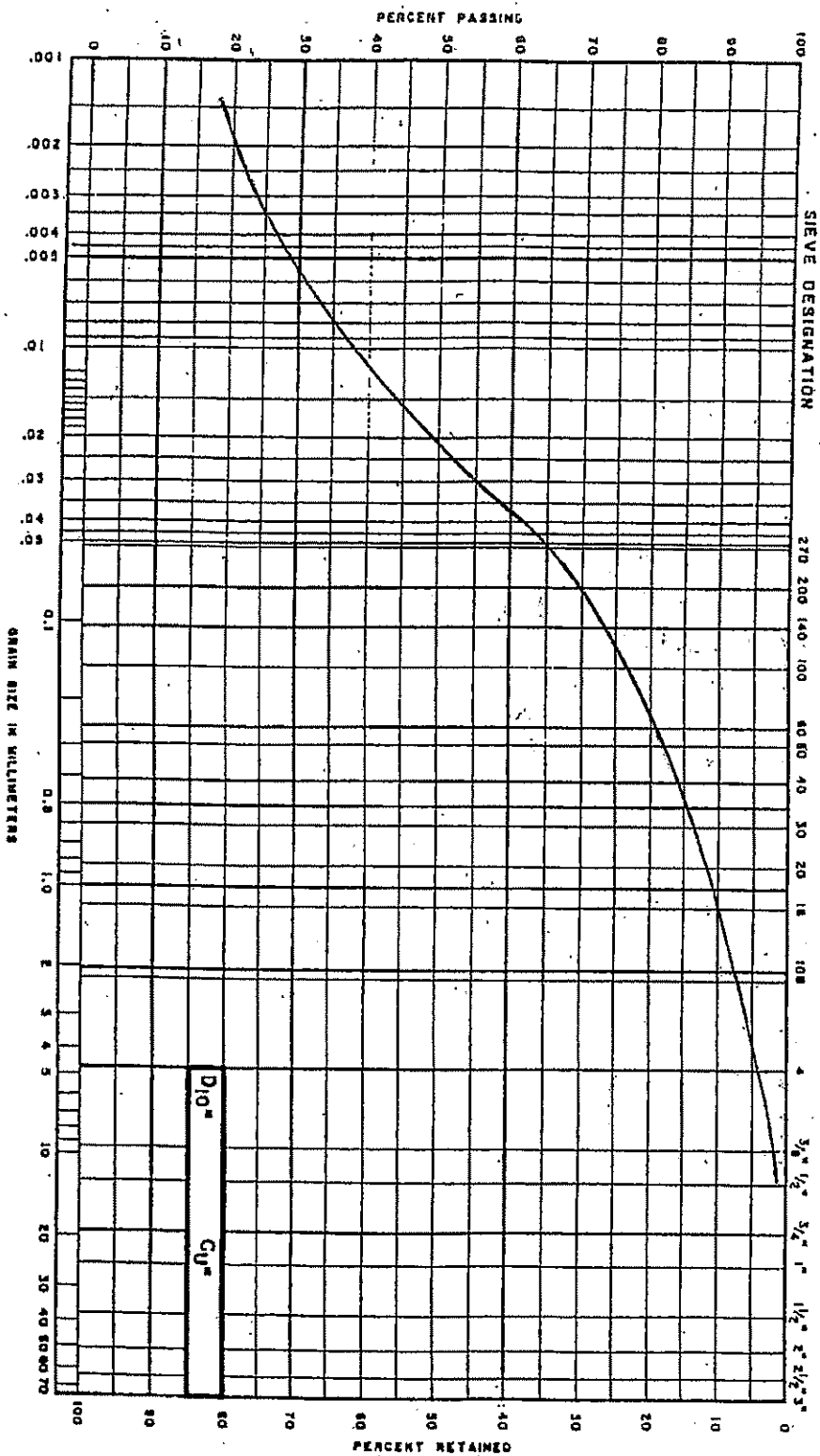


CLIENT:			SAMPLE ID: 8-105 BH3A @ 4.6m
JOB NO.: HAGE00304213A			DATE SAMPLED: June 13, 2008

Figure 4

UNIFIED SOIL CLASSIFICATION SYSTEM

Clay & Silt		Sand			Gravel		
		Fine	Medium	Coarse	Fine	Coarse	



CLIENT:

JOB NO.: HAGE00304216A

Trow

Figure 5

SAMPLE ID: 8-106 BH4 @ 4.6 m

DATE SAMPLED: June 12, 2008

ATTERBRG LIMITS

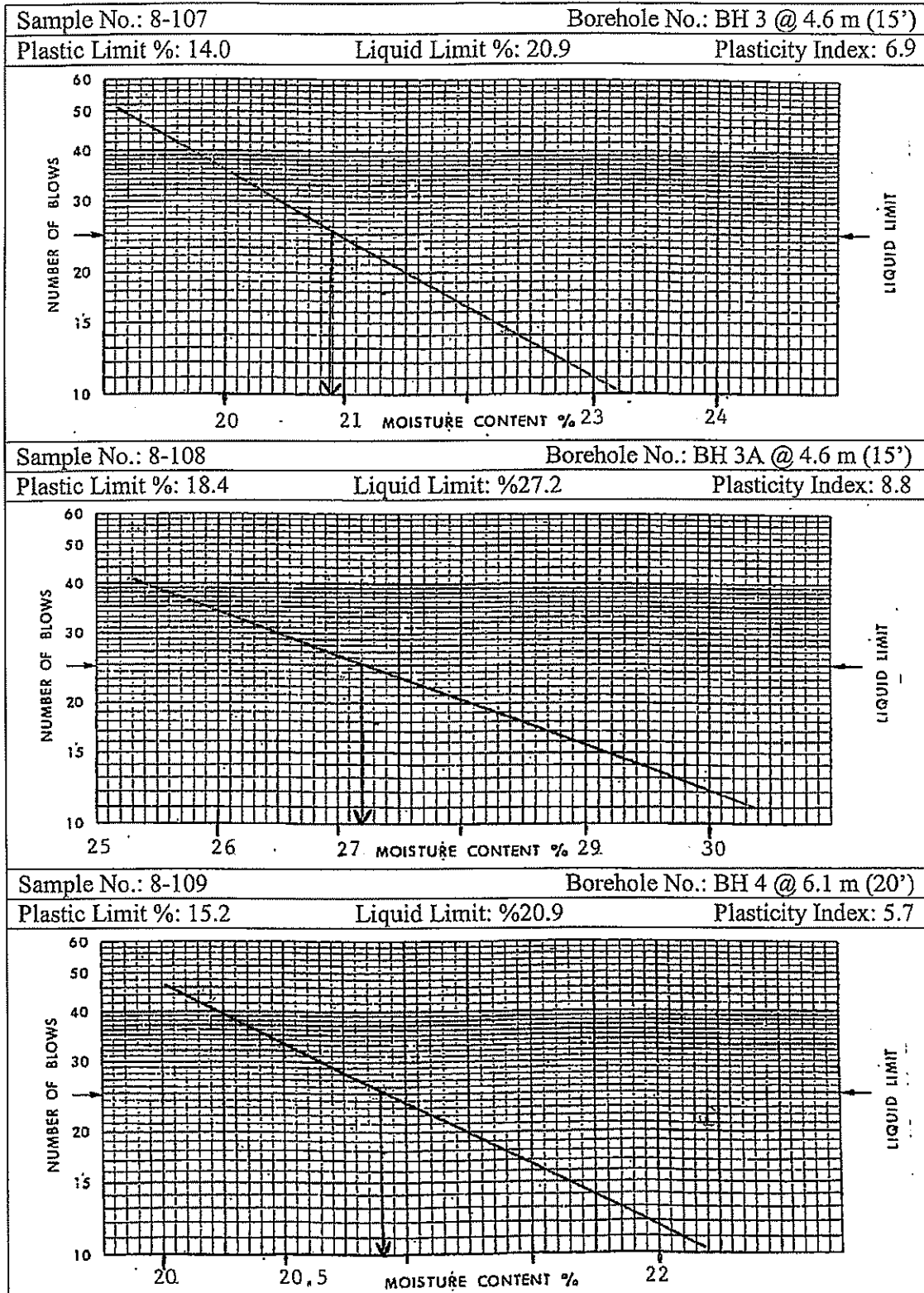


Figure 6