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CONT. No. 93-89

W. O. No.

STR. SITE No.

HWY. No. 403

LOCATION Hwy 403 from Q.E.W

Northerly to Hwy 5 (Overhead Signs)

No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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Ministry
of
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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 199-77-06A DIST 4

HWY 403/QEW STR SITE -

HML Poles and Overhead Signs

CONT 93-89

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FOUNDATION INVESTIGATION REPORT

FOR

HML POLES AND OVERHEAD SIGNS

HWY 403/Q.E.W., WP 199-77-06A

DISTRICT 4, BURLINGTON

INTRODUCTION

This report summarizes the results of a Foundation Investigation conducted in conjunction with High Mast Lighting Poles and Overhead Signs for the proposed Highway 403 between Highway 5 and the new Q.E.W./Hwy. 403 (Freeman) Interchange, the existing Q.E.W. northbound between Highway 2 and Fairview Street and the existing Highway 403 at King Road. The High Mast Lighting Pole and the Overhead Sign structures have been strategically positioned within the above mentioned areas, hereafter designated as sub-sections 1, 2 and 3, respectively.

SITE DESCRIPTION AND GEOLOGY

The three major sub-sectional areas, within which the investigation was conducted, are located within the City of Burlington, Regional Municipality of Halton. During the time of the investigation, construction activities were evident at various locations within the new Highway 403. Within the Freeman Interchange, new bridge structures and associated approach embankment fills were under construction and beyond this interchange, (North of North Service Road) excavation cuts were observed in a northerly direction up to approximately Upper Middle Road. Within sub-section 1 and north of North Service Road, the area is

located adjacent to existing residential developments. The other two subsections are located within the existing respective highway right-of-way.

The terrain within the site areas is generally flat or gently sloping and a number of meandering creeks traverse the area. Sections of the site which were not excavated consists of grassland.

Physiographically, the site is located in the region known as the "Iroquois Plain". The Iroquois Plain is the product of the advance and retreat of the Wisconsin ice sheet which covered the area during the Pleistocene epoch (over 12,000 years ago). At the site, the lowland bordering Lake Ontario, was inundated by the glacial lake called Lake Iroquois. Conditions in the old lake plain vary greatly from site to site.

At the site location two native deposits of glacial till origin were encountered. A cohesive, unsorted, unstratified heterogeneous mixture of clayey silt, sand and gravel exists surficially, underlain by a non-cohesive heterogeneous mixture of silt, sand and gravel. The overburden is underlain by shale bedrock of the Queenston Formation of the Upper Ordovician Period.

INVESTIGATION PROCEDURE

Physical and mechanical soil properties were obtained by in situ and laboratory testing. The field and laboratory investigation and testing programs are summarized below.

Field Investigation

The fieldwork for the investigation was carried out between 92-11-09 to 92-12-01 and consisted of (26) sampled boreholes advanced to depths ranging from 6.5 m to 18.9 m below the existing ground surface. A diesel powered track mounted Central Mining Equipment (CME) 55 drilling unit was used to advance the boreholes. Conventional solid stem augering techniques were used to penetrate the overburden and the surficial weathered bedrock. Rock coring techniques employing NW casing and a NX core barrel were used to retrieve up to 3.0 metres of rock core.

Four additional boreholes advanced as part of previous investigations conducted in the area (WP 199-77-09 and WP 199-77-10) between 91 09 18-25 have also been included in this report. The boreholes, formerly BH 31-A, BH 32-A, BH 31-E, and BH 32-E have been used to provide data for the foundation design of High Mast Lighting poles 7 and 8. These boreholes were also advanced using a diesel track mounted CME 55 drilling unit employing conventional solid stem augering and rock coring techniques.

Disturbed subsoil samples were retrieved at 1.5 metre intervals employing a standard split spoon sampler in accordance with the Standard Penetration Test (ASTM D1585). All subsoil samples were identified in the field and then placed in sealed plastic jars to ensure the preservation of the in situ natural moisture contents. Samples were subsequently transported to the laboratory and then classified employing both visual and laboratory methods as described below.

Rock core were identified in the field and physical index properties were determined by visual examination and also by measurement of rock quality designations (RQD's) and core recovery. All rock core were placed in standard rock core boxes and carefully transported to the laboratory.

Groundwater levels were determined by monitoring the water levels in the open boreholes throughout the duration of the field investigation. All boreholes were backfilled upon completion of the fieldwork.

The survey related to the location and elevation of the individual boreholes was provided by Central Region Surveys and Plans.

Laboratory Analyses

All subsoil samples were carefully visually examined in the laboratory in accordance with the procedures outlined in the Visual Method described in Chapter 2 of the MTO Soil Classification Manual. The behaviour, gradation and other pertinent properties of the soil were determined by conducting the appropriate laboratory test on representative samples. These tests included:

- 1) Atterberg Limit Tests
- 2) Particle Size Analysis
- 3) Natural Moisture Contents
- 4) Bulk Unit Weights

Sample preparation and testing were conducted in accordance with the MTO Laboratory Testing Manual and as described in Chapter 3 of the MTO Soil Classification Manual.

Detailed rock core logging was conducted in the laboratory by an in-house resident geologist.

Laboratory test results have been summarized below in the subsequent section of this report entitled "Subsurface Conditions" and are illustrated on the corresponding boreholes and figures included in the Appendix to this report.

SUBSURFACE CONDITIONS

General

The subsurface conditions across the three sub-sections are generally uniform and in many areas consists of an extensive surficial natural deposit, comprised of a cohesive heterogeneous mixture of clayey silt, sand and gravel. This deposit is a glacial till which extends to depths ranging from 3.5 m to 12.2 m, and as is characteristic of these deposits, boulders and cobbles inferred during augering, are present within this deposit.

The cohesive heterogeneous mixture of clayey silt, sand and gravel is generally, although not always, underlain by a second glacial till deposit consisting of a cohesionless heterogeneous mixture of silt, sand and gravel. This lower deposit has a thickness ranging up to 6.1 m. Both glacial till deposits are extremely competent and strongly over-consolidated materials. Refusal of the SPT was frequently encountered in both deposits indicating a hard cohesive heterogeneous

mixture of clayey silt, sand and gravel and a very dense heterogeneous mixture of silt, sand and gravel.

The lower cohesionless heterogeneous mixture of silt, sand and gravel when present is underlain by weathered shale ranging up to approximately 1.5 m in thickness at some locations. The weathered shale is underlain by more competent unweathered shale bedrock with interbedded siltstone.

At some locations across the site, the native material is overlain by fill material. The most prominent placement of fill material explored during the investigation exists at the north approach to the N/B and S/B Q.E.W. Underpass at ramp Q.E.W.-S to Highway 403 (WP 83-74-28 and 83-74-29), which is the location of the proposed Overhead Sign #8. At this location, an irregular mixture of a cohesive clayey silt, sand and gravel material has been placed up to a thickness of 10.8 metres. Some of this cohesive fill material was also encountered at the proposed high mast lighting pole #6, located at the west toe of the above-mentioned approach embankment. At this location, approximately 2.1 metres of this fill material was encountered.

At various other locations, cohesionless fill comprised of materials ranging from an irregular mixture of silt, sand and gravel to silt also exists. These materials were primarily used as roadbase fill materials or backfill to pipe culverts. Thicknesses of these materials were within 2 metres.

The boundaries between the various soil types, in situ and laboratory test results as well as groundwater levels established at the time of investigation are shown on the attached Record of Borehole sheets in the Appendix. A plan of the site illustrating the locations and elevations of the boreholes are provided on Dwg. No. 1997706A-A included in the Appendix. A detailed description of the subsurface conditions encountered at the site is given below.

Cohesionless Fill Material

Cohesionless fill materials were encountered at various locations across the entire site area and the fill composition varies from location to location. Generally the material varies from an irregular mixture of silt, sand and gravel to a silt with some clay and traces of sand and extends surficially for depths up to approximately 2 metres. The material is brown, moist and in a loose to compact state of denseness.

Cohesive Irregular Mixture of Clayey Silt to Silty Clay, Sand and Gravel (Fill Material)

The north approach embankment to the N/B and S/B Q.E.W. Underpass at ramp Q.E.W-S to Highway 403 (WP 83-74-28 and 83-74-29), the location of the proposed Overhead Sign #8, is composed of an irregular mixture of clayey silt, sand and gravel fill material. The material, which is brown in colour appears to be borrow material excavated from a native heterogeneous mixture of clayey silt, sand and gravel (Glacial Till) perhaps within the general area. The material exhibits a cohesive behaviour attributable to the clayey silt compositions which essentially binds the coarser sands and gravels. The thickness of this fill

material extends up to 10.8 metres at the top of the embankment. At the proposed High Mast Lighting Pole #6 (see BH H6), approximately 2.1 metres of this fill material was encountered at the toe of the above mentioned embankment, and the binder consisted of silty clay.

Grain size distribution curves determined by mechanical sieve and hydrometer analyses on samples of this fill material are illustrated in Figure 1 in the Appendix. The curves exhibit a broad range of material sizes with the fine grained portion (<75 micrometres) exceeding 50 percent of the material composition. The material is therefore categorized according to its behaviour and hence Atterberg Limit Tests were conducted on samples to determine the plasticity of the finer material (<425 micrometres). The test results shown in Figure 2 illustrate that the fine grained portion of the deposit has a low to intermediate plasticity and hence can be classified as a clayey silt to silty clay. Natural moisture contents are in the order of 14 to 17 percent, presumably close to the optimum compaction moisture contents.

The results of the Standard Penetration Test (SPT) conducted within this material revealed "N" values ranging from 13 blows/0.3 m to 27 blows/0.3 m indicating a stiff to very stiff consistency.

Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)

The predominant native material within the 3 sub-sections consists of a deposit comprised of a cohesive heterogeneous mixture of clayey silt, sand and gravel. This deposit of glacial till origin also contains boulders and cobbles as inferred by auger grinding during the borehole advancement and sampler bouncing during sample retrieval.

In the areas where this material has not been excavated, the upper 3 metres or so of the deposit has been oxidized and hence is brown in colour. Beneath the oxidized depth, the material is grey in colour. The colour at the interface with the underlying material varies from reddish brown to greyish red.

The main component of this unsorted, unstratified deposit is the clayey silt material. This material matrix essentially binds the coarser sands and gravels within the deposit. A grain size distribution envelope for the deposit as determined by mechanical sieve and hydrometer analyses is given in Figure 3 in the Appendix. The envelope includes particle sizes up to 75 mm (coarse gravel) and hence excludes the boulder and cobble sizes. The envelope reveals that the fine grained portions (less than 75 micrometre) contribute from approximately 48 percent to as much as 93 percent of this deposit.

Atterberg Limit Tests were carried out to define the behaviour and plasticity of the fine grained portion of the soil and the results are plotted in Figure 4. A summary of the indices is provided in Table 1. Bulk unit weights and natural moisture contents are also included in the table.

TABLE 1 HETEROGENEOUS MIXTURE OF CLAYEY SILT, SAND AND GRAVEL (GLACIAL TILL)		
	RANGE	NO. OF TESTS
Natural Moisture Content (w%)	4 - 20	21
Liquid Limit (W_L %)	20 - 35	21
Plastic Limit (w_p %)	13 - 19	21
Plasticity Index (I_p %)	7 - 16	21
Unit Weight (KN/m^3), γ	20.1 - 24.8	21

The test results reveal that the fine grained portion of the deposit is of low plasticity and hence is classified as clayey silt. Natural moisture contents are generally close to and less than the plastic limit of the soil indicating that the soil is in a plastic to semi-solid state.

Standard Penetration Tests (SPT) carried out in this deposit revealed N values ranging from 5 blows/0.3 m to 100 blows/0.08 m. The lower "N" values were encountered at shallower depths and penetration resistance increased with depth. SPT refusal was encountered frequently within this deposit particularly at lower depths. These "N" values are representative of an overconsolidated material of hard consistency. The consistency of the material in the upper portions of the deposit ranges generally from stiff to very stiff.

Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)

The cohesive heterogeneous mixture of clayey silt, sand and gravel is underlain at many locations by a greyish red cohesionless heterogeneous mixture of silt, sand and gravel. Boulders and cobbles, as inferred by auger grinding and sampler bouncing are also present within this deposit. The thickness of this deposit ranges up to 6.1 metres.

A grain size distribution envelope determined by mechanical sieve and hydrometer analyses is given in Figure 5 in the Appendix. Boulder and cobble sizes are not illustrated on the figure.

Standard Penetration Tests carried out in this deposit generally encountered refusal which is indicative of the very dense state of denseness inherent of this deposit.

Bedrock

The overburden across the site is underlain by shale bedrock with interbedded siltstone of the Queenston Shale Formation. The depth to bedrock varied from approximately 3.1 metres to 15.2 metres but generally varied between 7.5m to 10.5 m. Ground surface elevations and hence bedrock surface elevations vary considerably across the site as identified on the individual borehole logs.

The surficial 0.5 to 1.5 metres of the bedrock is severely weathered and deteriorated at various locations across the site. Solid stem augering methods easily penetrated this zone and sample retrieval was possible, although with

considerable penetration resistance (typically 100 blows/0.08 m).

Rock core ranging from 1.5m to 4.1m was retrieved using an NX core barrel. In general, three (3) metres of rock core was retrieved. The rock core confirms a surficial weathered zone underlain by more competent unweathered bedrock. Occasional clay seams approximately 50 mm to 100 mm in thickness exist within the weathered zone.

The shale bedrock is generally greyish red and has randomly interbedded greenish grey siltstone layers ranging from approximately 25 mm to 200 mm in thickness. The rock is horizontally bedded and is an extremely friable material with a very low slaking durability. The rock contains close to extremely close spaced fractures that are generally flat, planar to undulating and smooth.

Core recoveries and Rock Quality Designations (RQD's) were determined in-situ to evaluate the competence and integrity of the rock. Core recoveries ranged from 78% to 100% but were generally close to 100%. Rock Quality Designations (RQD's) ranged from 0% to 82% indicating a rock quality ranging from very poor to good. However, in general rock qualities were in the 30% to 70% indicating a rock of poor to fair quality. Rock quality generally improved with depth.

Rock strength as determined by index property examination in the laboratory is generally weak to very weak.

A detailed description of the characteristics and properties of the rock as determined by the logging of the rock core in the laboratory is attached in the Appendix under the heading "Rock Core Descriptions".

GROUNDWATER CONDITIONS

Observation of the groundwater level was carried out by measuring the water level in the open boreholes throughout the duration of the field investigation. The groundwater regime varies from location to location and groundwater levels are illustrated on the individual borehole logs.

Groundwater levels, in general, are subject to seasonal fluctuations and hence can vary from the values given in this report.

DISCUSSION AND RECOMMENDATIONS

In conjunction with the proposed Hwy. 403 between Hwy. 5 and the QEW and the proposed Hwy 403-QEW interchange (Freeman interchange), a total of eight (8) Overhead (OH) Signs have been proposed. Furthermore, a total of fourteen (14) High Mast Lighting Poles (HMLP) have been proposed within the new Hwy. 403 between Brant Street and the Freeman interchange and along the existing Hwy 403 adjacent to King Road. A plan illustrating the locations of the proposed structures is shown on drawing 1997706A - A in the Appendix. Tables 2A and 2B also in the Appendix provide information regarding elevations and locations of the proposed foundations.

Recommendations pertaining to the design and construction of the Overhead Sign and High Mast Lighting Pole foundation are contained in the scope of this report.

DESIGN CONSIDERATIONS/PARAMETERS

General

The foundation design of HMLP and OH Sign structures must satisfy the conditions of limit states design as specified in the O.H.B.D.C. Consequently, the size and embedment length of the foundation must be of appropriate dimension to provide the lateral resistance required to support the induced loadings.

The design of HML and OH Sign foundations is a function of the coefficient of horizontal subgrade reaction, pile length and size and pile stiffness. The coefficient of horizontal subgrade reaction is a function of the soil/rock

properties as discussed below. Typically, HML and OH Sign foundations consist of cast-in-place concrete bored piles (caissons) provided compatibility with the subsurface conditions is met.

For the design procedure, the designer can reference the MTO design manual entitled "Procedures for the Design for High Mast Pole Foundations" available at the Structural Office.

Foundations on Cut/Fill Slopes

Some of the foundations have been proposed within excavation cuts or within embankment fills. Comments are provided below to facilitate the design of HML/OH Sign foundations in cut/fill slope scenarios.

Fill Slopes

HMLP's #6 and #7 and Overhead Sign #8 are planned within or immediately adjacent to proposed or existing embankment fills. The following recommendations pertain to the design of these foundations.

- (a) The Foundation should be a minimum 3 metres from the crest of the slope. Should this not be possible, and the foundation is placed within the slope, the additional loading attributable to the sloping surface above the slope - foundation intersection (See Figure 6a - pt. A) shall be incorporated and secondly, the horizontal capacity of the embankment soil shall not be considered where the cover between the slope and the foundation is less than 3 metres (See Figure 6a).

- (b) The upper 60% of the embedment length within the fill (taken from frost penetration depth) should be disregarded for lateral resistance.
- (c) The properties of the fill material can vary within the limitations of OPSS 212 series. To account for uncertainties in material selection and method of placement, it is recommended that the shear strength parameters be reduced by 10%.
- (d) To avoid downdrag forces caused by the settlement of fill material on the foundation, it is recommended that the embankment fills be preloaded for three (3) months prior to the construction of the HML/Sign Foundation.

Cut Slopes

Foundations placed a minimum 3 metres from the toe of the excavation cut slope will not be influenced by the presence of that slope. However, for foundations located within 3 m of the toe of the slope or within the gradient of the slope itself, consideration has to be given to the additional lateral active earth thrust attributable to the upper slope. In addition for foundations on the gradient of the slope, a reduction of the lateral resistance must also be included in the design. The area of additional thrust and horizontal capacity reduction is shown on Figure 6b.

The magnitudes of the additional earth forces and reduction of the lateral soil capacity within cut/fill slopes are dependent on the soil properties and the geometry of the slope. Once the geometries have been finalized, this office can be contacted to ascertain these specific design parameters.

Proximity to Adjacent Structures/Utilities

The design of HML/OH Sign Foundations must compensate for any structures/utilities that may be located adjacent to the foundation such as at OH Sign #9. To minimize the influence of the HML/OH Sign Foundation loading on the adjacent structure, it is recommended that the HML/OH Foundation be placed a minimum of $3D$ metres (D = pile diameter) from the structure/utility. Should this minimum clearance criteria not be satisfied, it is prudent that the additional stresses imposed on the culvert be incorporated in the design of the culvert. In the design, it is recommended that the horizontal capacity offered by the backfill to the structure be neglected.

Caisson Socketed into Bedrock

Caissons penetrating the rock shall be socketed a minimum of 1.5 m into sound bedrock.

Soil/Rock Design Parameters

To facilitate the design of the HML/OH Sign foundation, pertinent soil parameters are required to determine the horizontal subgrade soil reaction necessary in the foundation computations. These parameters are summarized in Tables 3A and 3B in the Appendix for the HML/OH Sign foundations respectively.

The parameters provided at the OH Signs are applicable for ALL footing designs, including the offset footings that have been proposed. The parameters include:

1. the angle of internal friction (ϕ) for cohesionless soils.
2. the undrained shear strength (c_u) for cohesive soils (actually unconfined compressive strengths (q_u) of the soil have been tabulated, $q_u=2c_u$.)
3. the unconfined compressive strength of the bedrock (q_u)
4. saturated unit weight of soil (γ). The buoyant unit weight of soil (γ') shall be applied for soils submerged beneath the groundwater table.
5. the groundwater table elevation.

The shear strength parameters (ϕ , c_u) tabulated are unfactored and hence should be factored in accordance with Section 6-5.2 of the O.H.B.D.C.

The denseness of cohesionless soils and consistency of cohesive soils have also been described in Tables 3A and 3B in the Appendix. Weathered bedrock has also been distinguished from unweathered rock.

Frost Effects

The design of HMLP/OH Sign foundations shall be calculated neglecting lateral resistance in the frost penetration zone but including lateral loads within the

frost penetration zone. At the site, the frost penetration depth is equivalent to 1.2 m.

CONSTRUCTION CONSIDERATIONS

The cohesionless submerged heterogeneous mixture of silt, sand and gravel present at many locations in the site area will slough into an open hole produced in the advancement of an unprotected drilled shaft. This condition is the result of unbalanced hydrostatic head. It is recommended that the contractor be advised of this potential condition and instructed to render the bored pile stable without any soil cave-in throughout the installation of the concrete caisson. This information should be supplied to the contractor via a Non Standard Special Provision (NSSP) included in the contract documents.

Experience has shown the conventional bored caissons can be successfully advanced through cohesionless materials submerged beneath the groundwater table using one of two methods:

- (a) installing a temporary liner and constructing the caisson within the steel liner. After the liner has been cleaned out and the required reinforcing installed, the concrete should be placed in the dry or via tremie methods. A rapid withdrawal of the temporary casing should be avoided subsequent to concrete placement to prevent the intrusion of soil in the concrete (necking). Conversely, the temporary liner should not be allowed to get stuck in partial set concrete.

- (b) mud drilling and tremie techniques may be employed. The application of this method should be associated with a quality assurance program that will verify the quality of the bentonite slurry (density, viscosity, etc.).

Encountering Boulders During Drilling

It is recommended that a NSSP be included in the contract documents that makes the contractor aware of the fact that "boulders and cobbles are characteristic components of glacial till deposits such as those present across the site" and informs that the contractor is responsible for penetrating these larger particle sizes.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of T. Sangiuliano, Foundation Engineer and D. Walters, Engineering attachment utilizing equipment owned and operated by Malone's Soil Samples.

The project was carried out by T. Sangiuliano under the general supervision of P. Payer, Senior Foundation Engineer. The report was written by T. Sangiuliano, reviewed by P. Payer and approved by Mr. M.S. Devata, Chief Foundation Engineer.



A handwritten signature in black ink, appearing to read 'T. Sangiuliano'.

T. Sangiuliano, P.Eng.

Foundation Engineer

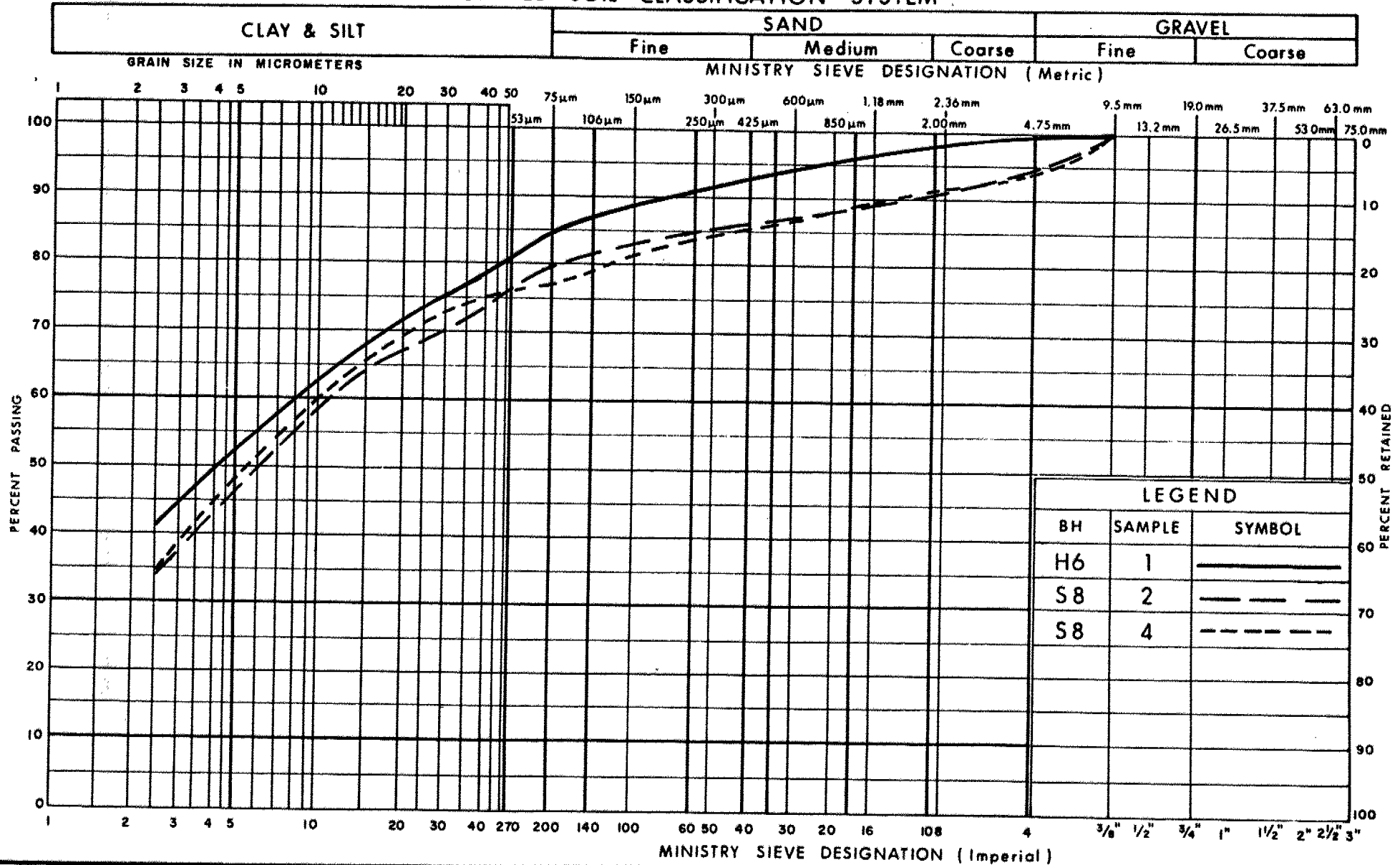
A handwritten signature in black ink, appearing to read 'M.S. Devata'.

M.S. Devata, P.Eng.

Chief Foundation Engineer

APPENDIX

UNIFIED SOIL CLASSIFICATION SYSTEM

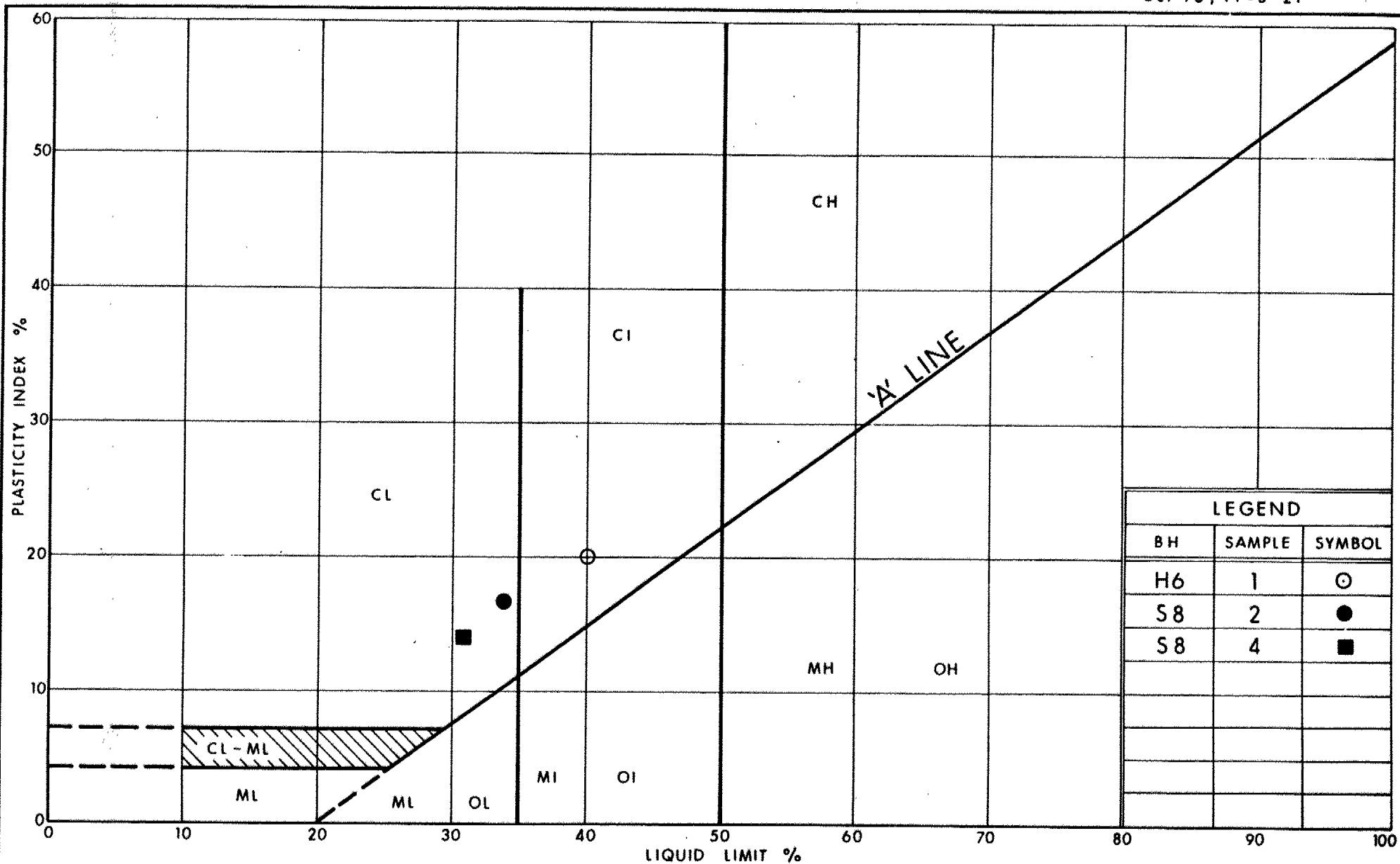


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GRAIN SIZE DISTRIBUTION
IRREGULAR MIXTURE OF CLAYEY SILT TO SILTY CLAY
SAND & GRAVEL (FILL MATERIAL)

FIG No 1

W P 199-77-06A



Ministry of
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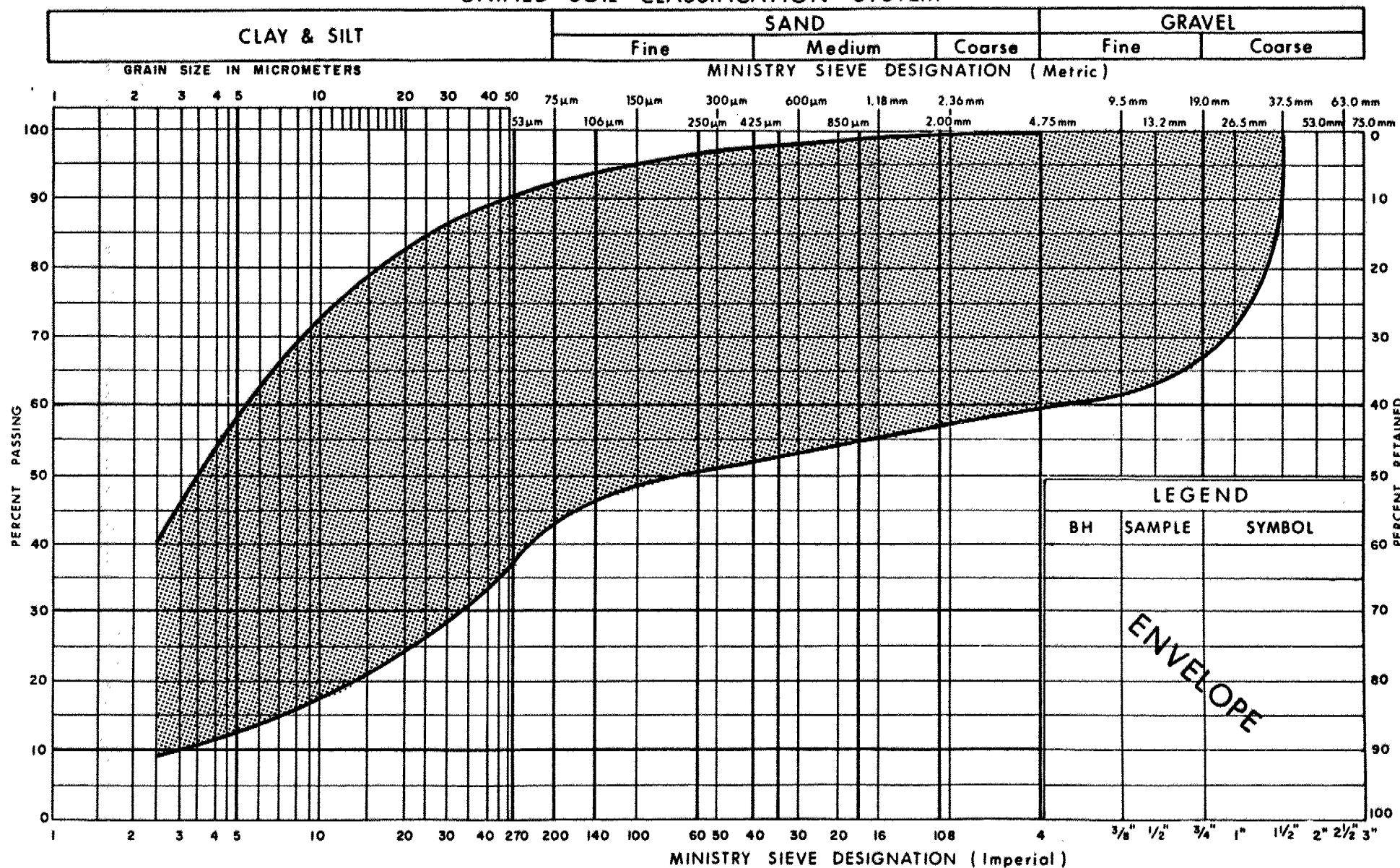
Ontario

PLASTICITY CHART
IRREGULAR MIXTURE OF CLAYEY SILT TO SILTY CLAY,
SAND & GRAVEL (FILL MATERIAL)

FIG No 2

W P 199-77-06 A

UNIFIED SOIL CLASSIFICATION SYSTEM

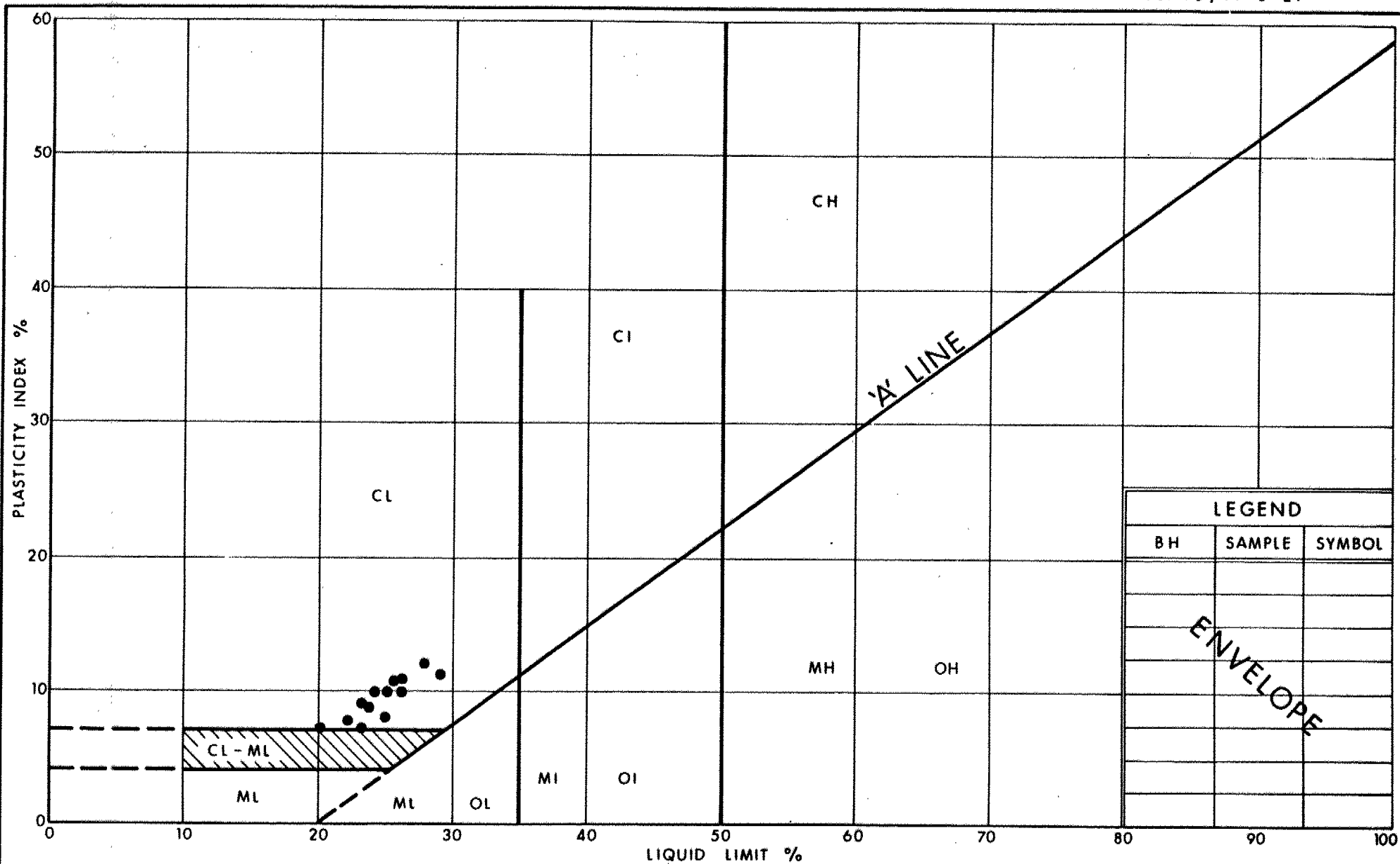


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GRAIN SIZE DISTRIBUTION
HET MIXTURE OF
CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG No 3

W P 119 - 77 - 06A



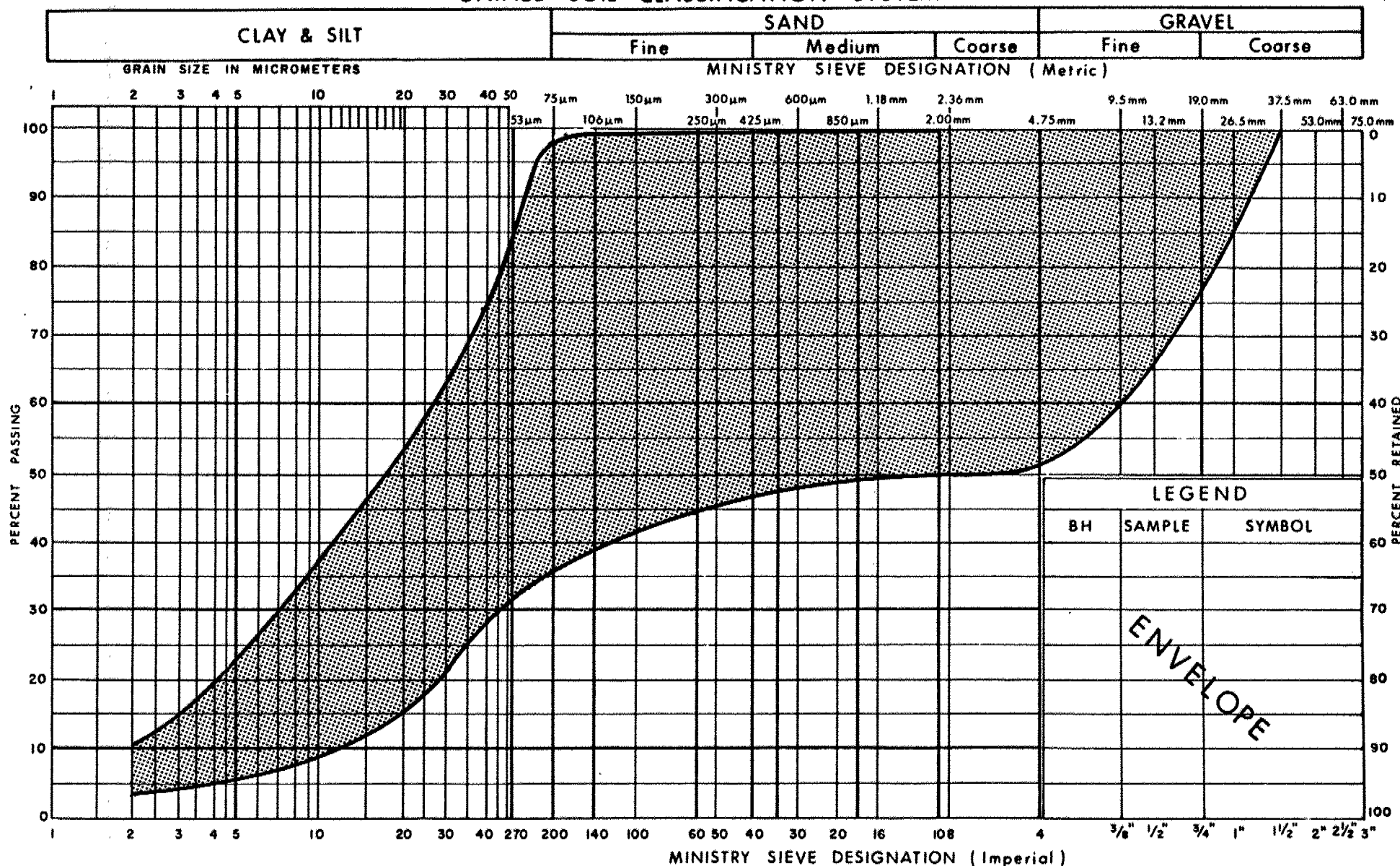
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PLASTICITY CHART
HET MIXTURE OF
CLAYEY SILT, SAND & GRAVEL (Glacial Till)

FIG No 4

W P 199 - 77 - 06 A

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

HET MIXTURE OF
SILT, SAND & GRAVEL (Glacial Till)

FIG No 5

W P 199 - 77 - 06 A

Figure 6a - FOUNDATION ON FILL SLOPES

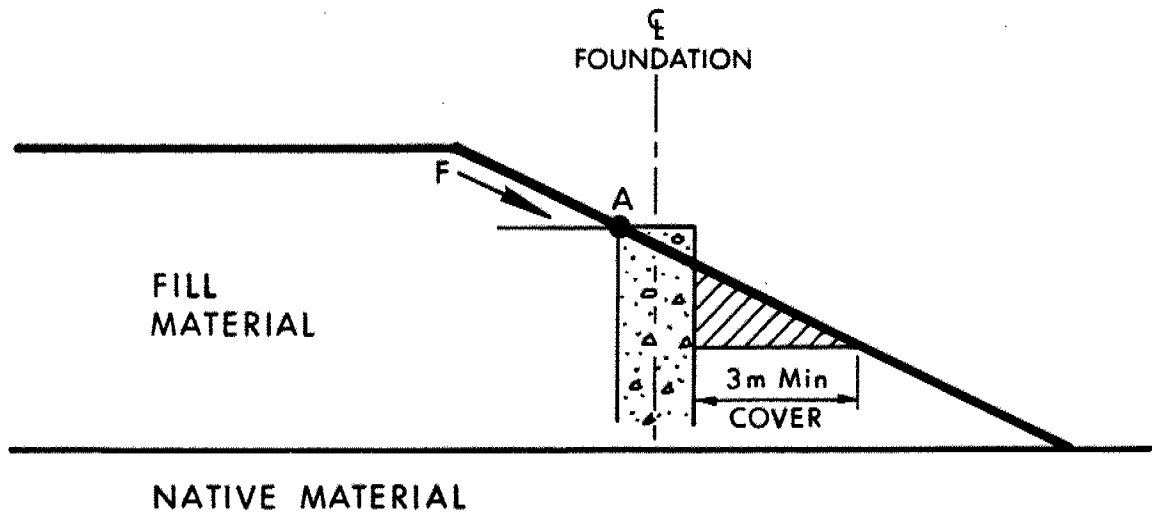
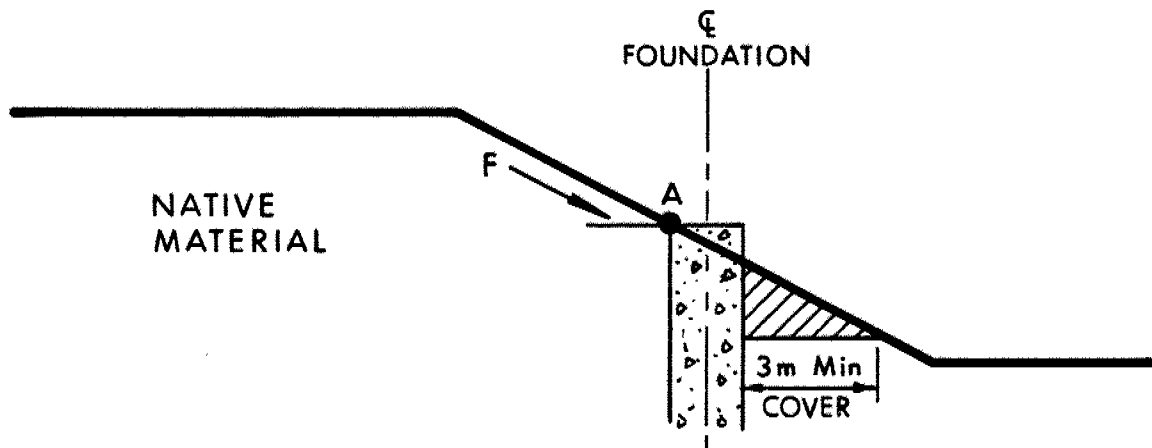


Figure 6b - FOUNDATION ON CUT SLOPES



LEGEND :

F ADDITIONAL SLOPING SURFACE
 EARTH PRESSURE THRUST .



SOIL INCAPABLE OF
HORIZONTAL CAPACITY

NOT TO SCALE

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3 m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

MECHANICAL PROPERTIES OF SOIL

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

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{\min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	KN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	KN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	KN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No H1

1 of 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 798 397.8; E 276 852.1 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 26 CHECKED BY PP

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
110.8	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Very Stiff		1	SS	17												
			2	SS	24												
			3	SS	20												
			4	SS	20												
103.3			5	SS	100	/15cm											
7.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense		6	SS	100	/15cm											
100.2			7	SS	60	/3cm											
10.7	Weathered Unweathered Shale Bedrock With interbedded Siltstone Weak to Very Weak, Greyish Red with Greenish Grey		8	RC	REC 100%												
98.7																	
12.2	End of Borehole • 92 11 30																

RECORD OF BOREHOLE No H2

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 798 535.5; E 276 958.4 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 26 CHECKED BY PP

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			20	40	60	80	100					
109.8	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	12												
	Stiff																
	Brown																
	Grey		2	SS	16												
			3	SS	10												
103.7																	
6.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		4	SS	60	/8cm											
	Greyish Red, Very Dense																
			5	SS	60	/5cm											
100.7																	
9.1	Shale Bedrock with interbedded Siltstone Weak to Very Weak, Unweathered Greyish Red with Greenish Grey		6	SS	60	/5cm											
99.1																	
			7	RC	REC 100%												RQD = 37%
10.7	End of Borehole • 92 11 30																

RECORD OF BOREHOLE No H3

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 798 677.7; E 277 068.0 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 30 CHECKED BY PP

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
108.0	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)																
	Hard		1	SS	32												
			2	SS	46												
			3	SS	39												
102.9			4	SS	70	/15cm											
6.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)																
	Greyish Red, Very Dense		5	SS	70	/15cm											
99.9																	
9.1	Shale Bedrock with interbedded Siltstone		6	SS	100	/15cm											
	Weathered Weak to Very Weak, Greyish Red with interbedded Greenish Grey		7	RC	REC 100%												
98.2																	
10.8	End of Borehole • 92 12 01																

RECORD OF BOREHOLE No H4

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 591.0; E 277 833.8 ORIGINATED BY JS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 11 CHECKED BY PP

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			20	40	60	80	100					
107.2	Ground Surface																
0.0	Irregular Mixture of Silt, Sand and Gravel (Fill Material) Brown, Compact						106										
105.7																	
1.5	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		1	SS	5												
104.1	Greyish Red, Loose		2	SS	100		104										
3.1	Shale Bedrock with interbedded Siltstone Weak to Very Weak, Greyish Red with interbedded Greenish Grey		3	RC	REC 88%		102										RQD = 0%
			4	RC	REC 100%												RQD = 13%
			5	RC	REC 100%		100										RQD = 42%
99.3																	
7.9	End of Borehole • 92 11 11																

RECORD OF BOREHOLE No H5

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 699.9 : E 277 882.0 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 09 / 10 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT W	PLASTIC LIMIT W _p	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			20	40	60	80	100					
110.9	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Brown, Stiff		1	SS	10												
107.4			2	SS	12											20.3	23 29 27 21
3.5	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Shale and Siltstone fragments Greyish Red, Very Dense		3	SS	67	/15cm											
			4	SS	100	/15cm											
			5	SS	100	/8cm										22.3	50 5 38 7
			6	SS	100	/15cm											
103.9			7	SS	100	/8cm											
7.0	Shale Bedrock with interbedded Siltstone Weak to Very Weak, Unweathered Greyish Red with interbedded Greenish Grey		8	RC	REC	= 100%											RQD = 34%
			9	RC	REC	= 100%											RQD = 55%
100.8																	
10.1	End of Borehole • 92 11 10																

RECORD OF BOREHOLE No H6

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 814.8; E 278 011.2 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 09 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT 7 KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
110.7	Ground Surface																
0.0	Irregular Mixture of Silty Clay, Sand and Gravel (Fill Material) Brown, Stiff		1	SS	13		110									18.5	0 15 48 37
108.6	Trace Organics																
2.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Stiff		2	SS	12		108										13 27 50 10
106.1			3	SS	100		106										
4.6	Shale Bedrock with interbedded Siltstone Weak to Very Weak, Unweathered Greyish Red with interbedded Greenish Grey		4	RC	REC 100%		104										RQD = 37%
102.9			5	RC	REC 100%												RQD = 78%
7.8	End of Borehole • 92 11 16																

RECORD OF BOREHOLE No H7

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 815.0 ; E 277 928.0 ORIGINATED BY MM
DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY JB
DATUM Geodetic DATE 91 09 18 CHECKED BY BI

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
114.0	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	49	*											
	Grey, Very Stiff to Hard		2	SS	20		112										
			3	SS	16												
			4	SS	17												
			5	SS	78		110										
			6	SS	120												
108.2			7	SS	78												
5.8	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		8	SS	120	/15cm	108										25 34 30 10
	Greyish Red, Very Dense		9	SS	90	/8cm											
105.6							106										
8.4	Shale Bedrock with interbedded Siltstone																
104.8			10	SS	120	/5cm											
9.2	End of Borehole • G.W.L not established																

+3, x³: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No H7A

1 OF 1

METRIC

(Formerly BH 32-A, WP 199-77-10)

W.P. 199-77-06A LOCATION Co-ords: N 4 799 820.0; E 277 952.0 ORIGINATED BY MM
DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY JB
DATUM Geodetic DATE 91 09 18 CHECKED BY BI

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
113.1	Ground Surface																
0.0						*											
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	22		112										
			2	SS	16												
			3	SS	14												
	Very Stiff																
	Hard		4	SS	31		110										
			5	SS	78												
			6	SS	81												
			7	SS	130	/28cm	108										
	Grey																
	Greyish Red		8	SS	175	** /23cm											
106.6																	
6.5	End of Borehole																
	* G.W.L. not established.																
	** Sampler Bouncing (Probable Bedrock)																

RECORD OF BOREHOLE No H8

1 OF 1

METRIC

W.P. 199-77-06A

LOCATION Co-ords: N 4 799 937.0; E 277 961.0

ORIGINATED BY AH

DIST 4 HWY 403

BOREHOLE TYPE SS Auger, NW Casing, NQ Core

COMPILED BY JB

DATUM Geodetic

DATE 91 09 25

CHECKED BY BI

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			20	40	60	80	100					
117.4	Ground Surface																
0.0																	
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	17												
			2	SS	14												
	Grey		3	SS	14												
			4	SS	17												
			5	SS	15												
			6	SS	22												
			7	SS	24												
	Stiff to Very Stiff		8	SS	60	/8cm											
	Hard		9	SS	60	/13cm											
			10	SS	60	/13cm											
106.8			11	SS	60	/3cm											
10.6			12	RC	REC 100%												
	Shale Bedrock With Interbedded Siltstone		13	RC	REC 92%												
	Weak to Very Weak, Unweathered Greyish Red with interbedded Greenish Grey																
103.5																	
13.9	End of Borehole																
	* 91 09 26																

RECORD OF BOREHOLE No H8A

1 OF 2

METRIC

W.P. 199-77-06A

LOCATION

Co-ords: N 4 799 930.0; E 277 941.0

ORIGINATED BY AH

DIST 4 HWY 403

BOREHOLE TYPE SS Auger, NW Casing, NQ Core

COMPILED BY JB

DATUM Geodetic

DATE

91 09 24

CHECKED BY BI

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			20	40	60	80	100					
117.2	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	20	*	116										
	Gray		2	SS	16												
			3	SS	17												
			4	SS	18		114										
			5	SS	7												
	Stiff to Very Stiff		6	SS	32												
	Hard		7	SS	29		112										
			8	SS	94												
			9	SS	103		110										
108.6																	
8.5	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		10	SS	80	/5cm	108										
107.0	Brown, Very Dense																
10.2			11	RC	REC 10%		106										RQD = 0%
	Weathered																
	Unweathered		12	RC	REC 80%												RQD = 27%
	Shale Bedrock with interbedded Siltstone						104										
	Weak to Very Weak.		13	RC	REC 83%												RQD = 37%
	Grayish Red with interbedded Greenish Grey		14	RC	REC 70%												RQD = 24%
102.0							102										
15.2																	

Continued

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No H8A 2 OF 2 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 930.0; E 277 941.0 ORIGINATED BY AH
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NQ Core COMPILED BY JB
 DATUM Geodetic DATE 91 09 24 CHECKED BY BI

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT W _L	UNIT WEIGHT 7 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					
102.0	Continued																
15.2			14	RC	REC 70%												
101.0																	
16.2	End of Borehole * G.W.L. not established																

RECORD OF BOREHOLE No H9

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 084.8; E 277 937.6 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 18 CHECKED BY PP

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			20	40	60	80	100					
118.9	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)																
	Grey		1	SS	13												
			2	SS	11												
			3	SS	17												
	Stiff to Very Stiff Hard		4	SS	60	/13cm											
111.3			5	SS	60	/13cm											
7.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)																
	Greyish Red, Very Dense		6	SS	60	/10cm											
108.2			7	SS	60	/0cm											
10.7	Shale Bedrock with interbedded Siltstone		8	RC	REC 100%												RQD = 70%
	Weak to Very Weak, Unweathered, Greyish Red with interbedded Greenish Grey		9	RC	REC 100%												RQD = 62%
105.2																	
13.7	End of Borehole = 92 11 19																

RECORD OF BOREHOLE No H10

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 239.8; E 277 934.2 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 16 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	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			20	40	60	80	100	W _p	W	W _L		
120.1	Ground Surface																
0.0																	
			1	SS	18												
							118										
	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		2	SS	17											22.0	8 15 50 27
			3	SS	21		116										
			4	SS	104		114										
			5	SS	82		112										
			6	SS	70	/15cm	110										
			7	SS	85	/15cm										22.6	34 13 42 11
109.1																	
11.0																	
	Shale Bedrock with interbedded Siltstone		8	RC	REC 100%		108										RQD = 65%
	Weak to Very Weak, Unweathered																
	Greyish Red with interbedded Greenish Grey		9	RC	REC 97%												RQD = 62%
106.1																	
14.0	End of Borehole * 92 11 18																

METRIC

15.2

20
15-5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No H11

2 OF 2

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 389.2; E 277 930.8 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 18 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	w _p	w		
109.3	Continued															
15.2	Weathered ----- Unweathered															
	Shale Bedrock with interbedded Siltstone		11	RC	REC 100%											RQD = 23%
	Weak to very Weak															
	Greyish Red with interbedded Greenish Grey		12	RC	REC 100%											RQD = 35%
105.6																
18.9	End of Borehole • 92 11 20															

RECORD OF BOREHOLE No H12

1 OF 2

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 546.7; E 277 927.1 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
 DATUM Geodetic DATE 92 11 20 CHECKED BY PP

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			20	40	60	80	100					
125.3	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)																
	Brown, Hard		1	SS	32												
	Grey, Very Stiff																
			2	SS	20												
			3	SS	18												
			4	SS	21												
	Hard		5	SS	60	/13cm										22.5	40 14 33 13
			6	SS	60	/13cm											
114.5			7	SS	65	/15cm											18 16 55 11
10.8	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)																
113.1	Greyish Red, Very Dense		8	SS	100	/8cm											
12.2	Weathered Unweathered Shale Bedrock with interbedded Siltstone		9	RC	REC 100%												RQD = 14%
	Weak to Very Weak, Greyish Red with interbedded Greenish Grey		10	RC	REC 100%												RQD = 60%
110.1																	

Continued

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No H12

2 OF 2

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 546.7; E 277 927.1 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 20 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80	100	W _p	W		
110.1 110.0	Continued															
15.3	End of Borehole • G.W.L. not established															

RECORD OF BOREHOLE No H13

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 689.6; E 277 923.8 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 23 CHECKED BY PP

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			20	40	60	80	100					
126.2	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey		1	SS	28		126										
							124										
			2	SS	22												
							122										
			3	SS	17												
							120										
			4	SS	42												
			5	SS	67	/15cm											
							118										
117.1																	
9.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense		6	SS	100	/15cm											
115.5							116										
10.7	Weathered Unweathered Shale Bedrock with Interbedded Siltstone Weak to Very Weak		7	SS	• •												
114.0			8	RC	REC 100%												
12.2	End of Borehole • 92 11 23 • • Sampler bouncing																

RECORD OF BOREHOLE No H14

1 OF 1

METRIC

W.P. 199-77-06A

LOCATION Co-ords: N 4 800 828.1; E 277 920.7

ORIGINATED BY TS

DIST 4 HWY 403

BOREHOLE TYPE SS Auger, NW Casing, NX Core

COMPILED BY TS

DATUM Geodetic

DATE 92 11 24/25

CHECKED BY PP

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			20	40	60	80	100					
128.3	Ground Surface																
0.0	Silt, some Sand Brown, Compact						128										0 15 74 11
126.3			1	SS	12												
2.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey		2	SS	26		126										
							124										
			3	SS	28											22.0	2 16 58 24
	Very Stiff Hard		4	SS	48		122										
			5	SS	60	/13cm	120										
119.2																	
9.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense		6	SS	65	/15cm	118										0 2 89 9
117.6																	
10.7	Weathered Unweathered Shale Bedrock with interbedded Siltstone Weak to Very Weak, Greyish Red with interbedded Greenish Grey		7	SS	100	/15cm	116										RQD = 37%
			8	RC	REC 100%												
			9	RC	REC 100%												RQD = 65%
114.6																	
13.7	End of Borehole • 92 11 25																

+3, x5: Numbers refer to
Sensitivity

20
15-0.5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No S7

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 800; E 277 870 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
DATUM Geodetic DATE 92 11 09 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W _p	W	W _L		
117.7	Ground Surface																
0.0	Heterogenous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey		1	SS	26		117										
			2	SS	17		115										
			3	SS	20		113										
			4	SS	25		111										
	Very Stiff		5	SS	90		109										
	Hard		6	SS	70		107										
107.0			7	SS	70	/38cm	107										
10.7	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		8	SS	100	/19cm											
105.4	Greyish Red, Very Dense																
12.3	End of Borehole • 92 11 10 • Shale Bedrock (Severely Weathered)																

RECORD OF BOREHOLE No S7A

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 786; E 277 886 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 10 CHECKED BY PP

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			20	40	60	80	100					
116.4	Ground Surface																
0.0	Heterogenous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey		1	SS	18		116										
			2	SS	19		114									23.4	13 22 39 26
			3	SS	19		112										
	Very Stiff ----- Hard		4	SS	74		110										
			5	SS	60		108									24.8	6 22 42 30
107.3			6	SS	82	/38cm	106										30 26 37 7
9.1	Heterogenous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense		7	SS	100	/13cm	104										
105.7			8	RC	REC 100%												RQD = 28%
10.7	Shale Bedrock with interbedded Siltstone Unweathered, Weak to Very Weak Greyish Red with interbedded Greenish Grey		9	RC	REC 100%												RQD = 27%
102.5																	
13.8	End of Borehole • 92 11 10																

RECORD OF BOREHOLE No S8

1 OF 2

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 760; E 278 055 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
 DATUM Geodetic DATE 92 11 13 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
116.2	Ground Surface												
0.0	Irregular Mixture of Clayey Silt, Sand and Gravel (Fill Material) Brown, Very Stiff		1	SS	15								
			2	SS	17							20.7	5 15 47 33
			3	SS	16								
			4	SS	17							21.5	6 17 43 34
			5	SS	27								
			6	SS	27								
105.4			7	SS	96							24.5	
10.8	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)												
104.0	Greyish Red, Hard		8	SS	100								
12.2	Shale Bedrock with interbedded Siltstone Greyish Red with interbedded Greenish Grey, Weak to Very Weak		9	RC	REC 100%								RQD = 42%
			10	RC	REC 100%								RQD = 27%
101.0													

15.2

Continued

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

Continued

RECORD OF BOREHOLE No S8

2 OF 2

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 799 760; E 278 055 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 13 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC UNIT W _P	NATURAL MOISTURE CONTENT W	LIQUID UNIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
101.0	Continued															
100.8																
15.4	End of Borehole • 92 11 16															

RECORD OF BOREHOLE No S9

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 172; E 277 915 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
DATUM Geodetic DATE 92 11 17 CHECKED BY PP

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W _P	W	W _L		
120.2	Ground Surface															
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	18											
			2	SS	19											
			3	SS	16											
	Gray, Very Stiff		4	SS	97	/10cm										
	Grayish Red, Hard		5	SS	65	/15cm										
111.1			6	SS	60	/10cm										
9.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		7	SS	65	/15cm										
	Grayish Red, Very Dense															
108.9	(Auger Grinding - Probable Bedrock)															
11.3	End of Borehole • 92 11 17															

RECORD OF BOREHOLE No S9A

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 173; E 277 935 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 17 CHECKED BY PP

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			20	40	60	80	100					
118.5	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	13		119										
			2	SS	12		117										
			3	SS	11		115										
	Grey, Stiff ----- Greyish Red, Hard		4	SS	103		113										
			5	SS	106		111										
110.4			6	SS	60	/Bcm											
9.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)																
109.1	Greyish Red, Very Dense																
10.4	Weathered ----- Unweathered Shale Bedrock with interbedded Siltstone Weak to Very Weak, Greyish Red with interbedded Greenish Grey		7	RC	REC 73%		109										RQD = 0%
			8	RC	REC 100%		107										RQD = 80%
106.5																	
13.0	End of Borehole * G.W.L not established																

RECORD OF BOREHOLE No S10

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 846; E 277 900 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 25 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
128.9	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)		1	SS	22												
	Brown ----- Grey		2	SS	26												
			3	SS	24												
	Very Stiff ----- Hard		4	SS	110	/25cm											
			5	SS	60	/15cm											
119.8			6	SS	60	/10cm											
9.1	Weathered ----- Unweathered		7	RC	REC 100%											RQD = 47%	
	Shale Bedrock with Interbedded Siltstone		8	RC	REC 100%											RQD = 58%	
116.3	Weak to Very Weak, Greyish Red with interbedded Greenish Grey																
12.6	End of Borehole • 92 11 26																

RECORD OF BOREHOLE No S10A 1 OF 1 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 800 846; E 277 912 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
 DATUM Geodetic DATE 92 11 25 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	W _p W W _L	W _p W W _L	W _p W W _L		
126.3	Ground Surface															
0.0	Silt, trace Clay (Fill Material) Brown, Compact		1	SS	11		128									0 4 82 14
126.3																
2.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey		2	SS	16		126									
			3	SS	16		124									3 15 54 28
			4	SS	41		122									
			5	SS	60	/15cm	120									
119.2																
9.1	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		6	SS	60	/8cm										
117.6	Grayish Red, Very Dense						118									
10.7	End of Borehole • 92 11 28 • • Sampler Bouncing (Probable Shale Bedrock)															

RECORD OF BOREHOLE No S11A 1 OF 1 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 801 378; E 277 886 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
 DATUM Geodetic DATE 92 11 24 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
134.1	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Grey, Very Stiff		1	SS	17												
			2	SS	26												
129.5			3	SS	60	/15cm											
4.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense		4	SS	60	/8cm											
126.5																	
7.6	End of Borehole • 92 11 25 • Sampler bouncing Powdered Shale in spoon (Probable Bedrock)																

RECORD OF BOREHOLE No S11A-A 1 OF 1 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 801 378; E 277 910 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
 DATUM Geodetic DATE 92 11 23/24 CHECKED BY PP

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 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
134.0	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel Grey, Hard		1	SS	30		132									23.0	5 16 51 28
129.4			2	SS	46		130										
4.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Greyish Red, Very Dense Siltstone fragments		3	SS	60	/15cm	128										10 23 58 9
126.4			4	SS	60	/5cm	126										
7.6	Shale Bedrock with interbedded Siltstone Weak to Very Weak, Unweathered Greyish Red with interbedded Greenish Grey		6	RC	REC 100%		124										RQD = 71%
123.3			7	RC	REC 100%												RQD = 67%
10.7	End of Borehole • 92 11 25 • • Sampler bouncing																

RECORD OF BOREHOLE No S13

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 803 856; E 277 820 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 12 01 CHECKED BY PP

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			20	40	60	80	100					
159.6	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Brown		1	SS	18		159									22.5	0 8 66 26
	Very Stiff Hard		2	SS	70	/15cm	157										
			3	SS	80	/15cm	155										
			4	SS	60	/10cm	153										12 20 48 20
152.0	Weathered		5	SS	**												
7.6	Unweathered		6	RC	REC 100%		151										RQD = 62%
	Shale Bedrock with interbedded Siltstone		7	RC	REC 100%												RQD = 68%
148.9	Weak to Very Weak, Greyish Red to Greenish Grey						149										
10.7	End of Borehole																
	* G.W.L. not established ** Sampler Bouncing																

RECORD OF BOREHOLE No S13A 1 OF 1 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 803 857; E 277 840 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
 DATUM Geodetic DATE 92 12 01 CHECKED BY PP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
159.3	Ground Surface																
0.0	Heterogeneous Mixture of Cloyey Silt, Sand and Gravel (Glacial Till)					DRY +	159										
	Hard		1	SS	48												
							157										
			2	SS	67												
	Brown						155										
	Grey		3	SS	60	/8cm											
	Greyish Red		4	SS	65	/15cm	153										
151.7																	
151.6			5	SS	80	/5cm											
7.7	End of Borehole																
	* * Shale Bedrock (Severely Weathered)																

RECORD OF BOREHOLE No S14

1 OF 1

METRIC

W.P. 199-77-05A LOCATION Co-ords: N 4 804 285; E 277 795 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 27 CHECKED BY PP

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			20	40	60	80	100					
159.2	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)					*											
	Brown, Hard		1	SS	60		158									23.2	1 11 59 29
			2	SS	100	/15cm	156										
154.6			3	SS	60	/8cm	154										
4.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till)		4	SS	60	/15cm	152										3 20 68 9
	Greyish Red, Very Dense		5	SS	60	/15cm	150										
151.6	Shale Bedrock With interbedded Siltstone		6	SS	60	/15cm	148										
7.6	Weak to Very Weak, Greyish Red with interbedded Greenish Grey		7	RC	REC 100%												RQD = 37%
	Weathered		8	RC	REC 100%												RQD = 55%
	Unweathered																
146.9																	
12.3	End of Borehole * C.W.L. not established																

RECORD OF BOREHOLE No S14A 1 OF 1 METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 804 283 E 277 823 ORIGINATED BY TS
 DIST 4 HWY 403 BOREHOLE TYPE SS Auger COMPILED BY TS
 DATUM Geodetic DATE 92 11 27 CHECKED BY PP

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			20	40	60	80	100					
158.4	Ground Surface																
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Brown, Hard		1	SS	41		158										
			2	SS	60	/15cm	156										
153.8			3	SS	60	/15cm	154										
4.6	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Very Dense Grey Greyish Red		4	SS	60	/15cm	152										
150.8			5	SS	60		150										
7.6	Shale Bedrock with interbedded Siltstone Greyish Red, Weathered Weak to Very Weak		6	SS	60												
149.0	End of Borehole • 92 12 01																

RECORD OF BOREHOLE No S15

1 OF 1

METRIC

W.P. 199-77-06A LOCATION Co-ords: N 4 798 666 E 279 202 ORIGINATED BY TS
DIST 4 HWY 403 BOREHOLE TYPE SS Auger, NW Casing, NX Core COMPILED BY TS
DATUM Geodetic DATE 92 11 30 CHECKED BY PP

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			20	40	60	80	100					
99.6	Asphaltic Surface																
0.0	Sand and Gravel (Fill Material) Brown, Compact					DRY +											
97.8			1	SS	11												
1.8	Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) Brown																
96.6			2	SS	80	/15cm											
3.0	Heterogeneous Mixture of Silt, Sand and Gravel (Glacial Till) Very Dense Greyish Red Grey																
			3	SS	100											24.0	6 20 53 21
			4	SS	70												
	Silt, Very Dense, Grey Greyish Red																
			5	SS	100												7 8 76 9
90.5			6	SS	100	/5cm											
9.1	Shale Bedrock with interbedded Siltstone Unweathered, Weak to Very Weak		7	RC	REC 100%												RQD = 8%
88.9																	
10.7	End of Borehole																

ROCK CORE DESCRIPTION **WP 199-77-06A**

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CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
H1	8	10.69-12.22	100	57	10.69-12.22	SHALE , greyish red, with interbedded greenish grey SILTSTONE (3%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
H2	7	9.20-10.72	100	37	9.20-10.72	SHALE , greyish red, with interbedded greenish grey SILTSTONE (7%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures close to extremely close spaced, flat to near vertical, planar to undulating, smooth.
H3	7	9.30-10.82	100	50	9.30-10.82	SHALE , greyish red, with interbedded greenish grey SILTSTONE (15%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 9.30-9.91 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
H4	3	3.66-5.18	88	0	3.66-7.92	SHALE , greyish red, with interbedded greenish grey SILTSTONE (11%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 3.66-3.96 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	4	5.18-6.40	100	13		
	5	6.40-7.92	100	42		
H5	8	7.01-8.53	100	34	7.01-10.06	SHALE , greyish red, with interbedded greenish grey SILTSTONE (19%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	9	8.53-10.06	100	55		

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%)

Logged by: DAW, Soils and Aggregates Section

ROCK CORE DESCRIPTION **WP 199-77-06A**

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CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
H6	4	4.72-6.25	100	37	4.72-7.77	SHALE, greyish red, with interbedded greenish grey SILTSTONE (18%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 5.49-5.61 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	5	6.25-7.77	100	78		
H8	12	10.90-12.34	100	45	10.90-13.87	SHALE, greyish red, with interbedded greenish grey SILTSTONE (13%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures close to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	13	12.34-13.87	92	33		
H8A	11	10.16-11.68	10	0	10.16-16.21	SHALE, greyish red, with interbedded greenish grey SILTSTONE (20%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 10.16-11.76 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	12	11.68-13.21	80	27		
	13	13.21-14.68	83	37		
	14	14.68-16.21	70	24		
H9	8	10.69-12.22	100	70	10.69-13.74	SHALE, greyish red, with interbedded greenish grey SILTSTONE (14%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	9	12.22-13.74	100	62		
H10	8	10.97-12.50	100	65	10.97-14.02	SHALE, greyish red, with interbedded greenish grey SILTSTONE (18%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	9	12.50-14.02	97	62		

*CR = CORE RECOVERY

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(NOTE: Depths are approximated where core recovery is less than 100%)

Logged by: DAW, Soils and Aggregates Section

ROCK CORE DESCRIPTION **WP 199-77-06A**

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CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
H11	11	15.85-17.37	100	23	15.85-18.90	SHALE , greyish red, with interbedded greenish grey SILTSTONE (11%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	12	17.37-18.90	100	35		
H12	9	12.27-13.79	100	14	12.27-15.32	SHALE , greyish red, with interbedded greenish grey SILTSTONE (21%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 12.27-12.60 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	10	13.79-15.32	100	60		
H13	8	10.72-12.24	100	82	10.72-12.24	SHALE , greyish red, with interbedded greenish grey SILTSTONE (20%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to very close spaced, flat to near vertical, planar to undulating, smooth.
H14	8	10.82-12.34	100	37	10.82-13.87	SHALE (with gypsum veinlets sub-parallel to bedding up to 0.2 cm thick, and gypsum-filled vugs, 13.26-13.80 m), greyish red, with interbedded greenish grey SILTSTONE (17%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	9	12.34-13.87	100	65		

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%)

Logged by: DAW, Soils and Aggregates Section

ROCK CORE DESCRIPTION **WP 199-77-06A**

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CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
S7A	8	10.72-12.24	100	28	10.72-13.77	SHALE , greyish red, with interbedded greenish grey SILTSTONE (8%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures close to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	9	12.24-13.77	100	27		
S8	9	12.34-13.87	100	42	12.34-15.39	SHALE , greyish red, with interbedded greenish grey SILTSTONE (13%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 13.41-13.74 m); fractures close to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	10	13.87-15.39	100	27		
S9A	7	9.91-11.43	73	0	9.91-10.42	OVERBURDEN (till).
	8	11.43-12.95	100	80	10.42-12.95	SHALE , greyish red, with interbedded greenish grey SILTSTONE (18%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 10.42-10.80 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
S10	7	9.60-11.13	100	47	9.60-12.65	SHALE , greyish red, with interbedded greenish grey SILTSTONE (18%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	8	11.13-12.65	100	58		

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%)

Logged by: DAW, Soils and Aggregates Section

ROCK CORE DESCRIPTION **WP 199-77-06A**

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CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
S11A-A	6	7.62-9.14	100	71	7.62-10.67	SHALE (with gypsum veinlets sub-parallel to bedding up to 0.5 cm thick, and gypsum-filled vugs, 9.85-10.36 m), greyish red, with interbedded greenish grey SILTSTONE (7%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	7	9.14-10.67	100	67		
S13	6	7.64-9.17	100	62	7.64-10.69	SHALE (with gypsum veinlets sub-parallel to bedding up to 0.2 cm thick, and gypsum-filled vugs, 7.85-9.10 m), greyish red, with interbedded greenish grey SILTSTONE (3%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 7.64-7.85 m); fractures moderate to extremely close spaced, flat to dipping, planar to undulating, smooth.
	7	9.17-10.69	100	68		
S14	7	9.30-10.82	100	37	9.30-12.34	SHALE (with gypsum veinlets sub-parallel to bedding up to 0.2 cm thick, and gypsum-filled vugs, 11.21-11.28 m), greyish red, with interbedded greenish grey SILTSTONE (11%); very fine grained; weak to very weak; unweathered to slightly weathered (moderately weathered, 9.30-10.82 m); fractures moderate to extremely close spaced, flat to near vertical, planar to undulating, smooth.
	8	10.82-12.34	100	55		
S15	7	9.20-10.72	100	8	9.20-10.72	SHALE , greyish red, with interbedded greenish grey SILTSTONE (19%); very fine grained; weak to very weak; unweathered to slightly weathered; fractures close to extremely close spaced, flat to near vertical, planar to undulating, smooth.

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%)

Logged by: DAW, Soils and Aggregates Section

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TABLE 2A

HIGH MAST ILLUMINATION POLE LOCATIONS

H.M.P. NO.	RAMP/HWY	STATION	OFFSET (m)	NORTHING	EASTING	ORIGINAL GROUND ELEVATION (m)	FINAL GROUND ELEVATION (m)	TOP OF FOOTING ELEVATION (m)
1	HWY. 403	15+420	MEDIAN	4798397.760	276852.147	108.97	111.000	112.300
2	HWY. 403	15+594	MEDIAN	4798535.543	276958.409	109.79	110.100	110.660
3	HWY. 403	15+773.5	MEDIAN	4798677.682	277068.030	110.91	108.700	109.920
4	403/E-QEW/S	10+807	25.0 RT.	4799591.044	277833.792	107.23	106.500	106.600
5	403/E-QEW/S	10+697	20.0 LT.	4799699.871	277882.070	110.92	110.700	110.800
6	QEW/S-403	10+475	22.5 LT.	4799814.774	278011.190	110.69	111.500	111.600
7	HWY. 403	17+241	1.5 LT.	4799819.175	277939.986	113.39	119.290	119.40
8	HWY. 403	17+382	2.95 LT.	4799959.843	277940.770	117.73	118.630	118.880
9	HWY. 403	17+517	2.95 LT.	4800094.807	277937.625	118.86	118.850	119.100
10	HWY. 403	17+662	2.95 LT.	4800239.767	277934.248	120.13	119.250	119.500
11	HWY. 403	17+811.5	2.95 LT.	4800389.227	277930.765	124.45	119.840	120.090
12	HWY. 403	17+969	2.95 LT.	4800546.684	277927.097	125.28	120.310	120.560
13	HWY. 403	18+112	2.95 LT.	4800689.645	277923.766	126.18	120.980	121.230
14	HWY. 403	18+245.5	2.95 LT.	4800823.109	277920.656	129.13	122.940	123.190

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TABLE 2B
OVERHEAD SIGN LOCATIONS

OH SIGN	BH *	STATION	FOUNDATIONS OFFSET (m) L	RAMP/HWY	COORDINATES		ORIGINAL GROUND	TOP OF FOOTING	REMARKS
					NORTHING	EASTING	ELEVATION (m)	ELEVATION (m)	
7	S7	10 + 600	8.63 RT	403E - QEW S	4 799 800	277 870	117.70	114.6	
	S7A		8.13 LT		4 799 796	277 886	116.37	114.8	
8	S8	10 + 542	7.76 RT	QEW S - 403E.	4 799 760	278 055	116.24	116.7	Location within approach fill
			16.01 LT		4 799 772	278 077	116.20	116.9	
9	S9	17 + 595	28.35 LT of Med.	Hwy. 403	4 800 172	277 910	121.01	119.5	Leg on slope
	S9A		3.05 LT of Med.		4 800 173	277 935	119.53	119.6	
10	S10	18 + 270	23.47 LT of Med.	Hwy. 403	4 800 846	277 900	128.92	123.8	Earth Stockpile at leg.
	S10A		3.05 LT of Med.		4 800 846	277 918	130.09	124.0	
11A	S11A	18 + 800	23.17 LT of Med.	Hwy. 403	4 801 378	277 886	134.11	135.7	
	S11A-A		Median		4 801 378	277 910	134.03	134.7	
13	S13	21 + 280	3.05 RT of Med.	Hwy. 403	4 803 856	277 820	159.60	157.4	
	S13A		23.47 RT of Med.		4 803 857	277 840	159.30	157.6	
14	S14	21 + 710	3.05 RT of Med.	Hwy 403	4 804 285	277 795	159.19	156.9	
	S14A		32.00 RT of Med.		4 804 283	277 823	159.27	156.9	
15	S15	11 + 400	27.43 LT of Med.	QEW	4 798 666	279 202	99.6	100.0	
			Median		4 798 645	279 185	99.8	100.6	

* For borehole locations see individual borehole logs.

HIGH MAST ILLUMINATION POLES - SOIL/ROCK DESIGN PARAMETERS

H.M.P. NO.	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q _u (kPa) φ(°)					
1.	H1	109.9	Cohesive Till Non-Cohesive Till Bedrock	110.9 - 103.3 103.3 - 100.2 <100.2	250 10,000	35°	V. Stiff V. Dense Unweathered	21 20 22	102	Soil cave-in possible
2.	H2	110.7	Cohesive Till Non-Cohesive Till Bedrock	109.8 - 103.7 103.7 - 100.7 <100.7	150 10,000	35°	Stiff V. Dense Unweathered	21 20 22	102	Soil cave-in possible
3.	H3	112.3	Cohesive Till Non-Cohesive Till Bedrock Bedrock	109 - 102.9 102.9 - 99.9 99.9 - 99.1 <99.1	350 1,000 10,000	35°	Hard V. Dense Weathered Unweathered	21 20 20 22	102	Soil cave-in possible
4.	H4	106.6	Non-Cohesive Fill Non-Cohesive Till Bedrock Bedrock	107.2 - 105.7 105.7 - 104.1 104.1 - 103.2 <103.2	 1,000 10,000	30° 30°	Compact Compact Weathered Unweathered	21 20 20 22	104	Soil cave-in possible
5.	H5	110.8	Cohesive Till Non-Cohesive Till Bedrock	110.9 - 107.4 107.4 - 103.9 <103.9	150 10,000	35°	Stiff V. Dense Unweathered	21 20 22	109.4	Soil cave-in possible
6.	H6	116.6	Cohesive Fill Non-Cohesive Till Bedrock	110.7 - 108.6 108.6 - 106.1 <106.1	150 10,000	30°	Stiff Compact Unweathered	20 20 22	108.6	Soil cave-in possible

HIGH MAST ILLUMINATION POLES - SOIL/ROCK DESIGN PARAMETERS

H.M.P. NO.	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q _u (kPa) φ(°)					
7.	H7,H7A	117.8	Cohesive Till Non-Cohesive Till Bedrock	113.1 - 110.2 110.2 - 108.2 108.2 - 106.0 <106.0 -104.5 <104.5	200 800 1,000 10,000	35°	V. Stiff Hard V Dense weathered Unweathered	21 21 20 20 22	107	Soil cave-in possible
8.	H8,H8A	118.9	Cohesive Till Non-Cohesive Till Bedrock	17.2 - 111.9 111.9 - 108.6 108.6 - 107.0 107.0 - 105.5 <105.5	200 1,000 1,000 10,000	35°	V. Stiff Hard V. Dense Weathered Unweathered	21 21 20 20 22	109.4	Soil cave-in possible
9.	H9	119.1	Cohesive Till Non-Cohesive Till Bedrock	118.9 - 112.8 112.8 - 111.3 111.3 - 108.2 <108.2	150 1,000 10,000	35°	Stiff Hard V. Dense Unweathered	21 21 20 22	112.9	Soil cave-in possible
10.	H10	119.5	Cohesive Till Bedrock	120.1 - 114 114.0 - 109.1 <109.1	200 1,000 10,000		V. Stiff Hard Unweathered	21 21 22	113.1	
11.	H11	120.1	Cohesive Till Non-Cohesive Till Bedrock	124.5 - 115.4 115.4 - 112.3 112.3 - 109.3 109.3 - 108.6 <108.6	200 500 1,000 10,000	35°	V. Stiff Hard V. Dense Weathered Unweathered	21 21 20 20 22	115.4	Soil cave-in possible

HIGH MAST ILLUMINATION POLES - SOIL/ROCK DESIGN PARAMETERS

H.M.P. NO.	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q _u (kPa) ϕ(°)					
12.	H12	120.6	Cohesive Fill Non-Cohesive Till Bedrock	125.3 - 117.7 117.7 - 114.5 114.5 - 113.1 113.1 - 112.7 <112.7	250 1,000 1,000 10,000	35°	V. Stiff Hard V. Dense Weathered Unweathered	21 21 20 20 22	113.5	Soil cave-in possible
13.	H13	121.2	Cohesive Till Non-Cohesive Till Bedrock	126.2 - 115.1 120.1 - 117.1 117.1 - 115.5 <115.5	200 500 10,000	35°	V. Stiff Hard V. Dense Unweathered	21 21 20 22	117.2	Soil cave-in possible
14.	H14	123.2	Non-Cohesive Fill Cohesive Till Cohesive Till Non-Cohesive Till Bedrock	128.3 - 126.3 126.3 - 120.7 120.7 - 119.2 119.2 - 117.6 <117.6	 300 1,000 10,000	30° 35°	Compact V. Stiff Hard V. Dense Unweathered	20 21 21 20 22	126	Soil cave-in possible

OVERHEAD SIGNS - SOIL/ROCK DESIGN PARAMETERS

O.H. SIGN	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q_u (kPa) ϕ (°)					
7.	S7	114.6	Cohesive Till Cohesive Till Non-Cohesive Till Bedrock	117.7 - 110.1 110.1 - 107 107 - 105.4 <105.4	250 800 10,000	35°	V. Stiff Hard V. Dense Unweathered	21 21 20 22	105.5	Soil cave-in possible
	S7A	114.8	Cohesive Till Cohesive Till Non-Cohesive Till Bedrock	116.4 - 110.3 110.3 - 107.3 107.3 - 105.7 <105.7	200 650 10,000	35°	V. Stiff Hard V. Dense Unweathered	21 21 20 22	108.8	Soil cave-in possible
8.	S8	116.7	Cohesive Till Cohesive Till Bedrock	116.2 - 105.4 105.4 - 104 <104	200 1,000 10,000		V. Stiff Hard Unweathered	21 21 22	105.5	
9.	S9	119.5	Cohesive Till Non-Cohesive Till Bedrock	120.2 - 114.1 114.1 - 111.1 111.1 - 108.9 <108.9	200 1,000 10,000	35°	V. Stiff Hard V. Dense Unweathered	21 21 20 22	115.5	Soil cave-in possible
	S9A	119.55	Cohesive Till Cohesive Till Non-Cohesive Till Bedrock	119.5 - 113.4 113.4 - 110.4 110.4 - 109.1 109.1 - 108.8 <108.8	150 1,000 1,000 10,000	35°	Stiff Hard V. Dense Weathered Unweathered	21 21 20 20 22	115.5	Soil cave-in possible

OVERHEAD SIGNS - SOIL/ROCK DESIGN PARAMETERS

O.H. SIGN	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q_u (kPa) ϕ (°)					
10	S10	123.8	Cohesive Till	128.9 - 122.8 122.8 - 119.8	250 1,000		V. Stiff Hard	21 21	126.4	
			Bedrock	119.8 - 119.3 <119.3	1,000 10,000		Weathered Unweathered	20 22		
	S10A	124	Non-Cohesive Fill	128.3 - 126.3		30°	Compact	20	126	Soil cave-in possible
			Cohesive Till	126.3 - 122.1 122.1 - 119.2	150 450		Stiff Hard	21 21		
			Non-Cohesive Fill	119.2 - 117.6		35°	V. Dense	20		
			Bedrock	117.6 - 116 <116	1,000 10,000		Weathered Unweathered	20 22		
11A	S11A	135.7	Cohesive Till	134.1 - 129.5	200		V. Stiff	21	136.4	Soil cave-in possible
			Non-Cohesive Till	129.5 - 126.5		35°	V Dense	20		
			Bedrock	<126.5	10,000		Unweathered	22		
	S11A-A	134.7	Cohesive Till	134.0 - 129.4	350		Hard	21	128.6	Soil cave-in possible
			Non-Cohesive Till	129.4 - 126.4		35°	V. Dense	20		
			Bedrock		10,000		Unweathered	22		

OVERHEAD SIGNS - SOIL/ROCK DESIGN PARAMETERS

O.H. SIGN	B.H. NO.	TOP OF FOOTING ELEVATION (m)	SOIL AND ROCK				CONSISTENCY/ DENSENESS/ WEATHERED	SATURATED UNIT WEIGHT γ (kN/m ³)	G.W.L. ELEVATION (m)	REMARKS	
			TYPE	ELEVATION (m)	STRENGTH PARAMETER q_u (kPa) ϕ (°)						
13	S13	157.4	Cohesive Till	159.6 - 156.6 156.6 - 152	200 1,000	35°	V. Stiff Hard	21 21	Dry		
			Bedrock	152 - 151.7 <151.7	1,000 10,000		V. Dense Weathered Unweathered	20 20 22			
	S13A	157.6	Cohesive Till	159.3 - 154.7 154.7 - 151.7	500 1,000	Hard Hard	21 21	Dry	Soil cave-in possible		
			Bedrock	<151.7		Unweathered	22				
14.	S14	156.9	Cohesive Till Non-Cohesive Till Bedrock	159.2 - 154.6 154.6 - 151.6 151.6 - 148.4 <148.4	600 1,000 10,000	35°	Hard V. Dense Weathered Unweathered	21 20 20 22	157.4	Soil cave-in possible	
			S14A	156.9	Cohesive Till Non-Cohesive Till Bedrock		158.4 - 153.8 153.8 - 150.8 150.8 - 148.4 <148.4	500 1,000 10,000			35°
	15.	S15	100	Non-Cohesive Fill Cohesive Till Non-Cohesive Till Bedrock	99.6 - 97.8 97.8 - 96.6 96.6 - 90.5 < 90.5	500 10,000	30° 35°	Compact Hard V. Dense Unweathered	20 21 20 22	Dry	



SEND
TOMR. TONY SANGIULIANO
FOUNDATION ENGINEER

FOUNDATION DESIGN SECTION - CENTRAL BUILDING

FROM

Morris Bendayan

DEPT.

Structural Section

DATE

93-04-21

SUBJECT

HML Poles - W.P. 199-77-06A

Further to the issue of your Foundation Investigation and Design Report covering above HML poles. At the last progress meeting held at McLennan Rankin it was pointed out the need to comply with present MTO policy re. grading cross-sections. The new policy is reflected on the attached typical Hwy. 403 cross-section sheet and on revised final ground and top of footing elevations for poles #7 to #14 inclusive. Please review this new information and inform us of any eventual revisions you may wish to make to your above mentioned report. Thank you.

REPLY

P.S. The change in elevations vary between 230 mm and 880 mm.

The elevation revisions will NOT impact our recommendations provided in the Foundation Design Report.

REPLY FROM

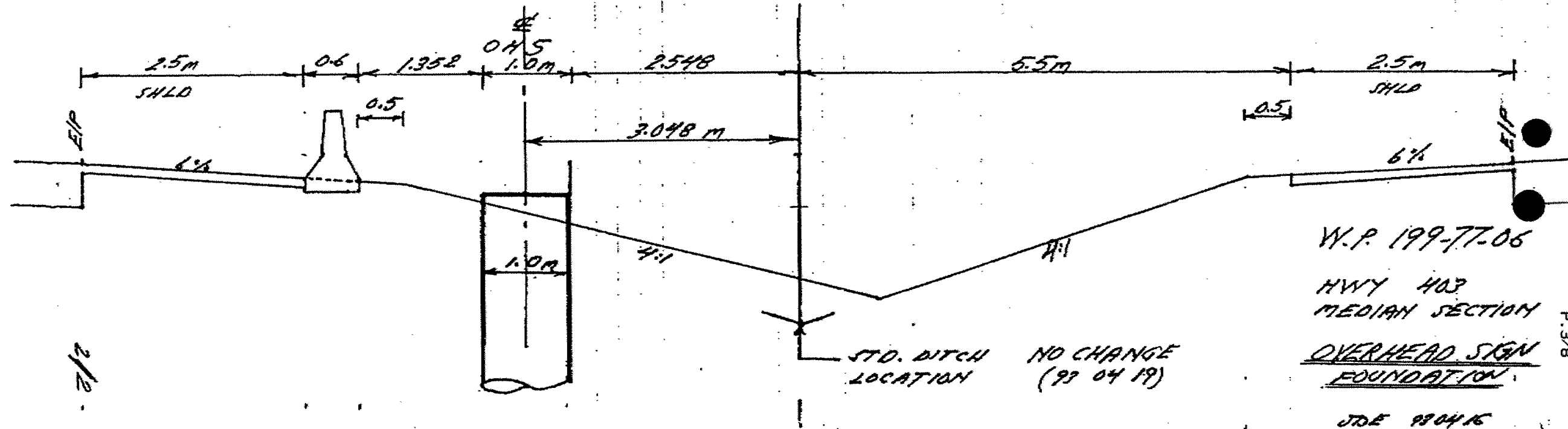
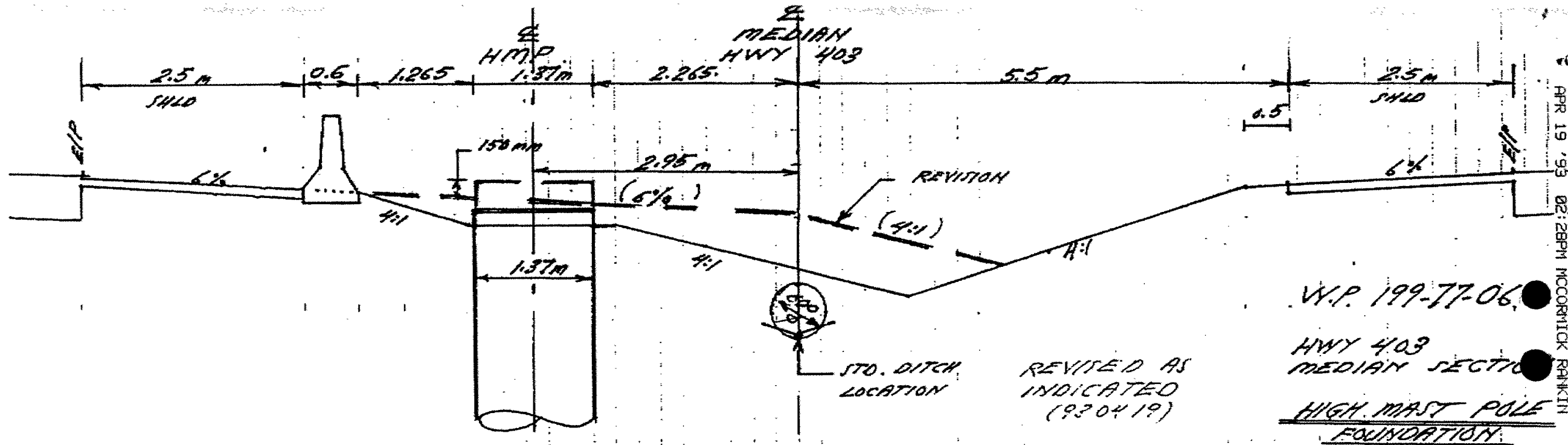
T. Sangiuliano

REPLY DATE

93 04 21

TO WRITE: HANDWRITE OR TYPE, REMOVE AND RETAIN YELLOW COPY, FORWARD BALANCE OF SET.

TO REPLY: WRITE REPLY IN BOTTOM AREA. SNAP SET APART.



HIGH MAST ILLUMINATION POLE LOCATIONS
HWY. 403 FROM KING ROAD TO BRANT ST.
W.P. 199-77-06

~~03-Sep-92~~
23 04 19

H.M.P. NO.	RAMP	STATION	OFFSET	NORTHING	EASTING	ORIGINAL GROUND	FINAL GROUND	TOP OF FOOTING
1	HWY. 403	15+773.5	MEDIAN	4798677.682	277068.030	108.700	108.700	109.920
2	HWY. 403	15+594	MEDIAN	4798535.543	276958.409	110.100	110.100	110.660
3	HWY. 403	15+420	MEDIAN	4798397.760	276852.147	111.000	111.000	112.300
4	403/E-QEW/S	10+807	25.0 RT.	4799591.044	277833.792	106.500	106.500	106.600
5	403/E-QEW/S	10+697	20.0 LT.	4799699.871	277882.070	110.700	110.700	110.800
6	QEW/S-403/N	10+475	22.5 LT.	4799814.774	278011.190	111.500	111.500	111.600
7	HWY. 403	17+241	MEDIAN	4799819.029	277941.479	113.650	117.500 118.380	117.750 118.530
8	HWY. 403	17+382	2.95 LT.	4799959.843	277940.770	120.320	118.630 118.960	118.880 119.110
9	HWY. 403	17+517	2.95 LT.	4800094.807	277937.625	118.900	118.850 119.380	119.100 119.530
10	HWY. 403	17+662	2.95 LT.	4800239.767	277934.248	120.470	119.250 119.820	119.500 119.970
11	HWY. 403	17+811.5	2.95 LT.	4800389.227	277930.765	124.610	119.840 120.270	120.090 120.420
12	HWY. 403	17+969	2.95 LT.	4800546.684	277927.097	125.360	120.310 120.740	120.560 120.890
13	HWY. 403	18+112	2.95 LT.	4800689.645	277923.766	129.390	120.980 121.410	121.230 121.560
14	HWY. 403	18+245.5	2.95 LT.	4800823.109	277920.656	127.400	122.940 123.410	123.190 123.560

NOTE: ALL DIMENSIONS IN METRES

1/2