

**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH FILL EMBANKMENTS, DEEP CUTS AND SWAMP CROSSINGS
HIGHWAY 11, HIGHWAY 518 WEST TO HIGHWAY 520
G.W.P. 480-93-00
VOLUME 1**

Geocres Number: 31E-233

Report to

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the locations of proposed high fill embankments, deep cuts and swamp crossings required for widening of Highway 11 at Katrine, Ontario.

The proposed works to widen Highway 11 include new construction, twinning sections of existing Highway 11, completion of Municipal Service Road, and realignment of Highway 592, Sunset Pass Drive and Tower Road.

The purpose of the investigation was to explore the subsurface conditions at the proposed embankment/cut locations, and based on the data obtained, to provide borehole location plans, borehole logs, stratigraphic profiles, cross-sections, and written descriptions of the subsurface conditions. A model of the subsurface conditions was developed using the data obtained during the present investigation as well as a preliminary investigation previously conducted by others. This model summarizes the expected geotechnical conditions influencing design and construction of the fill embankments, cuts and swamp crossings.

Thurber carried out this work as a sub-consultant to Marshall Macklin Monaghan, under the Ministry of Transportation Ontario (MTO) Agreement Number 5005-A-000285.

2 SITE DESCRIPTION

The project will upgrade Highway 11 to a divided, fully controlled access facility from 0.4 km north of Highway 518 West to 0.6 km south of Highway 520 at Burk's Falls, a distance of about 7.9 km. The project limits extend from Station 23+200 Perry Township to Station 16+600 Armour Township.

The site is located within the physiographic region known as the Canadian Shield, characterized by Pre-Cambrian bedrock which typically outcrops as rounded knobs and ridges. Locally, the area between the bedrock ridges is infilled with deposits of glacio-fluvial sands and gravels, overlain by glacio-lacustrine sands, silts and clays. More recent deposits include peat in poorly drained swamp areas and alluvial soils within the Magnetawan River floodplain. Anthropogenic deposits (fill) are also encountered as a result of construction activities.

Vegetation of the terrain varies from heavily wooded to fairly open and sparsely treed, with localized swampy areas. Dwellings and businesses are present along the existing Highway 11.

3 SITE INVESTIGATION AND FIELD TESTING

Thurber carried out site investigation and field testing at the location of each proposed high fill, deep cut and swamp crossing. The fieldwork was conducted during the period November 18, 2003 to November 24, 2004. Additional boreholes were drilled in two areas during August 2005 following an alignment shift.

The site investigation consisted of drilling and sampling boreholes supplemented by dynamic cone penetration testing (DCPT). In general, boreholes were positioned along the centreline of the embankments at longitudinal spacings of 25 m for investigation lengths of less than 250 m and at 50 m spacings for lengths greater than 250 m. At intermediate spacings between the centreline boreholes, one borehole was advanced at the embankment toe location and one DCPT was conducted at the opposite embankment toe location, alternating from side to side.

In addition to the borehole data obtained during the current investigation, select factual data from the following investigations was incorporated into the assignment:

- Foundation Investigations for the proposed underpass and bridge structures, carried out concurrently with this study.
- Preliminary investigation in several of the study areas by Shaheen & Peaker Limited (S&P, Preliminary Foundation Investigation Report, December 2001, WP 314-99-00).

The locations of the study areas are listed in Table A1 of Appendix A. The approximate locations of the boreholes are shown on the Borehole Locations and Soil Strata Drawings in Appendices B to T corresponding to each of the study areas.

The proposed roadway centreline alignments were staked in the field by Marshall Macklin Monaghan. The borehole locations (stations and offsets from centreline) were then established by Thurber relative to the centreline staking. Prior to the start of drilling, utility clearances and property access were obtained.

The drilling and sampling equipment used for the investigation was supplied and operated by All-Terrain Drilling Limited, George Downing Estate Drilling Limited, and Malone's Soil Samples Co. Ltd. In general, hollow stem augers were used to advance the boreholes and samples were obtained using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Where firm to soft cohesive soils were encountered, samples were also obtained using a thin-walled (Shelby) tube sampler. In situ vane shear testing was carried out to assess the undrained shear strength of soft to firm cohesive deposits. At several locations, NQ rock coring was used to prove shallow bedrock or penetrate bouldery material.

Standpipe piezometers were installed in a number of boreholes to monitor groundwater levels. The piezometer installations typically consisted of 19 mm PVC pipe with a 1.5 m slotted tip surrounded by filter sand. A bentonite seal was placed above the filter sand and the remainder of the borehole

was grouted with bentonite grout to the ground surface. Details of the piezometer installations are shown on the Record of Borehole sheets included in Appendices B to T.

Boreholes not containing piezometers were backfilled with bentonite grout.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The inspector logged the soil and groundwater conditions encountered in the boreholes, and collected, labelled, and arranged for transport of the recovered samples to Thurber's Oakville laboratory.

4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendices B to T.

Select samples were subjected to gradation analysis (sieve and hydrometer) and Atterberg Limits testing. The results are shown on the Record of Borehole sheets and on the plots included in Appendices B to T.

Laboratory consolidation tests were conducted on three samples of silty clay obtained from locations where significant depths of compressible soils were encountered. The results are presented in Appendix E (Municipal Service Road, Station 7+500 to 7+720), Appendix G (Highway 11, Station 11+950 to 12+030) and Appendix Q (Station 15+715 to 15+815).

5 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 General

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets and the Borehole Locations and Soil Strata Drawings in Appendices B to T of this report. A general description of the stratigraphy based on the conditions encountered in the boreholes is given in the following paragraphs. However, the factual data presented in the borehole logs takes precedence over this general description and interpretation of the site conditions.

The soil stratigraphy encountered along the project corridor generally consists of bedrock mantled by sand and gravel containing cobbles and boulders, which is overlain by deposits of silt, clay and sand, and a surficial veneer of topsoil, peat or fill. The specific conditions encountered at individual sites vary with location and depth of exploration.

Generalized descriptions of the individual strata at each fill, cut or swamp area are presented below. The reported groundwater levels are short-term readings and will vary with spring snowmelt, periods of heavy rainfall, or dry conditions.

5.2 Highway 592, Station 9+630 to 9+960 (Appendix B)

General

The stratigraphy encountered in this area generally comprises a surficial topsoil layer overlying discontinuous layers of loose to compact sands and silts. The silt/sand deposits are underlain by a layer of firm to very stiff silty clay which in turn overlies compact to dense sand. The silt and clay layers do not extend to the south end of the alignment. The boreholes were terminated in the sand and clay.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures B1 to B7 of Appendix B (Figures B1 to B3: sand to silty sand; Figures B4 and B5: silt to sandy silt; Figures B6 and B7: silty clay to clayey silt). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figures B8 and B9 of Appendix B.

Topsoil

Topsoil was identified surficially in all boreholes except the two most southerly boreholes in this section. The topsoil thickness ranged from 50 to 200 mm.

Sand, Silt, and Silty Sand to Sandy Silt

Non-cohesive sands and silts were encountered below the topsoil or surficially in all boreholes. With the exception of boreholes encountering the clay layer and boreholes at the extreme south end of the site, the sand/silt typically extended to the full exploration depths of 9.8 to 14.0 m. In general, this deposit comprised fine-grained silt, sandy silt and silty sand in the upper 3.0 to 6.0 m, and medium to coarse-grained sand in the lower portions.

Standard Penetration Test N-values measured in the sand/silt ranged from 11 to 66 blows/0.3 m penetration, indicating a compact to very dense condition. Lower SPT values of 3 to 10 blows/0.3 m penetration were obtained in surface SPTs driven through topsoil and the upper loose material. Occasional N-values of greater than 50 blows/0.3 m infer the presence of cobbles or boulders.

Moisture contents typically ranged from 18 to 30% in the upper fine-grained sands and silts, and from 2 to 10% in the coarser sands.

Silty Clay to Clayey Silt

A stratum of cohesive silty clay to clayey silt was encountered within/below the silt and sand deposit in seven boreholes located between Stations 9+730 and 9+905. The upper boundary of the cohesive deposit was contacted at depths of 1.8 to 9.1 m, approximate elevation 314 to 322 m. At locations where the cohesive layer was fully penetrated, the clay/silt was 2.6 to 4.6 m thick with a lower boundary near elevation 314 to 318 m. At three other locations, the boreholes were terminated in the silty clay/clayey silt at depths of 9.8 to 14.0 m, indicating a thickness exceeding 3.7 to 7.9 m.

Standard Penetration Tests conducted in this deposit yielded N-values of 5 to 27 blows/0.3 m penetration (firm to very stiff consistency). The results of Atterberg Limits testing (Figures B8 and B9 of Appendix B) classify the soil as low plastic silty clay (CL) with occasional zones of intermediate plasticity (CI) and low plastic clayey silt (ML). Moisture contents ranged between 18 and 50%, most commonly 21 to 33%.

Sand and Gravel with Cobbles and Boulders

A deposit of sand and gravel with cobbles and boulders was encountered below the sand in one borehole drilled near the south limit of the embankment area (Station 9+655). A SPT N-value of 49 indicates a dense condition. A moisture content of 2% was measured in one sample of this material. The borehole encountered refusal at a depth of 1.2 m into this deposit, at a total depth of 5.2 m.

Refusal

Refusal was met on bedrock or possible boulders in two boreholes and one cone penetration test (CPT) located at the south end of the embankment area (Station 9+641 to 9+660). The refusal depths ranged from 0.8 to 5.2 m, near elevation 322 to 328 m.

Groundwater

The groundwater levels measured in piezometers installed in five boreholes are shown in Table 5.1.

Table 5.1 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
9+680	CL	12.2	July 16, 2004	Dry	<312.0
9+755	L28	13.5	July 16, 2004	5.95	316.5
9+805	R26	7.2	July 16, 2004	4.22	319.0
9+880	CL	9.0	July 16, 2004	Dry	<313.5
9+955	L30	12.8	July 16, 2004	12.6	308.5

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.3 Sunset Pass Drive, Station 10+040 to 10+150 (Appendix C)

General

The stratigraphy encountered in this area generally comprises surficial fill and topsoil layers overlying loose to dense sands and silts, underlain by a discontinuous layer of firm to very stiff silty clay and by dense to very dense sand and gravel.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures C1 to C4 of Appendix C (Figure C1: silt to sandy silt; Figure C2: sand

to silty sand; Figure C3: silty clay; Figure C4: sand and gravel). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figure C5 of Appendix C.

Topsoil

Topsoil was identified surficially in six of nine boreholes drilled in this section. The topsoil thickness ranged from 100 to 200 mm.

Fill

A 0.6 m thick layer of sand and gravelly sand fill was encountered in three boreholes drilled between Station 10+112.5 and 10+150, along existing Sunset Pass Drive.

Sand to Silt

Non-cohesive sands and silts were encountered below the topsoil and fill in all boreholes. The sand/silt extended to depths of 1.8 to 6.2 m, with a lower boundary near elevations 312 to 320 m. The borehole drilled at Station 10+137.5 was terminated in silt upon auger refusal at 6.7 m depth.

Standard Penetration Test N-values measured in the sand/silt ranged from 11 blows/0.3 m to 50 blows/0.125 m penetration, indicating a compact to very dense condition. Occasional N-values of greater than 50 blows/0.125 m penetration infer the presence of cobbles or boulders. Moisture contents ranged widely from 2 to 30%, and were typically in the order of about 20%.

Silty Clay

A discontinuous stratum of cohesive silty clay was encountered below or as thin layers within the silt and sand deposit in six boreholes. Where fully penetrated, the clay layer was 0.6 to 2.7 m thick with the lower boundary near elevation 309 to 318 m, but two boreholes were terminated in the silty clay indicating a thickness exceeding 3.6 and 0.6 m.

Standard Penetration Tests conducted in this deposit yielded N-values of 6 to 20 blows/0.3 m penetration (firm to very stiff consistency). The results of Atterberg Limits testing (Figure C5 of Appendix C) classify the soil as medium to low plastic silty clay (CI to CL). Moisture contents ranged between 21 and 41%.

Sand and Gravel with Cobbles and Boulders

A deposit of sand and gravel with cobbles and boulders was encountered below the sand/silt and clay in the boreholes drilled between Stations 10+050 and 10+112.5 but not encountered west of this area. The upper boundary of this deposit generally rises towards the east, from approximate elevation 309 to 318 m. These boreholes were terminated in the sand and gravel at depths of 6.6 to 26.0 m.

SPT N-values of 31 to greater than 50 blows/0.3 m of penetration indicate a dense to very dense condition, as well the presence of numerous cobbles and boulders. Moisture

contents are typically in the range of 1 to 5%, locally increasing to 20% in the lower part of deeper borehole 395-4.

Refusal

Refusal was met on probable boulders in the sand and gravel deposit in four boreholes and in two cone penetration tests. The refusal depths ranged from 1.8 to 9.4 m, near elevation 310 to 319 m.

Groundwater

The groundwater levels measured in piezometers installed in two boreholes are shown in Table 5.2.

Table 5.2 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
BH 394-4	CL	26.0	October 19, 2004	15.2	307.4
			October 21, 2004	15.6	307.0
10+087.5	L24	9.1	July 23, 2004	9.1	311.5
			January 19, 2005	8.6	312.0
			February 28, 2005	8.7	311.9

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.4 Highway 11 NBL, Station 10+510 to 10+570 (Appendix D)

General

This area is located adjacent to the existing alignment of Highway 11 near a culvert location. As such, fill comprising the existing roadway embankment was encountered in many of the boreholes. The fill was underlain by silt to sand and silt, containing a silty clay layer. The boreholes were terminated in the silt/sand and clay.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures D1 to D4 of Appendix D (Figure D1: sand fill; Figure D2: silt to sand and silt; Figure D3: silty clay; Figure D4: silt). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figure D5 of Appendix D.

Fill

Sand fill was encountered surficially in all boreholes drilled along the proposed centreline of the Highway 11 median and northbound lanes. The fill thickness was 7.6 m in two boreholes drilled on either side of the existing culvert (Station 10+522.5 and 10+535) and ranged from 1.4 to 2.4 m at three other borehole locations. The lower boundary of the fill

was near elevation 297.5 m at the deeper fill locations, and near elevation 299 to 302 m in the other boreholes.

SPT N-values in the fill typically ranged from 6 to 16 blows/0.3 m of penetration, indicating a loose to compact condition. Below a depth of 1.5 m at the deeper fill locations, the N-values dropped to a range of 2 to 7 blows/0.3 m penetration, typically 4 to 5 blows, indicating a loose to very loose condition. Moisture contents in the fill varied from 3 to 28%.

Silt to Sand and Silt

A non-cohesive unit comprising silt varying to sand and silt was encountered below the fill and surficially near the proposed toe of slope. This upper layer of silt/sand overlies a silty clay stratum, and was 1.2 to 5.2 m thick, extending to near elevations 296 to 300 m. It was not encountered in one borehole at Station 10+535 R10. SPT N-values measured in the silt/sand ranged from 8 to 24 blows/0.3 m penetration, indicating a typically loose to compact condition. Moisture contents ranged from 16 to 26%.

Silty Clay

A stratum of cohesive silty clay was encountered below the upper silt to sand and silt deposit in all boreholes. The upper boundary of the cohesive deposit was contacted at depths of 1.2 to 9.1 m, approximate elevation 296 to 300 m. Where fully penetrated in three boreholes, the clay layer was 0.9, 4.6 and 4.9 m thick with a lower boundary near elevation 291 to 293 m. Three boreholes were terminated in the silty clay at depths of 6.7 to 9.8 m, indicating at minimum thickness of 0.6 to 0.8 m.

SPT tests conducted in this deposit yielded N-values of 7 to 21 blows/0.3 m penetration (firm to very stiff consistency). At Station 10+535, where a thin clay layer directly underlies fill, an N-value of 2 blows/0.3 m was obtained, indicating a soft to very soft consistency. The results of Atterberg Limits testing (Figure D5 of Appendix D) classify the soil as silty clay of intermediate plasticity (CI). Moisture contents ranged between 31 and 44%.

Silt to Silty Sand

The silty clay is underlain by non-cohesive silt to silty sand encountered in three boreholes (Stations 10+510, 10+535 and 10+547.5). SPT N-values of 9 to 26 blows/0.3 m penetration indicate a generally compact condition, with one value of 5 blows at Station 10+510 indicating a loose condition. Moisture contents ranged from 19 to 32%. The boreholes were terminated in this deposit at depths of 9.8 to 12.8 m.

Groundwater

Groundwater was observed in boreholes at Stations 10+522.5, 10+535 and 10+547.5 at depths of 8.5 to 9.4 m upon completion of drilling. The groundwater levels measured in a piezometer installed at Station 10+570 are shown in Table 5.3.

Table 5.3 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
10+570	R3	6.7	August 24, 2004	Dry	<299.0
			January 19, 2005	Dry	<299.0
			February 28, 2005	Dry	<299.0

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.5 Municipal Service Road, Station 7+500 to 7+720 (Appendix E)

General

The stratigraphy revealed in this area generally comprises a surficial fill, topsoil or peat layer overlying thin deposits of very loose to compact sands and silts, underlain by a relatively thick deposit of silty clay to clayey silt. The clay is underlain by loose to compact silt. Probable bedrock was contacted below the silt in boreholes near the north end of the section and outcrops were noted in this area.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures E1 to E5 of Appendix E (Figure E1: silt, sandy silt, clayey silt; Figures E2 and E3: silty clay; Figures E4 and E5: lower silt). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figures E6 and E7 of Appendix E.

Fill

A surficial fill layer placed to access borehole locations is shown on the borehole logs for Stations 7+562.5, 7+704 and 7+723. The fill was 0.7 to 0.8 m thick and comprises silt, sand, clay and/or topsoil.

Peat and Topsoil

A 0.3 to 1.5 m thick layer of peat with occasional sand layers was encountered in four boreholes located between Station 7+520 to 7+550 on the south part of the section. At Station 7+520, the peat was overlain by 0.3 m of very loose sand. SPT N-values of 2 blows/0.3 m penetration were obtained in the peat, and moisture contents ranged from 70 to 213%.

Topsoil was identified surficially in the majority of boreholes located north of Station 7+610. The topsoil thickness was typically 100 mm.

In two boreholes located at the west toe of the proposed embankment, at Stations 7+672.5 and 7+697.5, shallow bedrock was encountered beneath 200 to 300 mm of moss.

Sand to Silt

Non-cohesive sand to silt was encountered below the peat or topsoil in most boreholes drilled within this section. Where encountered, the sand/silt layer was 0.3 to 3.5 m thick with a lower boundary near elevation 298 to 302 m, locally elevation 295 m in one borehole near the north end of the section.

SPT N-values measured in the sand/silt ranged from 1 to 29 blows/0.3 m penetration, indicating a very loose to compact condition. Moisture contents generally ranged from 18 to 35% with higher values of up to 55%, reflecting the presence of silty clay seams and organics in this deposit.

Silty Clay to Clayey Silt

A stratum of cohesive silty clay to clayey silt was encountered below the topsoil or sand and silt deposit in the majority of boreholes. The upper boundary of the cohesive deposit was contacted at depths of 0.1 to 3.6 m, approximate elevation 295 to 303 m. Where fully penetrated, the clay/silt layer was generally 5.3 to 7.3 m thick, but thinned locally to as little as 2.3 m towards the north end of the site. The lower boundary was near elevation 292 to 296 m in these boreholes, but several boreholes were terminated in the silty clay/clayey silt indicating a thickness exceeding 2.5 to 6.7 m.

SPT tests conducted in this deposit yielded N-values of 2 to 24 blows/0.3 m penetration, most commonly in the 4 to 10 blow range. The undrained shear strength measured by in situ vane shear test ranged from 60 to 100 kPa (stiff) along most of the site, with lower values of 30 to 50 kPa (firm) measured locally north of Station 10+660. The results of Atterberg Limits testing (Figures E6 and E7 of Appendix E) classify the soil as silty clay with low to high plasticity (CL to CH). Moisture contents ranged between about 30 and 50%.

The results of consolidation testing conducted on a sample of the silty clay are included in Appendix E and summarized in Table 5.4.

Table 5.4 – Consolidation Test Parameters

Station Offset	Sample Depth (m)	w (%)	γ (kN/m ³)	e_o	p_o' (kPa)	p_c' (kPa)	OCR	C_c	C_r
<u>MSR 7+635</u> CL	4.6-5.2	40	17.9	1.14	60	400	6.7	0.36	0.06

Comparison of the existing and preconsolidation pressures (p_o' and p_c') derived from the test results indicate that the silty clay is preconsolidated. The coefficient of consolidation, c_v , recorded during the test generally ranged from 0.02 to 0.04 cm²/s with an average value near 0.028 cm²/s.

The parameters listed in the table were obtained from testing of one sample recovered from a discrete depth in the borehole. The compressibility characteristics will vary with depth in accordance with the moisture content and shear strength profiles.

Silt

An underlying silt deposit was encountered in boreholes where the cohesive clay/silt was fully penetrated. SPT N-values obtained in the silt varied from 3 to 37 blows/0.3 m of penetration, indicating a very loose to dense condition, typically loose to compact. Moisture contents of 19 to 35% were measured. The boreholes encountering the silt deposit were terminated in this unit or upon refusal at depths of 8.2 to 12.6 m.

Probable Bedrock

Refusal was met on probable bedrock in boreholes drilled along the centreline and left toe of the proposed embankment north of Station 7+672.5 and at Station 7+720 of the right toe of slope. The depth to refusal generally increased from 0.2 to 10.7 m in a southerly direction away from the rock outcrop located near the north end of the site. At the borehole locations, the bedrock surface falls from approximate elevation 300.5 to 287.5 m.

Refusal was also met at Station 7+660 CL and 7+662 (R5.5). At Station 7+660, the split spoon sampler contacted an obstruction at 10.8 m depth (elevation 288 m) and augering was continued until the augers broke at an apparent depth of 13.7 m. This breakage indicates that the augers may have been deflected from vertical and the depth to bedrock was therefore not confirmed. At Station 7+662, refusal was met at 9.1 m depth (elevation 292.9 m), indicating that refusal was on steeply sloping bedrock or a boulder.

Groundwater

Groundwater was observed at depths of 0.9 to 9.1 m in the eight open boreholes upon completion of drilling. The groundwater levels measured in piezometers installed in four boreholes are shown in Table 5.5.

Table 5.5 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
7+525	CL	7.6	July 7, 2004	5.01	296.3
			July 8, 2004	2.64	298.7
			February 28, 2005	3.91	297.4
7+562.5	R19	9.1	July 8, 2004	5.92	298.0
			February 28, 2005	4.94	299.0
7+635	CL	10.7	February 28, 2005	5.74	295.0
7+675	R2.75	8.5	June 5, 2001	3.3	298.3
			June 7, 2001	3.3	298.3

Considering the presence of a surficial peat layer on the south part of the site, it is anticipated that a perched groundwater table is near the ground surface in this area. The perched groundwater level is expected to be near the ground surface in the north section as

well. It appears that a downward hydraulic gradient exists on the site based on the lower piezometer readings in the underlying silt layer.

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.6 Municipal Service Road, Station 7+750 to 7+880 (Appendix F)

General

The stratigraphy revealed in this area generally comprises a thin layer of fill, topsoil and/or sand mantling bedrock.

Fill

A 0.2 to 0.6 m thick layer of fill comprising sand, cobbles, boulders and topsoil was present in four boreholes. The fill was constructed from indigenous materials graded to permit drillrig access.

Topsoil

Topsoil was identified surficially in two boreholes and three test pits in this section. The topsoil thickness ranged from 100 to 300 mm.

Sand

Non-cohesive sand to silty sand was encountered below the topsoil or surficially in two boreholes and four test pits. The sand layer was 0.5 to 3.1 m thick and mantles bedrock. It contains cobbles and occasional gravelly zones such as that in the lower 0.3 m of the test pit at Station 7+850. SPT N-values of 1 and 4 blows/0.3 m penetration indicate the sand is loose to very loose. Moisture contents of 10 and 19% were measured in the recovered samples.

Bedrock

Bedrock and probable bedrock (auger refusal) were contacted below the fill, topsoil or sand in all boreholes and test pits in this section. In general, the bedrock surface approximately follows the ground surface. Along the centreline of the proposed road, bedrock was contacted at depths of 0.3 to 1.4 m, locally 3.2 m at Station 7+775, ranging from approximate elevation 309 to 319 m. At the west top of cut, the depth to rock ranged from 0.1 to 0.8 m, varying from approximate elevation 314 to 325 m. The bedrock outcrops between the proposed centreline and west top of cut from approximate Station 7+760 to 7+860.

The bedrock was proven by coring in all six boreholes drilled along the proposed top of cut. In general, the bedrock consists of fresh to slightly weathered gneiss. The measured core recovery (TCR) ranged from 91 to 100%. The Rock Quality Designation (RQD) ranged from 83 to 100% (good to excellent quality) with the exception of the upper 1.0 m

at Station 7+775 where the RQD was 47% (poor quality). The unconfined compressive strength (UCS) of intact rock cores estimated from point load tests ranged from approximately 100 to 200 MPa, indicating a strong to very strong rock.

Groundwater

The groundwater levels measured in piezometers installed in the bedrock at three borehole locations are shown in Table 5.6.

Table 5.6 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
7+760	L20	4.1	June 30, 2004	0.97	320.5
7+800	L24	3.7	June 30, 2004	3.12	322.0
7+850	L13	4.2	-	-	-

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.7 Highway 11, Station 11+950 to 12+030 (Appendix G)

General

The stratigraphy encountered in this area generally comprises a surficial topsoil layer overlying loose to compact silt to sandy silt, underlain by a relatively thick deposit of silty clay. The clay in turn is underlain by loose to compact silt to silty sand.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures G1 to G5 of Appendix G (Figures G1 and G2: silt; Figures G3 and G4: silty clay; Figure G5: silt). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figures G6 and G7 of Appendix G.

Topsoil and Peat

A surficial layer of topsoil was encountered in all boreholes drilled in this section. The topsoil thickness reported during the preliminary study was 75 to 200 mm. During the current study, the topsoil was typically 200 mm thick and described as brown to dark brown silt with rootlets (sand at one location).

A 300 mm thick layer of frozen peat was encountered in borehole TMS4.

Silt to Sandy Silt

Non-cohesive silt to sandy silt was encountered below the topsoil layer in all boreholes drilled within this section. The silt layer was 1.3 to 5.9 m thick with a lower boundary at depths of 1.5 to 6.1 m, near elevation 292 to 294.5 m.

SPT N-values measured in the silt ranged from 2 to 26 blows/0.3 m penetration, typically in the range 8 to 15 blows/0.3 m, indicating a generally loose to compact condition. Moisture contents ranged from about 20 to 25%, with higher values of up to 65% obtained in the initial samples taken from the ground surface reflecting the presence of organics.

Silty Clay

A relatively thick layer of cohesive silty clay was encountered below the silt deposit. The upper boundary of the cohesive deposit was contacted at depths of 1.5 to 6.1 m, approximate elevation 292 to 294.5 m. Where fully penetrated, the clay layer was 4.5 to 7.5 m thick, with a lower boundary near elevation 285.5 to 288.5 m. Two boreholes were terminated in the silty clay at 8.1 m depth, indicating a thickness exceeding 3.7 and 6.0 m.

SPT tests conducted in this deposit yielded N-values of 4 to 10 blows/0.3 m penetration during the current study, and 1 to 8 blows/0.3 m penetration during the preliminary study. The undrained shear strength measured by in situ vane testing ranged from 50 to over 100 kPa, typically between 65 to 85 kPa, indicating a stiff consistency. The sensitivity ranged from 2.8 to 5.0, and was 8.5 during the preliminary study.

The results of Atterberg Limits testing (Figures G6 and G7 of Appendix G) classify the soil as silty clay with low to intermediate plasticity (CL to CI). Moisture contents ranged between about 25 and 50%.

The results of consolidation testing conducted on a sample of the silty clay are included in Appendix G and summarized in Table 5.7.

Table 5.7 – Consolidation Test Parameters

Station Offset	Sample Depth (m)	w (%)	γ (kN/m ³)	e_o	p_o' (kPa)	p_c' (kPa)	OCR	C_c	C_r
12+015 R44	6.1-6.7	47	17.1	1.32	75	300	4.0	0.48	0.07

Comparison of the existing and preconsolidation pressures (p_o' and p_c') derived from the test results indicate that the silty clay is preconsolidated. The coefficient of consolidation, c_v , recorded during the test generally decreased with increasing pressure from 0.06 to 0.003 cm²/s, with an average value near 0.028 cm²/s for the typical pressure range anticipated in the field.

The parameters listed in the table were obtained from testing of one sample recovered from a discrete depth in the borehole. The compressibility characteristics will vary with depth in accordance with the moisture content and shear strength profiles.

Silt

In all boreholes which extended below the clay unit, an underlying silt was encountered. This deposit was variable in texture, grading locally to a sandy silt or silty sand. SPT

N-values obtained in the silt varied from 6 to 26 blows/0.3 m of penetration, indicating a loose to compact condition. Moisture contents of about 25 to 38% were measured. The boreholes encountering the silt deposit were terminated in this unit at depths of 9.6 to 12.8 m.

Groundwater

Upon completion of drilling, groundwater was observed at depths of 0.6 to 11.6 m in all but two boreholes. The groundwater levels measured in piezometers installed in four boreholes are shown in Table 5.8.

Table 5.8 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
11+962.5	R55	9.8	August 20, 2004	0.42	296.7
			January 19, 2005	0.61	296.5
			February 28, 2005	0.59	296.5
11+975	L18.75	12.2	July 22, 2004	2.48	294.5
			August 20, 2004	1.54	295.5
			October 7, 2004	0.64	296.5
			January 19, 2005	0.64	296.5
			February 28, 2005	0.61	296.5
TML-1	NBL CL	9.8	July 21, 2004	0.65	295.4
			July 22, 2004	0.15	295.9
			August 20, 2004	0.00	296.0
			October 7, 2004	0.39	295.6
12+004	L50	9.8	August 20, 2004	0.67	295.1
			October 7, 2004	0.72	295.0
			January 19, 2005	2.45	293.5
			February 28, 2005	2.43	293.5

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.8 Highway 11, Station 12+070 to 12+140 (Appendix H)

General

The stratigraphy revealed in this area generally comprises a surficial topsoil layer overlying discontinuous silt to sandy silt deposits, underlain by a variable thickness of silty clay to clayey silt. The clay is in turn underlain by silt then sand to silty sand.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures H1 to H3 of Appendix H (Figure H1: silty clay to clayey silt; Figure H2: silt to sandy silt; Figure H3: sand to silty sand). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figure H4 of Appendix H.

Fill

A 500 mm thick layer of sand and gravel fill was encountered surficially at one location (Station 12+110 SBL). Possible silt fill containing organics and extending to 1.8 m depth was encountered in borehole TMS3.

Topsoil and Organic Silt

A surficial layer of topsoil was encountered in all but one borehole (Station 110 SBL) drilled in this section. The topsoil thickness generally ranged from 50 to 150 mm, and was 500 mm at one location (Station 12+115 L45).

A very soft organic silt and clayey silt was encountered below the fill in borehole TMS3. The organic layer was 500 mm thick and extended to 2.3 m depth.

Silt to Sandy Silt

A layer of non to slightly plastic silt to sandy silt was encountered below the topsoil in the two most southerly boreholes in this section. The silt layer extends to 3.0 and 2.1 m depth and has a lower boundary near elevation 292 to 293 m. The silt was very loose to loose (very soft where cohesive), with N-values of 2 to 4 blows/0.3 m penetration, 8 blows for one test.

An isolated 500 mm thick layer of stiff silt was also encountered below the topsoil at Station 12+130 R20. An N-value of 10 blows/0.3 m penetration and moisture content of 30% were obtained in this layer.

Silty Clay to Clayey Silt

A relatively thick layer of cohesive silty clay to clayey silt was encountered below the topsoil and silt deposit. The upper boundary of the cohesive deposit was contacted at depths of 0.1 to 3.0 m, approximate elevation 292 to 298 m. The clay layer was 1.8 to 7.5 m thick, with a lower boundary near elevation 290 to 292.5 m.

The cohesive deposit typically exhibits an approximate 1.2 m thick, very stiff to hard upper crust with SPT N-values ranging from 18 to 46 blows/0.3 m. Below the crust, N-values ranged from 4 to 15 blows/0.3 m penetration (firm to stiff) during the current study, and 3 to 6 blows/0.3 m penetration (soft to firm) during the preliminary study. The undrained shear strength determined by in situ vane testing generally ranged from 75 kPa (stiff) to greater than 100 kPa (very stiff to hard). One vane test result of 25 kPa measured at 5.5 m depth at Station 12+130 R20 indicates a firm consistency.

The results of Atterberg Limits testing (Figure H4 of Appendix H) classify the soil as silty clay with low to intermediate plasticity (CL to CI). Moisture contents ranged between about 20 and 45%.

Silt

The cohesive clay/silt layer is underlain by a silt stratum in all boreholes. The silt deposit graded locally to a sandy silt. SPT N-values obtained in silt varied from 2 to 24 blows/0.3 m of penetration, indicating a very loose to compact condition. Moisture contents of about 20 to 30% were measured. The silt layer is 1.4 to 4.6 m thick with a lower boundary near elevation 287.5 to 290 m.

Sand

Sand to silty sand was encountered below the silt in all boreholes at depths of 5.9 to 10.7 m (elevation 287.5 to 290 m). SPT N-values obtained in the sand generally increase with depth from 1 to 38 blows/0.3 m penetration (very loose to dense). Moisture contents ranged from about 18 to 25%. The sampled boreholes were terminated in the sand at depths of 8.1 to 14.2 m.

Groundwater

Groundwater was observed at depths of 1.8 to 2.7 m in three boreholes upon completion of drilling. The groundwater levels measured in piezometers installed in two boreholes are shown in Table 5.9

Table 5.9 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
12+128	L21	9.0	October 7, 2004	0.55	295.5
			January 19, 2005	1.00	295.0
			February 28, 2005	0.96	295.0
12+130	R20	14.2	October 4, 2004	3.90	294.2
			October 7, 2004	3.60	294.5
			January 19, 2005	4.21	293.9
			February 28, 2005	4.15	294.0

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.9 Highway 11, Station 12+280 to 12+480 including E/W-N Ramp, Three Mile Lake Road (Appendix I)

General

The stratigraphy encountered in the valley adjacent to Magnetawan River generally consists of a surficial peat or topsoil layer overlying alluvial sediments comprising very loose to compact fine sands and silts, grading to sand to silty sand with depth and becoming dense below depths of about 14 to 18 m. Isolated layers of silty clay and clayey silt were encountered in the upper part of the sand/silt deposit. Bedrock was contacted

below the sand in three deeper boreholes drilled for the Magnetawan River North Crossing Foundation Investigation at the south end of this embankment section.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures I1 to I5 of Appendix I (Figures I1 and I2: sandy silt to silty sand; Figure I3 and I4: sand; Figure I5: silty clay to clayey silt). The results of Atterberg Limits tests conducted on cohesive samples are presented on Figure I6 of Appendix I.

Peat and Topsoil

Peat was encountered surficially in 11 boreholes drilled through the central part of the site (Stations 12+342.5 to 12+405, as well as 12+430 SBL CL and 12+467.5 CL). In general, the peat ranged in thickness from 0.1 to 0.7 m. Locally at Stations 12+392.5 (SBL toe) and 12+430 (SBL CL), the peat thickness was 1.4 and 2.2 m respectively. Moisture contents of 130 to 290% were measured in the peat.

Topsoil was identified surficially in the majority of boreholes where peat was not encountered. The topsoil thickness ranged from 100 to 200 mm.

Sands and Silts

Non-cohesive sands and silts, grading to sand with depth, were encountered below the peat and topsoil in all boreholes. In general, the upper 2 to 6 m of this deposit was finer-grained, grading as a silt, sandy silt or silty sand, and contained organics. Below these depths, it became primarily sand to silty sand with no organic content identified. The upper part of the sand/silt also contained discontinuous layers of silty clay and clayey silt.

The majority of the boreholes drilled within this section were terminated in the sand at about 6.7 m depth. In the three structure boreholes drilled at the south end of this section, the sand extended to bedrock at depths of 22.1 to 24.5 m (elevation 269.7 to 272.7 m). In borehole 396N-1, the sand was interrupted by a dense silt layer between 17.5 to 18.8 m depth, and became gravelly below 18.8 m depth.

Standard Penetration Test N-values measured in the sands and silts typically ranged from 0 to 10 blows/0.3 m penetration (loose to very loose), with occasional values of 10 to 20 blows/0.3 m penetration (compact). In the deep boreholes, the sand became compact (N-values of 10 to 25 blows/0.3 m) below depths of about 9 to 11 m (elevation 284 to 286 m), and became dense with cobbles and boulders (N-values of 30 to greater than 50 blows/0.3 m) below depths of about 14 to 18 m (elevation 277 to 280 m). DCPT profiles at other locations in this section confirmed the trend of relative density with depth.

Moisture contents in the sand and sands and silts typically ranged from about 15 to 25% in the absence of organics. Higher moisture contents of about 30 to 60% were measured in the upper 2 to 6 m when organics were present, with occasional values of up to 155%.

Silty Clay to Clayey Silt Layers

In six boreholes, relatively thin, discontinuous layers of cohesive silty clay and clayey silt with organic pockets were encountered within the upper 6 m of the silts and sands unit. The cohesive layers were typically 0.7 to 2.3 m thick.

SPT tests conducted in these layers yielded N-values of 1 to 9 blows/0.3 m penetration, indicating a very soft to firm consistency. The results of Atterberg Limits testing conducted on one sample (Figure I6 of Appendix I) classify the soil as low plastic silty clay (CL). Moisture contents ranged between 20 to 50%, and up to 134% where organics were present.

Bedrock

Bedrock was contacted below the sand in boreholes 400-1, 396N-1 and 396S-1 drilled for the Magnetawan River North Crossing Foundation Investigations. The depth to bedrock ranged from 22.1 to 24.5 m (elevation 269.7 to 272.7 m).

Groundwater

Upon completion of drilling, groundwater was observed in all boreholes at depths of 0.0 to 2.7 m. The groundwater levels measured in piezometers installed in two boreholes for the current study as well as three boreholes for the structure investigation are shown in Table 5.10.

Table 5.10 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
BH 400-1	E/W-N Ramp CL	25.9	-	-	-
BH 396N-1	NBL CL	25.8	-	-	-
BH 396S-1	SBL CL	28.9	February 28, 2005	0.75	293.6
12+355	R18.75	5.1	January 19, 2005	0.31	294.2
			February 28, 2005	0.36	294.2
12+478	L20.5	6.1	January 19, 2005	0.42	294.2
			February 28, 2005	0.44	294.2

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall, and is expected to vary in accordance with the water levels in the adjacent Magnetawan River.

5.10 Platts Access Road, Station 10+300 to 10+400 (Appendix J)

General

The Platts Access Road will cross over a valley approximately 100 m wide and 10 m deep at this location. The stratigraphy revealed in the base of this valley generally comprises a

layer of peat over sand which mantles probable bedrock. Along the valley slopes, silty clay, clayey silt and silt deposits were encountered overlying the sand and bedrock.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures J1 to J3 (Figure J1: silty clay to clayey silt; Figure J2: silt to silt and sand; Figure J3: sand to silty sand) of Appendix J. The results of Atterberg Limits testing conducted on samples of the clay are presented on Figure J4, Appendix J.

Peat and Topsoil

Peat was encountered surficially in three boreholes drilled through the central part of the site (Station 10+300 to 10+350). DCPT testing at Station 10+362.5 (right toe of slope) indicates that the peat layer was also present at this location. The peat layer was 600 to 800 mm thick.

A 150 to 200 mm thick topsoil layer was identified surficially in two boreholes at the south end of the section (Station 10+300 and 10+312.5).

Silty Clay to Clayey Silt

Discontinuous deposits of cohesive silty clay and clayey silt were encountered in four boreholes, typically located on slopes adjacent to the valley base. The cohesive strata were 0.6 to 2.8 m thick, with a lower boundary near elevation 304.5 to 308.5 m.

The cohesive deposits are stiff to hard with SPT N-values ranging from 8 to 53 blows/0.3 m penetration. The results of Atterberg Limits testing carried out on two samples (Figure J4 of Appendix J) classify the soil as silty clay with intermediate plasticity (CI). Moisture contents ranged between about 20 and 35%.

Silt to Silt and Sand

The cohesive clay/silt is underlain by a non-plastic silt stratum in three boreholes. Silt was also encountered surficially in one borehole and within the sand deposit in another borehole. SPT N-values obtained in silt typically varied from 9 to 21 blows/0.3 m of penetration, indicating a loose to compact condition. N-values of 32 and 51 blows/0.3 m were obtained in single SPT tests. Moisture contents of 11 to 39% were measured.

Where boreholes fully penetrated this unit, the non-cohesive silt layer is 0.8 to 1.1 m thick. One borehole (Station 10+312.5) was terminated in the silt at 6.7 m depth, indicating a thickness exceeding 3.8 m. Refusal was encountered beneath the silt and sand at 1.5 m depth at Station 10+362.5, and at 2.9 m depth at Station 10+400.

Sand

Non-cohesive sand to silty sand was encountered surficially or below the peat and silt in all but two boreholes. The upper boundary of the sand deposit was encountered near elevation 304.5 to 310.5 m, at depths of 0.0 to 1.4 m, locally to 4.1 m depth at Station 10+300. The sand extended to refusal at depths of 1.5 to 6.2 m where encountered.

The sand is typically compact to dense with SPT N-values ranging from 12 to 47 blows/0.3 m penetration. N-values of 3 (very loose) and greater than 50 blows/0.3 m (very dense) were obtained locally. Moisture contents were typically 10 to 20%, locally up to 30%.

Refusal

Refusal to further penetration of the augers or DCPT was met on boulders or probable bedrock in all but two boreholes at the south end of the section. The depth to refusal ranged from 1.5 to 6.2 m. In general, the refusal level is about elevation 305.5 and 308.5 m at the south and north ends of the site, respectively, and falls to elevation 299 m at the centre.

Groundwater

Upon completion of drilling, groundwater was observed in five boreholes at depths of 0.6 to 2.4 m. The groundwater level measured in a piezometer installed in one borehole is shown in Table 5.11.

Table 5.11 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
10+337.5	L26	6.2	November 24, 2005	0.0	307.0

The groundwater measurement and the presence of peat indicates that the stabilized groundwater level is near the ground surface in the valley base. The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.11 Municipal Service Road, Station 9+600 to 9+815 (Appendix K)

General

The stratigraphy encountered in this area generally comprises a layer of topsoil over sand and/or silt, mantling bedrock.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figure K1 of Appendix K.

Topsoil

Topsoil with occasional wood fragments was identified surficially in all boreholes in this section. The topsoil thickness ranged from 100 to 600 mm.

Sand to Silt

Non-cohesive deposits of sand, silty sand, sandy silt and silt were encountered below the topsoil in the boreholes. This layer is 0.7 to 4.8 m thick, contains cobbles and boulders, and typically mantles bedrock.

SPT N-values in the surficial sand and silt varied from 2 to 10 blows/0.3 m penetration, indicating a loose to very loose condition. N-values where cobbles and boulders were encountered are generally greater than 50 blows/0.15 m. Rock coring methods were required to penetrate the bouldery material in 40% of the boreholes. Moisture contents of 10 to 23% were measured in the sand/silt, with higher values of up to 55% in the upper 0.6 m, presumably reflecting an organic constituent.

Sand and Gravel

Sand and gravel with cobbles and boulders was encountered below the silt/sand deposits in one borehole located at the north end of the site (Station 9+812.5 L24). The sand and gravel was 4.2 m thick with an upper boundary at 2.7 m depth (elevation 317 m) and lower boundary (bedrock) at 6.9 m depth (elevation 313 m). The layer was very dense with N-values exceeding 50 blows/0.3 m.

A 0.7 m thick layer of gravelly sand was encountered above the bedrock at Station 9+687.5.

Bedrock

Bedrock was contacted below the sand/silt and sand/gravel in all boreholes at depths of 0.9 to 6.9 m, generally deeper towards both ends of the section. The bedrock surface rises towards the centre of the section, from elevation 307 to 324 m at the borehole locations. The bedrock outcrops on the west side of the corridor between approximate Station 9+737 and 9+765.

Bedrock was proven by coring in all ten boreholes drilled at the site. In general, the bedrock consists of fresh gneiss. The measured core recovery (TCR) varied from 63 to 100%, typically in the 90 to 100% range. The Rock Quality Designation (RQD) typically ranged from 79 to 100% (good to excellent quality), with values of 15 to 58% (very poor to fair quality) at several locations. The unconfined compressive strength (UCS) of intact rock cores determined from point load tests ranged from 79 to 191 MPa, indicating a strong to very strong rock.

Groundwater

The groundwater levels measured in the piezometers installed in the boreholes are shown in Table 5.12.

Table 5.12 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
9+592.5	L13	8.5	June 18, 2004	3.30	310.2
			June 24, 2004	3.41	310.1
9+612.5	L28	6.6	June 18, 2004	5.03	308.5
			June 24, 2004	5.01	308.5
9+637.5	L15	4.7	June 18, 2004	1.89	317.7
			June 24, 2004	2.28	317.3
9+662.5	L36	3.7	June 18, 2004	2.18	317.4
			June 24, 2004	2.92	316.7
9+687.5	L16	4.8	June 18, 2004	1.97	319.2
			June 24, 2004	2.29	318.9
			February 28, 2005	1.64	319.5
9+712.5	L32	5.2	June 18, 2004	1.29	320.3
			June 24, 2004	1.47	320.1
9+737.5	L14	6.3	June 24, 2004	4.86	315.4
			February 28, 2005	Dry	<314.0
9+762.5	L26	5.1	June 24, 2004	1.62	321.4
9+787.5	L14	7.3	June 24, 2004	Dry	<312.0
9+812.5	L24	10.6	June 24, 2004	8.76	310.9

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.12 Highway 11, Station 12+930 to 12+940 (Appendix L)

General

The stratigraphy encountered at this location generally comprises a topsoil layer overlying a cohesive deposit of silty clay to clayey silt, which is in turn underlain by loose to compact silt. The cohesive layer was overlain by a non-cohesive sandy silt at one location.

Topsoil

Topsoil was identified surficially in both boreholes in this section. The topsoil thickness was 100 and 300 mm at the borehole locations.

Sandy Silt

A 0.7 m thick layer of non-cohesive sandy silt was encountered below the topsoil in the NBL centreline borehole. An SPT N-value of 18 blows/0.3 m penetration indicates the silt is compact. A moisture content of 15% was determined.

Silty Clay to Clayey Silt

A stratum of cohesive silty clay to clayey silt was encountered below the topsoil or sandy silt in both boreholes. The clay/silt layer was 5.3 and 4.0 m thick at the borehole locations and extended to depths of 6.1 and 4.3 m (elevation 304 and 307 m).

SPT tests conducted in this deposit yielded N-values of 7 to 20 blows/0.3 m penetration, indicating a firm to very stiff consistency. An N-value of 54 blows/0.3 m obtained in the upper 0.6 m of this deposit at one location indicates a hard condition. Moisture contents ranged between 22 and 43%.

Silt

The cohesive clay/silt was underlain by non-cohesive silt with occasional sand seams below depths of 6.1 and 4.3 m, elevation 304 and 307 m. SPT N-values obtained in the silt varied from 5 to 28 blows/0.3 m of penetration, indicating a loose to compact condition. Moisture contents of 28 to 38% were measured. The boreholes were terminated in this unit at 8.2 m depth.

Groundwater

Upon completion of drilling, groundwater was observed at 2.4 m depth in the borehole drilled at the proposed east crest of cut slope. Wet conditions were encountered near the ground surface in the other borehole.

The reported groundwater conditions are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.13 Highway 11, Station 13+100 to 13+150 (Appendix M)

The stratigraphy revealed at this location generally consisted of a surficial peat or topsoil layer overlying a variable deposit of cohesive silty clay or clayey silt, underlain by silt, and sand to silty sand. Refusal was encountered at shallow depth in many of the boreholes.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures M1 (clayey silt) and M2 (silt to sand) of Appendix M. The results of laboratory testing conducted during the preliminary study are also appended.

Peat and Topsoil

A 0.7 m thick layer of peat was encountered at Station 13+125 of the NBL centreline. In addition, a 0.3 m thick layer of peat and topsoil was documented at Station 13+130 of the median centreline. Moisture contents of 29 and 36% were measured in this material.

Topsoil was identified surficially in nearly all other boreholes where sampling commenced from the ground surface. The topsoil was stripped during access preparation at Station 13+146 and was not encountered in the borehole. The topsoil thickness ranged from 100 to 300 mm.

Silty Clay to Clayey Silt

A discontinuous stratum of cohesive silty clay to clayey silt was encountered below the topsoil in boreholes located at either end of the section (Stations 13+100, 13+112.5, 13+137.5, 13+140 and 13+146). The clay/silt layer was 0.6 to 2.0 m thick at the borehole locations and had a lower boundary near elevation 299 to 304 m. Auger refusal was met at 2.1 m depth (elevation 299 m) at Station 13+112.5 CL.

SPT tests conducted in this deposit yielded N-values of 10 to 34 blows/0.3 m penetration, indicating a generally stiff to very stiff consistency. N-values of 2 to 5 blows/0.3 m were obtained in the upper 0.6 m below the ground surface, indicating a softened condition. Moisture contents ranged between 22 and 43%.

Sand to Silt

Non-cohesive deposits of silt, sand and silty sand were encountered below the cohesive clay/silt layer and below the topsoil in the other boreholes. The lower boundary of the silt/sand was encountered upon auger and cone refusal in several boreholes. Elsewhere, the investigation did not extend below this layer.

At locations where the silt and sand were not overlain by the cohesive layer, they typically contained organics, rootlets and/or wood fibres to depths of about 3.0 m. SPT N-values ranged from 0 (disturbed) to 30 blows/0.3 m of penetration, indicating the condition of these deposits varies from very loose to compact. Blow counts of greater than 50 blows/0.3 m were encountered immediately above the refusal depths, likely reflecting the presence of cobbles, boulders or sloping bedrock. Cobbles and boulders were noted at higher elevations in the sand at two locations. Moisture contents varied widely from 10 to 40%, locally to 50%, reflecting the presence of organics and wet conditions.

Refusal

Refusal to further penetration of the augers or DCPT was met on boulders or bedrock in the majority of boreholes at depths ranging from 2.0 to 12.3 m. In general, the refusal level ranged from elevation 296 to 299 m. However, at Station 13+146 and Station 13+137.5, refusal was encountered near elevations 303.5 and 286.5 m, respectively.

Two boreholes advanced by hand-sampling equipment during the preliminary study met refusal on a probable tree stump or roots at depths of 1.5 and 1.6 m.

Groundwater

Upon completion of augering and sampling, groundwater was observed in eight boreholes at depths of 0.2 to 1.9 m. The groundwater levels measured in piezometers installed in two boreholes are shown in Table 5.13.

Table 5.13 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
13+100	L14	7.7	-	-	-
13+140	L48	6.9	February 28, 2005	1.65	301.0

The groundwater level is believed to be near the ground surface in the low area of the site, seasonally near elevation 301 m. Ponded water was observed in this area.

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.14 Highway 11, Station 13+520 to 14+100 (Appendix N)

General

The stratigraphy encountered in this area generally comprises a layer of topsoil overlying sand which mantles bedrock.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures N1 to N3 of Appendix N.

Topsoil

Topsoil was identified surficially in all boreholes in this section. The topsoil thickness ranged from 100 to 500 mm.

Sand

A layer of non-cohesive sand to silty sand containing numerous cobbles and boulders was encountered below the topsoil in all boreholes. The thickness of the sand deposit generally increases towards the north, from 0.7 to 8.4 m. The sand overlies bedrock at most locations with the exception of the two northernmost boreholes which were terminated in the sand at depths of 6.7 and 9.4 m, and at Station 13+750 where a layer of sand and gravel was encountered below the sand.

SPT N-values obtained in the sand ranged from 16 blows/0.3 m penetration to 50 blows/0.05 m penetration, indicating a compact to very dense condition. The higher N-values likely reflect the presence of coarse gravel or numerous cobbles and boulders in the sand. At one location (Station 13+855), rock coring methods were required to penetrate bouldery material. Moisture contents of about 10 to 16% were measured in the sand unit.

Sand and Gravel

A deposit of sand and gravel with cobbles and boulders was encountered below the sand at one location (Station 13+750). The sand and gravel layer was 2.5 m thick with an upper

boundary at 5.2 m depth (elevation 333 m). It was very dense and required rock coring methods to penetrate.

Bedrock

Bedrock was contacted below the sand or sand and gravel at depths of 0.9 to 8.8 m in all boreholes except the northernmost two boreholes which did not extend to bedrock. In general, the bedrock surface falls towards the north, from elevation 336 to 328 m at the borehole locations. The bedrock outcrops in the proposed northbound lanes near Station 13+650.

Bedrock was proven by coring where encountered in nine boreholes. In general, the bedrock consists of fresh to slightly weathered gneiss. The measured core recovery (TCR) varied from 94 to 100%. The Rock Quality Designation (RQD) ranged from 76 to 100% (good to excellent quality), with one value of 35% (poor quality) obtained in the upper 0.6 m of core at Station 13+800. The unconfined compressive strength of the rock determined from point load tests ranged from about 85 to 200 MPa, indicating a strong to very strong rock.

Groundwater

The groundwater levels measured in the piezometers installed in the boreholes are shown in Table 5.14.

Table 5.14 – Groundwater Depths and Elevations

Station	Offset	Tip Location		Date	Water Level (m)	
		Depth (m)	Material		Depth	Elevation (approx)
13+600	L14	3.2	Rock			
13+650	L28	4.3	Rock	January 19, 2005	1.49	336.0
13+700	L15	6.3	Rock	January 19, 2005	1.42	335.0
13+750	L28	10.5	Rock			
13+800	L15	8.9	Rock	January 19, 2005	-	Destroyed
13+855	L29	12.0	Rock			
13+900	L14	7.2	Rock	January 19, 2005	6.24	330.5
13+950	L26	9.6	Rock	January 19, 2005	6.10	333.0
14+000	L14	11.9	Rock	July 7, 2004	1.43	335.5
14+050	L22	9.4	Sand	July 7, 2004	1.14	336.0
14+100	L13	6.7	Sand	June 30, 2004	3.97	329.5
				July 7, 2004	2.26	331.2

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.15 Highway 11, Station 14+290 to 14+390 (Appendix O)

General

The stratigraphy encountered in this area generally comprises a layer of topsoil overlying silty sand which mantles probable bedrock or boulders.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures O1 and O2 of Appendix O.

Topsoil

Surficial topsoil was identified in all boreholes in this section. The topsoil thickness ranged from 300 to 700 mm.

Sand

A layer of silty sand was encountered below the topsoil in all boreholes. Locally this deposit graded from sand, some silt to sandy silt. The sand mantled probable bedrock or boulders at all but one location at depths ranging from 1.4 to 4.2 m. The borehole at Station 14+300 (R18.75) was terminated in silty sand at 6.7 m depth.

SPT N-values obtained in the sand typically ranged from 35 to greater than 50 blows/0.3 m penetration, indicating a dense to very dense condition. The higher N-values may reflect the presence of cobbles and boulders in the sand. Lower N-values of 24 and 11 blows/0.3 m penetration obtained at the north end of the section (Stations 13+375 and 13+387.5) indicate a compact condition. Moisture contents of about 10 to 15%, locally up to 25%, were measured in the sand.

Refusal

Refusal to further penetration of the augers or DCPT was met on probable bedrock or boulders in all but one borehole, at depths ranging from 1.5 to 4.2 m. In general, the ground surface and elevation at which refusal was encountered rises towards the west, from elevation 309.5 m at the NBL embankment toe to elevation 325.0 m at the SBL embankment toe.

Groundwater

Upon completion of augering and sampling, groundwater was observed in three boreholes at depths of 0.8 to 3.1 m. Groundwater was not observed in the other boreholes during drilling. Based on these observations, it appears that the groundwater level slopes down towards the east similar to the surface topography, ranging from approximate elevation 322.5 m at the SBL embankment toe to elevation 310.0 m at the NBL embankment toe.

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.16 Highway 11, Station 15+220 to 15+290 (Appendix P)

General

The stratigraphy revealed in this area generally comprises a discontinuous layer of peat or topsoil overlying sand to sand and silt, mantling probable bedrock or boulders. A silty clay layer was encountered in one borehole drilled beyond the NBL toe of slope.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures P1 to P4 of Appendix P. The results of Atterberg Limits testing conducted on a sample of the cohesive deposit are presented on Figure P5.

Peat and Topsoil

A 200 to 600 mm thick layer of peat was encountered surficially in five boreholes (Station 15+227 NBL, 15+224.5 NBL, 15+256.1 NBL toe, 15+266.7 beyond NBL toe, 15+270 NBL). Moisture contents of 45 to 182% were measured in the peat.

Topsoil was identified surficially in two boreholes (Station 15+237 CL, 15+280.5 NBL toe). The topsoil thickness at the borehole locations was 150 and 200 mm.

Silty Clay

A layer of cohesive silty clay was encountered below the peat in one borehole located beyond the proposed NBL embankment toe, Station 15+266.7. SPT N-values obtained in the clay ranged from 2 to 7 blows/0.3 m penetration, indicating a soft to firm consistency. Moisture contents ranged from about 31 to 52%. The thickness of the silty clay was 4.8 m, and the lower boundary was encountered at 5.0 m depth (elevation 294.0 m). The results of Atterberg Limits testing conducted on one sample indicates the silty clay is of medium plasticity (CI).

Sand to Sandy Silt

A layer of sand to sandy silt with occasional cobbles and boulders was encountered below the clay at Station 15+266.7 and below the peat and topsoil in the other boreholes. Auger refusal conditions indicate that the sand mantles probable bedrock or boulders at depths ranging from 2.1 to 4.3 m. Locally at Station 15+256.1 of the NBL toe, the lower 1.1 m of the sand deposit was gravelly. The borehole at Station 15+266.7 beyond the NBL toe was terminated in sand and silt at 6.7 m depth without encountering refusal.

SPT N-values obtained in the sand varied widely from 8 blows/0.3 m to 50 blows/0.05 m penetration, indicating a loose to very dense condition. The higher N-values likely reflect the presence of cobbles and boulders in the sand. Moisture contents of about 10 to 15%, locally up to 25%, were measured in the samples.

Refusal

Refusal to further penetration of the augers or DCPT was met on probable bedrock or boulders in all boreholes along the median and NBL centrelines. Refusal was encountered at depths of 2.1 to 4.3 m, near elevation 296.0 to 300.0 m.

Groundwater

Upon completion of augering and sampling, groundwater was observed in six of the eight boreholes at depths of 0.3 to 5.5 m. The groundwater level measured in a piezometer installed in one borehole is shown in Table 5.15.

Table 5.15 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
15+280.5	R41.8	4.3	January 19, 2005	0.50	299.5
			February 28, 2005	0.48	299.5

Based on the borehole observations and presence of surficial peat, the groundwater level at the site is believed to be near elevation 299 to 300 m. The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.17 Highway 11, Station 15+715 to 15+815 (Appendix Q)

General

The stratigraphy encountered at this location generally consists of a surficial peat or topsoil layer overlying a relatively thick layer of cohesive silty clay, underlain by silt to the maximum depth of investigation.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures Q1 to Q10 of Appendix Q. The results of Atterberg Limits tests conducted on samples of the cohesive materials are provided in Figures Q11 to Q15.

Peat and Topsoil

Peat was encountered surficially in six boreholes located in the central part of the site (Station 15+740 to 15+790), including three locations along the median centreline. The thickness of the peat layer ranged from 0.4 to 0.9 m. In addition, a 75 mm thick layer of peat was identified within the clay at 0.3 m depth at Station 15+677.5 (beyond NBL toe).

Topsoil was identified surficially in ten boreholes. The topsoil thickness typically ranged from 150 to 300 mm, with local measurements of 75 and 500 mm.

Silt to Sand

At three isolated borehole locations, thin deposits of non-cohesive silt and sand were encountered interbedded between the topsoil and the underlying clay layer. These deposits comprised loose to very loose sandy silt and compact sand. SPT N-values ranged from 3 to 8 blows/0.3 m penetration. The thickness of the silt/sand deposits ranged from 0.6 to 1.8 m.

Silty Clay

An extensive layer of cohesive silty clay was encountered below the peat, topsoil and isolated silt/sand deposits in all boreholes. The clay layer was 5.0 to 9.9 m thick with an upper boundary near elevation 297 to 300 m and the lower boundary near elevation 290 to 292 m. The upper 0.9 to 2.0 m of the cohesive layer varied from clayey silt to silty clay. A laminated or varved appearance was noted at some locations.

The clay layer typically exhibits an upper crust of firm (N-values of 4 to 8 blows/0.3 m) or stiff to very stiff (N-values of 9 to 30 blows/0.3 m) material, underlain by predominantly softer clay (N-values of 0 to 4 blows/0.3 m). The undrained shear strength of the clay below the upper crust, determined by field vane shear testing, ranged from 18 to 62 kPa, typically between 20 and 40 kPa. Based on the vane test data, the consistency of the clay is generally soft to firm. The sensitivity ranged from 1.5 to 3.1, locally up to 4.0.

Atterberg Limits testing (Figures Q11 to Q15) indicates that the plasticity of the clay ranges from low to high (CL to CH). Moisture contents ranged between 15 and 90%, with the lower values of 15 to 25% typically measured in the upper stiff to very stiff crust, and a typical range of 30 to 70% measured in the underlying material.

The results of consolidation testing conducted on a sample of the silty clay (Sta. 15+740 R40.7, formerly 15+665 R18.75) are included in Appendix Q and summarized below:

Table 5.16 – Consolidation Test Parameters

Station Offset	Sample Depth (m)	w (%)	γ (kN/m ³)	e_o	p_o' (kPa)	p_c' (kPa)	OCR	C_c	C_r
15+740 R40.7	4.6-5.2	72	15.6	1.98	35	40	1.14	0.63	0.09

Comparison of the existing and preconsolidation pressures (p_o' and p_c') derived from the test results indicate that the silty clay is normally consolidated. The coefficient of consolidation, c_v , recorded during the test generally ranged from 0.001 to 0.0036 cm²/s with an average value near 0.003 cm²/s in the likely pressure range anticipated in the field.

The parameters listed in the table were obtained from testing of one sample recovered from a discrete depth in the borehole. The compressibility characteristics will vary with depth in accordance with the moisture content and shear strength profiles.

Silt

Non- to slightly cohesive silt was encountered below the silty clay layer at depths of 6.9 to 10.2 m (elevation 290 to 292.5 m) in all boreholes. The silt extended to the maximum sampled depth of 9.8 to 15.8 m.

SPT N-values ranged from 0 to 11 blows/0.3 m of penetration, indicating a loose to very loose condition. DCPT testing in the boreholes appears to confirm the loose nature of this deposit. Moisture contents generally varied from 20 to 40%.

Refusal

Refusal to the DCPT was met on boulders or bedrock at one location (Station 15+645 CL) at 28.8 m (elevation 270.5 m). Refusal was not encountered in the other boreholes or DCPT tests extended to depths of 11.3 to 24.4 m (elevation 288 to 279 m).

Groundwater

Upon completion of augering and sampling, groundwater was measured in 13 boreholes at depths of 0.0 to 3.8 m. Artesian conditions were noted in seven boreholes. The artesian groundwater levels measured in a piezometer on separate dates are shown in Table 5.17.

Table 5.17 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
15+677.5	R38	10.7	September 9, 2004	+0.35	298.2
			September 10, 2004	+0.60	298.5
			February 28, 2005	+0.40	298.3

+ indicates above ground surface.

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.18 Municipal Service Road, Station 13+525 to 13+575 (Appendix R)

General

The stratigraphy revealed at this location varies substantially within the embankment section. Over northern portions of the area, surficial sloping bedrock or a layer of sand and silt overlying shallow bedrock was encountered. At the south end of this area, topsoil overlying a relatively thick layer of silty clay was encountered. The clay was underlain by bedrock or boulders in one borehole.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figures R1 and R2 of Appendix R. The results of Atterberg Limits tests conducted on samples of the cohesive materials are provided in Figure R3.

Topsoil

Topsoil was identified surficially in three boreholes drilled along the roadway centreline. The topsoil thickness was 700 mm at Stations 13+525 and 13+550, and 200 mm at Station 13+565.

Sandy Silt to Sand and Silt

A layer of sand and silt was encountered below the topsoil at the north end of the proposed embankment, Stations 13+550 ad 13+565 CL. The sand and silt layer was 1.2 and 1.1 m thick and mantled probable bedrock as indicated by refusal depths of 1.9 and 1.3 m. SPT values of 15 to greater than 50 blows/0.3 m indicate the sand is compact to very dense. Cobbles and boulders were identified in the sand and silt, as reflected in the elevated N-values obtained in this deposit.

A layer of very loose to compact sandy silt (N-values of 3 and 19 blows/0.3 m) was encountered above the clay at one location along the west toe of embankment. This layer was 1.5 m thick.

Silty Clay

A relatively thick stratum of cohesive silty clay was encountered below the topsoil and sandy silt layers in two boreholes near the south limit of the section (Station 13+525 CL and 13+537.5 west toe). The upper boundary of this stratum was near elevation 308.5 to 309 m. The borehole at Station 13+525 was terminated on boulders or probable bedrock below the clay at 7.7 m depth (elevation 302 m), after extending through 7.0 m thickness of clay. At Station 15+537.5, the clay layer was 7.6 m thick with a lower boundary near elevation 300.5 m.

The clay layer exhibits a stiff to very stiff upper crust (N-values of 11 to 22 blows/0.3 m) about 0.7 to 1.5 m thick, and becomes softer with depth (N-values of 0 to 7 blows/0.3 m) below this zone. The undrained shear strength of the clay below the upper crust, determined by field vane shear testing, ranged from 30 to 40 kPa, indicating a firm consistency.

Silt

At one location (Station 13+537.5 L23), the clay was underlain by slightly cohesive silt. The silt was contacted at 9.1 m depth (elevation 300.5 m) and extended to the maximum sampled depth of 9.8 m. An SPT N-value of 9 blows/0.3 m of penetration was obtained, indicating a stiff condition. A moisture content of about 35% was measured.

Bedrock

Bedrock was exposed at the ground surface at the two borehole locations along the proposed east toe of the embankment. Probable bedrock was also contacted at depths of 1.9 and 1.3 m along the road centreline at Stations 13+550 and 13+565. At Station 13+525 CL, the sampler contacted boulders or possible bedrock at 7.7 m depth

(elevation 302 m). The inferred bedrock surface generally slopes down towards the south and west, from elevation 316.5 m (ground surface) to elevation 302 m at the southernmost borehole.

Groundwater

The groundwater level measured in a piezometer installed in one borehole is shown in Table 5.18.

Table 5.18 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
13+537.5	L23	5.2	July 23, 2004	1.07	309.0

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

5.19 Tower Road, Station 10+020 to 10+155 (Appendix S)

This section consists of a bedrock outcrop with bedrock exposed at the ground surface. Boulders and thin accumulations of moss or sand are present locally. The bedrock surface rises from about elevation 330.5 m at Station 10+020 to about elevation 344 m at Station 10+090, before falling to elevation 332.5 m at Station 10+155. Photographs of the terrain typical of this location are presented in Appendix S.

5.20 Municipal Service Road, Station 14+200 to 14+510 (Appendix T)

General

The stratigraphy encountered in this area generally comprises a layer of topsoil overlying sand and silty sand mantling bedrock.

The results of grain size distribution analyses conducted on recovered soil samples are presented in Figure T1 of Appendix T.

Topsoil

Topsoil was identified surficially in all boreholes in this section except at Station 14+500 at the north end where bedrock was exposed. The topsoil thickness ranged from 100 to 300 mm.

Sand

A layer of sand and silty sand with cobbles and boulders was encountered below the topsoil in all boreholes. The sand mantled bedrock at depths ranging from 0.7 to 3.0 m. SPT N-values obtained in the sand ranged from 10 blows/0.3 m surficially to greater than 50 blows/0.3 m penetration, indicating a compact to very dense condition. The higher N-

values may reflect the presence of cobbles and boulders in the sand. Moisture contents varied substantially from 10 to 35%.

Bedrock

Bedrock was contacted below the sand at depths ranging from 0.7 to 3.0 m, and was exposed at the ground surface at Station 14+500. In general, the bedrock surface rises to the north from elevation 317.5 m to elevation 329.5 m at Station 14+450, before dropping to elevation 322.5 m at Station 14+500. The bedrock outcrops frequently in this area.

Bedrock was proven by coring where overlain by sand. In general, the bedrock consists of grey gneiss and light pink granite, varying from fresh to moderately weathered. The measured core recovery (TCR) was typically 100%, and 52% in one run at Station 14+250. The Rock Quality Designation (RQD) ranged from 24 to 88%, indicating poor to good quality rock. The unconfined compressive strength of the rock determined from point load tests ranged from about 60 to 144 MPa, indicating a strong to very strong rock.

Groundwater

The groundwater levels measured in piezometers installed in two boreholes are shown in Table 5.19.

Table 5.19 – Groundwater Depths and Elevations

Station	Offset	Tip Depth (m)	Date	Water Level (m)	
				Depth	Elevation (approx)
14+250	CL	4.7	February 16, 2005	4.33	319.0
14+450	L10	3.2	February 16, 2005	Dry	<326.7

The reported groundwater levels are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall.

6 MISCELLANEOUS

Marshall Macklin Monaghan completed field layout for the site investigation and provided borehole coordinates and ground surface elevations.

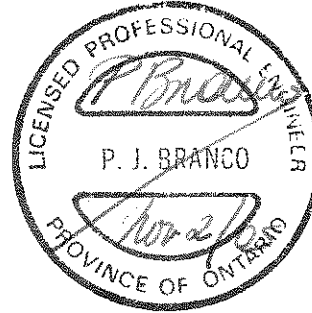
Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. George Azzopardi, Mr. Stephane Loranger and Mr. Warren Wunderlick of Thurber.

Interpretation of the field data and preparation of the investigation report was conducted by Mr. Murray Anderson, P.Eng. Overall supervision of the field program was performed by Mr. Alastair E. Gorman, P.Eng. The investigation report was reviewed by Mr. Paulo J. Branco, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.
Murray R. Anderson, P.Eng., M.Eng.
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Review Principal.



**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH FILL EMBANKMENTS, DEEP CUTS AND SWAMP CROSSINGS
HIGHWAY 11, HIGHWAY 518 WEST TO HIGHWAY 520
G.W.P. 480-93-00**

Geocres Number: 31E-233

PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 INTRODUCTION

This report presents interpretation of the geotechnical data in the factual report and presents foundation design recommendations for embankments and cut slopes exceeding 6 m in height as well as for swamp crossings.

The discussion and recommendations presented in this report are based on our understanding of the project and on the factual data obtained during the course of the investigation.

The project information used for preparation of this report, including plans and profiles of the proposed alignments as of October 2004, were provided by MMM. For the purpose of reporting, the data for each section of embankment, cut or swamp has been assigned to an appendix, Appendix B through T. A summary of the designations is presented in Table A1 of Appendix A.

8 ENGINEERING ANALYSIS METHODOLOGY

8.1 General

Major factors governing embankment foundation design on this project include:

- Embankment geometry (height, slope angle, berms);
- Embankment material type (earth fill, rockfill, SSM);
- Extent and thickness of organic soils within the embankment footprint;
- Thickness and engineering properties of the mineral soils;
- Bedrock and groundwater conditions

The geotechnical analyses summarized in this report include assessment of the global stability of the embankment and cut slope geometries and material types for both short and long term conditions. Assessment of immediate and long-term settlements, including magnitude and time rate, was also carried out for the embankments. The analyses were based on the soil profiles and properties encountered at various locations, selected for less favourable conditions.

8.2 Design Alternatives

Design alternatives considered during analysis of the embankments included the following:

- Sub-excavation of the peat and organic soils;
- Provision of berms and flattening of slopes to improve global stability;
- Ground improvement techniques such as preloading/surcharging and geosynthetic reinforcement;
- Construction techniques such as wick drain installation or staged construction;
- Use of lightweight fill.

Analysis and comparison of the various alternatives are presented in subsequent sections of the report along with recommendations for the preferred option.

8.3 Stability and Settlement Analyses

The stability analyses were carried out using the commercially available slope stability program GSLOPE developed by Mitre Software Inc. Bishop's modified method of slices was used for the limit equilibrium analyses. Based on consideration of the risk involved and past experience with highway embankment design/monitoring, a factor of safety of 1.3 is considered appropriate to achieve both short and long-term stability for embankments founded on cohesionless soils. For cohesive foundation soils, the recommended factor of safety is 1.3 for short-term conditions and 1.5 for long-term conditions.

Immediate foundation settlements due to compression of the subgrade soils have been estimated based on the methods described in CHBDC 2000 Commentary Section C6.6.3.6.

For cohesive soils, the estimated primary consolidation settlement and time to achieve 90% of the consolidation was calculated based on Terzaghi's one-dimensional vertical consolidation formulation combined with computation of stresses in two-dimensional elastic half-space as described in CHBDC Commentary Section C6.6. The parameters used in the analyses were determined by laboratory oedometer tests conducted during the current study as well as correlation with soil moisture and strength data obtained from similar geologic units in the Central Ontario region.

Settlement due to secondary consolidation of the cohesive deposits was assessed for a design period of 30 years using the following equation and a secondary compression ratio selected based on soil moisture correlations:

$$S_{\text{creep}} = C_{\alpha\epsilon} H \text{Log} (t/t_p)$$

where S_{creep} = settlement due to secondary consolidation (m)

$C_{\alpha\epsilon}$ = secondary compression ratio

H = initial thickness of compressible layer (m)

t = time over which secondary compression is to be calculated

t_p = time to completion of primary consolidation

8.4 Seismic Considerations

The following seismic parameters have been used in design:

- Velocity Related Seismic Zone 1
- Zonal Velocity Ratio 0.05
- Acceleration Related Seismic Zone 1
- Zonal Acceleration Ratio 0.05

The Soil Profile Type at all locations except Area Q has been classified as Type I. Thus, according to Table 4.4.6.1 of the CHBDC, a Site Coefficient “S” of 1.0 should be used in seismic design. A peak horizontal acceleration (PHA) at the ground surface of 0.08 g, where g is the acceleration due to gravity, has been used. The thickness of soft clay at Area Q exceeds 9.0 m and therefore the Soil Profile Type, Site Coefficient and PHA at this site are Type III, 1.5 and 0.12 g, respectively. The PHA values correspond to a probability of exceedance of 10% in 50 years.

The stability of the embankments under seismic loading was assessed based on a pseudo-static approach using the parameters above. The pseudo-static analysis considers the application of the PHA to the soil mass on a non-softening foundation to assess the embankment stability.

9 EMBANKMENT DESIGN AND CONSTRUCTION

9.1 General

The generalized subsurface conditions and embankment heights/cut depths for the various alignments are summarized on Table A1 of Appendix A. The subsurface conditions vary substantially from site to site, and include the following soil profiles:

- Relatively thick deposits of competent non-cohesive sands and silts with discontinuous or continuous layers of pre-consolidated clays and silts;
- Cohesionless sands and silts overlying shallow bedrock;
- Deep deposits of loose to very loose sands and silts overlying competent sands.
- A thick stratum of soft to firm silty clay overlying silt.

Relatively thin deposits of peat were encountered at several locations. The groundwater level was near the ground surface in areas adjacent to the Magnetawan River and in swamp areas. Elsewhere, the groundwater level was variable.

9.2 Peat and Topsoil Removal

It is standard procedure on MTO projects to sub-excavate all peat deposits not exceeding 6 m in depth from within the footprint of the embankment, and backfill the resulting excavation with rock or granular fill. Where firm mineral soils are encountered at depths

of less than 6.0m, full peat removal is an economical and efficient method of improving stability during construction and minimizing the potential for large post-construction settlements.

Within the project limits addressed in this report, the depth of peat and organic soils is less than 2.2 m. It is therefore recommended that all peat and organic soils should be sub-excavated from within the proposed fill footprint. The foundation area should be backfilled with rock or granular material as described later in this report. Placement of coarse rockfill is recommended where standing water is encountered.

Table A2 in Appendix A provides a summary of the anticipated depth of sub-excavation for peat and topsoil removal along the proposed alignments. The depth of stripping is based on the thickness of organics noted at the borehole locations. Stripping depths may vary at locations between and away from the boreholes.

Dewatering may be required in areas where subexcavation of peat will be carried out, subject to the groundwater levels at the time of excavation and the relative depth of peat. Comments regarding the potential need for dewatering, based on the borehole information, are presented in Table 9.1. The contractor is responsible for design and implementation of appropriate dewatering schemes.

Table 9.1 – Dewatering During Peat Removal

Location	Comments
E Municipal Service Road Sta. 7+500 to 7+720	The peat overlies a sand layer underlain by clay. The groundwater appears to be perched above the clay and may be at the ground surface seasonally. Dewatering of the peat/sand layers may be required subject to water levels at the time of construction
I Highway 11 Sta. 12+280 to 12+480, including EW-N Ramp, Three Mile Lake Road	The groundwater level will be governed by the water level in adjacent Magnetawan River. Dewatering in local areas where thicker peat extends below the water level will be difficult due to the relatively high permeability of the silt/sand alluvial deposits.
S Platts Access Road Sta. 10+300 to 10+400	The groundwater level in this area is likely to be seasonally near the ground surface. The peat overlies sand. Dewatering to lower the groundwater level in the sand may be required.
M Highway 11 Sta. 13+100 to 13+150	Ponded water is present at this location. Drainage of the pond and lowering of the water level in the underlying sand/silt deposits may be required.
F Highway 11 NBL Sta. 15+220 to 15+290	Thin peat layers may be present due to seasonally poor drainage along a drainage course. Dewatering may not be necessary if work is carried out in dry periods.
Q Highway 11 Sta. 15+715 to 15+815	Water near the ground surface appears to be perched over clay in this area of poor drainage. Drainage of the perched water may be required subject to conditions at the time of construction.

The groundwater levels reported on the borehole logs are short-term readings and seasonal fluctuations are to be expected. In particular, the groundwater level may be at a higher elevation during spring snowmelt or after periods of heavy rainfall. Selection of a suitable dewatering method must take into account these potential variations.

In the stability and settlement analyses, it has been assumed that the organic deposits have been removed and replaced with rock or granular material as appropriate.

9.3 Stability Analysis

The input parameters and soil model used in the stability analyses, including soil stratigraphy, engineering properties, groundwater conditions, and embankment geometry, are shown for sample analyses on Figures A1 to A19 in Appendix A.

Analyses were carried out for both earth fill and rockfill embankments, under static and seismic loading conditions. For cohesive soils, short term (undrained) and long term (effective stress) conditions were assessed. Embankment slope inclinations of 2H:1V for earth fill and 1.25H:1V for rockfill were assumed. Mid-height berms of 2 m width were applied to all slopes exceeding 6 m in height.

Results of the stability analyses carried out at selected critical locations are summarized in Table A3 in Appendix A. The results indicate that the Factor of Safety (FS) for all embankment geometries analysed will be greater than 1.3 for short-term conditions, near 1.5 or greater for long-term conditions on cohesive soils, and greater than 1.0 for the seismic analyses. Therefore, stabilizing berms, slope flattening and geosynthetic reinforcement are not required.

Berms (2 m wide bench) incorporated in embankment construction to address surficial stability of slopes exceeding 6 m in height have been included in the analysis. We understand that MTO policy is presently undergoing revision to permit rockfill slopes up to 10 m high without a berm. The stability of the embankment slopes will need to be reassessed if unbroken rockfill slopes exceeding 6 m in height are planned.

Based on the subsurface conditions encountered at the embankment locations, the potential for liquefaction of the foundation soils during a seismic event is considered to be low in accordance with CHBDC Section C4.6. Some local liquefaction and resulting toe failure may occur during a seismic event, but this is expected to be readily repaired.

9.4 Settlement Analysis

Foundation Settlement

Settlement analysis involved computation of the immediate settlement of the foundation soils under the imposed embankment loading using elastic theory, and calculation of long-term consolidation settlement using Terzaghi one-dimensional consolidation theory. Secondary consolidation settlement was assessed as discussed previously.

The engineering properties of the soils used in the analyses are listed in Table A4 of Appendix A. Input parameters were selected based on laboratory oedometer testing conducted during the current study as well as on correlations developed between index/strength tests and compression parameters from previous investigations involving similar materials.

The results of the settlement analyses are summarized in Table A5 of Appendix A. The estimated elastic and primary consolidation settlement at all embankment locations except two (Stations 15+715 to 15+815 and 13+525 to 13+575) is less than 150 mm, and this settlement is expected to be at least 90% completed within three months of embankment construction.

The estimated primary consolidation settlement at Station 15+715 to 15+815 of the Highway 11 main line is 760 mm due to the presence of a thick deposit of normally consolidated clay. This settlement is expected to be approximately 40% complete after a three month period and require a period of 19 months to achieve 90% of primary consolidation. At Station 13+525 to 13+575 of Highway 11, a consolidation settlement of 150 mm is anticipated, expected to be 50% complete after three months and require 13 months for 90% completion.

The estimated time to 90% consolidation at these two sites is based on a coefficient of consolidation, c_v , of 10 m²/yr determined from laboratory consolidation testing of one silty clay sample. The actual time to 90% consolidation may vary subject to the thickness of the clay layer at a particular location, layer boundary conditions, variations in the consolidation coefficient with depth, and the presence of silt partings in the clay. Additional laboratory testing may be warranted to further evaluate the consolidation parameters, and construction monitoring is recommended to confirm when primary consolidation nears completion.

Surcharging, installation of vertical wick drains, use of lightweight fill and/or a combination of methods will be required to reduce post-construction settlement in the two sections where higher long-term settlements are anticipated. Advantages and disadvantages of the options are outlined in Table A6 of Appendix A. Detailed analysis for design of such elements is beyond the scope of this report.

Where cohesive foundation soils are present, secondary consolidation settlement during the 30 years following construction is expected to be less than 15 mm at all locations except Stations 15+715 to 15+815 and 13+525 to 13+575, where secondary consolidation settlements of 40 and 30 mm are anticipated.

A suitable camber should be applied along the invert of culverts in the embankment areas to accommodate future settlement. Design and installation procedures for the proposed box culverts under Highway 11 near Station 15+770 must recognize the anticipated consolidation settlements and should be assessed in conjunction with embankment construction procedures (i.e., surcharging). Supporting the culverts on pile foundations or installation of temporary CSPs during the preloading stage may be required.

Embankment Compression

The estimated settlement of earth fill embankments due to compression of the compacted earth fill is 0.5% of the embankment height and is expected to be completed within one to two years after construction.

Settlement of rockfill due to particle re-orientation and degradation of the interparticle contacts is expected to continue at a decreasing rate for many years. The magnitude of this settlement is expected to be in the order of 0.1% of the embankment height after 1 year and 0.3% of the embankment height after 20 years.

The estimated settlements due to embankment compression at the maximum height of embankment in each section are included in Table A5 of Appendix A.

9.5 Embankment Construction

Embankment construction should be carried out in accordance with OPSS 206 as amended by Special Provision “Amendment to OPSS 206, December 1993” dated November 2002. Earth fill may consist of granular materials and Select Subgrade Material (SSM) in compliance with Special Provision 110F113, “Amendment to OPSS 1010, March 1993.

Mid-height berms comprising 2 m wide benches should be incorporated along the length of embankments exceeding 6 m in height. Where the embankment is constructed of earth fill, the bench should maintain a 2% slope to shed surface run-off. It is understood that MTO policy has recently been revised to permit rockfill slopes up to 10 m high without a berm, however this policy will not be applied to the current project.

In accordance with Northern Region policy (Directive NRE 98-200), the embankment platform should be widened a minimum 2.0 m on both sides of Highway 11 and 1.0 m on both sides of other roads to accommodate consolidation of embankment materials (rockfill), consolidation of foundation soils, and future pavement overlays. Assuming that future grade raises will be carried out using granular material with sideslopes of 4H:1V on Highway 11 and 3H:1V on other roadways, the platform should be overbuilt beyond the NRE directive at two locations to the following widths:

Highway 11 NBL and SBL, Sta. 15+715 to 15+815:	4.0 m each side
Municipal Service Road, Sta. 13+525 to 13+575:	1.2 m each side

Earth fill embankment slopes must be provided with erosion protection in accordance with Special Provision SP572SO1.

Construction of new embankments over swamp should be carried out in accordance with OPSS 209 “Construction Specification for Embankments Over Swamps”, March 1998, with specific reference to OPSD 203.010 “Embankments Over Swamp, New Construction”.

For backfilling of subexcavation below the water table or in swamps where surface water may be periodically present over the ground surface, it is recommended that rock fill or coarse granular materials (OPSS Granular B) be used as backfill. At the pavement subgrade level or if earth fill is to be placed over rock fill, the rock fill subgrade must be blinded with spall material and covered by a minimum 600 mm thickness of OPSS Granular B Type II fill.

Existing embankment fill comprising loose sand is present below the proposed alignment of the new northbound lanes of Highway 11 at Station 10+510 to 10+570. To minimize the potential for future instability or deleterious settlement of the new roadway embankment constructed over this fill, it is recommended that the loose fill be subexcavated from below the roadway footprint (shoulder to shoulder) and be replaced with engineered fill. Review of contour information indicates that this operation will entail partial removal of a benched area over the existing culvert and will not extend within a 2H:1V slope from the crest of the existing Highway 11 embankment. Therefore it is anticipated that shoring to support the existing road will not be required. If shoring is required elsewhere to retain the existing Highway 11 embankment fill during construction, an item titled "Roadway Protection" as per SP539SO1 should be included in the contract documents. Performance Level 2 is recommended as per Clause 539.04.02.01.

10 CUT SLOPE DESIGN AND CONSTRUCTION

The proposed cut sections are generally in areas of shallow bedrock and/or dense sand. Stability analyses indicate that the Factor of Safety of earth cut slopes will be greater than 1.3 for slope inclinations of 2H:1V (Table A3).

Rock cuts should be designed in conformity with Northern Region Engineering Directive NRE 2000-204. Rock excavation utilizing blasting should be carried out in accordance with OPSS 120, including blast design by a qualified Engineer/firm, explosive use by a competent blasting contractor, monitoring by a blast monitoring consultant, preparation of a pre-blast survey, and notification of any nearby utility authorities. Rock mapping should be carried out prior to blast design to determine pertinent conditions such as the locations and orientation of joints and fractures in the rock mass.

The earth cut at Station 12+930 to 12+940 of Highway 11 NBL will extend through silty clay and into a silt stratum, some 3.5 m below the groundwater level observed in the boreholes. In this regard, the following are noted:

- Some sloughing may occur within the silt stratum as a result of groundwater seepage.
- It is recommended that the cut be constructed in conjunction with the remainder of mainline construction to enable drainage of the silt deposit and lowering of the groundwater table.
- Movement of construction equipment on the silt subgrade must be avoided for a period of at least 2 months to minimize the potential for disturbance and rolling of the silt subgrade as pore pressures drain.

- Cut slopes in this area should be provided with rock protection, including geotextile, from the ditch invert up to at least elevation 307. Rock protection should be constructed in accordance with OPSS 511/SP 511S01.

The cut at Station 13+520 to 14+000 of Highway 11 SBL will extend through sand to silty sand to bedrock, some 5 m below the observed groundwater levels. Installation of an interceptor drain is recommended along the west side of the cut slope in this area. From approximate Station 13+675 to 13+960, the base of the cut will encounter bedrock. The interceptor drain should be positioned along the bedrock surface some 3 m behind the toe of the overlying sand slope, to lower the groundwater table and prevent emanation of seepage at the sand/bedrock interface. North of Station 13+960, the interceptor drain should be positioned along the toe of the earth slope. The drain should comprise 150 mm diameter perforated pipe placed in a clear stone trench lined with geotextile.

Typical cut slope sections for earth and rock cut are illustrated on Figure A20, Appendix A.

11 CONSTRUCTION CONCERNS

During construction, qualified geotechnical staff should be retained to observe activities related to embankment construction and advise the Contract Administrator on construction concerns or issues related to embankment stability or settlement.

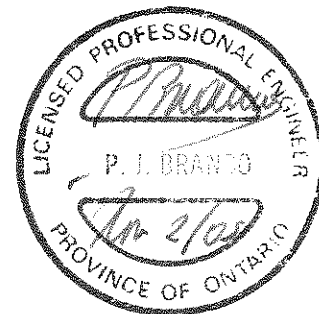
Potential construction concerns include, but are not necessarily limited to:

- The thickness and presence of organic deposits were investigated at the borehole locations only. Organic deposits may extend to greater depths or be encountered at other locations between boreholes.
- Geotechnical confirmation is required that all organics and peat materials within the proposed embankment footprint are sub-excavated and replaced with approved backfill.
- Movement of construction equipment may be difficult in areas of organic or excessively soft, loose and/or saturated subgrade. Disturbance of the subgrade by construction traffic should be minimized.

12 CLOSURE

Engineering analysis and preparation of the foundation design report was conducted by Mr. Murray Anderson, P.Eng. The report was reviewed by Mr. Paulo J. Branco, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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Appendix A

Tables and Figures

TABLE A1
SUMMARY OF EMBANKMENT, CUT AND SWAMP LOCATIONS AND CONDITIONS

Appendix	Alignment	Stations	Maximum Embankment Height or Cut Depth (m)	Generalized Stratigraphy*	Groundwater Conditions
B	Highway 592	9+630 to 9+960	12.2 Fill	SAND to SILT, compact, 1.8 to 9.1 m thick; over CLAY, silty, firm to very stiff, 1.6 to >7.9 m thick, discontinuous; over SAND, compact to dense.	Local perched condition over clay layer
C	Sunset Pass Drive	10+040 to 10+150	9.3 Fill	SAND to SILT, compact to dense, 1.8 to 6.7 m thick; over CLAY, silty, firm to very stiff, 0.8 to >3.6 m thick, discontinuous; over SAND and GRAVEL, dense to very dense.	9.1 to 15.6 m depth
D	Highway 11 NBL	10+510 to 10+570	10.5 Fill	FILL, sand, compact to loose, up to 7.6 m deep; over SILT, sandy, compact, 0.9 to 5.2 m thick; over CLAY, silty, stiff to very stiff, 1.1 to 4.9 m thick; over SILT, compact.	9.1 to 9.4 m depth upon completion of drilling
E	Municipal Service Road	7+500 to 7+720	8.0 Fill	PEAT, very localized, up to 1.5 m deep; and/or SILT to SAND, very loose to compact, 0.3 to 3.6 m thick; over CLAY, silty, soft to very stiff, 2.3 to 7.6 m thick; over SILT, loose to compact.	2.6 to 5.9 m depth in piezometers
F	Municipal Service Road	7+750 to 7+880	16.3 Cut	SILT to SAND, 0.0 to 1.1 m thick; over BEDROCK.	1.0 to 3.1 m depth in piezometers
G	Highway 11 NBL and SBL	11+950 to 12+030	8.7 m Fill	SILT, loose to compact, 1.5 to 6.1 m thick; over CLAY, silty, very soft to stiff, 4.5 to 7.5 m thick; over SILT to SAND, loose to compact.	0.0 to 1.5 m depth in piezometers

* Refer to Table A2 for topsoil thickness.

TABLE A1

SUMMARY OF EMBANKMENT, CUT AND SWAMP LOCATIONS AND CONDITIONS

Appendix	Alignment	Stations	Maximum Embankment Height or Cut Depth (m)	Generalized Stratigraphy*	Groundwater Conditions
H	Highway 11 NBL and SBL	12+070 to 12+140	9.0 m Fill	SILT, very loose/very soft, 0.7 to 3.1 m thick, localized; over CLAY, silty, to SILT, clayey, very soft to hard, 1.8 to 7.5 m thick; over SAND, very loose to dense.	0.5 to 3.6 m depth in piezometers
I	Highway 11 NBL and SBL, and Three Mile Lake Road EW-N Ramp	12+280 to 12+480	6.9 m Fill	SAND to SILT, sandy, very loose to compact; over SAND, becoming dense at 14.3 to 17.8 m depth; over BEDROCK, at 22.1 to 24.5 m depth.	0.0 to 1.8 m depth upon completion
J	Platts Access Road	10+300 to 10+400	10.5 m Fill	CLAY to SILT, stiff to hard, 0.6 to 2.8 m; or PEAT, 0.6 to 0.8 m; over SAND, compact to dense; over BEDROCK or BOULDERS at 1.5 to 6.2 m.	0.0 m depth in piezometer
K	Municipal Service Road	9+600 to 9+815	10.5 m Cut	SAND to SILT, with cobbles and pockets of sand and gravel, loose to very dense, 0.9 to 6.9 m thick; over BEDROCK	1.5 to 8.8 m depth in piezometers
L	Highway 11 NBL	12+930 to 12+940	7.2 m Cut	SILT, clayey to CLAY, silty, very stiff to stiff, 4.3 to 6.1 m deep; over SILT, loose to compact	2.4 m depth upon completion in one of two boreholes
M	Highway 11 NBL and SBL	13+100 to 13+150	11.1 m Fill	PEAT, 0.7 m, in one borehole only; or SILT, clayey to CLAY, silty, isolated locations only, firm to stiff, 1.0 to 2.2 m thick; over SAND, silty to SILT, very loose to very dense; over SAND, very loose to compact, below 3.5 to 4.1 m at three locations only; over PROBABLE BEDROCK, at 1.6 to 12.3 m depth.	0.2 to 1.9 m depth upon completion of augering

* Refer to Table A2 for topsoil thickness.

TABLE A1

SUMMARY OF EMBANKMENT, CUT AND SWAMP LOCATIONS AND CONDITIONS

Appendix	Alignment	Stations	Maximum Embankment Height or Cut Depth (m)	Generalized Stratigraphy*	Groundwater Conditions
N	Highway 11 SBL	13+520 to 14+100	10.4 m Cut	SAND, trace silt to silty, with cobbles and boulders, compact to very dense; over BEDROCK, at 0.9 to 8.8 m.	1.1 to 2.3 m depth in piezometers
O	Highway 11 NBL and SBL	14+290 to 14+390	9.4 m Fill	SAND, silty, dense to very dense; over PROBABLE BEDROCK, at 1.4 to 4.2 m depth.	0.7 to 3.1 m depth; typically dry upon completion
P	Highway 11 NBL	15+220 to 15+290	6.9 m Fill	PEAT, 0.2 to 0.6 m thick; over SAND to SILT, sandy, compact to very dense; over PROBABLE BEDROCK OR BOULDERS, at 2.1 to 6.7 m.	0.3 to 5.5 m upon completion of drilling
Q	Highway 11 NBL and SBL	15+715 to 15+815	4.2 m Fill	PEAT, 0.4 to 0.9 m thick; over CLAY, silty, very stiff to very soft, to depths of 6.9 to 10.2 m; over SILT, loose to very loose.	Artesian flow upon completion and noted in piezometers
R	Municipal Service Road	13+525 to 13+575	7.7 m Fill	CLAY, silty, very stiff to very soft, to 9.1 m depth in south section; or SAND, compact to very dense; over PROBABLE BEDROCK at 0.0 to 1.9 m in north section.	1.1 m depth in one piezometer
S	Tower Road	10+020 to 10+155	19.1 m Cut	BEDROCK	-
T	Municipal Service Road	14+200 to 14+510	13.4 m Cut	SAND, compact to very dense; over BEDROCK at 0.7 to 3.0 m.	4.3 m depth in piezometer

* Refer to Table A2 for topsoil thickness.

TABLE A2
DEPTH OF PEAT AND TOPSOIL

Appendix	Alignment	Stations	Maximum Embankment Height or Cut Depth (m)	Depth of Peat and Topsoil (mm)	
				Range	Average
B	Highway 592	9+630 to 9+960	12.2 Fill	50 - 200	150
C	Sunset Pass Drive	10+040 to 10+150	9.3 Fill	100-200	150
D	Highway 11 NBL	10+510 to 10+570	10.5 Fill	-	-
E	Municipal Service Road	7+500 to 7+720	8.0 Fill	100-300 Topsoil 300-1500 Peat	150 900
F	Municipal Service Road	7+750 to 7+880	16.3 Cut	100-300	200
G	Highway 11 NBL and SBL	11+950 to 12+030	8.7 m Fill	75-300	150
H	Highway 11 NBL and SBL	12+070 to 12+140	9.0 m Fill	50-500	150
I	Highway 11 NBL and SBL, and Three Mile Lake Road EW-N Ramp	12+280 to 12+480	6.9 m Fill	100-200 Topsoil 100-2200 Peat	150 650
J	Platts Access Road	10+300 to 10+400	10.5 m Fill	150-200 Topsoil 600-800 Peat	200 700
K	Municipal Service Road	9+600 to 9+815	10.5 m Cut	100-600	250
L	Highway 11 NBL	12+930 to 12+940	7.2 m Cut	100-300	200
M	Highway 11 NBL and SBL	13+100 to 13+150	11.1 m Fill	100-300 Topsoil 700-700 Peat	250 700
N	Highway 11 SBL	13+520 to 14+000	10.4 m Cut	75-500	300
O	Highway 11 NBL and SBL	14+290 to 14+390	9.4 m Fill	300-700	450
P	Highway 11 NBL	15+220 to 15+290	6.9 m Fill	100-200 Topsoil 200-600 Peat	150 300
Q	Highway 11 NBL and SBL	15+715 to 15+815	4.2 m Fill	75-500 Topsoil 400-900 Peat	300 550
R	Municipal Service Road	13+525 to 13+575	7.7 m Fill	200-700	550
S	Tower Road	10+020 to 10+155	19.1 Cut	-	-
T	Municipal Service Road	14+200 to 14+510	13.4 Cut	100-300	200

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TABLE A3
RESULTS OF STABILITY ANALYSES

Appendix	Alignment	Analysis Profile Location (Sta.)	Embankment Height or Cut Depth	Factor of Safety				
				Short-Term Static		Long-Term Static		Seismic
				Earth Fill	Rockfill	Earth Fill	Rockfill	
B	Highway 592	9+700 9+750 9+950	12.2 m Fill 10.4 m Fill 12.0 m Fill	1.75 1.82 1.59	1.89 1.81 1.64	1.75 1.82 1.59	1.89 1.81 1.64	1.43 1.48 1.30
C	Sunset Pass Drive	10+100	9.2 m Fill	1.71	1.75	1.71	1.75	1.40
D	Highway 11 NBL	10+530	10.0 m Fill	1.61	1.47	1.55	1.42	1.25
E	Municipal Service Road	7+550 7+660	6.6 m Fill 7.8 m Fill	1.46 1.58	1.42 1.54	1.59 1.58	1.56 1.58	1.27 1.27
F	Municipal Service Road	7+780	16.3 m Rock Cut	-	-	-	-	
G	Highway 11 NBL and SBL	11+990	8.4 m Fill	1.73	1.71	1.73	1.75	1.41
H	Highway 11 NBL and SBL	12+090	8.8 m Fill	1.51	1.47	1.60	1.66	1.28
I	Highway 11 NBL and SBL, and Three Mile Lake Road EW-N Ramp	12+360	6.6 m Fill	1.55	1.50	1.55	1.50	1.23
J	Platts Access Road	10+350	10.5 m Fill	1.47	1.47	1.47	1.47	1.20
K	Municipal Service Road	9+660	10.5 m Rock Cut	-	-	-	-	

Highway 11: Highway 518 West to Highway 520
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TABLE A3
RESULTS OF STABILITY ANALYSES

Appendix	Alignment	Analysis Profile Location (Sta.)	Embankment Height or Cut Depth	Factor of Safety					
				Short-Term Static		Long-Term Static		Seismic	
				Earth Fill	Rockfill	Earth Fill	Rockfill		
L	Highway 11 NBL	12+935	7.0 m Earth Cut	2.42 (cut)	-	1.51 (cut)	-	1.22 (cut)	
M	Highway 11 NBL and SBL	13+130L 13+130R	11.0 m Fill 8.2 m Fill	1.72 1.63	1.73 1.71	1.72 1.63	1.73 1.71	1.39 1.32	
N	Highway 11 SBL	13+640 14+000	9.7 m Rock Cut 6.0 m Earth Cut	- 1.65 (cut)	- -	- 1.65 (cut)	- -	- 1.37 (cut)	
O	Highway 11 NBL and SBL	14+310	9.2 m Fill	>1.5	>1.5	>1.5	>1.5	>1.0	
P	Highway 11 NBL	15+270	6.8 m Fill	1.46	1.47	1.58	1.61	1.29	
Q	Highway 11 NBL and SBL	15+765	4.2 m Fill	1.44	1.44	1.44	1.51	1.06	
R	Municipal Service Road	13+530	7.6 m Fill	1.38	1.34	1.72	1.54	1.38	
S	Tower Road	10+020 to 10+155	19.1 m Rock Cut	-	-	-	-	-	
T	Municipal Service Road	14+200 to 14+510	13.4 m Rock Cut	-	-	-	-	-	

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

TABLE A4

ENGINEERING PARAMETERS USED IN SETTLEMENT ANALYSES

Appendix	Alignment	Station	Depth Interval (m)	Soil Type	Unit Weight (kN/m ³)	Initial Void Ratio	Elastic Modulus (MPa)	Poisson's Ratio	Compression Index C_c	Recompression Index C_r	Preconsolidation Pressure (kPa)	Coefficient of Consolidation c_v (m ² /yr)	Secondary Compression Ratio $C_{\alpha}/(1+e_0)$
B	Highway 592	9+630 to 9+960	0-2	Sand	20	0.6	30	0.3	-	-	-	-	-
			2-6	Silt	20	0.7	20	0.3	-	-	-	-	-
			6-9	Clay	19	0.6	20	0.3	0.15	0.015	400	80	0.0006
			9-14	Clay	20	0.8	25	0.3	0.30	0.030	450	80	0.0006
C	Sunset Pass Drive	10+040 to 10+150	0-4	Sand/Silt	20	0.6	40	0.3	-	-	-	-	-
			4-6	Clay	19	1.1	20	0.3	0.40	0.040	300	80	0.0006
			6-8	Sand/Gravel	21	0.5	65	0.3	-	-	-	-	-
			8-12	Sand/Gravel	21	0.5	100	0.3	-	-	-	-	-
D	Highway 11 NBL	10+510 to 10+570	0-4	Fill	20	0.8	15	0.3	-	-	-	-	-
			4-5	Silt	20	0.6	20	0.3	-	-	-	-	-
			5-9	Clay	9	1.1	20	0.3	0.40	0.040	350	80	0.0007
			9-15	Silt	10	0.6	30	0.3	-	-	-	-	-
E	Municipal Service Road	7+500 to 7+720	0-1	Sand	20	0.6	15	0.3	-	-	-	-	-
			1-4	Clay	8	1.3	20	0.3	0.55	0.055	300	80	0.0007
			4-8	Clay	9	1.1	20	0.3	0.40	0.040	350	80	0.0007
			8-14	Silt	10	0.6	30	0.3	-	-	-	-	-
G	Highway 11 NBL and SBL	11+950 to 12+030	0-3	Silt	15	0.7	15	0.3	-	-	-	-	-
			3-6	Clay	8	1.1	20	0.3	0.45	0.045	250	40	0.0007
			6-9	Clay	9	0.9	20	0.3	0.40	0.040	325	40	0.0007
			9-13	Silt	11	0.6	30	0.3	-	-	-	-	-
H	Highway 11 NBL and SBL	12+070 to 12+140	0-1.5	Clay	20	0.9	20	0.3	0.35	0.035	250	40	0.0007
			1.5-5	Clay	9	1.1	15	0.3	0.50	0.050	250	40	0.0007
			5-8	Silt	10	0.7	20	0.3	-	-	-	-	-
			8-13	Sand	10	0.6	30	0.3	-	-	-	-	-

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

TABLE A4
ENGINEERING PARAMETERS USED IN SETTLEMENT ANALYSES

Appendix	Alignment	Station	Depth Interval (m)	Soil Type	Unit Weight (kN/m ³)	Initial Void Ratio	Elastic Modulus (MPa)	Poisson's Ratio	Compression Index C_c	Recompression Index C_r	Preconsolidation Pressure (kPa)	Coefficient of Consolidation c_v (m ² /yr)	Secondary Compression Ratio $C_{\alpha}/(1+e_0)$
I	Highway 11 NBL and SBL, and Three Mile Lake Road EW-N Ramp	12+280 to 12+480	0-2 2-12 12-18 18-22	Sand Sand Sand Sand/Gravel	9 10 10 11	0.8 0.8 0.7 0.6	5 10 35 100	0.3 0.3 0.3 0.3	- - - -	- - - -	- - - -	- - - -	- - - -
J	Platts Access Road	10+300 to 10+400	0-1 1-3 3-5 5-6	Sand Sand Sand Sand	20 20 20 21	0.6 0.6 0.6 0.5	30 40 65 100	0.3 0.3 0.3 0.3	- - - -	- - - -	- - - -	- - - -	- - - -
M	Highway 11 NBL and SBL	13+100 to 13+150	0-0.5 0.5-2 2-4 4-6	Sand Sand Sand Sand	20 10 11 11	0.6 0.6 0.7 0.8	10 20 35 45	0.3 0.3 0.3 0.3	- - - -	- - - -	- - - -	- - - -	- - - -
Q	Highway 11 NBL and SBL	15+715 to 15+815	0-1.5 1.5-4.5 4.5-8.5 8.5-18.5	Clay Clay Clay Silt	18 7 8 10	0.8 1.5 1.0 0.6	20 10 15 30	0.3 0.45 0.4 0.3	0.30 0.70 0.35 -	0.030 0.070 0.035 -	150 35 60 -	10 10 10 -	0.0006 0.006 0.005 -
R	Municipal Service Road	13+525 to 13+575	0-1 1-2 2-5 5-7	Clay Clay Clay Clay	20 19 9 10	0.6 0.8 1.5 0.6	20 20 15 20	0.3 0.3 0.45 0.3	0.20 0.40 0.60 0.30	0.020 0.040 0.060 0.030	275 220 180 230	10 10 10 10	0.0006 0.005 0.006 0.0006

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

TABLE A5
RESULTS OF SETTLEMENT ANALYSES

Appendix	Alignment	Analysis Profile Location (Sta.)	Maximum Embankment Height (m)	Predicted Settlement				
				Elastic (mm)	Primary Consolidation (mm)	Time to 90% Consolidation (months)	Secondary Compression (mm in 30 yrs)	Embankment Compression (mm) Earth Fill Rockfill
B	Highway 592	9+630 to 9+960	12.2	100	30	2.5	<15	60 35
C	Sunset Pass Drive	10+040 to 10+150	9.3	40	20	0.5	<15	50 30
D	Highway 11 NBL	10+510 to 10+570	10.5	100	30	1.0	<15	55 30
E	Municipal Service Road	7+500 to 7+720	8.0	50	90	2.0	<15	40 25
G	Highway 11 NBL and SBL	11+950 to 12+030	8.7	75	75	2.5	<15	45 25
H	Highway 11 NBL and SBL	12+070 to 12+140	9.0	70	80	2.0	<15	45 30
I	Highway 11 NBL and SBL, and Three Mile Lake Road EW-N Ramp	12+280 to 12+480	6.9	150	0	-	-	35 20
J	Platts Access Road	10+300 to 10+400	10.5	20	0	-	-	55 30
M	Highway 11 NBL and SBL	13+100 to 13+150	11.1	30	0	-	-	55 35
O	Highway 11 NBL and SBL	14+290 to 14+390	9.4	<25	0	-	-	50 30
P	Highway 11 NBL	15+220 to 15+290	6.9	<25	0	-	-	35 20
Q	Highway 11 NBL and SBL	15+715 to 15+815	4.2	40	760	19	40	20 15
R	Municipal Service Road	13+525 to 13+575	7.7	30	150	13	30	40 25

TABLE A6

OPTIONS TO REDUCE POST-CONSTRUCTION SETTLEMENT OF EMBANKMENTS

Alternative	Advantages	Disadvantages
1. Re-locate highway away from the area with compressible soil	<ul style="list-style-type: none"> - Removes need for fill placement over compressible soil - Construction schedule is not impacted 	<ul style="list-style-type: none"> - Increased property requirements - Large impact on highway route design with possibly less favourable highway geometries - Significant redesign will be required
2. Sub-excavate the compressible soil and replace it with compacted earth or rockfill	<ul style="list-style-type: none"> - Completely removes compressible soil - Little construction delay 	<ul style="list-style-type: none"> - Deep excavation of clay is not practical due to costs - Imported material is required for backfill - Potential exists for settlement within backfill material - Artesian groundwater may be encountered in excavation
3. Preload and surcharge by temporarily increasing the embankment height in advance of pavement construction	<ul style="list-style-type: none"> - Majority of consolidation settlement occurs prior to finish grading and pavement construction - Increases time rate of consolidation - Reduces post-construction settlement - Inexpensive 	<ul style="list-style-type: none"> - Time is required to allow consolidation to occur, with possible construction delay - Effectiveness of preloading will be limited since the height of the embankment and surcharge is limited by the stability of the silty clay foundation soil - Increased property requirements if stability during preload is addressed by flattening slopes
4. Install wick drains to enhance drainage of pore pressures in the silty clay	<ul style="list-style-type: none"> - Significantly increases rate of consolidation, reducing construction delay - Foundation stability is not impacted 	<ul style="list-style-type: none"> - Drain installation and consolidation monitoring increases costs - Some construction delay - Artesian conditions must be considered in design
5. Construct embankment using lightweight fill	<ul style="list-style-type: none"> - Reduces embankment loading and magnitude of consolidation settlement 	<ul style="list-style-type: none"> - Expensive - Some consolidation settlement will remain
6. Combination of Alternatives 3, 4 and/or 5	<ul style="list-style-type: none"> - Same as Alternatives 3, 4, 5 	<ul style="list-style-type: none"> - Same as Alternatives 3, 4, 5

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 592 Area B
 February, 2005
 Station 9+950
 Earth Fill, Short & Long Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	30	0
Silt	20	30	0
Sand	20	32	0
Dense Sand	21	38	0

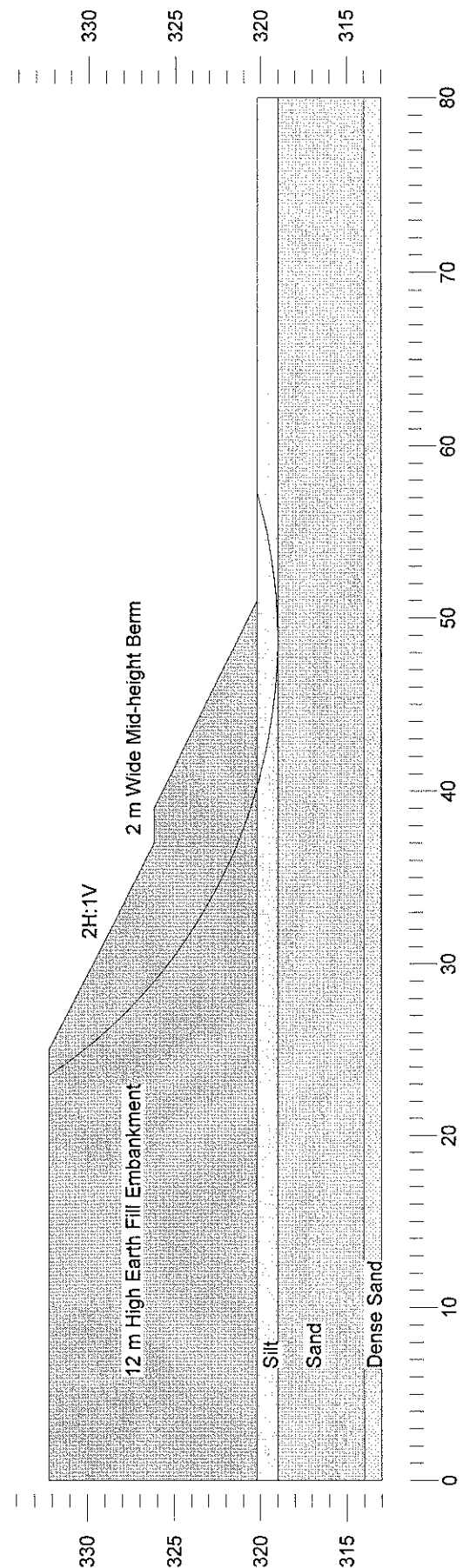
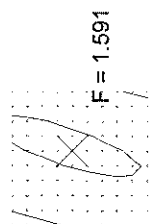


Fig. A1

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 592 Area B
 February, 2005
 Station 9+950
 Earth Fill, Seismic

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	30	0
Silt	20	30	0
Sand	20	32	0
Dense Sand	21	38	0

Seismic coefficient = 0.08

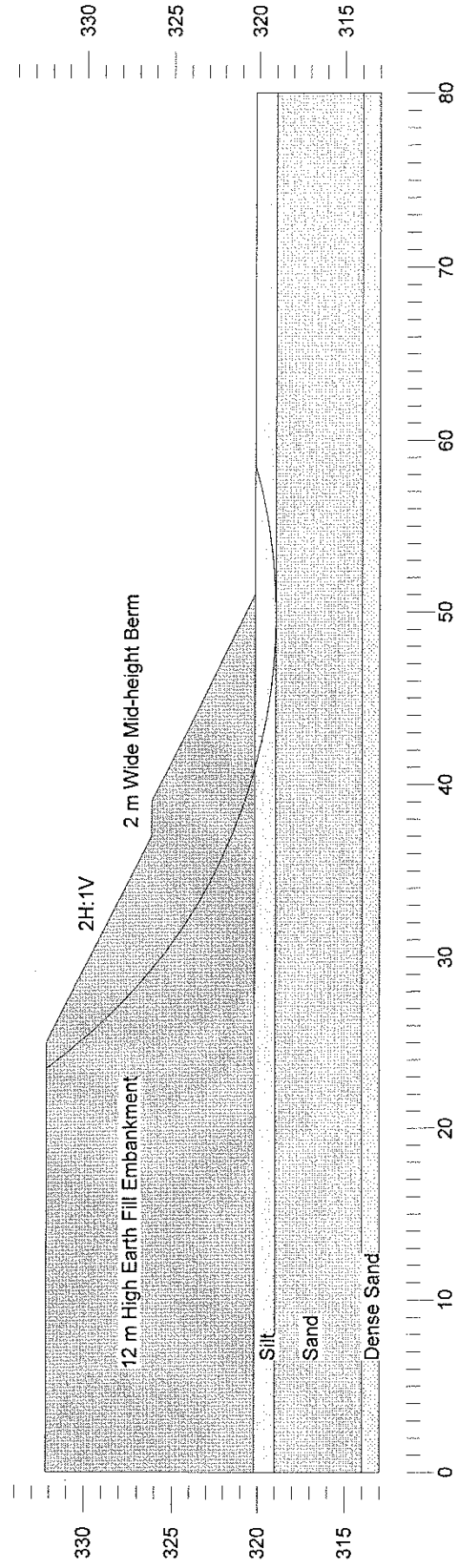
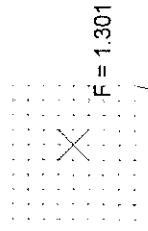


Fig. A2

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 592 Area B
 February, 2005
 Station 9+950
 Rockfill, Short & Long Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Rockfill	20	0	42
Silt	20	0	30
Sand	20	0	32
Dense Sand	21	0	38

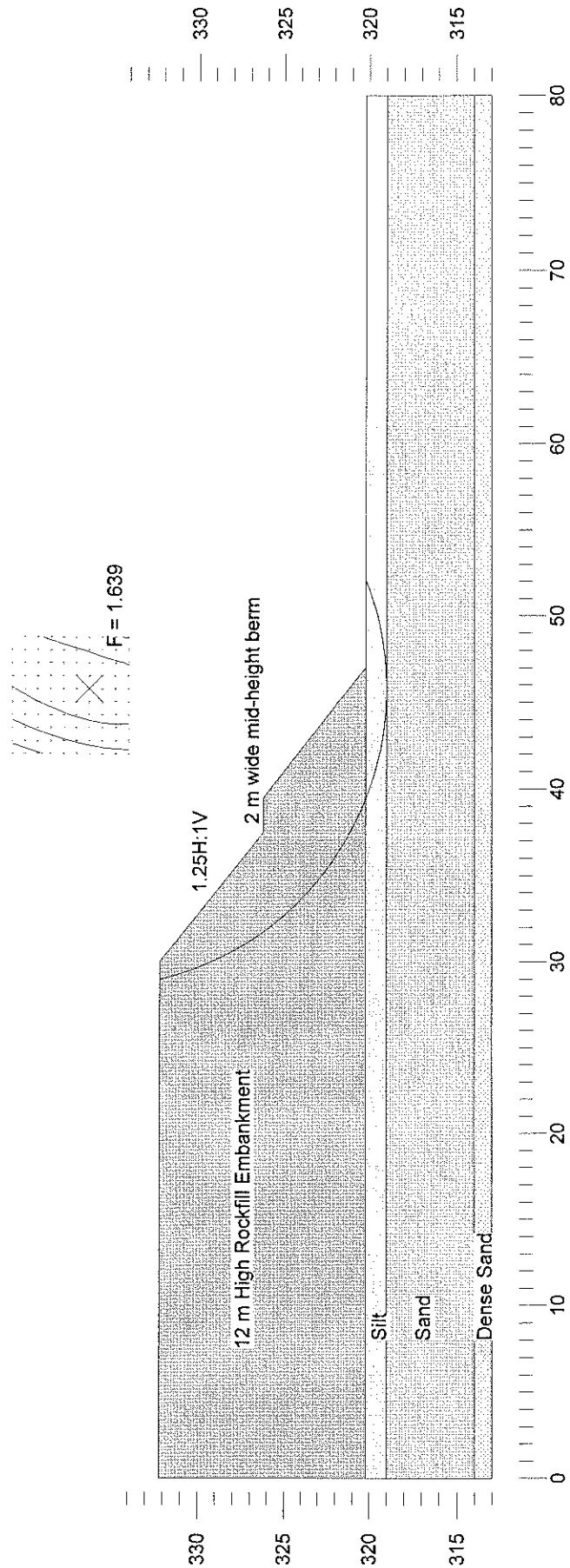


Fig. A3

Thurber Engineering Ltd. - Toronto
 19-1423-16
 MSR Area E
 December, 2005
 Station 7+660
 Earth Fill, Short Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Earth Fill	20	0	0
Clay	18	40	0
Silt	20	0	1
Hard Bottom	20	0	1
	(Infinitely Strong)		

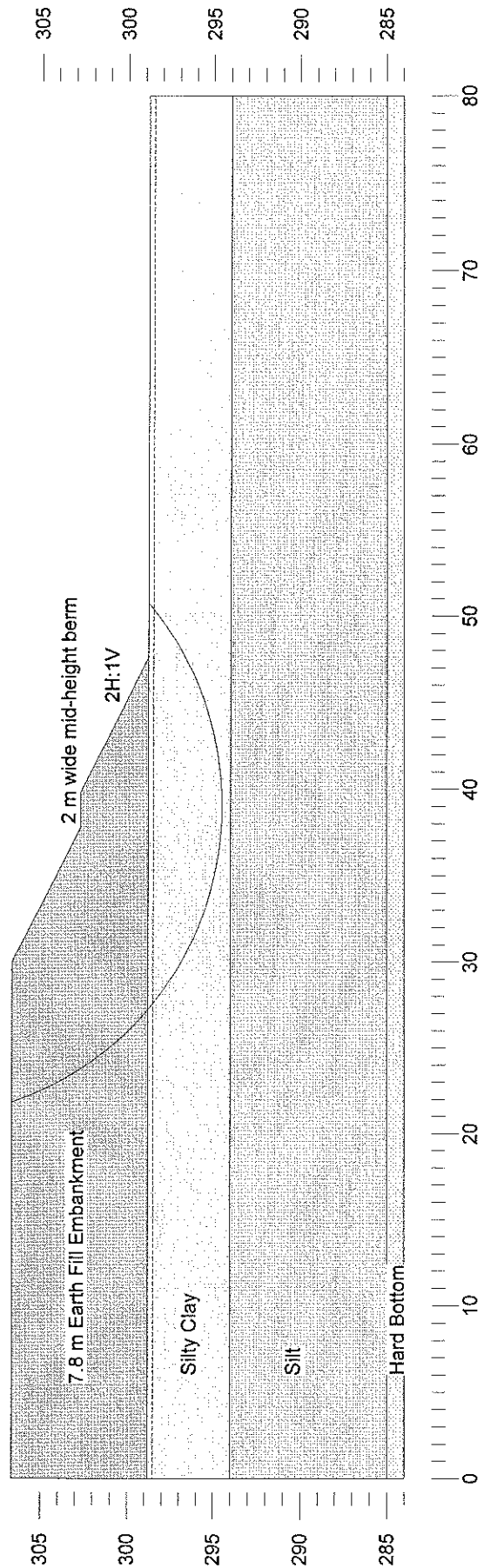
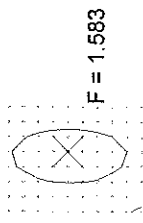


Fig. A4

Thurber Engineering Ltd. - Toronto
 19-1423-16
 MSR Area E
 December, 2005
 Station 7+660
 Earth Fill, Long Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	0	0
Clay	19	0	1
Silt	20	0	1
Hard Bottom	(Infinitely Strong)	30	

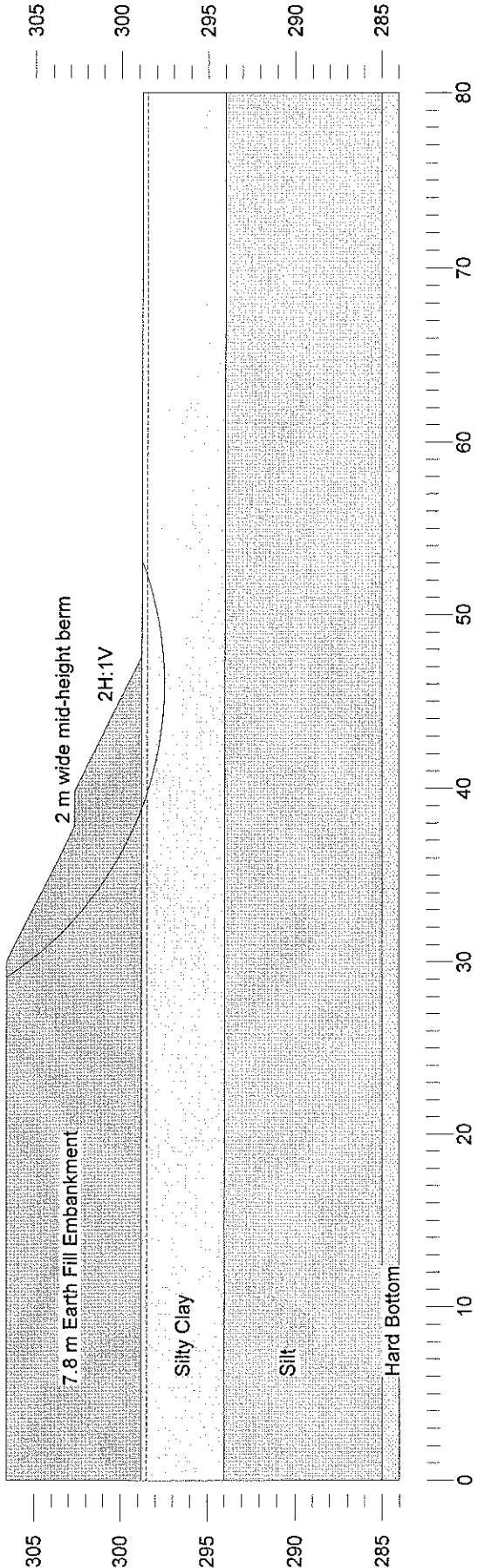
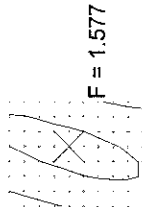


Fig. A5

Thurber Engineering Ltd. - Toronto
 19-1423-16
 MSR Area E
 December, 2005
 Station 7+660
 Earth Fill, Seismic

	Gamma	C	Phi	Piezo
	kN/m ³	kPa	deg	Surf.
Earth Fill	20	0	30	0
Clay	19	0	29	1
Silt	20	0	30	1
Hard Bottom	(Infinitely Strong)			
Seismic coefficient = 0.08				

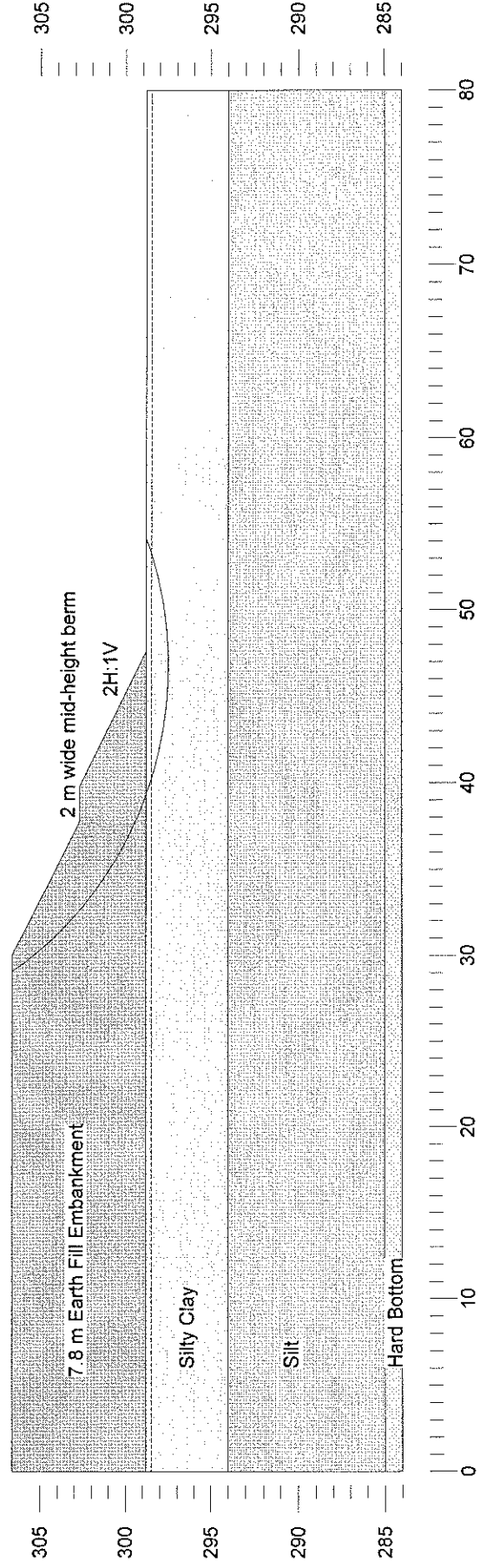
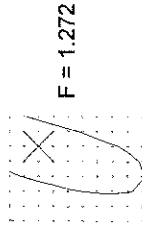


Fig. A6

Thurber Engineering Ltd. - Toronto
 19-1423-16
 MSR Area E
 February, 2005
 Station 7+660
 Rockfill, Short Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Rockfill	20	0	0
Clay	18	40	0
Silt	20	0	1
Hard Bottom	20	0	1
	(Infinitely Strong)		

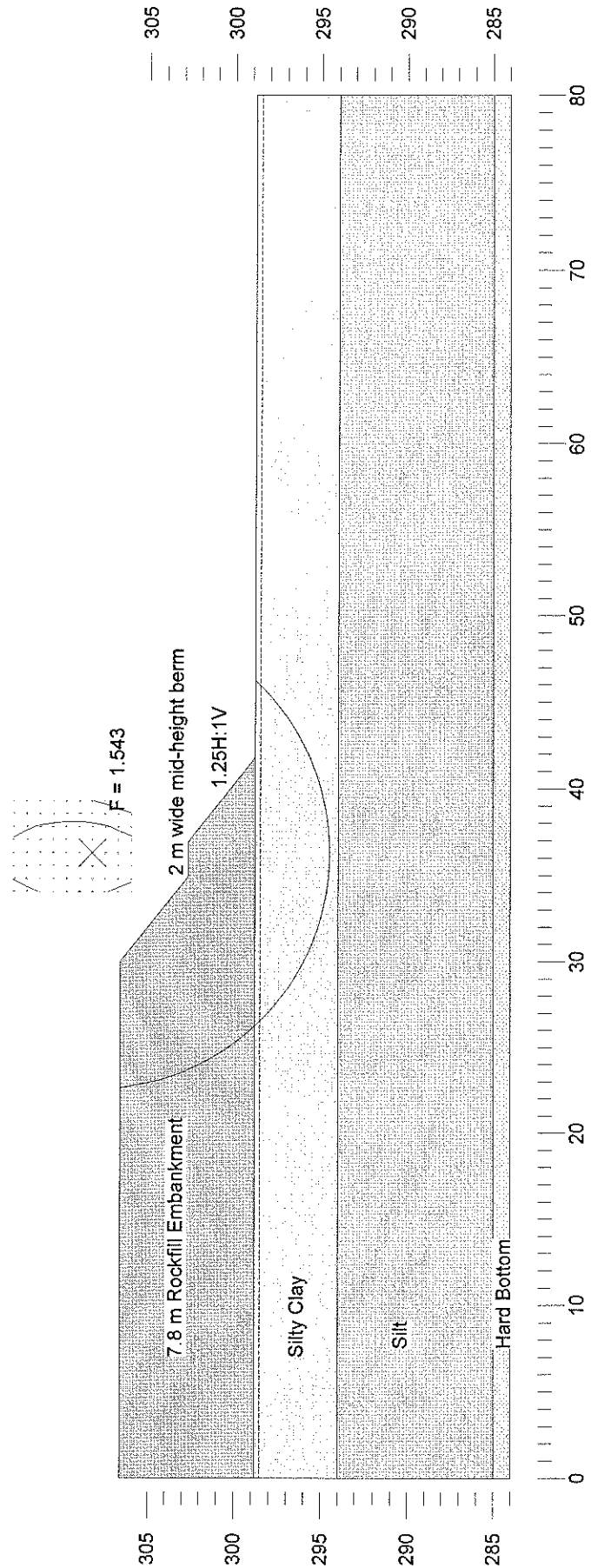


Fig. A7

Thurber Engineering Ltd. - Toronto
19-1423-16
MSR Area E
February, 2005
Station 7+660
Rockfill, Long Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Rockfill	20	0	0
Clay	19	0	1
Silt	20	0	1
Hard Bottom	(Infinitely Strong)		

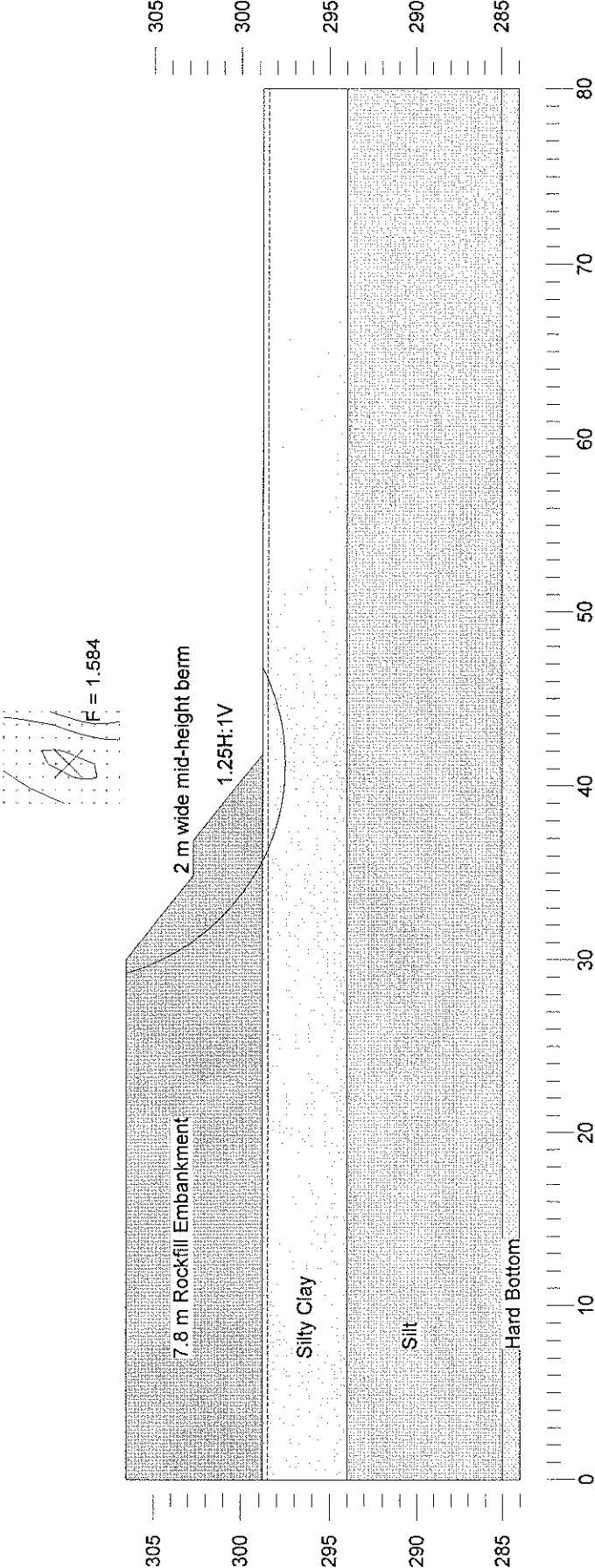


Fig. A8

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area I
 February, 2005
 Station 12+360
 Earth Fill, Short & Long Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	0	30
Silt/Sand	19	0	29
Sand	20	0	31
Sand & Gravel	21	0	34
Hard Bottom	(Infinitely Strong)		

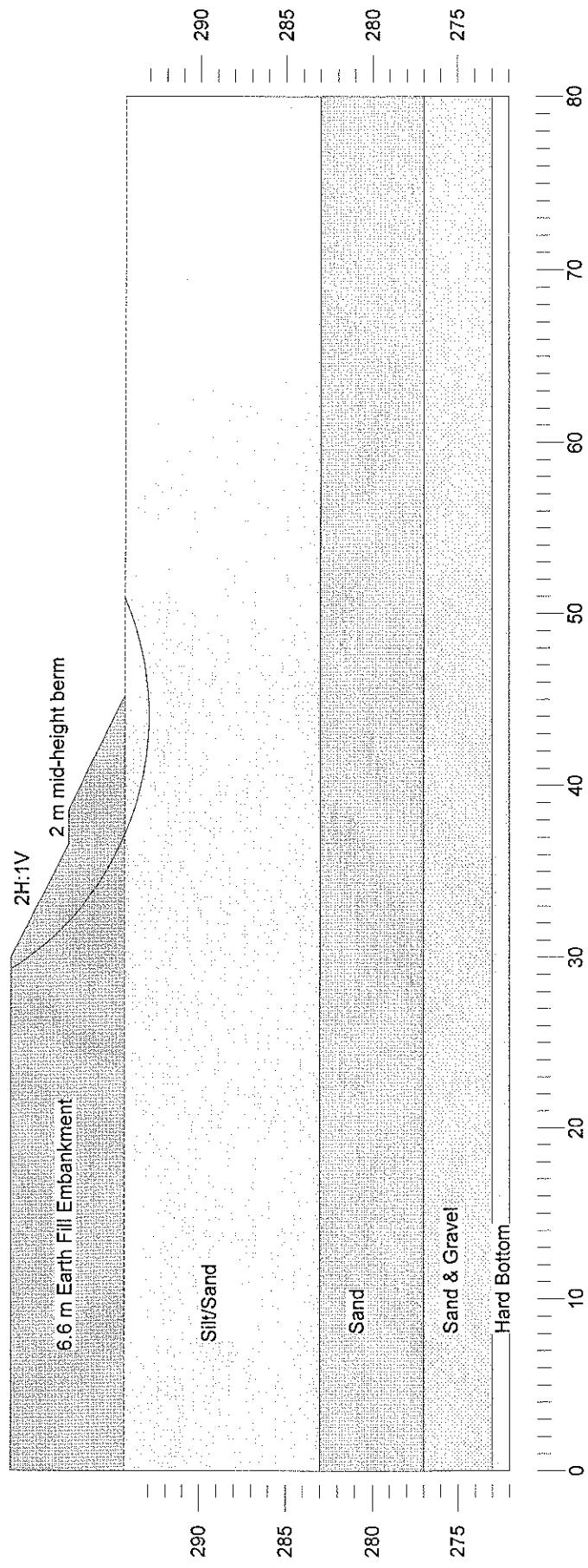
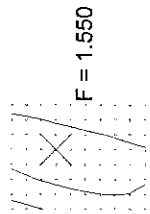


Fig. A9

Thurber Engineering Ltd. - Toronto
19-1423-16
Hwy 11 Area I
February, 2005
Station 12+360
Earth Fill, Seismic

	Gamma C	Phi	Piezo
	kN/m3	kPa	deg
Earth Fill	20	0	30
Silt/Sand	19	0	29
Sand	20	0	31
Sand & Gravel	21	0	34
Hard Bottom	(Infinitely Strong)		

Seismic coefficient = 0.08

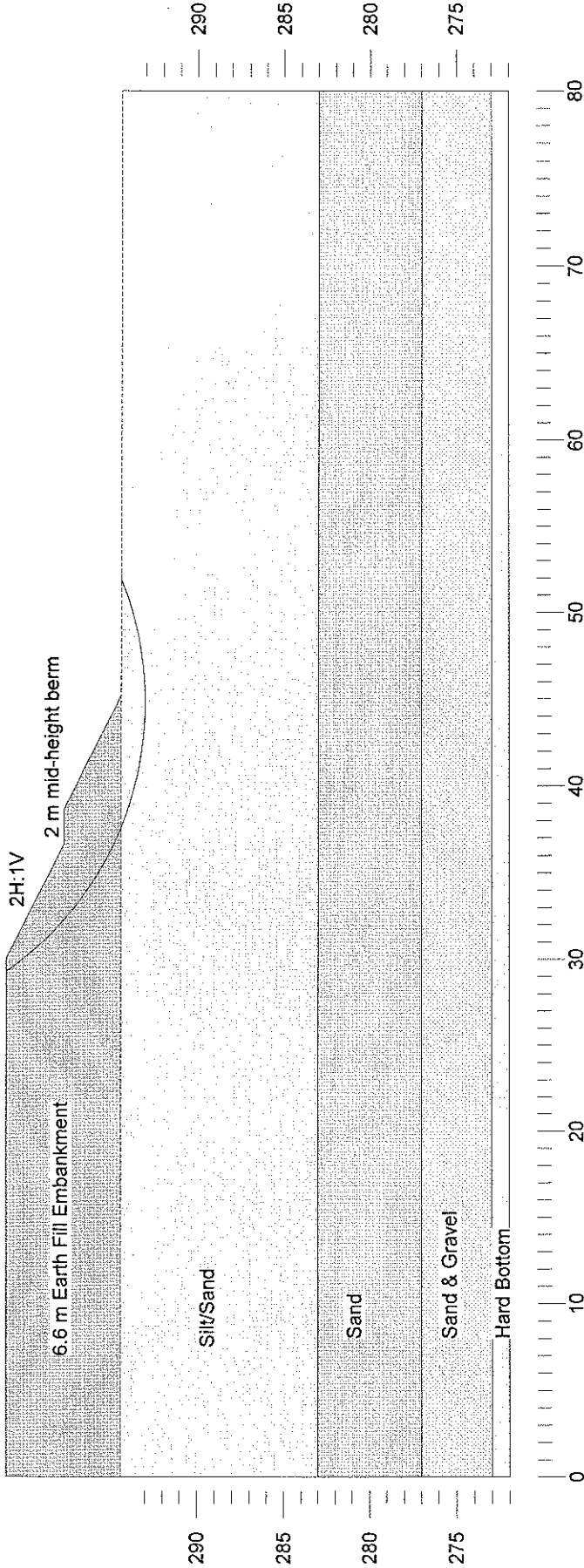
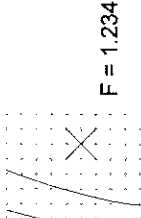
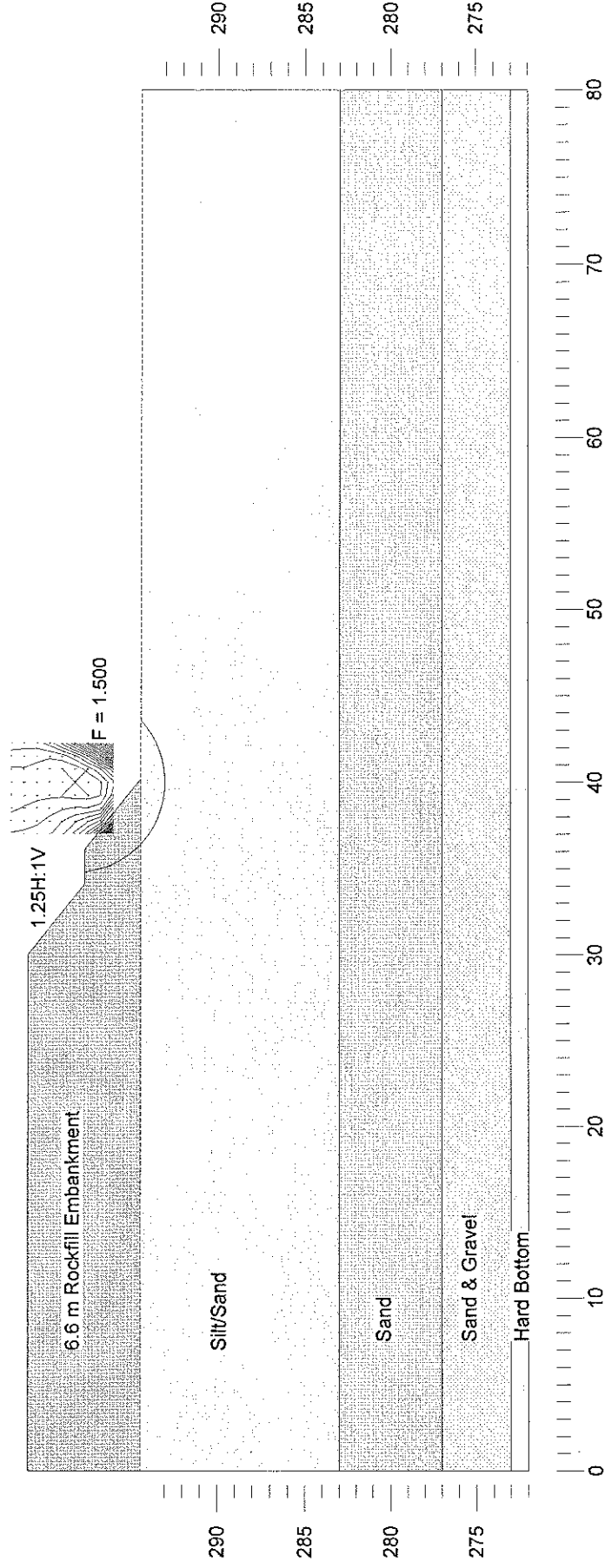


Fig. A10

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Rockfill	20	0	0
Silt/Sand	19	0	1
Sand	20	0	1
Sand & Gravel	21	0	1
Hard Bottom	(Infinitely Strong)		



Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area L
 February, 2005
 Station 12+935
 Earth Cut, Short Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Very Stiff Clay	20	125	0
Stiff Clay	20	75	0
Loose Silt	19	0	30
Compact Silt	20	0	32
Hard Bottom	(Infinitely Strong)		

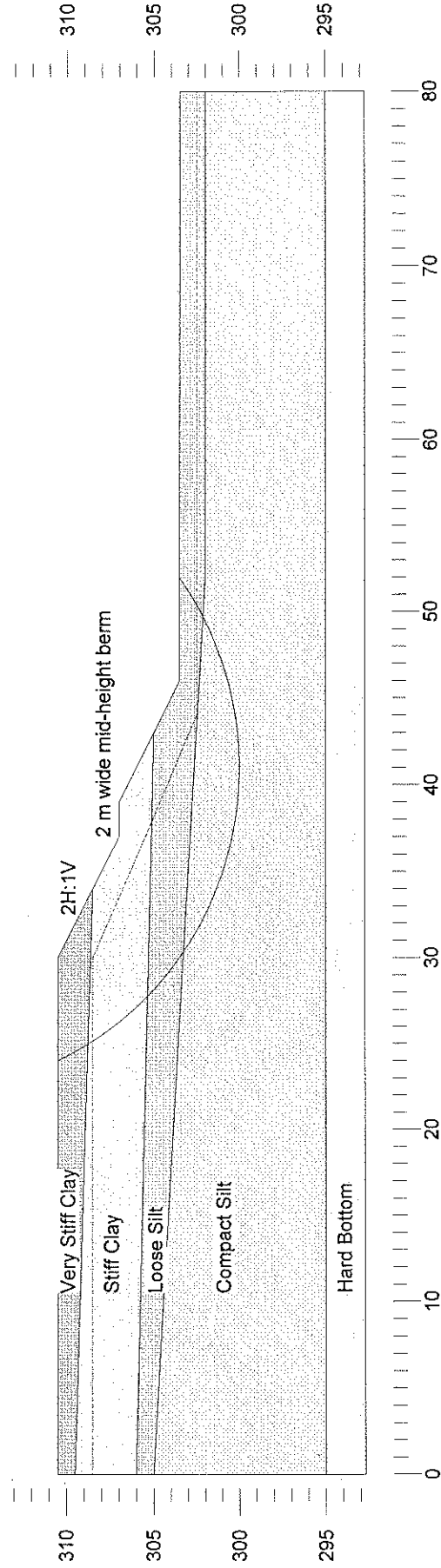
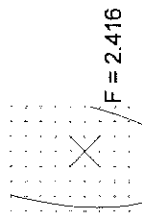


Fig. A12

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Very Stiff Clay	20	30	0
Stiff Clay	20	5	29
Loose Silt	19	0	30
Compact Silt	20	0	32
Hard Bottom	(Infinitely Strong)		

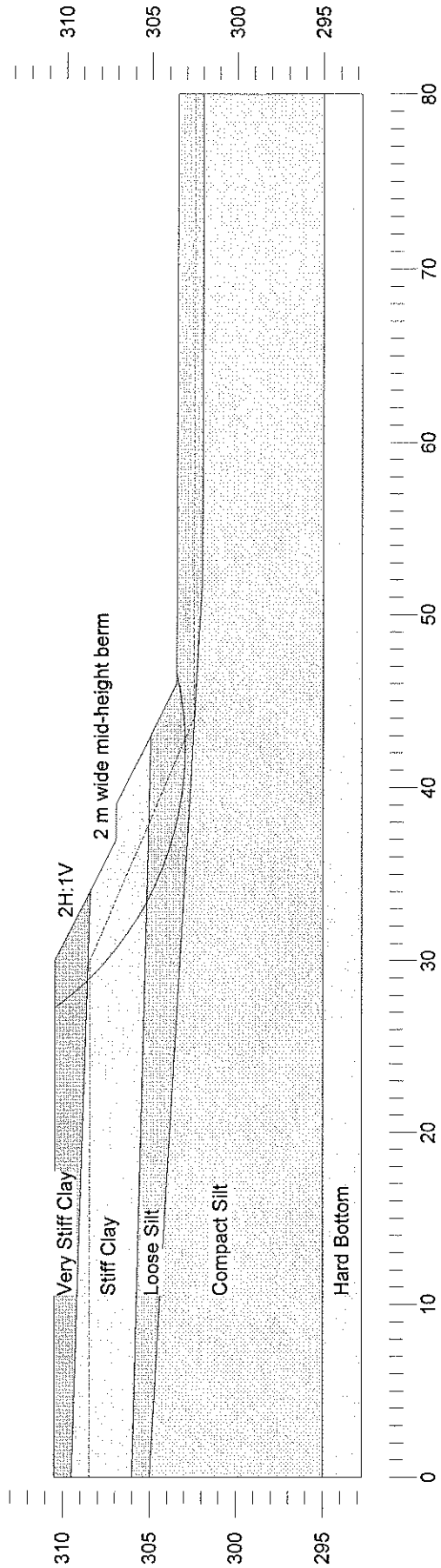
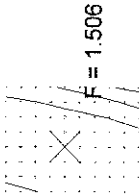


Fig. A13

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area L
 February, 2005
 Station 12+935
 Earth Cut, Seismic

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Very Stiff Clay	20	30	0
Stiff Clay	20	5	1
Loose Silt	19	0	1
Compact Silt	20	0	1
Hard Bottom	(Infinitely Strong)	32	1

Seismic coefficient = 0.08

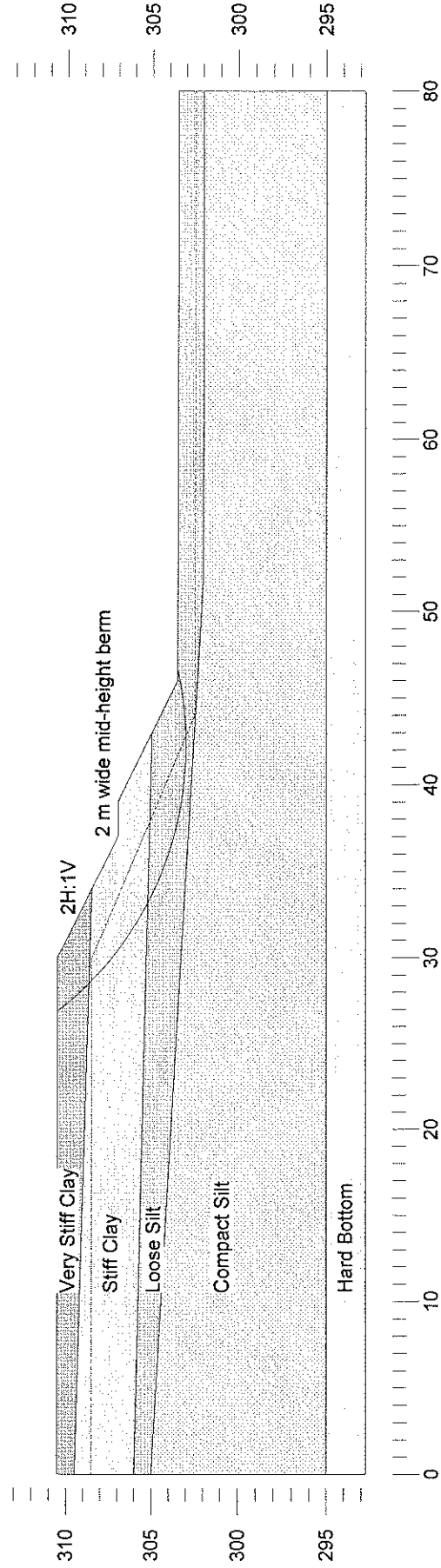
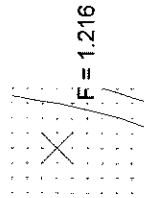


Fig. A14

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area Q
 February, 2005
 Station 15+765
 Earth Fill, Short Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	0	0
Peat	14	10	1
Firm Clay	19	35	1
Soft Clay	19	20	1
Firm Clay	19	35	1
Silt	20	0	1
Hard Bottom	(Infinitely Strong)	30	1

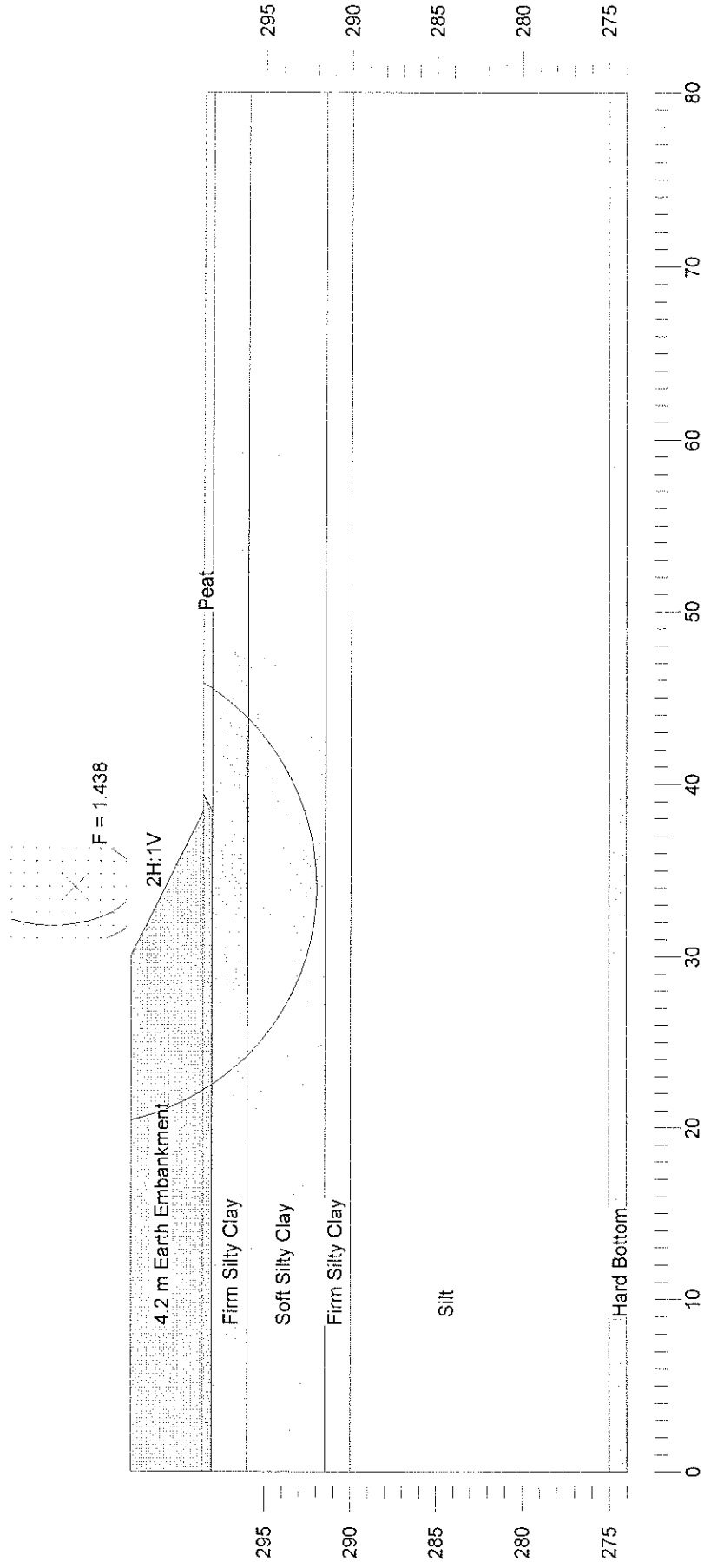


Fig. A15

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area Q
 February, 2005
 Station 15+765
 Earth Fill, Long Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	0	0
Peat	14	10	1
Firm Clay	19	0	28
Soft Clay	19	0	28
Firm Clay	19	0	28
Silt	20	0	30
Hard Bottom	(Infinitely Strong)		

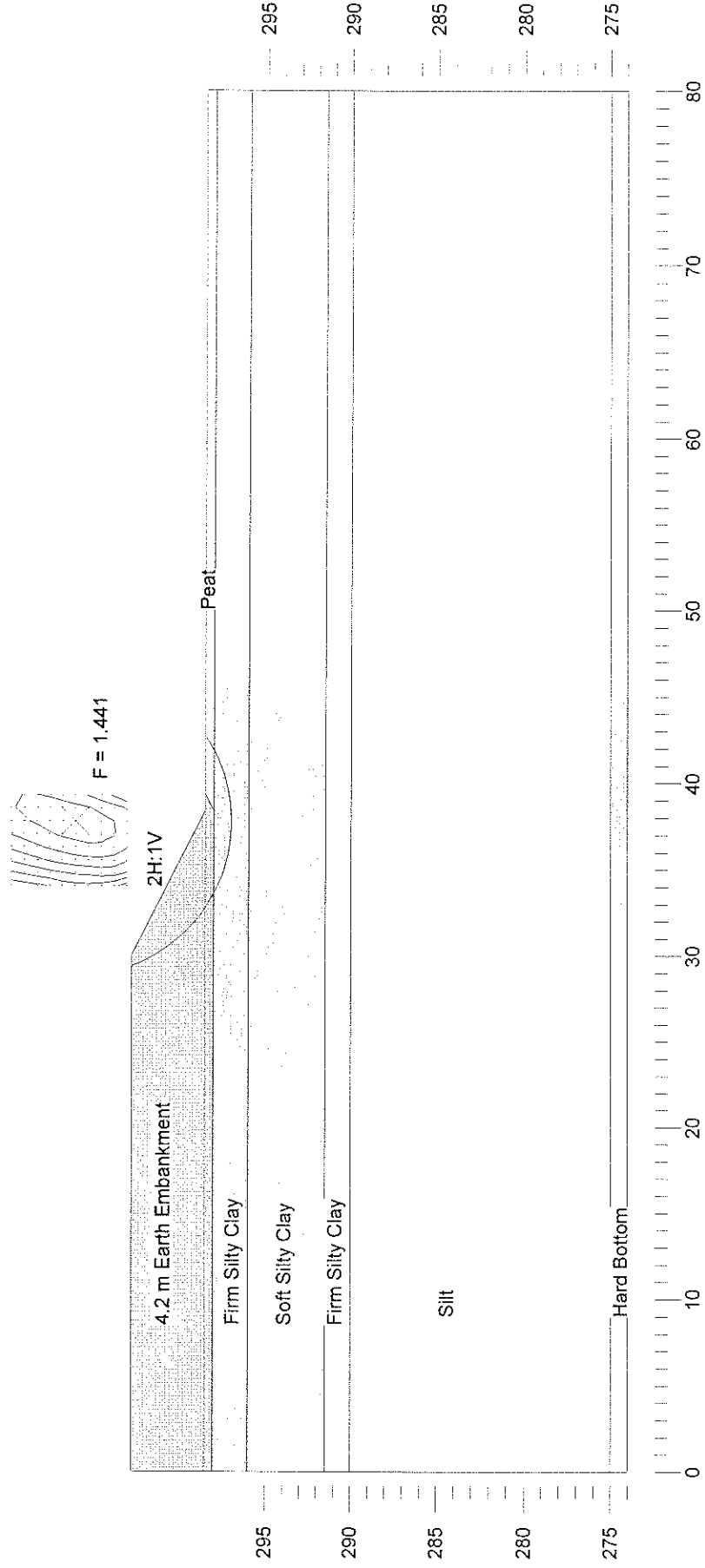


Fig. A16

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area Q
 February, 2005
 Station 15+765
 Earth Fill, Seismic

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Earth Fill	20	0	0
Peat	14	10	1
Firm Clay	19	0	28
Soft Clay	19	0	28
Firm Clay	19	0	28
Silt	20	0	30
Hard Bottom	(Infinitely Strong)		

Seismic coefficient = 0.12

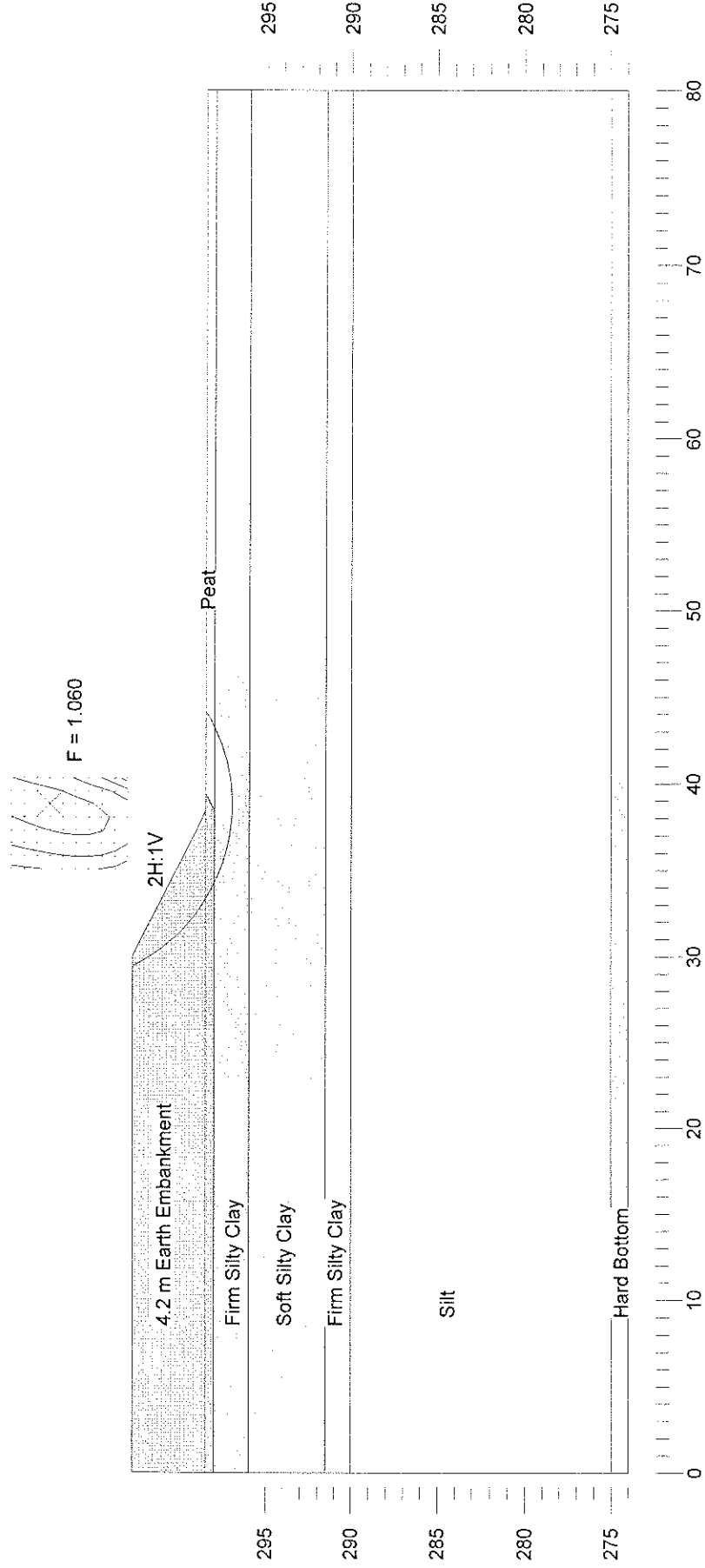


Fig. A17

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area Q
 February, 2005
 Station 15+765
 Rock Fill, Short Term

	Gamma C	Phi	Piezo
	kN/m3	deg	Surf.
Rock Fill	20	0	0
Peat	14	10	0
Firm Clay	19	35	0
Soft Clay	19	20	0
Firm Clay	19	35	0
Silt	20	0	30
Hard Bottom	(Infinitely Strong)		

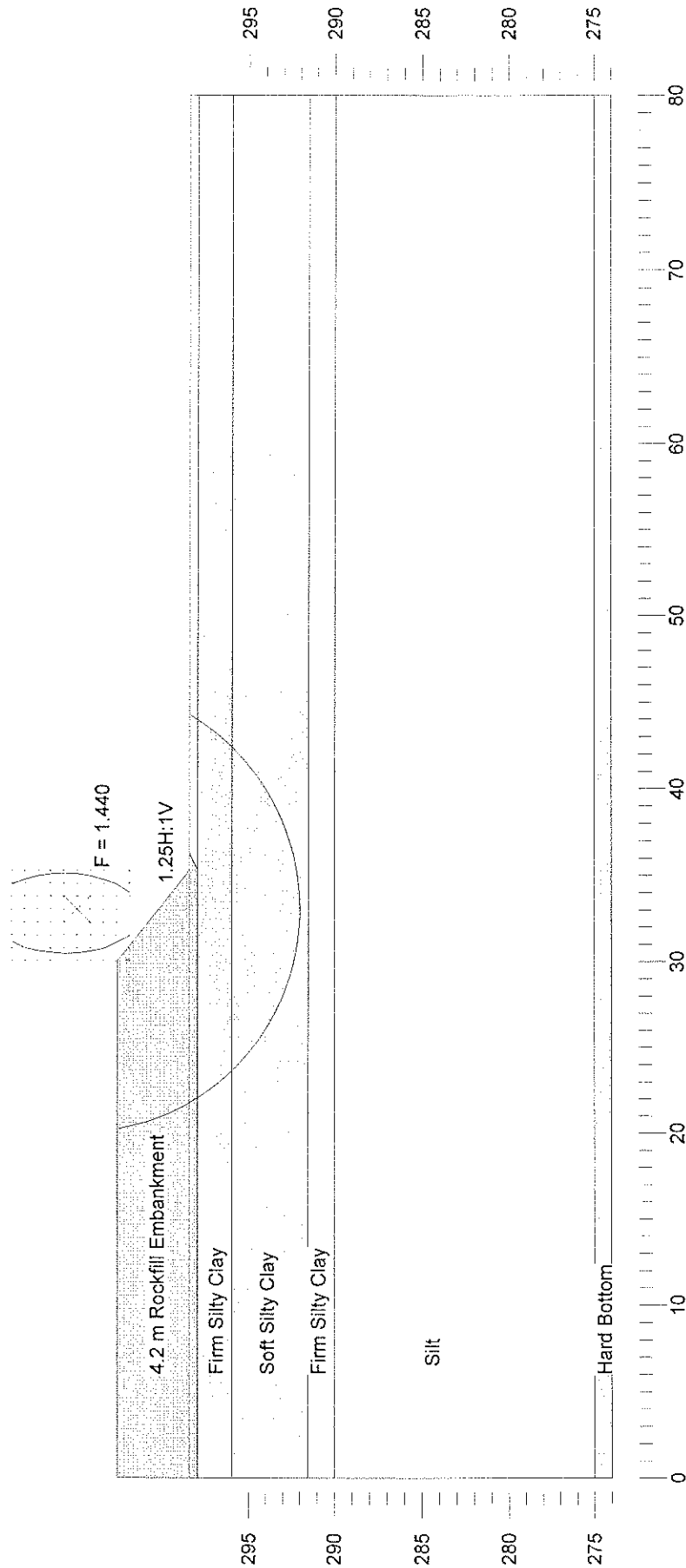


Fig. A18

Thurber Engineering Ltd. - Toronto
 19-1423-16
 Hwy 11 Area Q
 February, 2005
 Station 15+765
 Rock Fill, Long Term

	Gamma C	Phi	Piezo
	kN/m ³	deg	Surf.
Rock Fill	20	0	0
Peat	14	10	1
Firm Clay	19	0	28
Soft Clay	19	0	28
Firm Clay	19	0	28
Silt	20	0	30
Hard Bottom	(Infinitely Strong)		

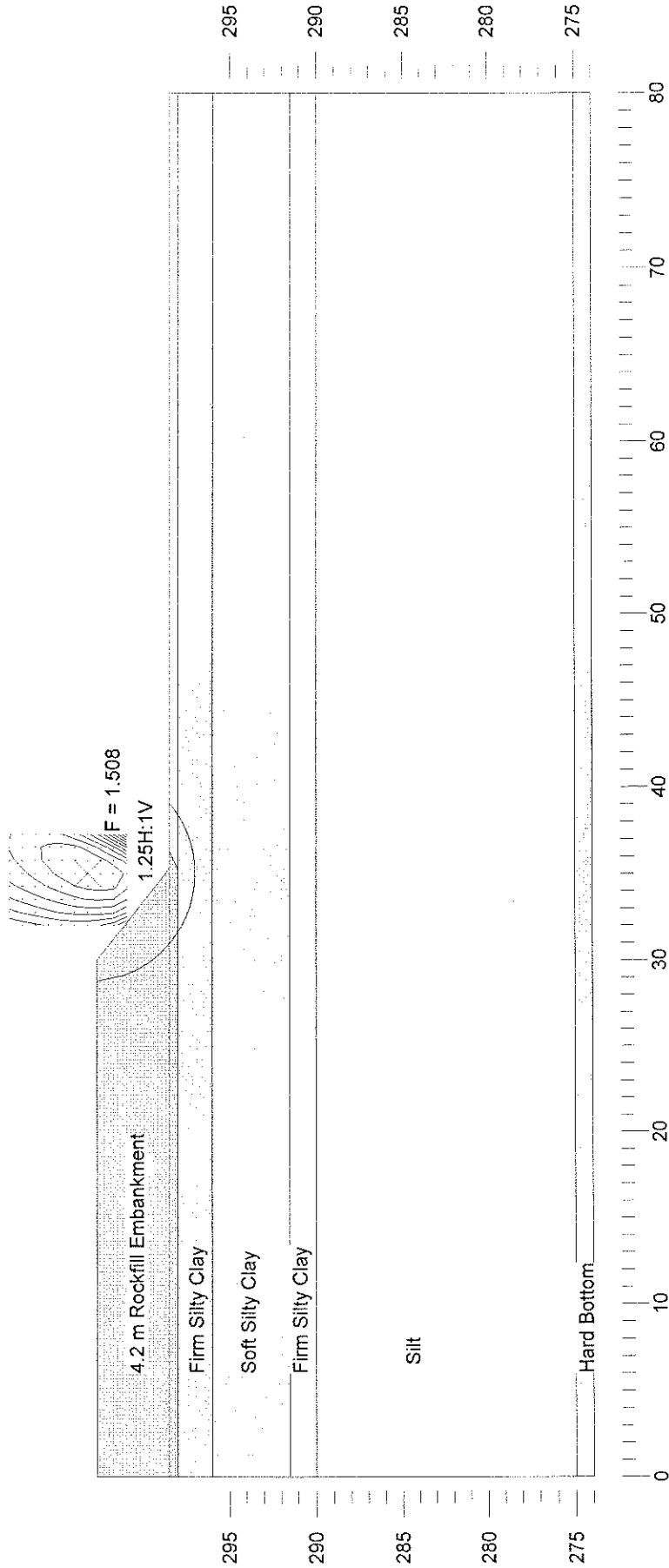
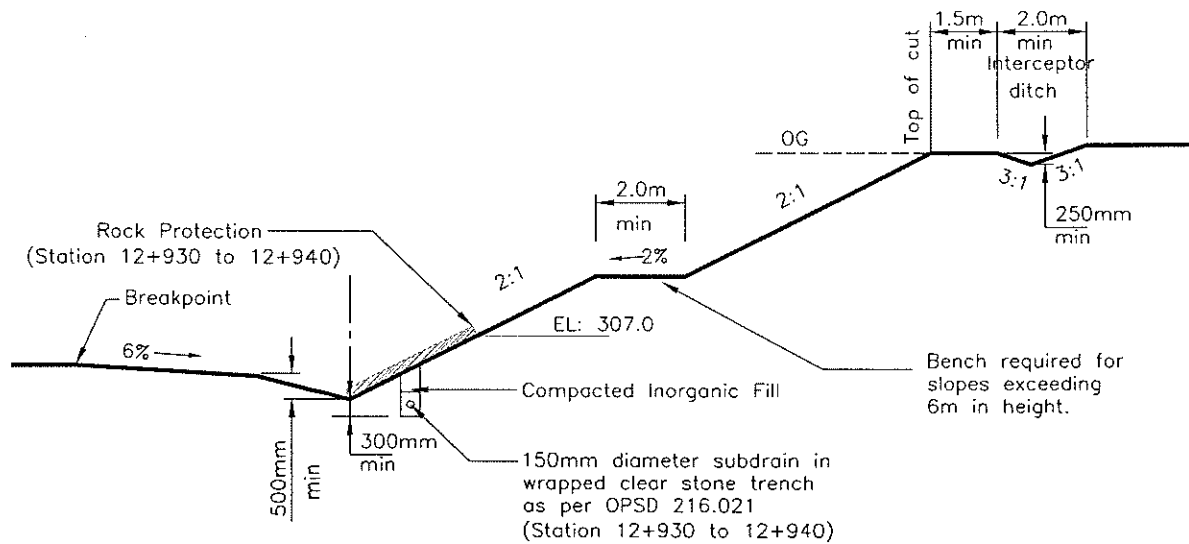
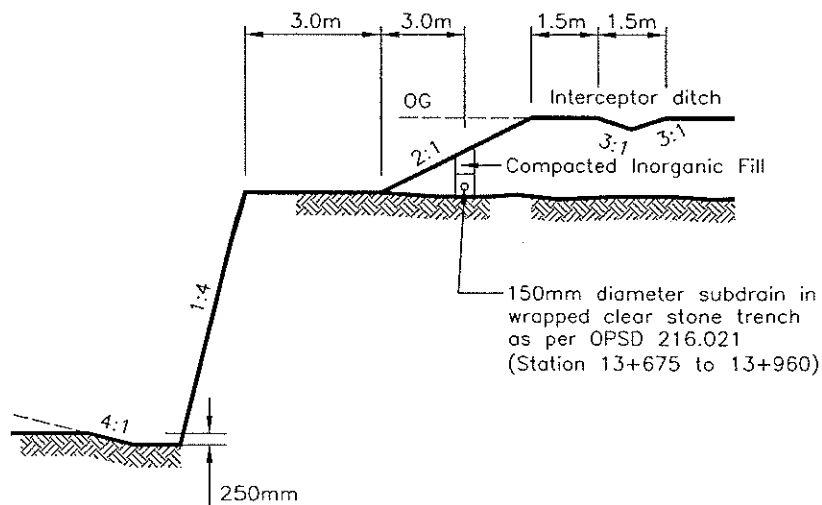


Fig. A19



EARTH CUT SECTION



ROCK CUT SECTION

Reference: OPSD 200.020 and 201.020

Marshall Macklin Monaghan

TYPICAL CUT SLOPE SECTIONS



THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

ENGINEER:	DRAWN:	APPROVED:
MRA	HS	
DATE:	SCALE:	DRAWING No.
APRIL 05, 2005	NTS	FIG A20

19-1423-16

HWY 11, KATRINE

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix B

Highway 592, Station 9+630 to 9+960

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT 'N' VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$


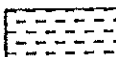



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value -- refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test -- Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION		SYMBOLS	
Fresh (FR)	No visible signs of weathering.		
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

TERMS	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.



RECORD OF BOREHOLE No 592 9+641 R3

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+641, O/S 3R ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 09.07.04 - 09.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
0.0	SAND, trace silt, trace topsoil, occasional rootlets Compact Dark Brown Dry		1	SS	20									
0.8	END OF BOREHOLE AT 0.76 m. AUGER REFUSAL AT 0.76 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 0.76 m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE.													

ONTMT4 2316.GPJ 25/01/05

RECORD OF BOREHOLE No 592 9+655 L21

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+655, O/S 21L ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 09.07.04 - 09.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE														
								● QUICK TRIAXIAL × LAB VANE														
						20	40	60	80	100	20	40	60				GR	SA	SI	CL		
0.0	SILT , trace sand, trace clay, trace gravel, occasional rootlets and organics Dark Brown SAND , fine grained, trace silt, trace to some iron oxide staining Dense Brown Dry to Moist		1	SS	10																	
0.3																						
			2	SS	30																	
1.4																						
			3	SS	37																	
	SAND , fine to medium grained, trace gravel, trace silt Dense Brown Dry to Moist																					
			4	SS	31																	
			5	SS	31																	
4.0	SAND and GRAVEL , occasional cobbles or boulders, trace silt Dense Brown Dry to Moist																					
			6	SS	49																	
5.2	END OF BOREHOLE AT 5.18 m. AUGER REFUSAL AT 5.18 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN TO 5.18 m AND DRY UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																					

+³, ×³: Numbers refer to Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+660 R27

1 OF 1

METRIC

W.P. 460-93-00 LOCATION Hwy 592, ST. 9+660, O/S 27R ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 09.07.04 - 09.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60					
2.1	END OF DCPT AT 2.13 m ON PROBABLE BEDROCK OR BOULDER.												

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+³ ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+680 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+680, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 10.07.04 - 10.07.04 CHECKED BY JL

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		
0.0	TOPSOIL, some rootlets													
0.2	SAND, mixed with topsoil Loose Dark Brown		1	SS	7									
0.6	SAND, fine to medium grained, trace silt Dense to Compact Brown Moist to Wet		2	SS	46									
			3	SS	26									
			4	SS	20									
			5	SS	27									0 92 8 (SI+CL)
			6	SS	26									
			7	SS	31									
			8	SS	23									
9.1	trace gravel Dense to Very Dense Dry to Moist		9	SS	39									8 83 9 (SI+CL)

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+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+680 CL

2 OF 2

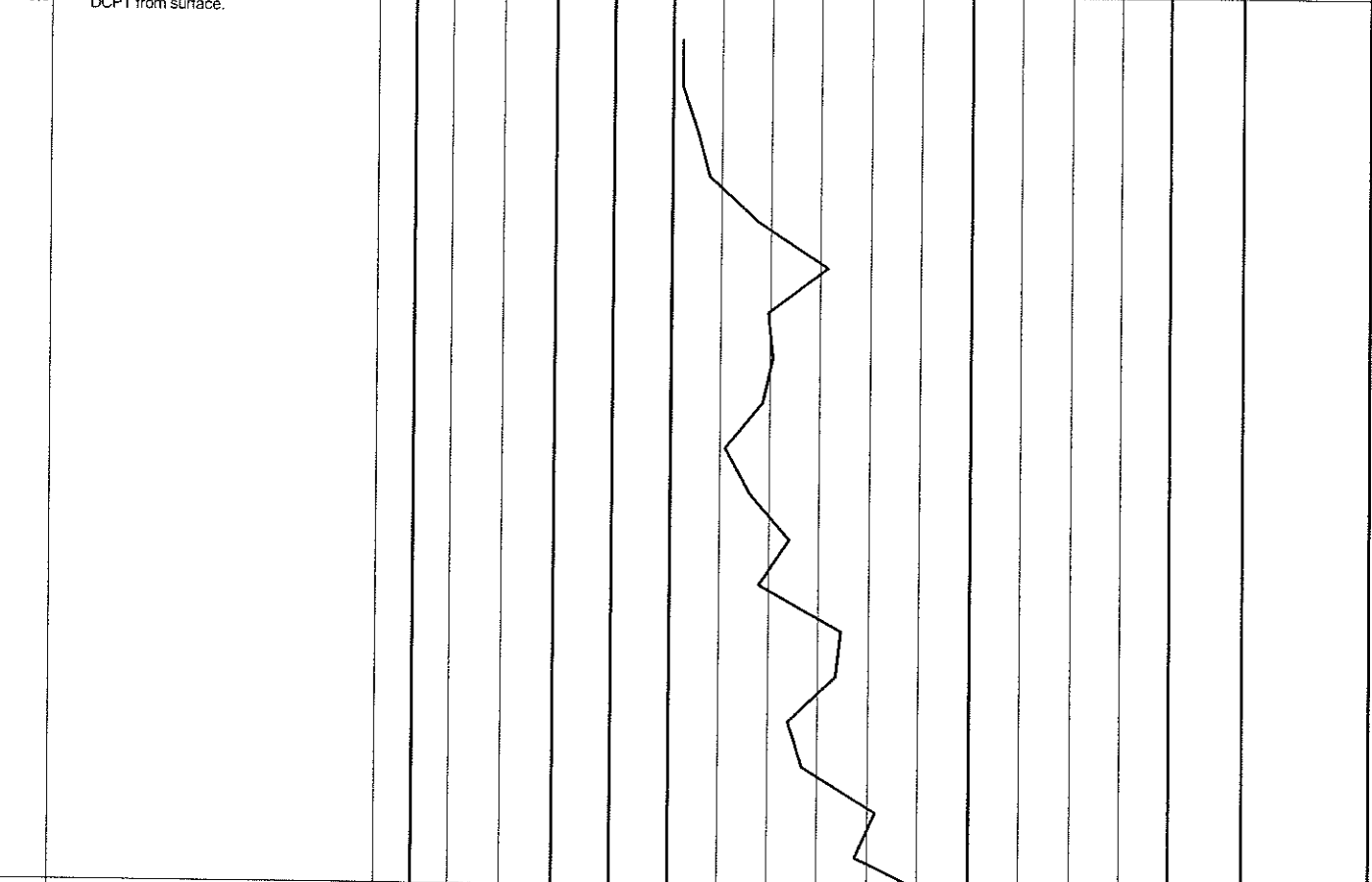
METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+680, CL ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 10.07.04 - 10.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L	WATER CONTENT (%)			
			10	SS	64									
12.2	END OF BOREHOLE AT 12.19 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH 16.07.04 (m) Dry		11	SS	40/.025									

METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P — W — W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa			
0.0	DEPTH from surface						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60 80 100 20 40 60			GR SA SI CL



6.0	END OF DCPT AT 5.99 m.
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RECORD OF BOREHOLE No 592 9+705 R31

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+705, Q/S 31R ORIGINATED BY GAWRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 09.07.04 - 09.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
							20	40	60	80	100									
0.0	TOPSOIL		1	SS	14												0 98 2 (SI+CL)			
0.1	SAND, fine to medium grained, trace silt Compact to Dense Brown Moist to Dry		2	SS	24															
			3	SS	30															
			4	SS	19															
			5	SS	21															
			6	SS	14															
			7	SS	25															
			8	SS	25															
		9	SS	32												0 93 7 (SI+CL)				

Continued Next Page

+ 3 . × 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+705 R31

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+705, O/S 31R ORIGINATED BY GAWRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 09.07.04 - 09.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Becoming Very Dense		10	SS	72/ 225									
11.0	END OF BOREHOLE AT 11.05 m. BOREHOLE BACKFILLED WITH QUICK GEL AND BENTONITE GROUT TO SURFACE.													

RECORD OF BOREHOLE No 592 9+730 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+730, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 10.07.04 - 10.07.04 CHECKED BY MA


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W P	W	W L		
0.0	TOPSOIL, some rootlets							20 40 60 80 100						
0.2	SAND, mixed with topsoil		1	SS	4			20 40 60 80 100						
0.6	Silty SAND, fine grained Dense to Compact Brown Wet		2	SS	34									
			3	SS	25									0 71 29 (SI+CL)
			4	SS	16									
			5	SS	22									
4.6	Silty SAND, some clay Loose Brown Wet		6	SS	5									0 65 23 11
5.3	Silty CLAY, trace sand Stiff to Very Stiff Brown Wet		7	SS	11									
			8	SS	23									0 3 70 27
9.0	SAND, fine grained, trace silt, trace gravel Dense to Very Dense Grey Dry to Moist		9	SS	37									

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES		SHEAR STRENGTH kPa	WATER CONTENT (%)		
							20 40 60 80 100  ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	W _p ————— W ————— W _L 20 40 60				

[illegible][illegible]

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+³, ×³: Numbers refer to Sensitivity

METRIC

[illegible]

Depth	Description	Soil Type	Moisture Content (%)
0.0	TOPSOIL, some rootlets		
0.2	SAND, mixed with organics Brown	1 SS 4	0
0.6	SAND, fine grained, trace silt Dense to Compact Brown Moist	2 SS 32 3 SS 20	0 0
2.3	Sandy SILT, trace clay Compact Grey Moist to Wet	4 SS 19 5 SS 11 6 SS 12	0 0 0
6.1	Clayey SILT, some sand Stiff to Firm Grey Wet	7 SS 12 8 SS 6 9 SS 7	0 0 0

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+755 L28

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+755, O/S 28L ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
DATUM Geodetic DATE 11.07.04 - 11.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W P W W L	20 40 60			
10.7	Silty CLAY, trace sand Firm to Stiff Grey Wet		10	SS	6									
			11	SS	9									0 3 62 35
14.0	END OF BOREHOLE AT 14.02 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 16.07.04 5.95													

RECORD OF BOREHOLE No 592 9+755 R27

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+755, O/S 27R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 11.07.04 - 11.07.04 CHECKED BY JL

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								
0.0	DCPT from surface.							20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60			kN/m ³	GR SA SI CL

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity


20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+755 R27

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+755, O/S 27R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 11.07.04 - 11.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100	20 40 60				kN/m ³	GR SA SI CL
														
10.7	END OF DCPT AT 10.67 m.													

+³, ×³: Numbers refer to
Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+780 R3

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+780, O/S 3R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 11.07.04 - 11.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
0.0	TOPSOIL, some rootlets						20	40	60	80	100									
0.1	SAND mixed with topsoil Loose Dark Brown		1	SS	6															
0.6	SAND, fine grained, trace silt Compact Brown Moist		2	SS	20															
			3	SS	24															
			4	SS	17												0 92 8 (SI+CL)			
			5	SS	13															
4.6	Sandy SILT, trace clay Dense to Compact Brown-Grey Moist		6	SS	36															
			7	SS	15												0 26 70 4			
			8	SS	11															
9.1	Silty CLAY, trace to some sand Firm to Stiff Grey Wet																			
			9	SS	6															

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+780 R3

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+780, O/S 3R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 11.07.04 - 11.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) 20 40 60 W _p W W _L				
			10	SS	12											0 11 55 33	
			11	SS	15												
12.8	END OF BOREHOLE AT 12.80 m. BOREHOLE GROUTED TO SURFACE.																

RECORD OF BOREHOLE No 592 9+805 L25

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+805, O/S 25L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA Si CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W P	W	W L	WATER CONTENT (%)		
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
9.1	END OF DCPT AT 9.14 m.													

ONTMT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 592 9+805 R26

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+805, O/S 26R ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 12.07.04 - 12.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _P	W	W _L			

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+805 R26

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+805, O/S 26R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 12.07.04 - 12.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 16.07.04 4.22															

RECORD OF BOREHOLE No 592 9+830 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+830, CL ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 12.07.04 - 12.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa													
								20 40 60 80 100													
								20 40 60 80 100													
							WATER CONTENT (%)														
							20 40 60 80 100					20 40 60									
0.0	TOPSOIL, some rootlets																				
0.1	SAND, mixed with topsoil Loose Dark Brown		1	SS	5																
0.6	SAND, fine grained, trace silt Compact Brown Moist to Wet		2	SS	18																
			3	SS	30																
1.8	Silty CLAY, trace sand Hard to Very Stiff Brown Moist to Wet																				
			4	SS	19																
			5	SS	16																
			6	SS	17																
			7	SS	19																
6.4	SAND, fine grained, trace silt Compact to Dense Brown Dry to Moist																				
			8	SS	18																
			9	SS	21																

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+830 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+830, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 12.07.04 - 12.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
			10	SS	37								
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE BACKFILLED WITH QUICK GEL AND BENTONITE GROUT TO SURFACE.												

RECORD OF BOREHOLE No 592 9+855 L25

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+855, O/S 25L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL × LAB VANE									
					20 40 60 80 100					20 40 60							
0.0	TOPSOIL, some rootlets																
0.1	SAND, mixed with topsoil Loose		1	SS	6												
0.5	Dark Brown																
	SILT, some clay, trace sand																
	Compact																
	Grey																
	Moist to Wet		2	SS	26												
			3	SS	19											0 3 86 11	
			4	SS	12												
2.9	SAND, fine to medium grained, trace silt Dense to Compact Brown Dry																
			5	SS	39												
			6	SS	35												
			7	SS	25											0 97 3 (SI+CL)	
			8	SS	17												
			9	SS	36												
9.8	END OF BOREHOLE AT 9.75 m.																

Continued Next Page

+ ³/₁₀ × ³/₁₀: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+855 L25

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+855, O/S 25L ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)			
	BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.													

RECORD OF BOREHOLE No 592 9+855 R25

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+855, O/S 25R ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
0.0	DCPT from surface.												
7.6	END OF DCPT AT 7.62 m.												

ONTMT4 2316.GPJ 03/02/05

RECORD OF BOREHOLE No 592 9+880 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+880, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
0.0	TOPSOIL, some rootlets							20	40	60	80	100										
0.1	SAND, mixed with topsoil Loose Dark Brown		1	SS	6																	
0.6	SILT and SAND, fine grained Compact Brown Moist to Wet		2	SS	23																	
1.4	SILT, some clay, trace sand Compact Brown Moist to Wet		3	SS	22																	
		4	SS	14																		
3.0	Silty CLAY, trace sand Stiff Brown Wet		5	SS	11												0 1 70 29					
4.6	SILT, trace sand, trace clay Compact Brown Wet		6	SS	23													0 10 85 5				
6.1	SAND, fine grained, trace silt Compact to Dense Brown Dry to Moist		7	SS	27																	
		8	SS	25														0 96 4 (SI+CL)				
			9	SS	41																	
9.8	END OF BOREHOLE AT 9.75 m.																					

Continued Next Page

+ 3, x 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+880 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+880, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 13.07.04 - 13.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH 16.07.04 (m) Dry																

ONTMT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 592 9+905 L28.5 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+905, O/S 28L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 14.07.04 - 14.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		WATER CONTENT (%)			UNIT WEIGHT Y 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	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W		
0.0	DCPT from surface.												
9.1	END OF DCPT AT 9.14 m.												

ONTM14 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 592 9+905 R25

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+905, O/S 25R ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 14.07.04 - 14.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20	40	60	80	100								
								○ UNCONFINED + FIELD VANE												
								● QUICK TRIAXIAL × LAB VANE												
								20	40	60	80	100	20	40	60	kN/m ³	GR SA SI CL			
0.0	TOPSOIL, some rootlets																			
0.2	SAND, mixed with topsoil		1	SS	4									○						
0.6	SAND, some silt Compact to Loose Brown Moist to Wet		2	SS	15									○						
			3	SS	9									○						
			4	SS	18									○						
2.2	Silty CLAY, trace sand Very Stiff to Stiff Brown Moist to Wet		5	SS	14									14			0 2 75 24			
			6	SS	11									○						
			7	SS	21									○						
5.2	SAND, fine grained, some silt Compact Brown Dry to Moist		8	SS	25									○			0 81 19 (SI+CL)			
			9	SS	29									○						
9.8	END OF BOREHOLE AT 9.75 m.																			

Continued Next Page

+³ × 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+905 R25

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+905, O/S 25R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 14.07.04 - 14.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100	20 40 60 80 100	W _p W W _L	20 40 60		
	BOREHOLE GROUTED TO SURFACE.												

RECORD OF BOREHOLE No 592 9+930 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+930, O/S CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 14.07.04 - 14.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE														
							20	40	60	80	100	20	40	60		GR	SA	SI	CL			
0.0	TOPSOIL, some rootlets																					
0.1	SAND, mixed with topsoil Loose Dark Brown		1	SS	7								○									
0.6	SILT, some clay, trace sand Compact Grey Wet		2	SS	24								○					0	2	87	12	
			3	SS	17									○								
2.8	SAND, fine grained, trace silt Compact to Dense Brown Dry to Moist		4	SS	27								○									
			5	SS	23									○					0	91	9	(SI+CL)
			6	SS	18									○								
			7	SS	53/ 225									○								
	8	SS	22									○						0	97	3	(SI+CL)	
			9	SS	36							○										

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+930 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+930, O/S CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 14.07.04 - 14.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
			10	SS	42												
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.																

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+955 L30

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+955, O/S 30L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY JL

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						
								SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
							WATER CONTENT (%)							
							20 40 60							

0.0	TOPSOIL, some rootlets													
0.1	Silty SAND, mixed with topsoil Very Loose Dark Brown		1	SS	3									
0.8	SILT, trace sand, trace clay Compact Brown Moist to Wet		2	SS	29									
			3	SS	24									0 9 86 3
2.1	SAND, fine to medium grained, trace silt Compact to Dense Brown Moist		4	SS	19									
			5	SS	12									0 97 3 (SI+CL)
			6	SS	20									
			7	SS	41									
			8	SS	38									
			9	SS	23									

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 9+955 L30

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+955, O/S 30L ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
			10	SS	44												0 91 9 (SI+CL)
			11	SS	45												
12.8	END OF BOREHOLE AT 12.80 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 16.07.04 12.60																

RECORD OF BOREHOLE No 592 9+955 R32

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592, ST. 9+955, O/S 32R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY JL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60					
2.4	END OF DCPT AT 2.44 m ON PROBABLE BEDROCK OR BOULDER.												

RECORD OF BOREHOLE No 394-5

1 OF 2

METRIC

W.P. 5404-04-01 LOCATION N 5 046 316.5 E 317 057.9, Hwy 592/Sunset Pass ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.10.04 - 19.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
321.0	TOPSOIL (50 mm)						321							
320.9	Sandy SILT, occasional rootlets		1	SS	6									
0.1	Loose to Compact													
	Brown													
	Dry													
			2	SS	11		320							
	some sand													
			3	SS	26									
318.7							319							0 16 79 5
2.3	SAND, fine to medium grained, trace silt		4	SS	24									
	Compact													
	Grey to Brown													
	Dry													
			5	SS	24		318							0 98 2 (SI+CL)
							317							
316.4														
4.6	SAND, fine to coarse grained, trace gravel, occasional cobbles		6	SS	26		316							
	Compact to Dense													
	Brown													
	Dry													
							315							
			7	SS	29									
							314							
			8	SS	45		313							
							312							
			9	SS	66									5 90 5 (SI+CL)

Continued Next Page

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 394-5

2 OF 2

METRIC

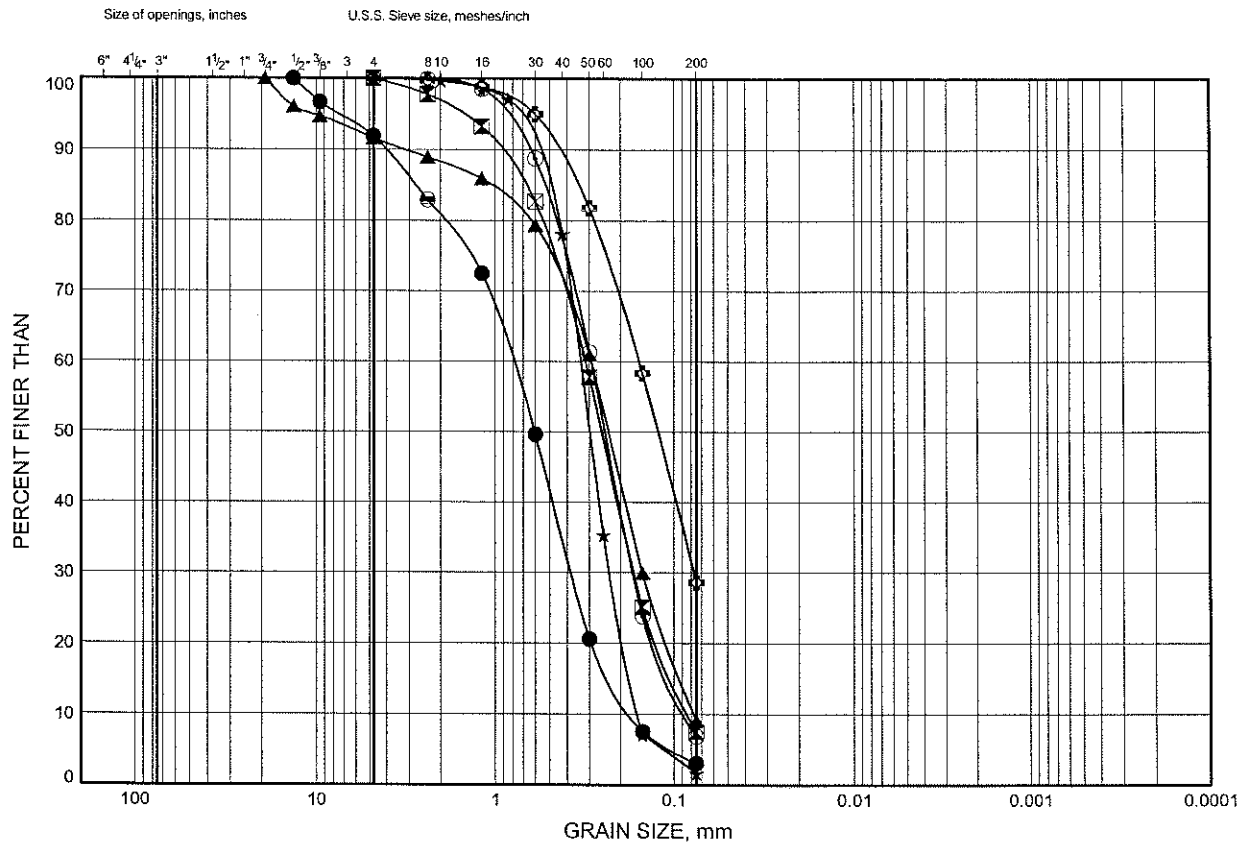
W.P. 5404-04-01 LOCATION N 5 046 316.5 E 317 057.9, Hwy 592/Sunset Pass ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.10.04 - 19.10.04 CHECKED BY MA

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		
310.3							311							
10.7	SAND, fine grained, trace silt		10	SS	47									
309.9	Dense													
	Brown													
11.1	Dry						310							
	END OF BOREHOLE AT 11.13 m.													
	BOREHOLE GROUTED TO													
	SURFACE.													

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE B1

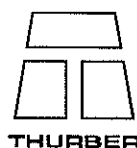
SAND to Silty SAND



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+655 L21	1.83	
⊠	592 9+680 CL	3.35	
▲	592 9+680 CL	9.45	
★	592 9+705 R31	2.59	
⊙	592 9+705 R31	7.92	
⊛	592 9+730 CL	1.83	

Date January 2005

Project 5404-04-01



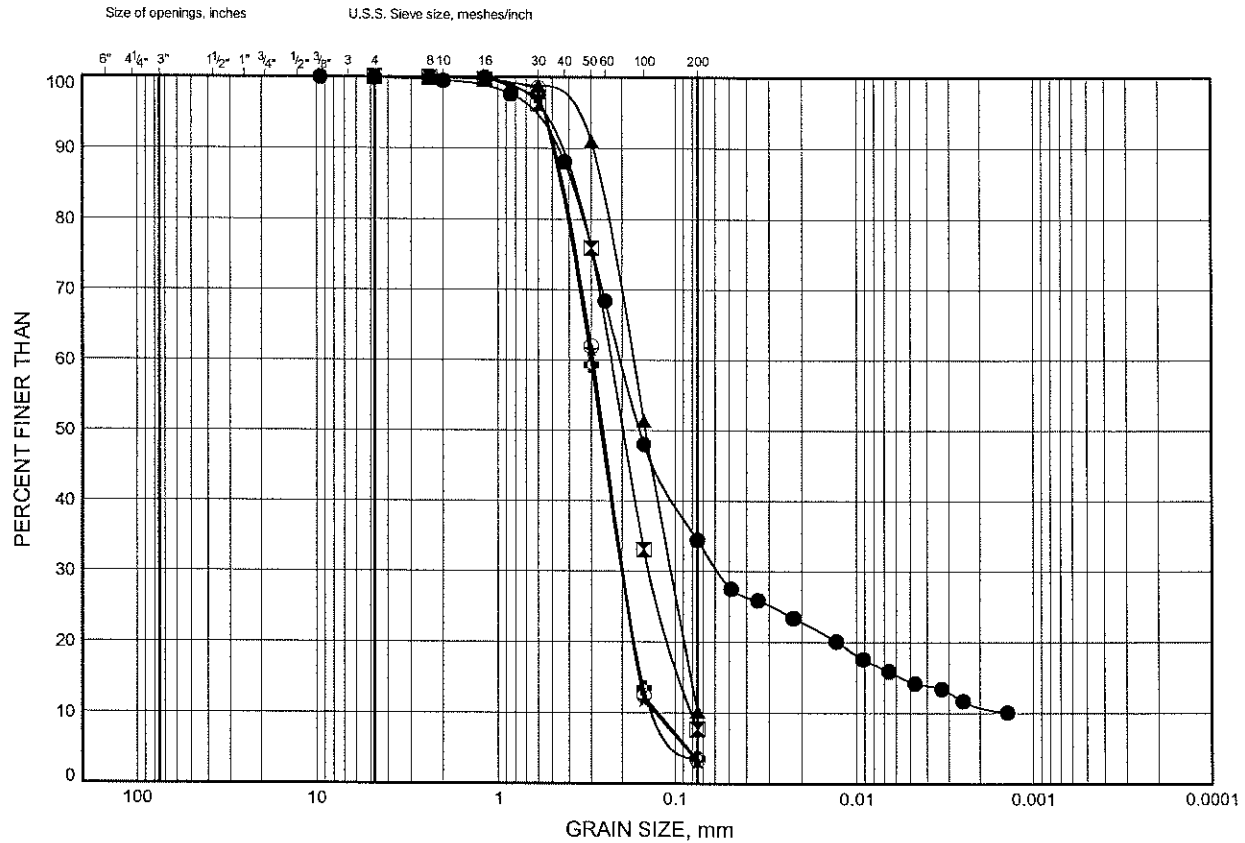
Prep'd WM

Chkd. MA

Hwy 11 Katrina GRAIN SIZE DISTRIBUTION

FIGURE B2

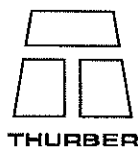
SAND to Silty SAND



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+730 CL	4.88	
⊠	592 9+780 R3	2.59	
▲	592 9+805 R26	1.83	
★	592 9+830 CL	7.92	
⊙	592 9+855 L25	6.40	
⊛	592 9+880 CL	7.92	

Date January 2005
Project 5404-04-01

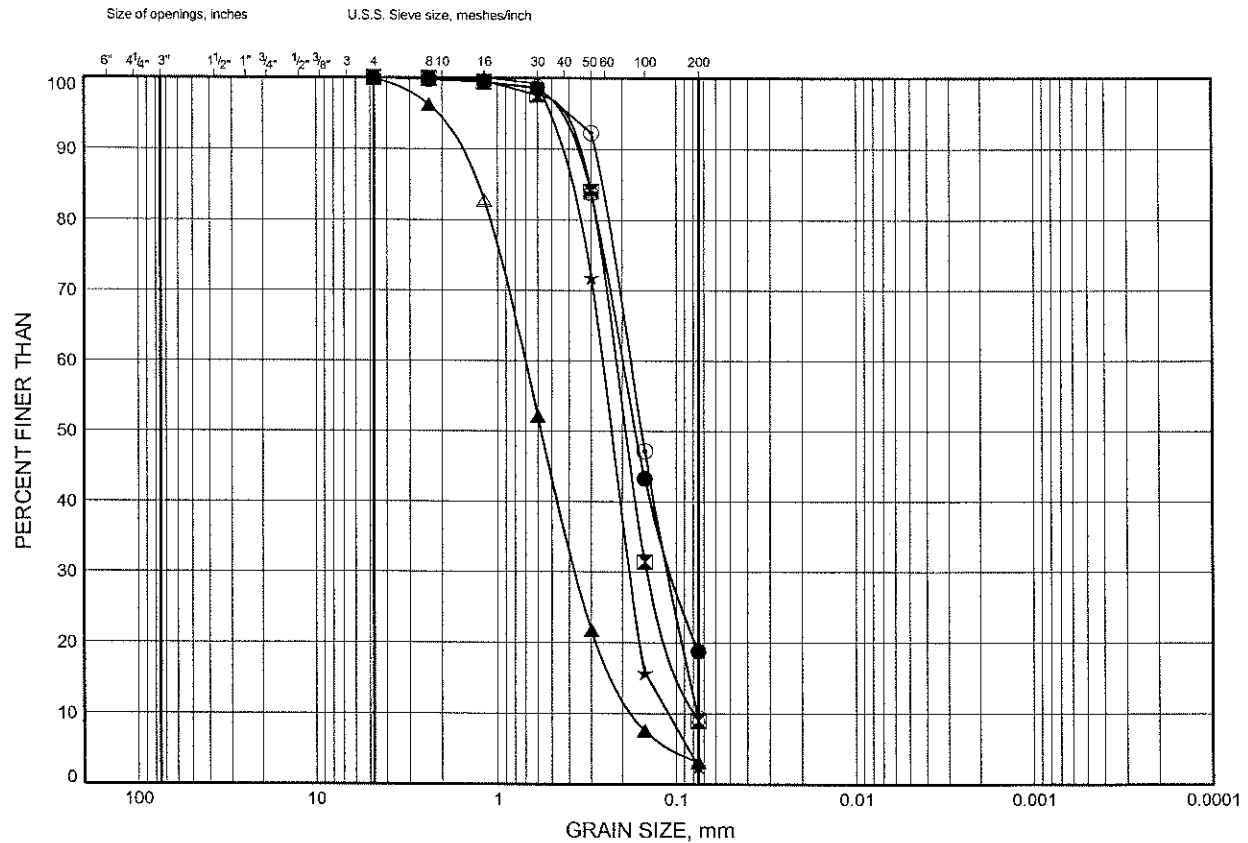


Prep'd WM
Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE B3

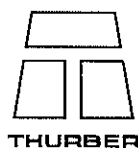
SAND to Silty SAND



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+905 R25	7.92	
⊠	592 9+930 CL	3.35	
▲	592 9+930 CL	7.92	
★	592 9+955 L30	3.35	
⊙	592 9+955 L30	10.97	

Date January 2005
Project 5404-04-01

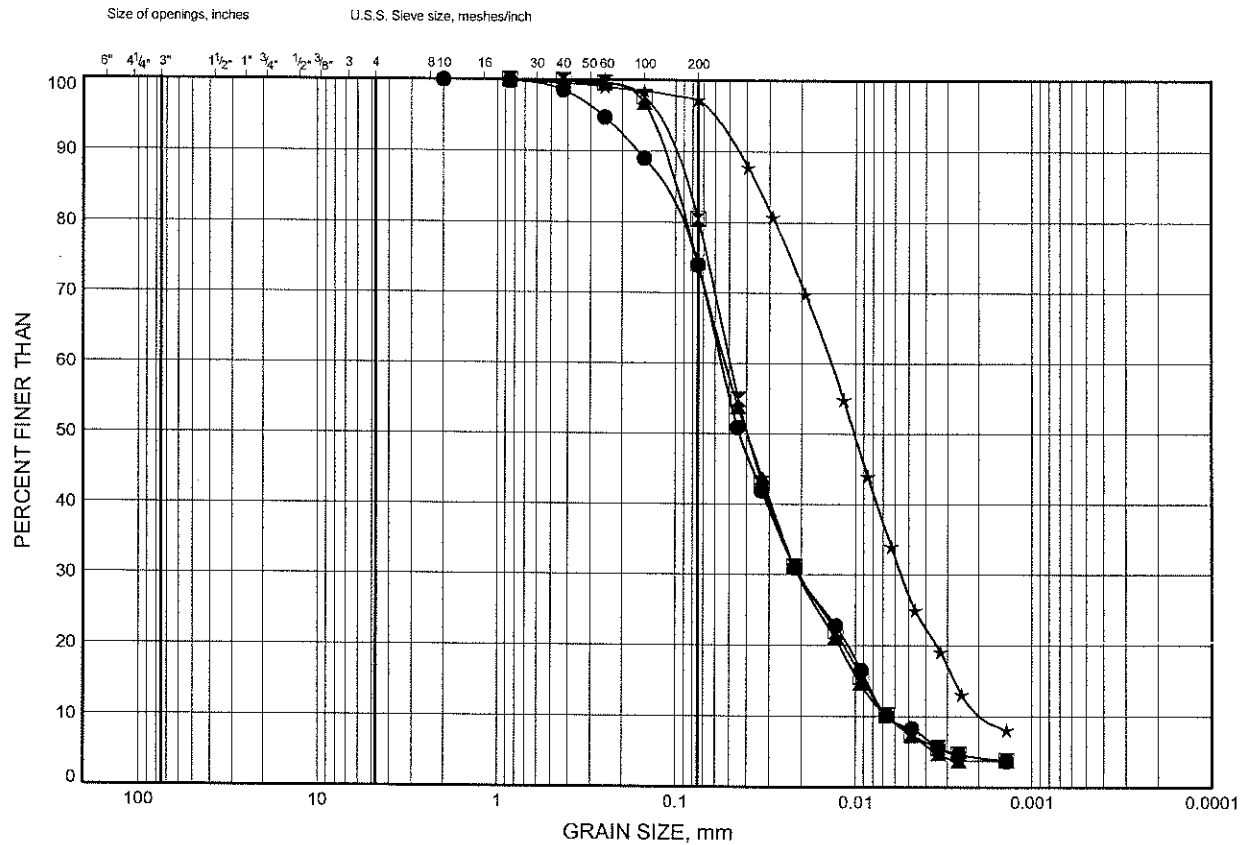


Prep'd WM
Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE B4

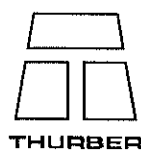
SILT to Sandy SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+755 L28	2.59	
⊠	592 9+755 L28	4.88	
▲	592 9+780 R3	6.40	
★	592 9+855 L25	1.83	

Date January 2005
Project 5404-04-01

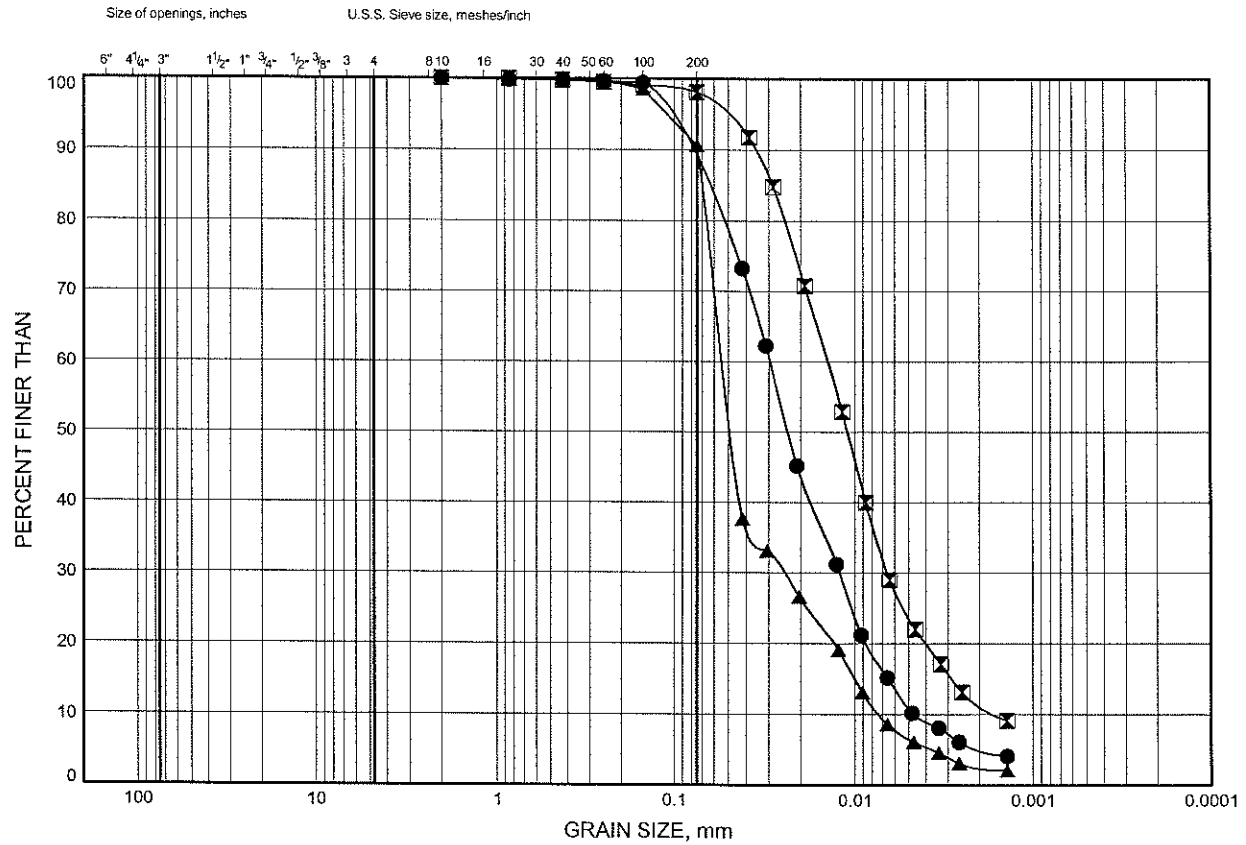


Prep'd WM
Chkd. MA

Hwy 11 Katrina GRAIN SIZE DISTRIBUTION

FIGURE B5

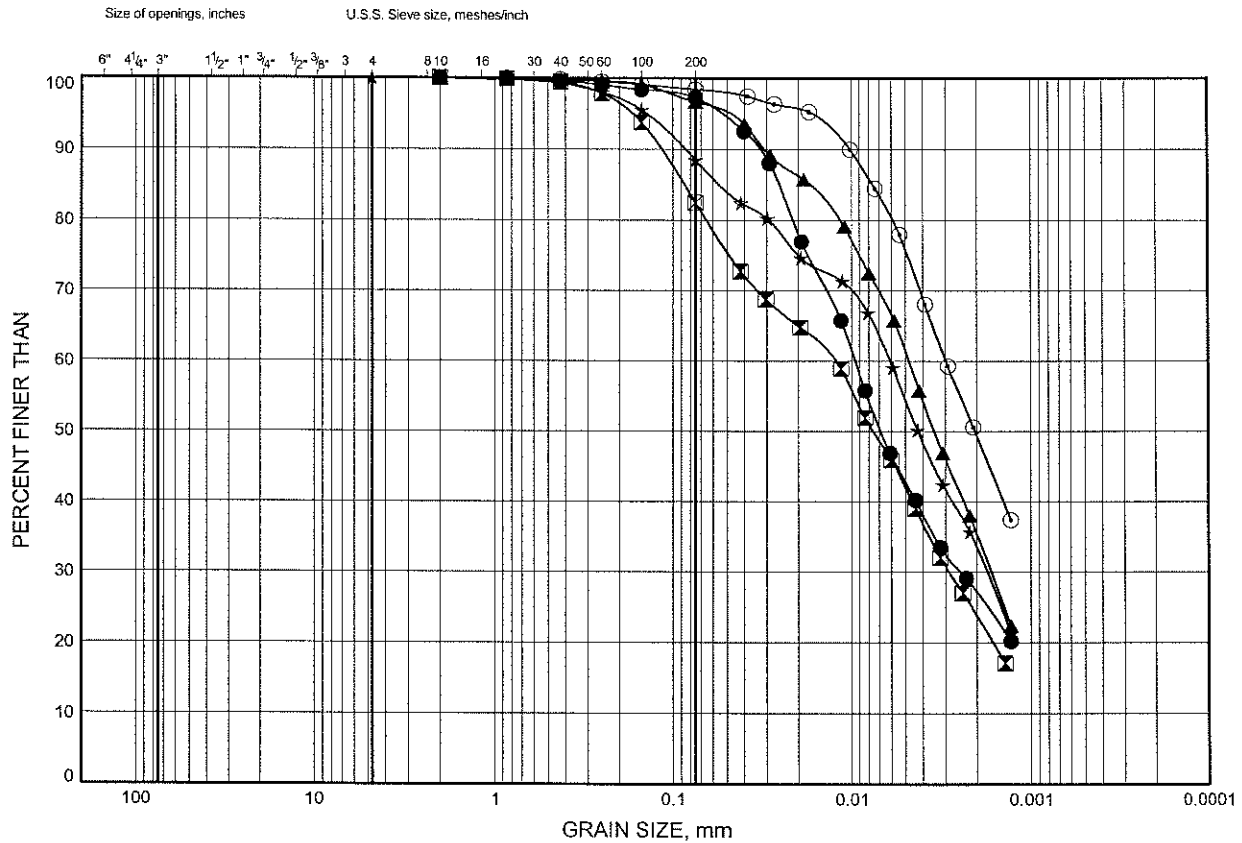
SILT to Sandy SILT



Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE B6

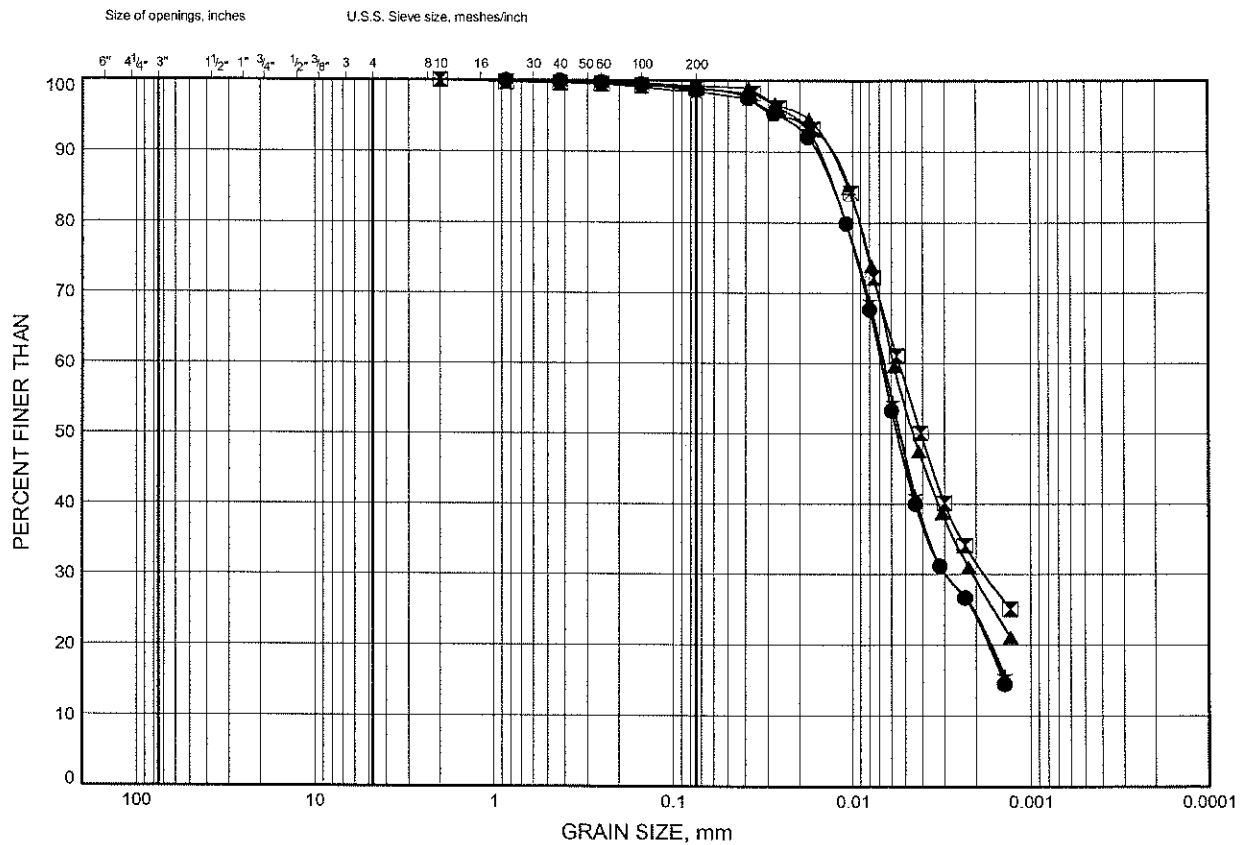
Silty CLAY to Clayey SILT



Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE B7

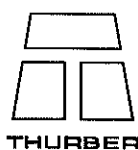
Silty CLAY to Clayey SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+805 R26	7.92	
☒	592 9+830 CL	3.35	
▲	592 9+880 CL	3.35	
★	592 9+905 R25	3.35	

Date January 2005

Project 5404-04-01

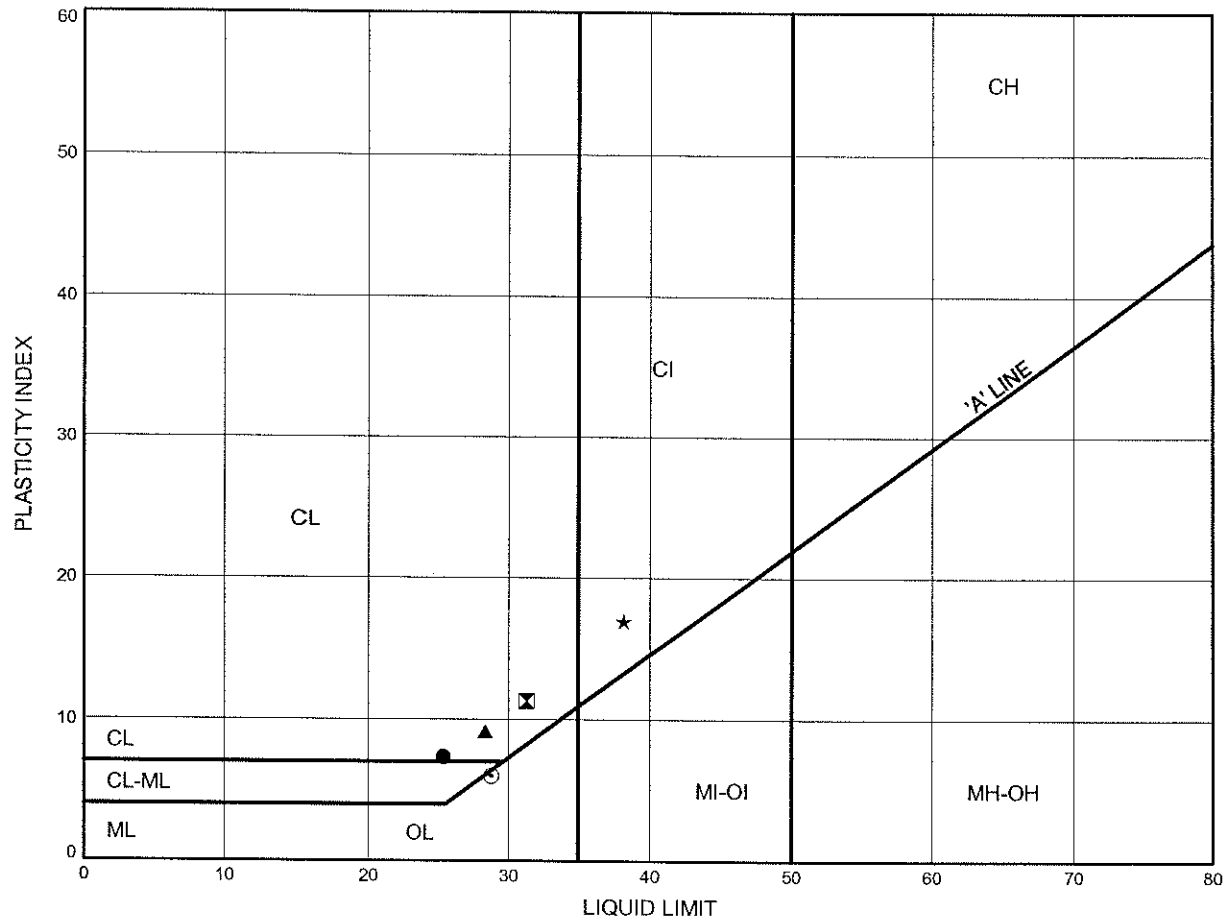


Prep'd WM

Chkd. MA

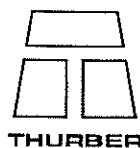
Hwy 11 Katrine
ATTERBERG LIMITS TEST RESULTS

FIGURE B8



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+730 CL	7.92	
⊠	592 9+755 L28	12.50	
▲	592 9+780 R3	10.97	
★	592 9+805 R26	4.88	
⊙	592 9+805 R26	7.92	

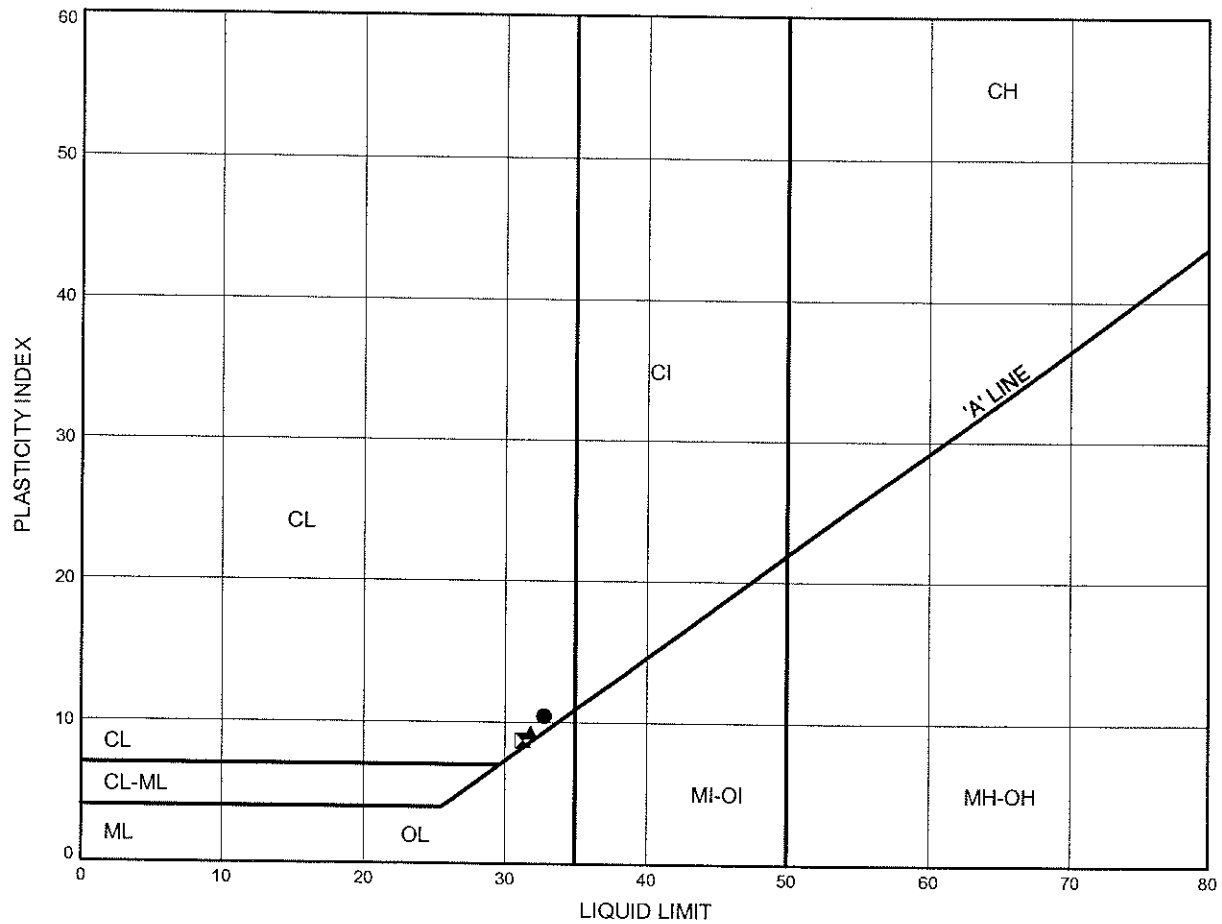
Date January 2005
 Project 5404-04-01



Prep'd WM
 Chkd. MA

Hwy 11 Katrine ATTERBERG LIMITS TEST RESULTS

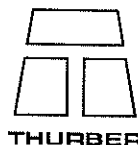
FIGURE B9



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 9+830 CL	3.35	
⊠	592 9+880 CL	3.35	
▲	592 9+905 R25	3.35	

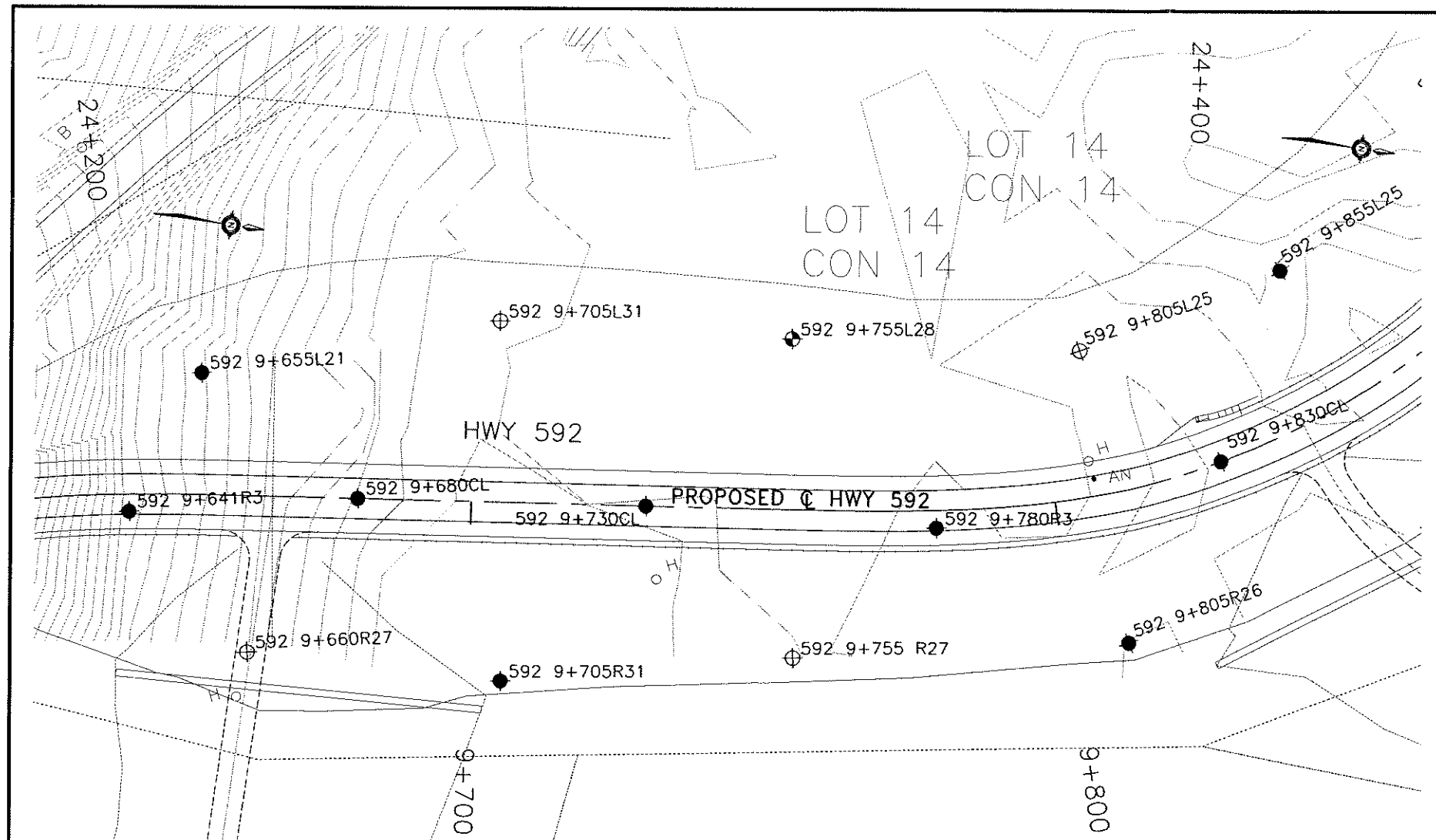
Date January 2005

Project 5404-04-01



Prep'd WM

Chkd. MA



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

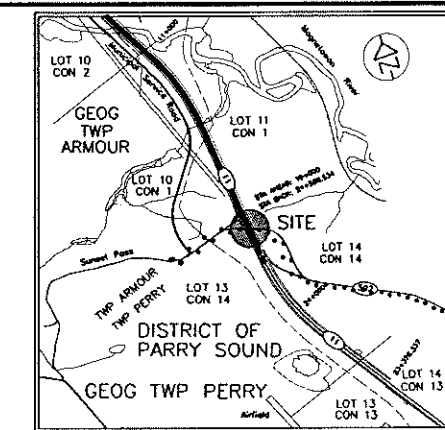
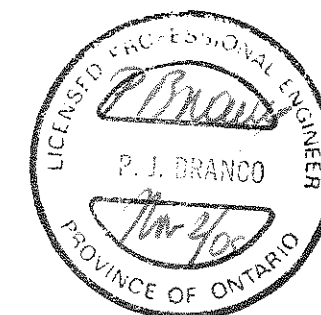
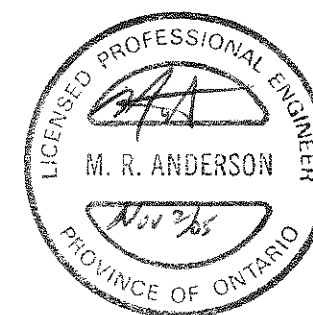
HWY 11
CONT No
WP No 480-93-00

HIGHWAY 592 REALIGNMENT
STATION 9+630 TO 9+960
CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.
THURBER

NO	STATION	OFFSET FROM CL
592 9+805 R26	9+805	R26
592 9+830 CL	9+830	CL
592 9+855 L25	9+855	L25
592 9+855 R25	9+855	R25
592 9+880 CL	9+880	CL
592 9+905 L28.5	9+905	L28.5
592 9+905 R25	9+905	R25
592 9+930 CL	9+930	CL
592 9+955 L30	9+955	L30
592 9+955 R32	9+955	R32



KEYPLAN
0 500m 1km

LEGEND

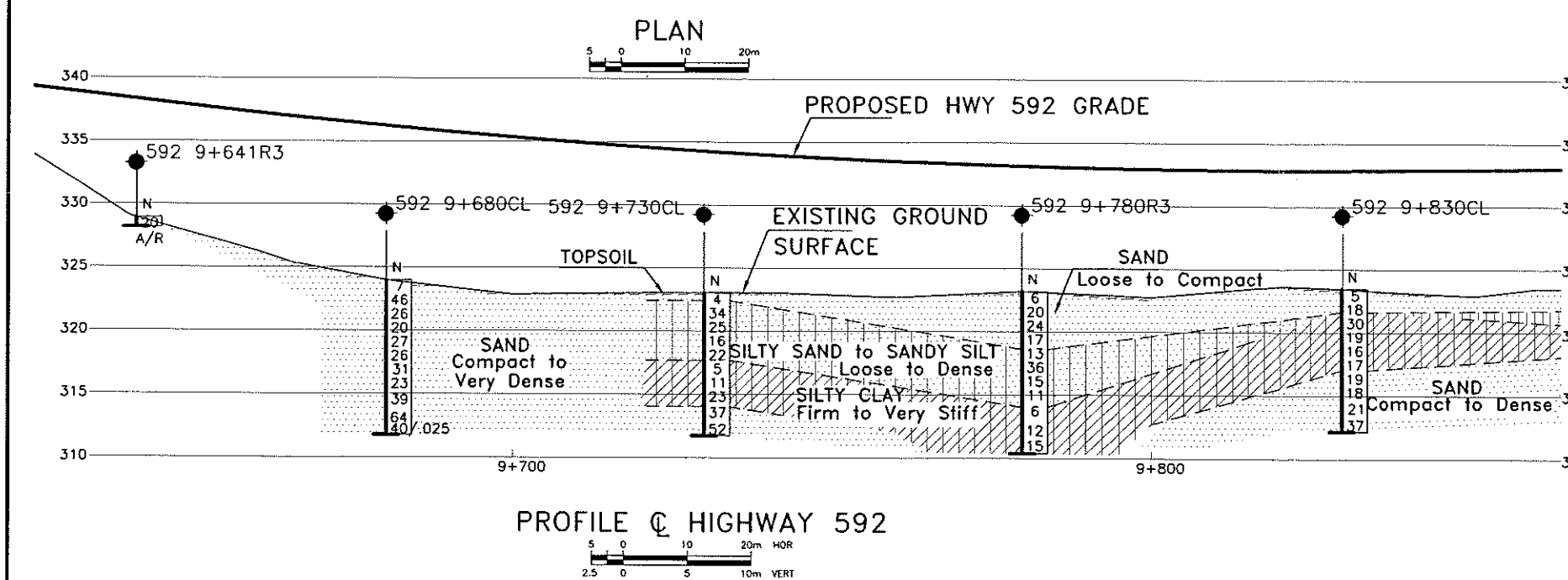
- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM CL
592 9+641 R3	9+641	R3
592 9+655 L21	9+655	L21
592 9+660 R27	9+660	R27
592 9+680 CL	9+680	CL
592 9+705 L31	9+705	L31
592 9+705 R31	9+705	R31
592 9+730 CL	9+730	CL
592 9+755 L28	9+755	L28
592 9+755 R27	9+755	R27
592 9+780 R3	9+780	R3
592 9+805 L25	9+805	L25

NOTE

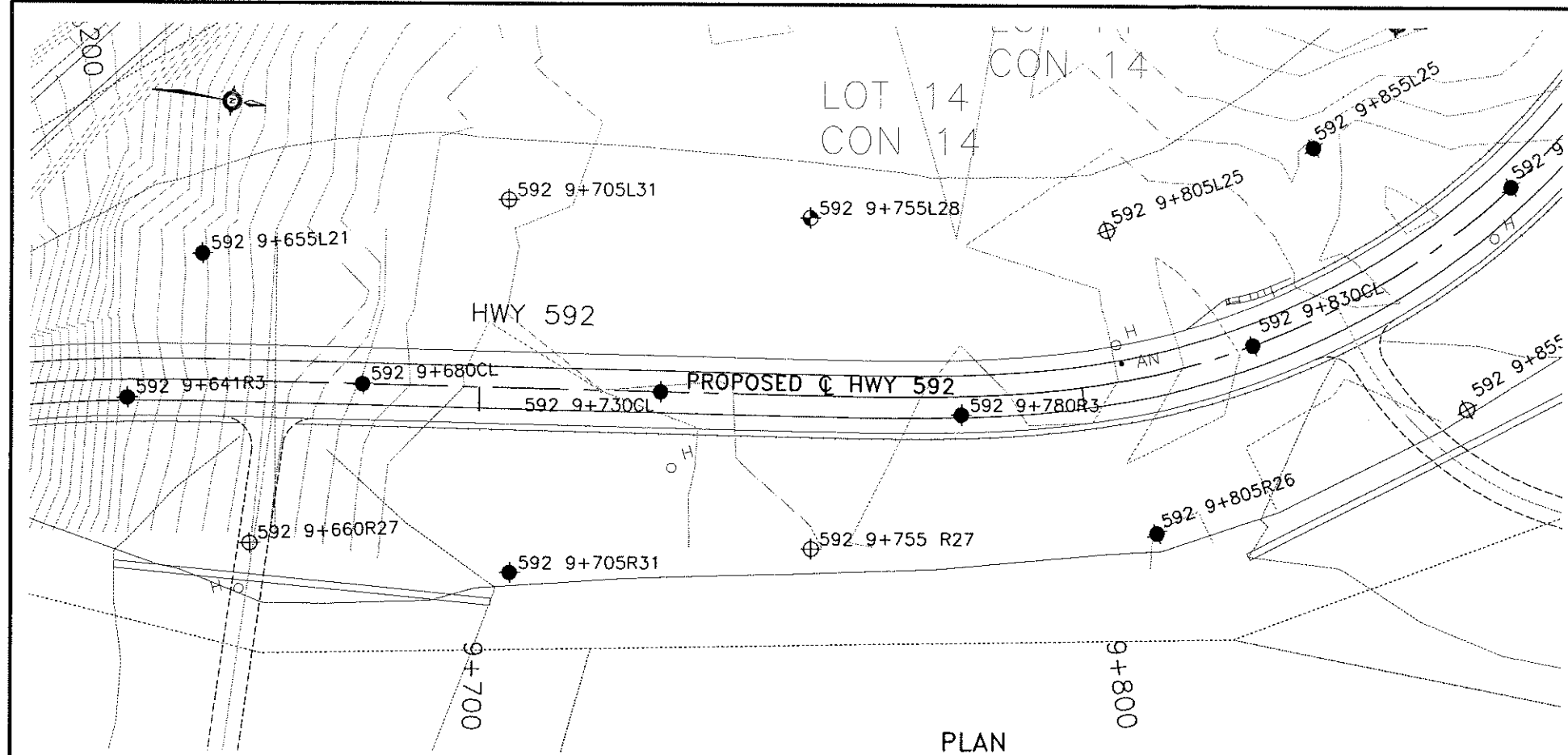
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

CONTINUED ON DRAWING B3



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW	
DATE	BY	DESCRIPTION	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT
			SCHEME
			DWG B1



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

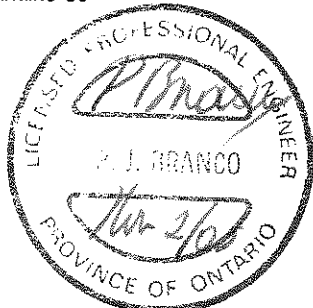
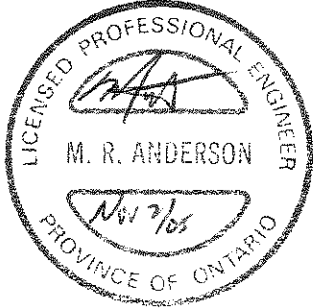
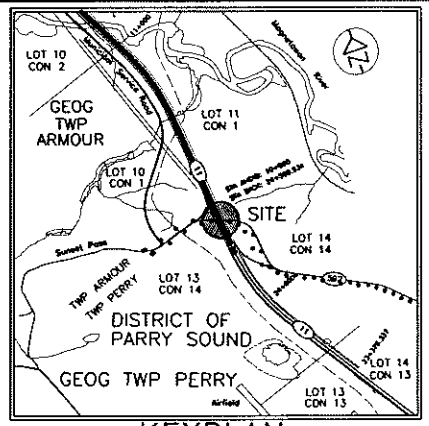
HWY 11
CONT No
WP No 480-93-00

HIGHWAY 592 REALIGNMENT
STATION 9+630 TO 9+960
RIGHT TOE AND LEFT TOE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.
THURBER

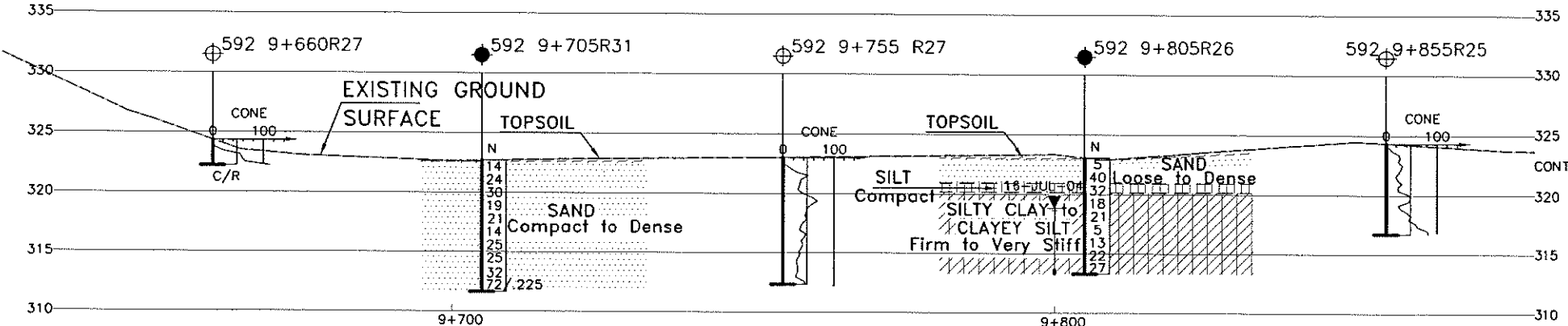
NO	STATION	OFFSET FROM CL
592 9+805 R26	9+805	R26
592 9+830 CL	9+830	CL
592 9+855 L25	9+855	L25
592 9+855 R25	9+855	R25
592 9+880 CL	9+880	CL
592 9+905 L28.5	9+905	L28.5
592 9+905 R25	9+905	R25
592 9+930 CL	9+930	CL
592 9+955 L30	9+955	L30
592 9+955 R32	9+955	R32



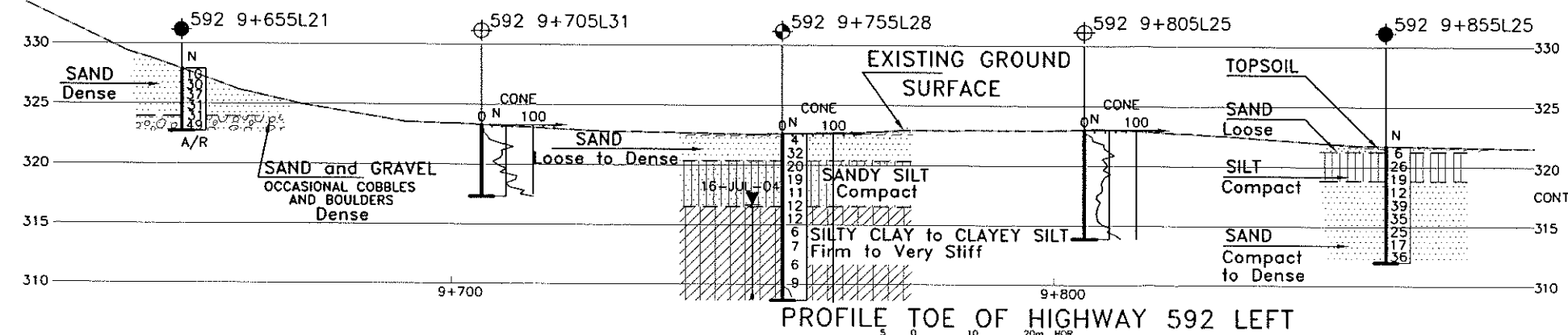
LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (cone) or Probe Hole
- Bore Hole & Cone
- Blows/0.3m (Std pen Test, 475J/blow)
- Blows/0.3m (60' Cone, 475J/blow)
- Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (ROD)
- A/R Auger Refusal
- C/R Cone Refusal

PROFILE TOE OF HIGHWAY 592 RIGHT

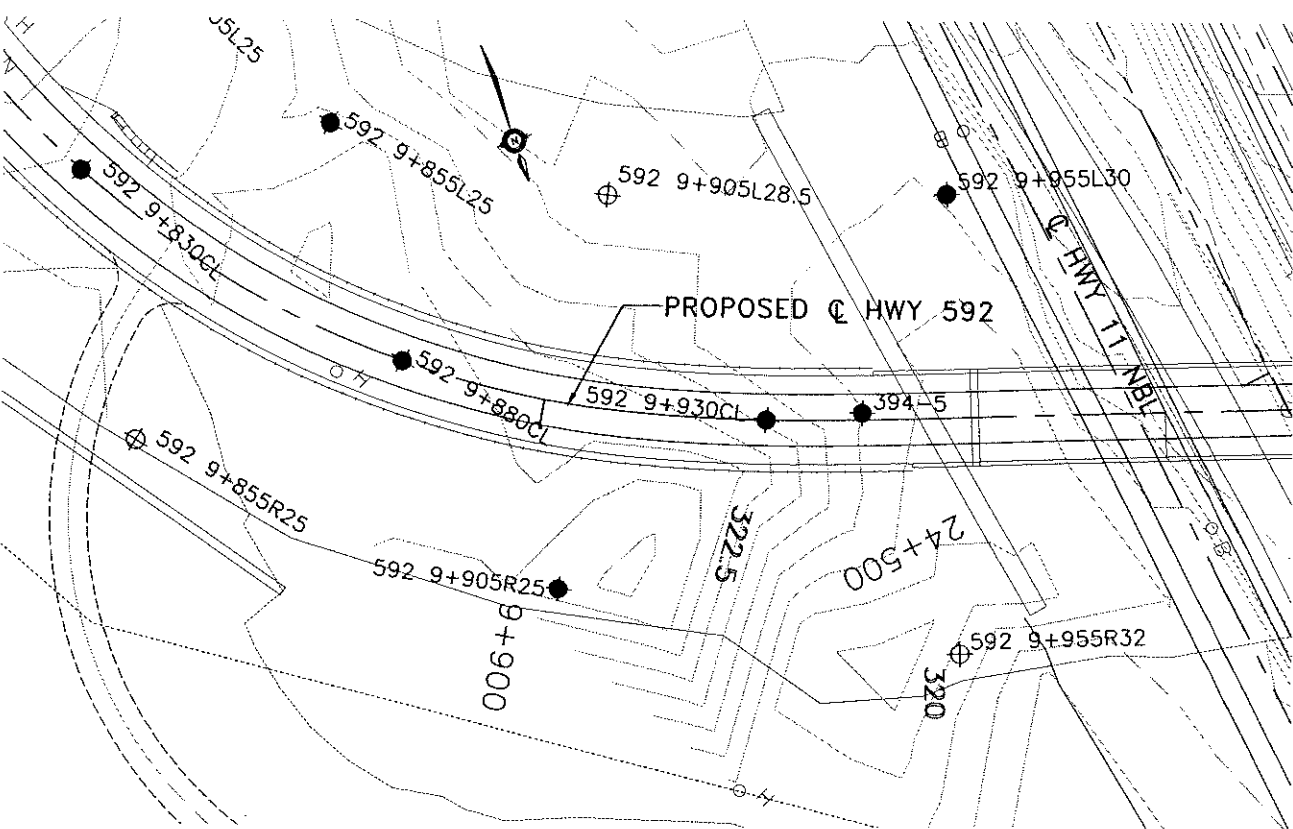


PROFILE TOE OF HIGHWAY 592 LEFT

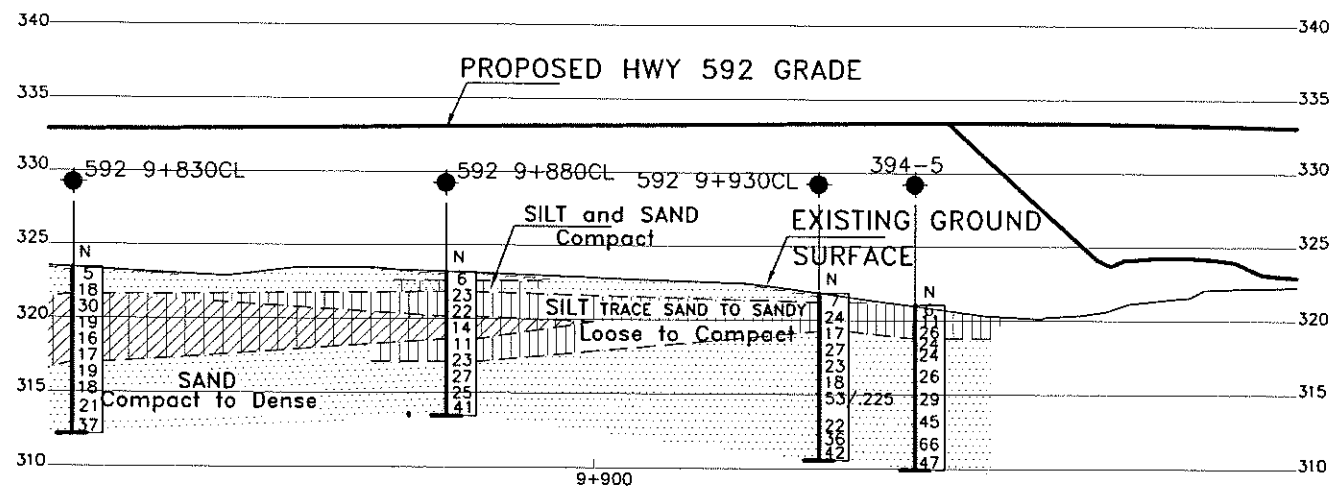


REVISIONS	DATE	BY	DESCRIPTION
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

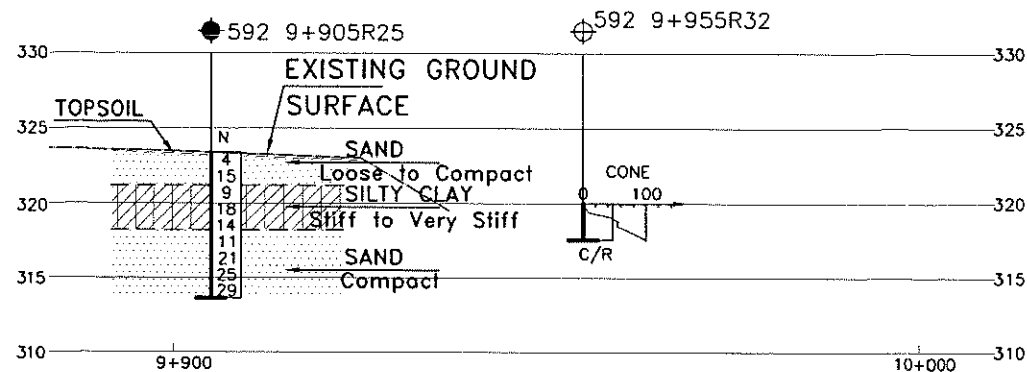


PLAN
5 0 10 20m
2.5 0 5 10m VERT



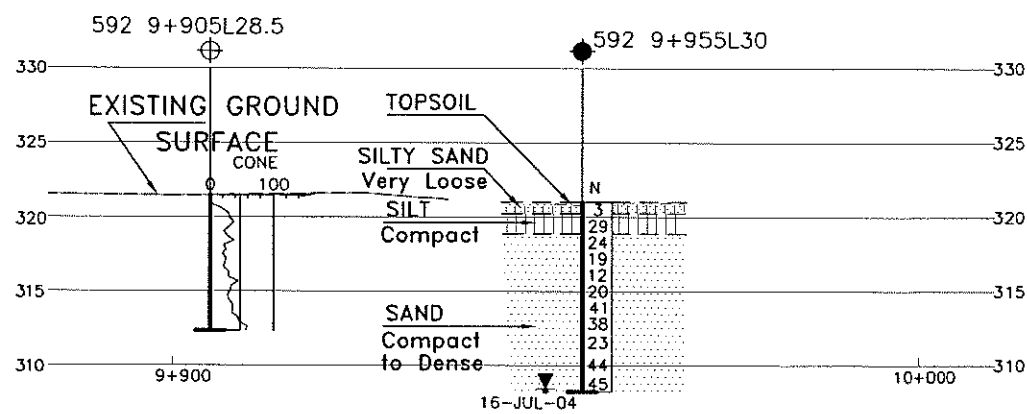
PROFILE OF HIGHWAY 592

5 0 10 20m HOR
2.5 0 5 10m VERT



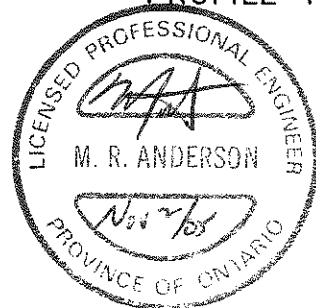
PROFILE TOE OF HIGHWAY 592 RIGHT

5 0 10 20m HOR
2.5 0 5 10m VERT



PROFILE TOE OF HIGHWAY 592 LEFT

5 0 10 20m HOR
2.5 0 5 10m VERT



NO	STATION	OFFSET FROM CL
592 9+805 R26	9+805	R26
592 9+830 CL	9+830	CL
592 9+855 L25	9+855	L25
592 9+855 R25	9+855	R25
592 9+880 CL	9+880	CL
592 9+905 L28.5	9+905	L28.5
592 9+905 R25	9+905	R25
592 9+930 CL	9+930	CL
592 9+955 L30	9+955	L30
592 9+955 R32	9+955	R32

NO	ELEVATION	NORTHING	EASTING
394-5	321.0	5046316.5	317057.9

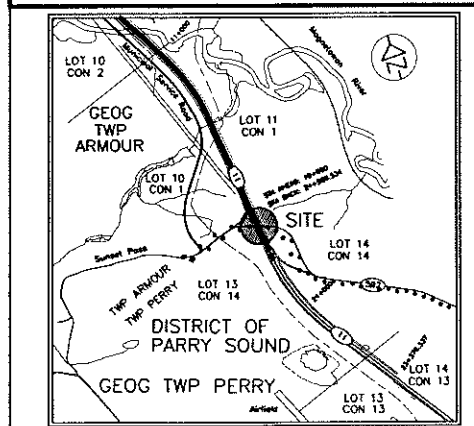
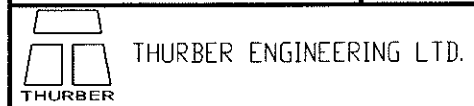
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

HIGHWAY 592 REALIGNMENT
STATION 9+630 TO 9+960
CENTRELINE, RIGHT AND LEFT TOE
BOREHOLE LOCATIONS AND SOIL STRATA



KEYPLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (cone) or Probe Hole
- Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM CL
592 9+641 R3	9+641	R3
592 9+655 L21	9+655	L21
592 9+660 R27	9+660	R27
592 9+680 CL	9+680	CL
592 9+705 L31	9+705	L31
592 9+705 R31	9+705	R31
592 9+730 CL	9+730	CL
592 9+755 L28	9+755	L28
592 9+755 R27	9+755	R27
592 9+780 R3	9+780	R3
592 9+805 L25	9+805	L25

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
JAN, 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT
		SCHEME	LDWG B3

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix C

Sunset Pass Drive, Station 10+040 to 10+150

RECORD OF BOREHOLE No 592 10+050 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+050, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	x LAB VANE							
							20	40	60	80	100						GR SA SI CL	
0.0	TOPSOIL, some rootlets																	
0.1	SAND, some silt, some organics, trace rootlets Loose		1	SS	4													
0.6	Dark Brown Silty SAND, fine grained Dense Brown Wet		2	SS	35												0 78 22 (SI+CL)	
			3	SS	34													
1.8	Silty CLAY, trace sand Very Stiff Brown Wet		4	SS	20												0 3 53 45	
			5	SS	20													
3.8	SAND and GRAVEL, trace silt, occasional cobbles Dense to Very Dense Brown Dry		6	SS	40													
			7	SS	67												46 49 5 (SI+CL)	
			8	SS	40													
8.2	END OF BOREHOLE AT 8.23 m. AUGER REFUSAL AT 8.23 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE GROUTED WITH QUICK GEL/BENTONITE GROUT TO SURFACE.																	

ONTMT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 592 10+062.5 L26 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+062.5, O/S 26L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 19.07.04 - 19.07.04 CHECKED BY MA

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			20	40	60	80	100		
0.0	DCPT from surface.												
1.8	END OF DCPT AT 1.80 m. CONE REFUSAL AT 1.80 m ON PROBABLE BEDROCK OR BOULDER.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+075 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+075, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE												
								● QUICK TRIAXIAL × LAB VANE												
						20	40	60	80	100	20	40	60							
0.0	TOPSOIL, some rootlets																			
0.2	Silty SAND, mixed with organics, trace rootlets		1	SS	13															
0.6	Compact Dark Brown																			
	Sandy SILT, trace clay		2	SS	39											0 36 54 10				
	Dense																			
	Brown																			
	Dry																			
1.5	SAND, medium to coarse grained, trace silt, trace gravel		3	SS	50/ .125															
	Dense																			
	Brown		4	SS	32															
	Moist																			
			5	SS	32											1 95 5 (SI+CL)				
4.6	SAND and GRAVEL, trace silt, occasional cobbles		6	SS	77															
	Very Dense																			
	Brown																			
	Dry to Damp		7	SS	50/ .125											45 49 6 (SI+CL)				
6.6	END OF BOREHOLE AT 6.55 m. AUGER REFUSAL AT 6.55 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE GROUTED WITH QUICK GEL/BENTONITE GROUT TO SURFACE.																			

ONTMT4 2316.GPJ 26/01/05

+ 3, × 3: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+087.5 L24 1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+087.5, O/S 24L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 16.07.04 - 16.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100	20 40 60				kn/m ³	GR SA SI CL
0.0	TOPSOIL, some rootlets													
0.2	SAND mixed with TOPSOIL, trace silt, trace gravel Loose Dark Brown		1	SS	4									
0.8	Dry to Moist SILT, some sand Dense to Compact Brown Moist to Wet		2	SS	48									0 13 80 7
			3	SS	22									
2.3	Silty CLAY, trace sand Very Stiff Brown Moist		4	SS	15									0 2 47 51
3.2	SAND, coarse grained, some to trace gravel, trace silt, occasional cobbles Dense to Compact Brown Dry		5	SS	41									
			6	SS	39									13 83 4 (SI+CL)
			7	SS	33									
			8	SS	23									
9.1	SAND and GRAVEL, trace silt Dense Brown Dry		9	SS	43									34 56 10 (SI+CL)
9.8	END OF BOREHOLE AT 9.75 m.													

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+087.5 L24 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+087.5, O/S 24L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 16.07.04 - 16.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W		
	Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 23.07.04 9.10 19.01.05 8.64 28.02.05 8.71															

ONTMT4 2316.GPJ 10/03/05

RECORD OF BOREHOLE No 592 10+087.5 R20 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+087.5, O/S 20R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 19.07.04 - 19.07.04 CHECKED BY MA

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE									"N" VALUES
0.0	DCPT from surface.						<p>SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE</p>						
4.8	END OF DCPT AT 4.83 m. CONE REFUSAL AT 4.83 m ON PROBABLE BEDROCK OR BOULDER.												

RECORD OF BOREHOLE No 592 10+100 CL 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+100, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100	20 40 60							
0.0	TOPSOIL, some rootlets														
0.1	SAND, mixed with topsoil, trace rootlets Loose		1	SS	3										
0.6	Dark Brown SAND, medium grained, trace silt Dense Brown Moist		2	SS	47										
			3	SS	33										
2.3	Sandy SILT, trace clay Compact Brown Wet		4	SS	19									0 20 75 6	
			5	SS	11										
4.6	Silty CLAY, trace sand Firm Grey Wet		6	SS	6									0 2 46 52	
5.2	SAND and GRAVEL, trace silt, trace cobbles Dense to Very Dense Brown Moist		7	SS	31									34 61 5 (SI+CL)	
			8	SS	47										
			9	SS	50/										
9.4	END OF BOREHOLE AT 9.40 m. AUGER REFUSAL AT 9.40 m ON PROBABLE BEDROCK OR				.100										

Continued Next Page

+³ ×³: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+100 CL 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+100, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

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					
	BOULDER. BOREHOLE GROUTED WITH QUICK GEL/BENTONITE GROUT TO SURFACE.																

ONT/MT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 592 10+112.5 L24 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+112.5, O/S 24L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES				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							
0.0	DCPT from surface.						SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	20 40 60			20 40 60	GR SA SI CL
9.1	END OF DCPT AT 9.14 m.											

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+112.5 R16 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+112.5, O/S 16R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	Gravelly SAND, trace silt Dark Brown (FILL)													
0.6	SAND, fine grained, trace silt, trace gravel Compact to Dense Brown Moist to Wet		1	SS	20									
			2	SS	48									
2.1	SILT, some sand Compact Brown Wet		3	SS	20									
			4	SS	18									0 17 78 5
			5	SS	13									
5.8	Silty CLAY, trace sand Firm to Stiff Grey Moist		6	SS	6									0 4 49 47
			7	SS	13									
8.5	SAND and GRAVEL, coarse grained, trace silt, occasional cobbles Dense Brown Moist		8	SS	48									29 65 6 (SI+CL)
9.8	END OF BOREHOLE AT 9.75 m.													

ONTMT4 2316.GPJ 26/01/05

Continued Next Page

+ 3, x 3. Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

METRIC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT 	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE						
							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	WATER CONTENT (%) 20 40 60		GR SA SI



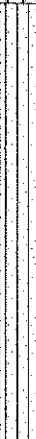
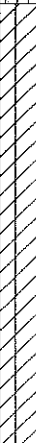

BOREHOLE BACKFILLED WITH
QUICK GEL/BENTONITE GROUT TO
SURFACE.

RECORD OF BOREHOLE No 592 10+125 R5

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+125, O/S 5R
 HWY 11 BOREHOLE TYPE Hollow Stem Augers
 DATUM Geodetic DATE 21.07.04 - 21.07.04
 ORIGINATED BY WRW
 COMPILED BY WM
 CHECKED BY MA

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			SHEAR STRENGTH kPa						
								20 40 60 80 100						
0.0	SAND, some gravel, trace silt Dark Brown (FILL)													
0.6	Silty SAND, fine grained Dense Brown Moist		1	SS	35									
			2	SS	49									
			3	SS	43									
			4	SS	41									
3.4	SILT, some sand, trace clay Compact Brown Wet		5	SS	22									
6.2	Silty CLAY, trace sand, occasional sand seams Stiff to Firm Grey Wet		6	SS	12									
			7	SS	7									
			8	SS	16									
9.8	becoming Very Stiff													
9.8	END OF BOREHOLE AT 9.75 m.													

Continued Next Page

+³, x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+125 R5

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+125, O/S 5R ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%) 20 40 60			
	BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.												

RECORD OF BOREHOLE No 592 10+137.5 L22

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+137.5, O/S 22L ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 04.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20 40 60 80 100										20 40 60		

0.0	TOPSOIL, some rootlets															
0.1	SAND, fine grained, trace to some silt Loose to Compact Brown Wet		1	SS	5											
			2	SS	21											
			3	SS	28											
			4	SS	13											0 86 14 (SI+CL)
			5	SS	26											
4.6	SILT, trace to some sand, trace clay Compact Brown Wet		6	SS	15											0 11 81 8
			7	SS	15											
6.7	END OF BOREHOLE AT 6.71 m. AUGER REFUSAL AT 6.71 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH BENTONITE GROUT TO SURFACE.															

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 592 10+150 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Hwy 592 and Sunset Pass Drive, ST. 10+150, CL ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					w _p w w _L				
							20	40	60	80	100	20	40	60			
0.0	Gravelly SAND, trace silt Brown (FILL)																
0.6	SAND, fine grained, some silt Compact to Very Dense Brown Moist		1	SS	16												
			2	SS	70												
			3	SS	27												
			4	SS	13												
3.5	Sandy SILT, trace clay Compact Brown Moist		5	SS	21												
6.1	Silty CLAY, some sand Very Stiff Brown		6	SS	20												
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE BACKFILLED WITH QUICK GEL/BENTONITE GROUT TO SURFACE.																

ONTMT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 394-4

1 OF 3

METRIC

W.P. 480-93-00 LOCATION N 5 046 354.5 E 316 948.7, Hwy 592/Sunset Pass ORIGINATED BY WRW/GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers, Casing and Coring COMPILED BY WM
 DATUM Geodetic DATE 15.10.04 - 18.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
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		
322.6													
322.4	TOPSOIL (150 mm)												
0.2	SAND, fine grained, trace to some silt Compact Brown Moist to Wet		1	SS	27		322						
			2	SS	19		321						
320.3							320						
2.3	Silty CLAY, laminated, trace sand Stiff to Firm Grey-Brown		3	SS	11								
			4	SS	7		319						
318.5							318						
4.1	Gravelly SAND, trace silt, occasional cobbles and boulders Dense to Very Dense Brown Dry		5	SS	37		317						
			6	SS	68		316						
			7	SS	68		315						
			8	SS	99		314						
							313						

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100			
							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100				

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	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W		
312.4												
10.2	SAND, trace gravel, trace silt Dense Brown Dry		9	SS	49							5 90 5 (SI+CL)
310.4												
12.2	SAND, fine grained, with cobbles and boulders, trace silt to silty Very Dense Grey Dry		10	SS	100/ 225							
			11	SS	40/ .075							
			12	SS	63							0 71 29 (SI+CL)
305.8												
16.8	SAND and GRAVEL, with cobbles and boulders, trace silt Dense to Very Dense Grey Dry		13	SS	49							
			14	SS	63							52 43 4 (SI+CL)
303.7												
18.9	SAND, trace to some gravel, trace silt, occasional cobbles and boulders Very Dense Brown Wet		15	SS	81							

+ 3, × 3: Numbers refer to Sensitivity

ONTMT4 2316.GPJ 28/10/04

RECORD OF BOREHOLE No 394-4

3 OF 3

METRIC

W.P. 5404-04-01 LOCATION N 5 046 354.5 E 316 948.7, Hwy 592/Sunset Pass ORIGINATED BY WRW/GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers, Casing and Coring COMPILED BY WM
 DATUM Geodetic DATE 15.10.04 - 18.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100	20 40 60					
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100	20 40 60					
			16	SS	100/ .225									GR SA SI CL 0 95 5 (SI+CL)
			17	SS	105		302							
301.3														
21.3	SAND and GRAVEL, with cobbles and boulders, trace silt Very Dense Brown Wet		18	SS	103/ .125		301							
							300							
			19	SS	102/ .150									
							299							
			20	SS	100/ .100		298							
296.6							297							
26.0	END OF BOREHOLE AT 25.98 m. BOREHOLE OPEN TO 25.98 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 19.10.04 15.2 21.10.04 15.6		21	SS	100/ .075									

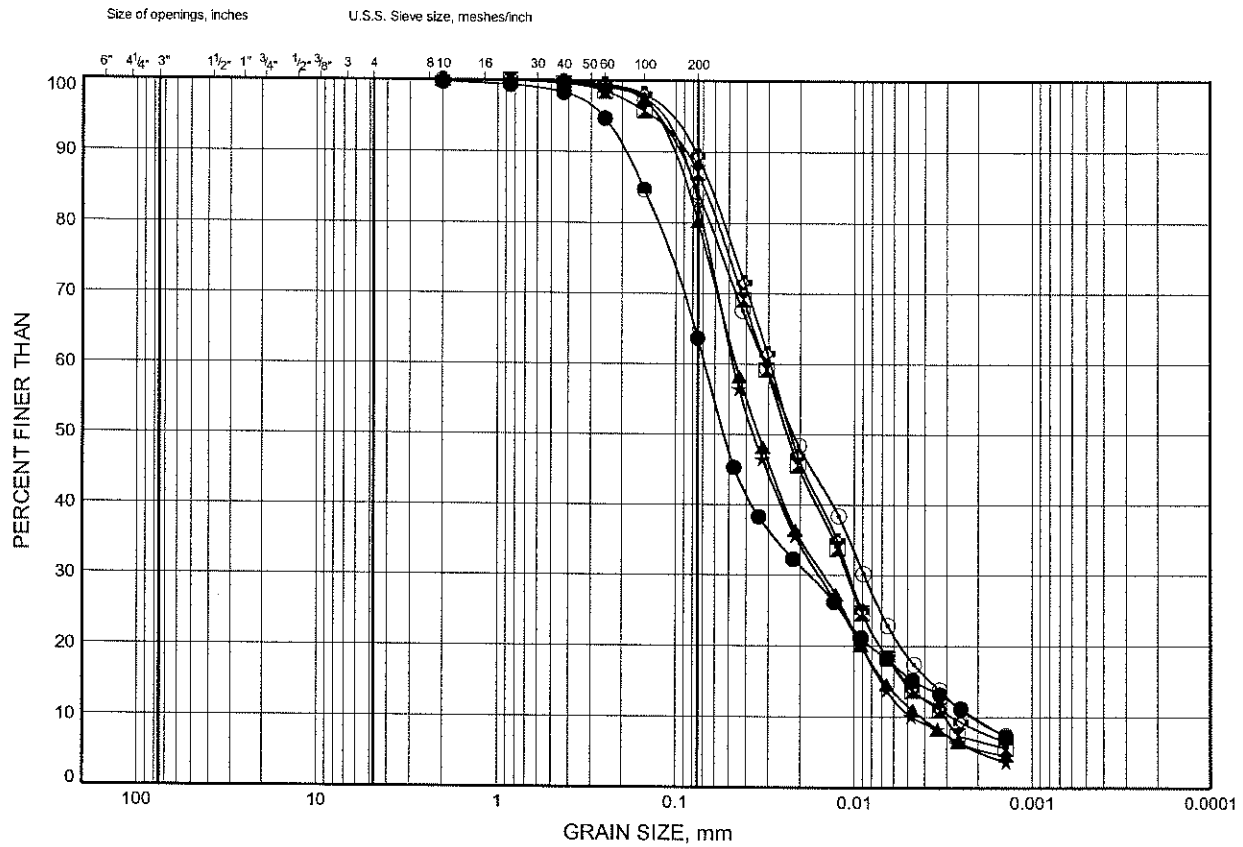
+ 3 . X 3 : Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

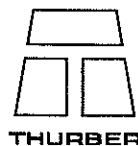
FIGURE C1

SILT to Sandy SILT



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 10+075 CL	1.07	
⊠	592 10+087.5 L24	1.83	
▲	592 10+100 CL	2.59	
★	592 10+112.5 R16	3.35	
⊙	592 10+125 R5	4.88	
⊛	592 10+137.5 L22	4.88	

Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

FIGURE C2

Size of openings, inches

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

6" 4 1/2" 3" 1 1/2" 1" 3/4" 1/2" 3/8" 3 4 8 10 16 30 40 50 60 100 200

PERCENT FINER THAN

100 90 80 70 60 50 40 30 20 10 0

100 10 1 0.1 0.001 0.0001

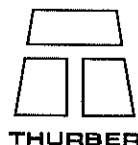
GRAIN SIZE, mm

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 10+050 CL	1.07	
⊠	592 10+075 CL	3.35	
▲	592 10+125 R5	2.59	
★	592 10+137.5 L22	2.59	
⊙	592 10+150 CL	1.83	

Date January 2005
Project 480-93-00

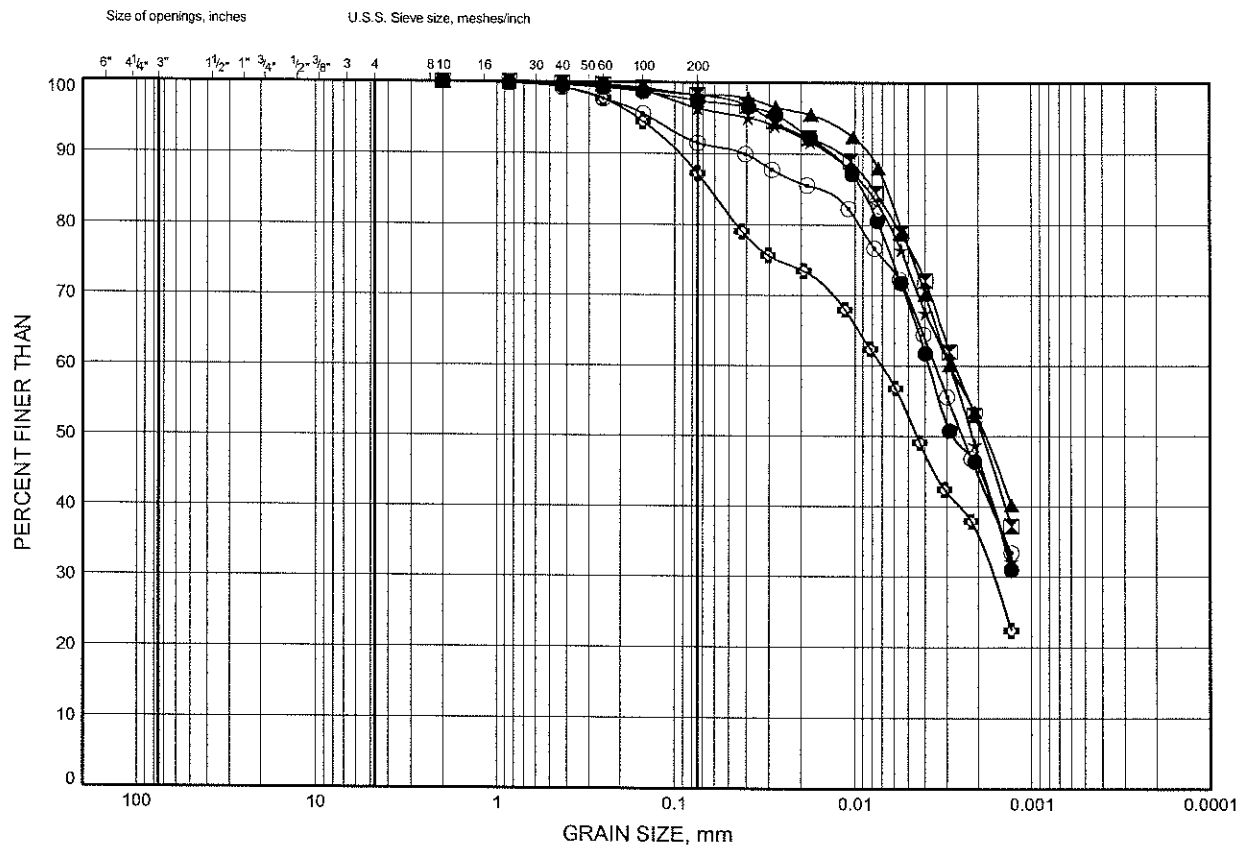
Prep'd WM
Chkd. MA



Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE C3

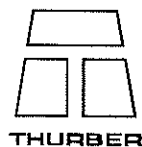
Silty CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 10+050 CL	2.59	
⊠	592 10+087.5 L24	2.59	
▲	592 10+100 CL	4.88	
★	592 10+112.5 R16	6.40	
⊙	592 10+125 R5	7.92	
⊗	592 10+150 CL	6.40	

Date January 2005
Project 480-93-00

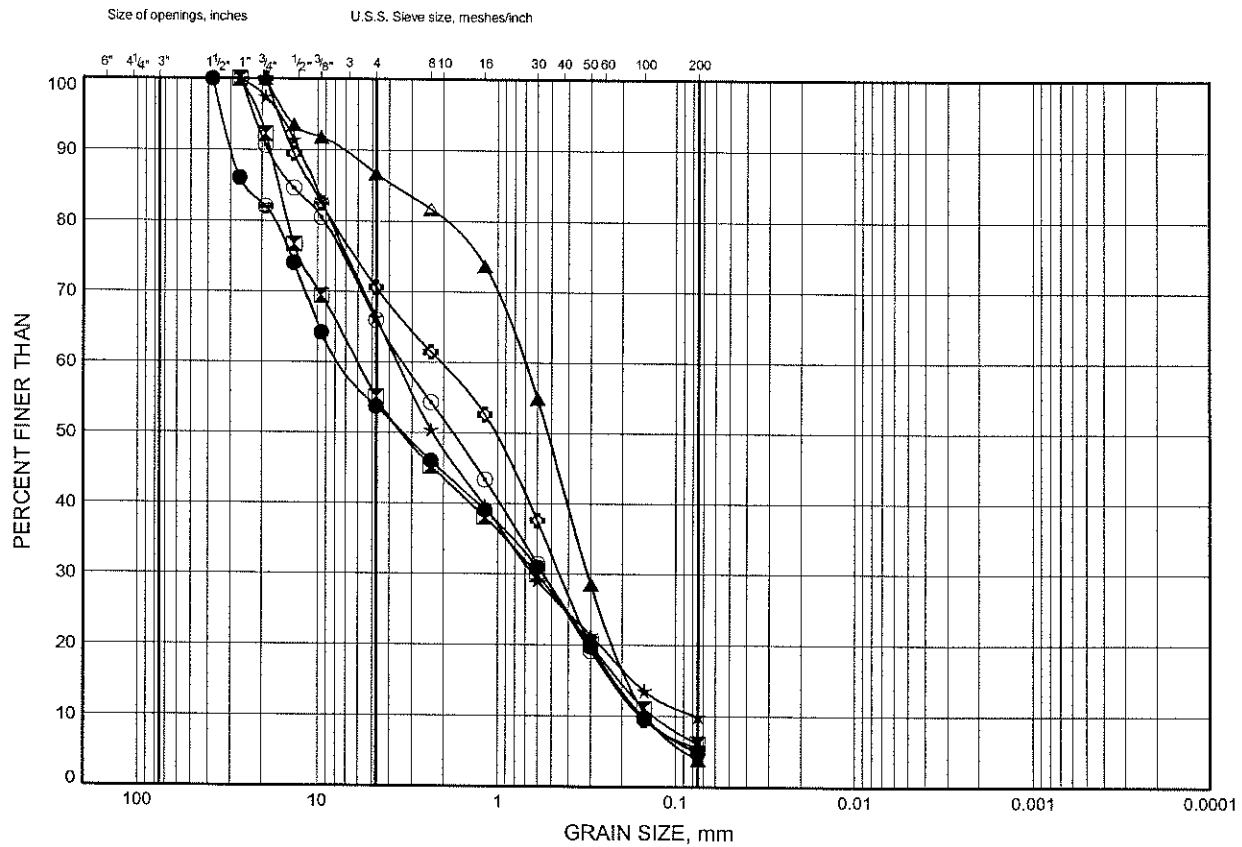


Prep'd WM
Chkd. MA

Hwy 11 Katrina GRAIN SIZE DISTRIBUTION

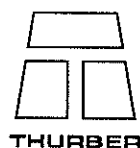
FIGURE C4

SAND and GRAVEL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 10+050 CL	6.40	
⊠	592 10+075 CL	6.23	
▲	592 10+087.5 L24	4.88	
★	592 10+087.5 L24	9.45	
⊙	592 10+100 CL	6.40	
⊛	592 10+112.5 R16	9.45	

Date January 2005
Project 480-93-00

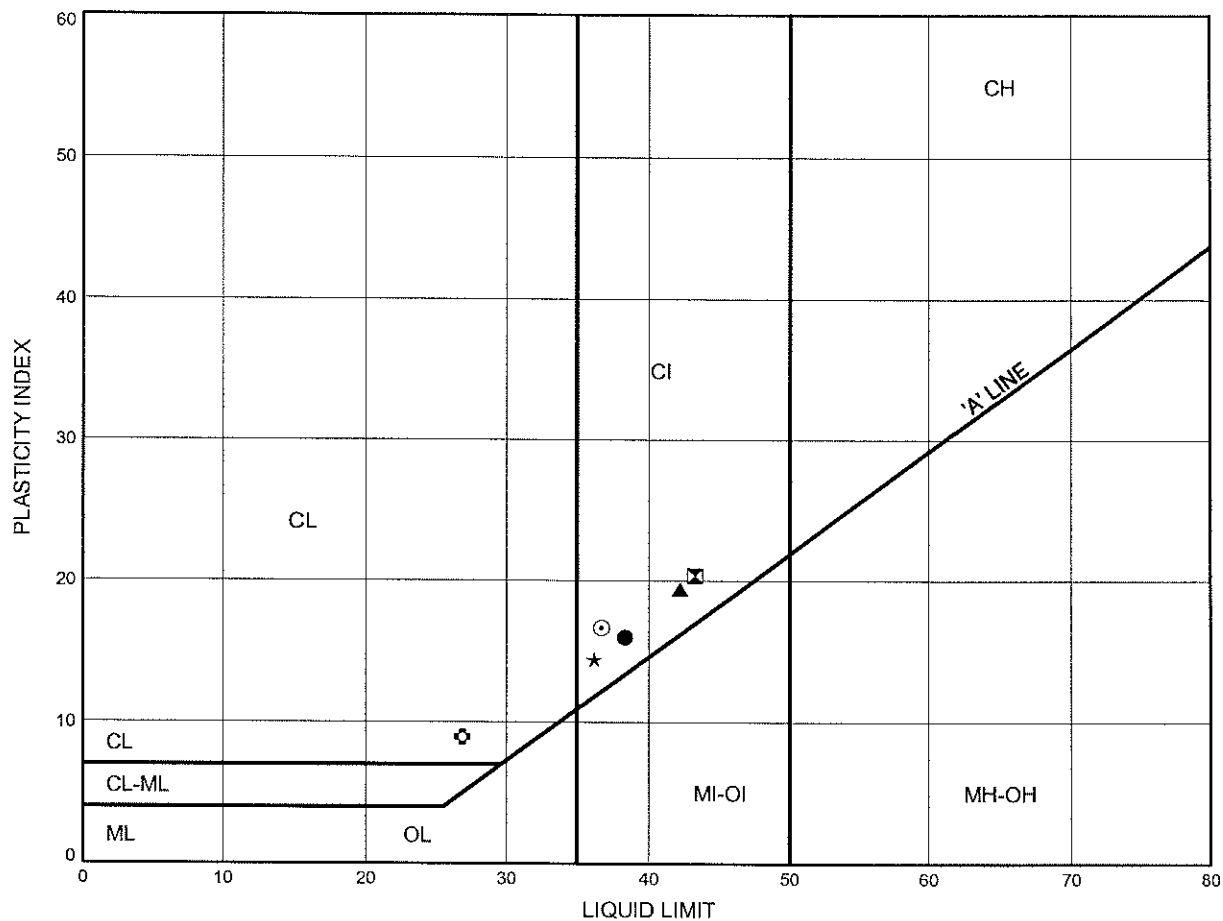


Prep'd WM
Chkd. MA

Hwy 11 Katrine

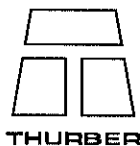
ATTERBERG LIMITS TEST RESULTS

FIGURE C5

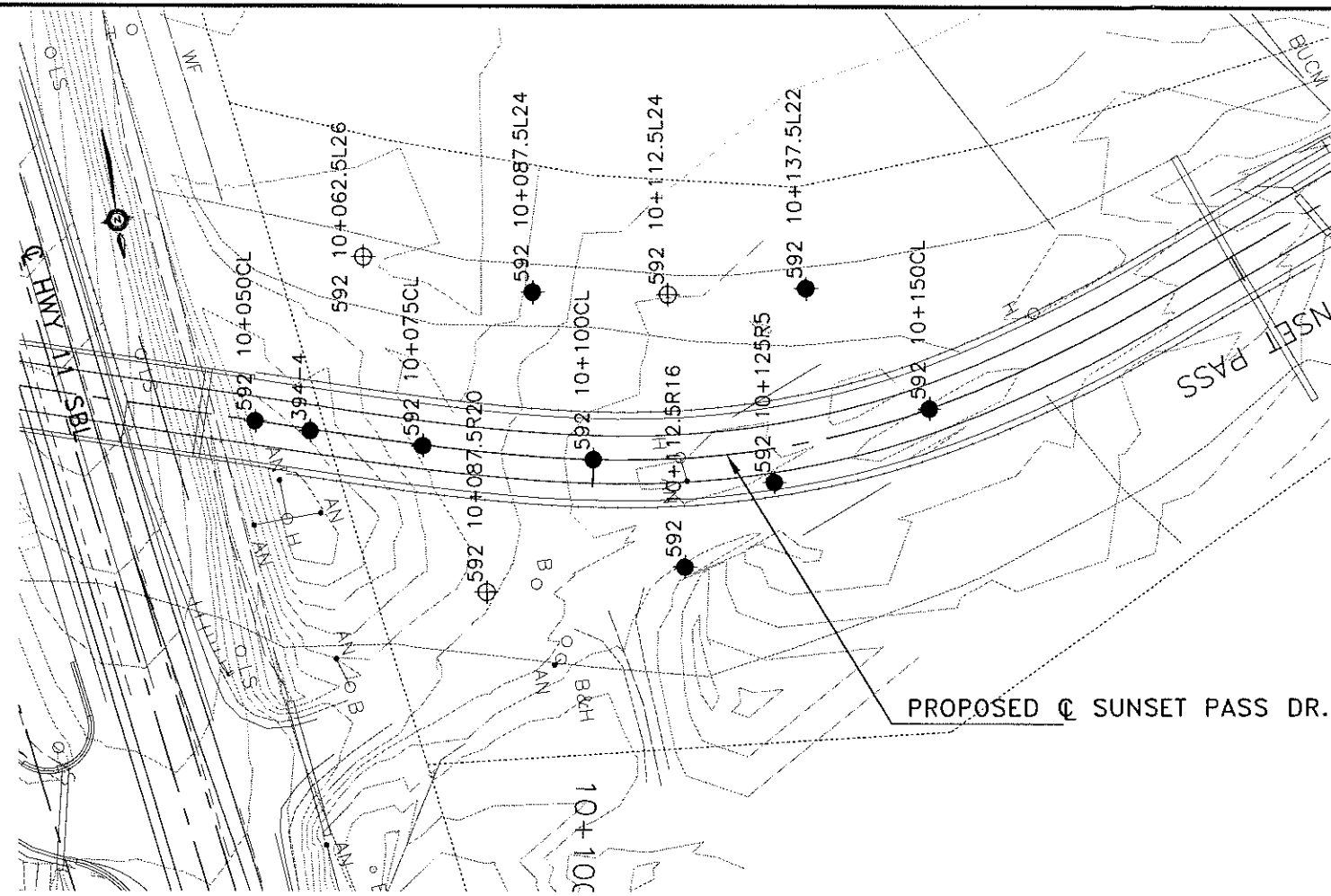


SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	592 10+050 CL	2.59	
⊠	592 10+087.5 L24	2.59	
▲	592 10+100 CL	4.88	
★	592 10+112.5 R16	6.40	
⊙	592 10+125 R5	7.92	
⊕	592 10+150 CL	6.40	

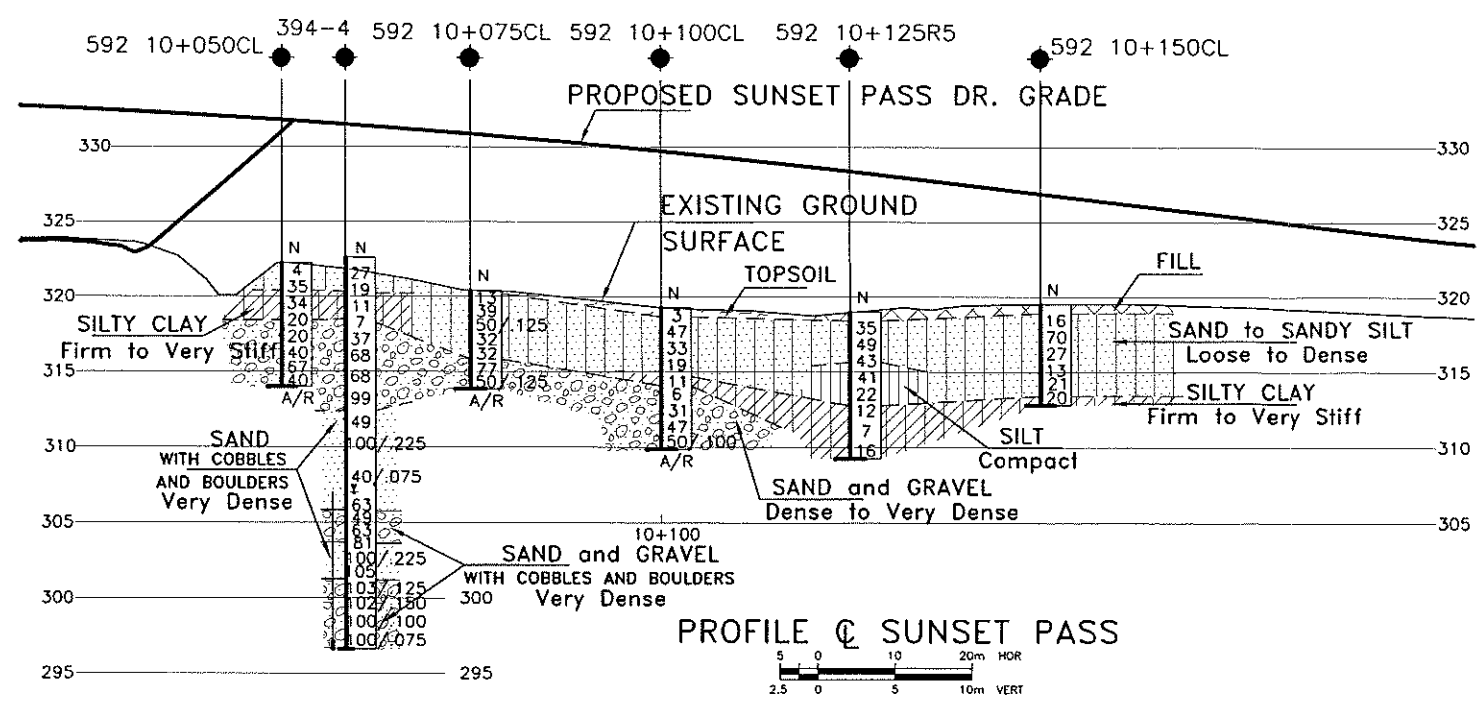
Date January 2005
 Project 480-93-00



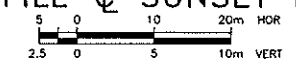
Prep'd WM
 Chkd. MA



PLAN

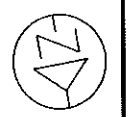


PROFILE @ SUNSET PASS



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

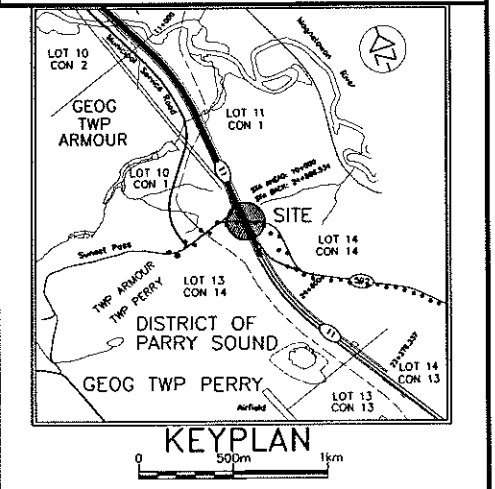
HWY 11
CONT No
WP No 480-93-00
SUNSET PASS DRIVE REALIGNMENT
STATION 10+040 TO 10+150
CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.
THURBER



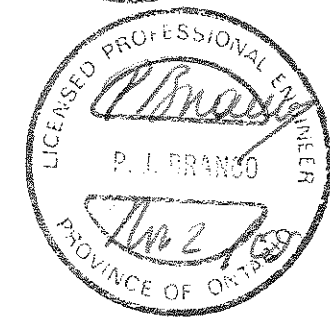
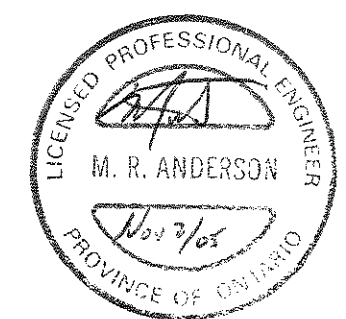
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM CL
592 10+050 CL	10+050	CL
592 10+062.5 L26	10+062.5	L26
592 10+075 CL	10+075	CL
592 10+087.5 R20	10+087.5	R20
592 10+087.5 L24	10+087.5	L24
592 10+100 CL	10+100	CL
592 10+112.5 R16	10+112.5	R16
592 10+112.5 L24	10+112.5	L24
592 10+125 R5	10+125	R5
592 10+137.5 L22	10+137.5	L22
592 10+150 CL	10+150	CL

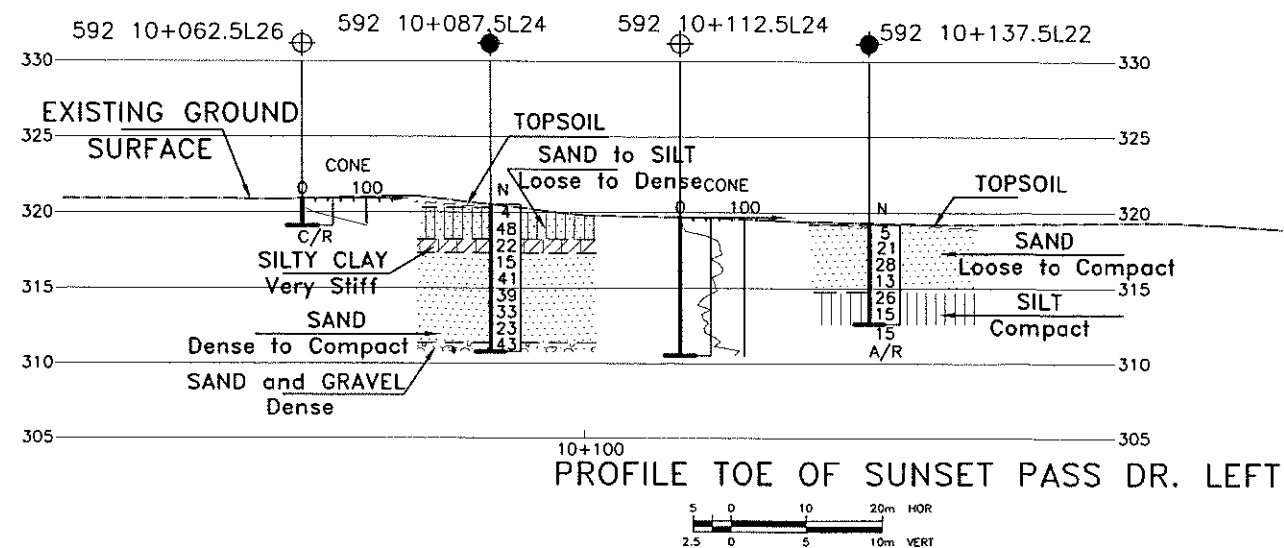
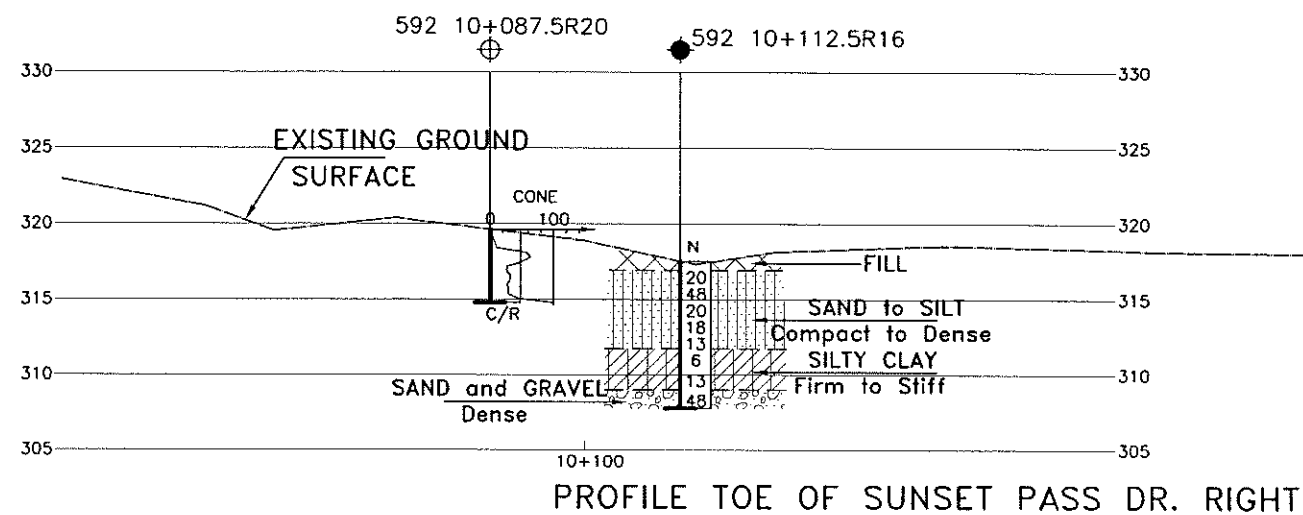
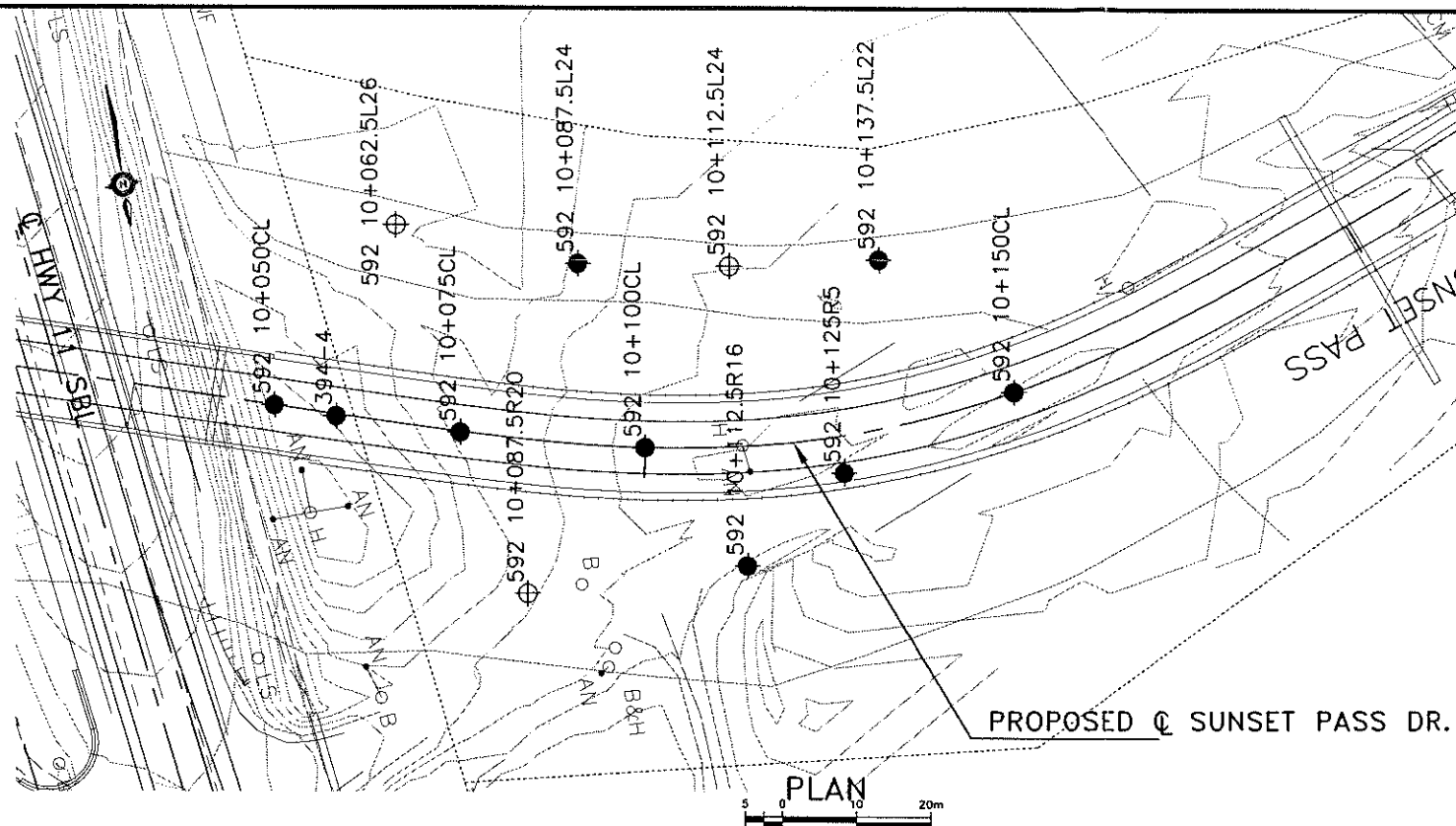
NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	MA	BY	DESCRIPTION
JAN 05	MA			ISSUED AS DRAFT FOR REVIEW
DESIGN	MA	CHK AEG	CODE CHBDC	LOAD
DRAWN	HS	CHK MA	SITE	STRUCT SCHEME DWG C1



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

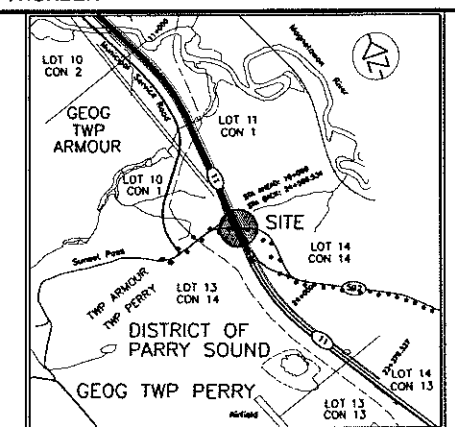


SUNSET PASS DRIVE REALIGNMENT
STATION 10+040 TO 10+150
RIGHT TOE AND LEFT TOE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

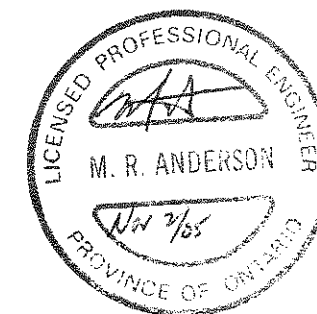


THURBER ENGINEERING LTD.
THURBER



KEYPLAN

NO	ELEVATION	NORTHING	EASTING
394-4	322.6	5046342.9	316951.8



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊗ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
592 10+050 CL	10+050	CL
592 10+062.5 L26	10+062.5	L26
592 10+075 CL	10+075	CL
592 10+087.5 R20	10+087.5	R20
592 10+087.5 L24	10+087.5	L24
592 10+100 CL	10+100	CL
592 10+112.5 R16	10+112.5	R16
592 10+112.5 L24	10+112.5	L24
592 10+125 R5	10+125	R5
592 10+137.5 L22	10+137.5	L22
592 10+150 CL	10+150	CL

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
JAN, 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN	MA	CHK AEG	CODE CHBDC
DRAWN	HS	CHK MA	SITE
			LOAD
			STRUCT
			SCHEME
			DWG C2

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix D

Highway 11 NBL, Station 10+510 to 10+570

RECORD OF BOREHOLE No 10+510 R18.75

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+510, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 23.08.04 - 23.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _p	W	W _L		
								20 40 60 80 100						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
0.0	SAND, trace silt, trace rootlets													
0.2	Brown SAND, fine grained, occasional iron oxide staining Loose Damp (Possible Fill)		1	SS	6									
			2	SS	9									
1.4	Sandy SILT, occasional iron oxide staining Compact Brown Moist		3	SS	10									
			4	SS	19									
3.0	Silty CLAY, trace sand, varved Firm to Stiff Brown to Grey Wet		5	SS	7									
			6	SS	8									
			7	SS	7									
7.6	SILT, trace sand Compact Grey Wet		8	SS	15									
9.1	Silty SAND, fine grained Loose Grey Wet		9	SS	9									

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+510 R18.75

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+510, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 23.08.04 - 23.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								<div>○ UNCONFINED + FIELD VANE</div> <div>● QUICK TRIAXIAL x LAB VANE</div>												
								20	40	60	80	100								
10.7	SILT, trace sand Loose to Compact Gray Wet		10	SS	5												0 7 89 4			
			11	SS	24															
12.8	END OF BOREHOLE AT 12.80 m. BOREHOLE GROUTED TO SURFACE.																			

METRIC

SOIL PROFILE						SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							
0.0	SAND, fine grained, some silt Compact to Loose Brown Dry (FILL)	[Cross-hatched pattern]	1	SS	10													
			2	SS	16													
			3	SS	7													
			4	SS	4													
			5	SS	5													
			6	SS	5													
			7	SS	5													
7.6	SILT, trace sand, trace clay Compact Grey Wet	[Horizontal lined pattern]	8	SS	11													
9.1	Silty CLAY, trace sand, varved Very Stiff Grey	[Diagonal lined pattern]	9	SS	21													
9.8	END OF BOREHOLE AT 9.75 m.																	

+³, ×³: Numbers refer to Sensitivity

ONTMT4 2316.GPJ 04/11/04

RECORD OF BOREHOLE No 10+522.5 R4.0

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+522.5, O/S R4.0 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA


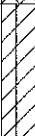

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				W _p	W	W _L		
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 8.53 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.															

RECORD OF BOREHOLE No 10+535 R10.0

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+535, O/S R10.0 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
								○ UNCONFINED + FIELD VANE										
								● QUICK TRIAXIAL × LAB VANE										
							20 40 60 80 100					20 40 60						
							20 40 60 80 100					20 40 60						
0.0	SAND, fine grained, some silt to silty Compact to Very Loose Brown Dry (FILL)		1	SS	9													
			2	SS	15													
			3	SS	5													
			4	SS	4													
			5	SS	4													0 74 26 (SI+CL)
			6	SS	4													
			7	SS	2													
			becoming wet															
7.6	Silty CLAY, trace silt Soft Grey Wet		8	SS	2													
8.5	Silty SAND, trace wood fibers Compact Grey Wet		9	SS	23													
9.8	END OF BOREHOLE AT 9.75 m.																	

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+535 R10.0

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+535, O/S R10.0 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	20 40 60						
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.14 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

RECORD OF BOREHOLE No 10+547.5 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+547.5, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
0.0	DCPT from surface													
7.6	END OF DCPT AT 7.62 m.													

ONTMT4 2316.GPJ 04/11/04

+³. ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+547.5 R50

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+547.5, O/S R50 ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 23.08.04 - 23.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						
0.0	SILT, some sand, trace rootlets Loose		1	SS	8									
0.3	Dark Brown Sandy SILT Loose to Compact Brown Dry		2	SS	15									
1.2	Silty CLAY, varved Very Stiff to Stiff Brown to Grey Wet	3	SS	19										
		4	SS	13										
		5	SS	10										0 1 53 46
		6	SS	9										
6.1	SILT, some clay, trace to some sand Compact Grey Wet	7	SS	18										
		8	SS	10										0 10 79 11
		9	SS	26										
9.8	END OF BOREHOLE AT 9.75 m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10+547.5 R50

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+547.5, O/S R50 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 23.08.04 - 23.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p	W	W _L	20 40 60				
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.45 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

RECORD OF BOREHOLE No 10+560 R12.0

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+560, O/S R12.0 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20	40	60	80	100						20	40	60

ONTMT4 2316.GPJ 26/01/05

RECORD OF BOREHOLE No 10+568 R44

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+568, O/S R44 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 23.08.04 - 23.08.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
0.0	DCPT from surface.													
6.1	END OF DCPT AT 6.1 m.													

RECORD OF BOREHOLE No 10+570 R3.0

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 10+570, O/S R3.0 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 24.08.04 - 24.08.04 CHECKED BY MA

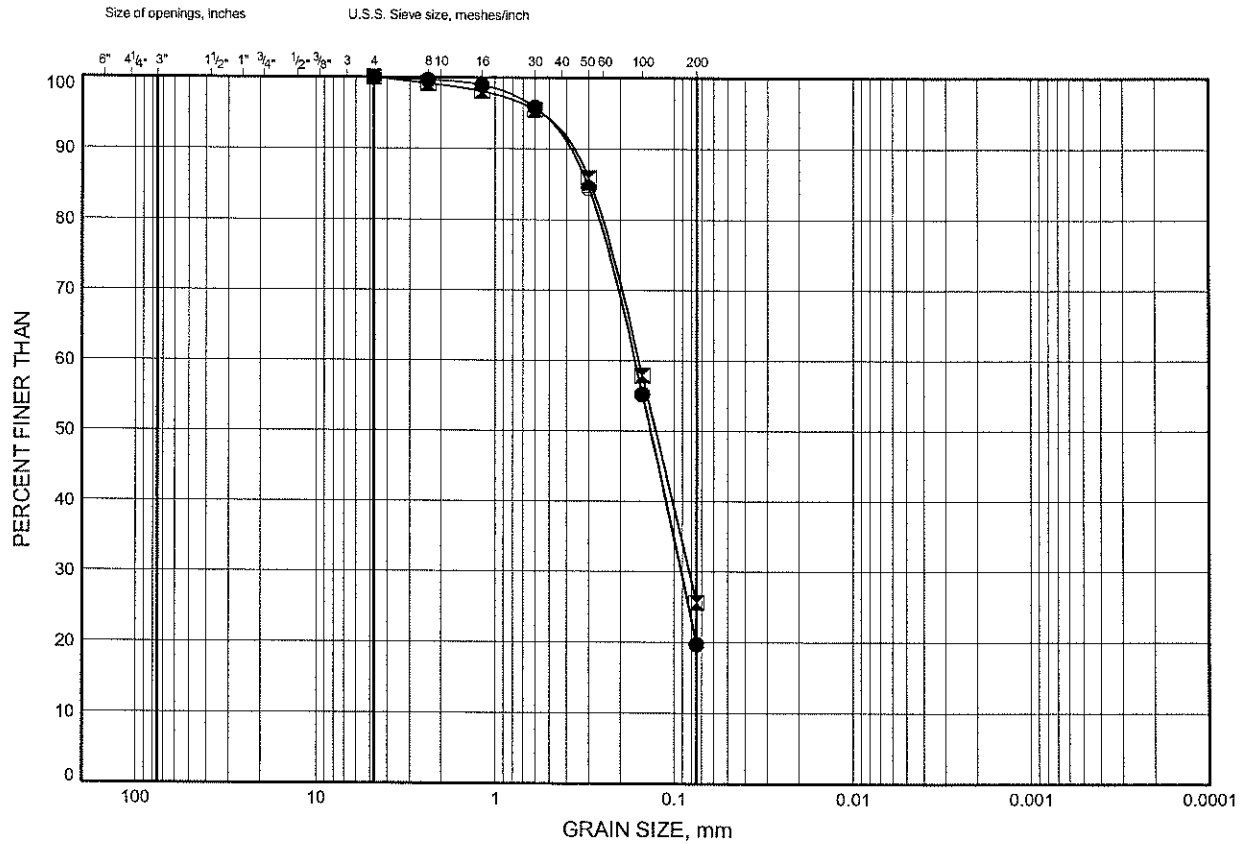
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE										● QUICK TRIAXIAL × LAB VANE				
								20	40	60	80	100						20	40	60	80	100
0.0	SAND, fine grained, occasional iron oxide staining Compact Brown Dry (FILL)		1	SS	12																	
			2	SS	14																	
1.5	SAND and SILT, fine grained Compact Brown to Grey Damp		3	SS	16																	
			4	SS	24												0 43 53 3					
			5	SS	17																	
4.6	Sandy SILT, trace to some clay Compact Grey Wet		6	SS	20												0 21 67 12					
6.1	Silty CLAY, trace sand Very Stiff Grey Wet		7	SS	15																	
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 6.71 m AND DRY UPON COMPLETION. Piezometer installation consists of 19 mm diameter consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 24.08.04 Dry 19.01.05 Dry 28.02.05 Dry																					

ONTM/T4 2316.GPJ 09/03/05

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE D1

Sand Fill

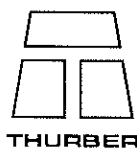


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	10+522.5 R4.0	2.59	
◻	10+535 R10.0	3.35	

Date November 2004

Project 480-93-00



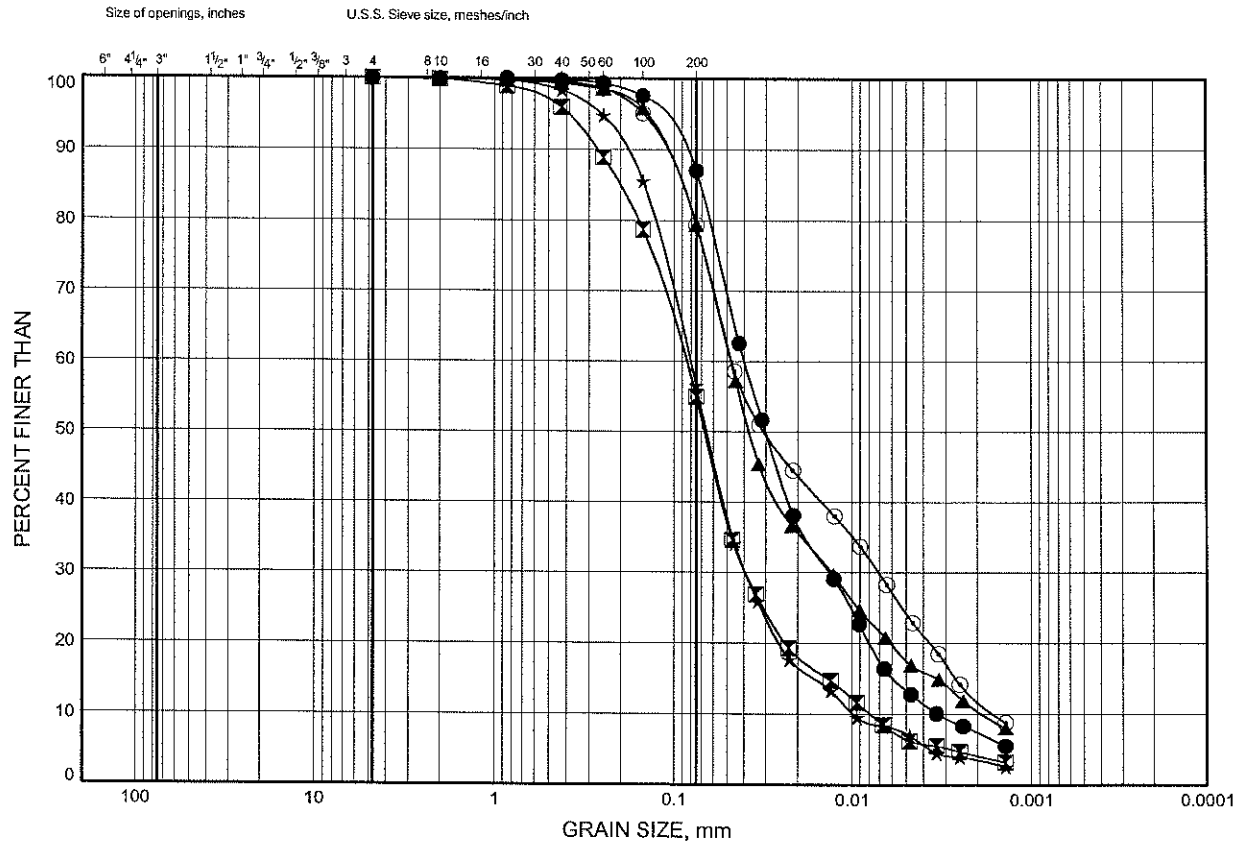
Prep'd WM

Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE D2

Silt to Sand and Silt

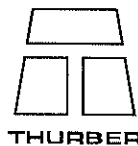


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	10+560 R12.0	2.59	
⊠	10+560 R12.0	3.35	
▲	10+560 R12.0	6.40	
★	10+570 R3.0	2.59	
⊙	10+570 R3.0	4.88	

Date November 2004

Project 480-93-00



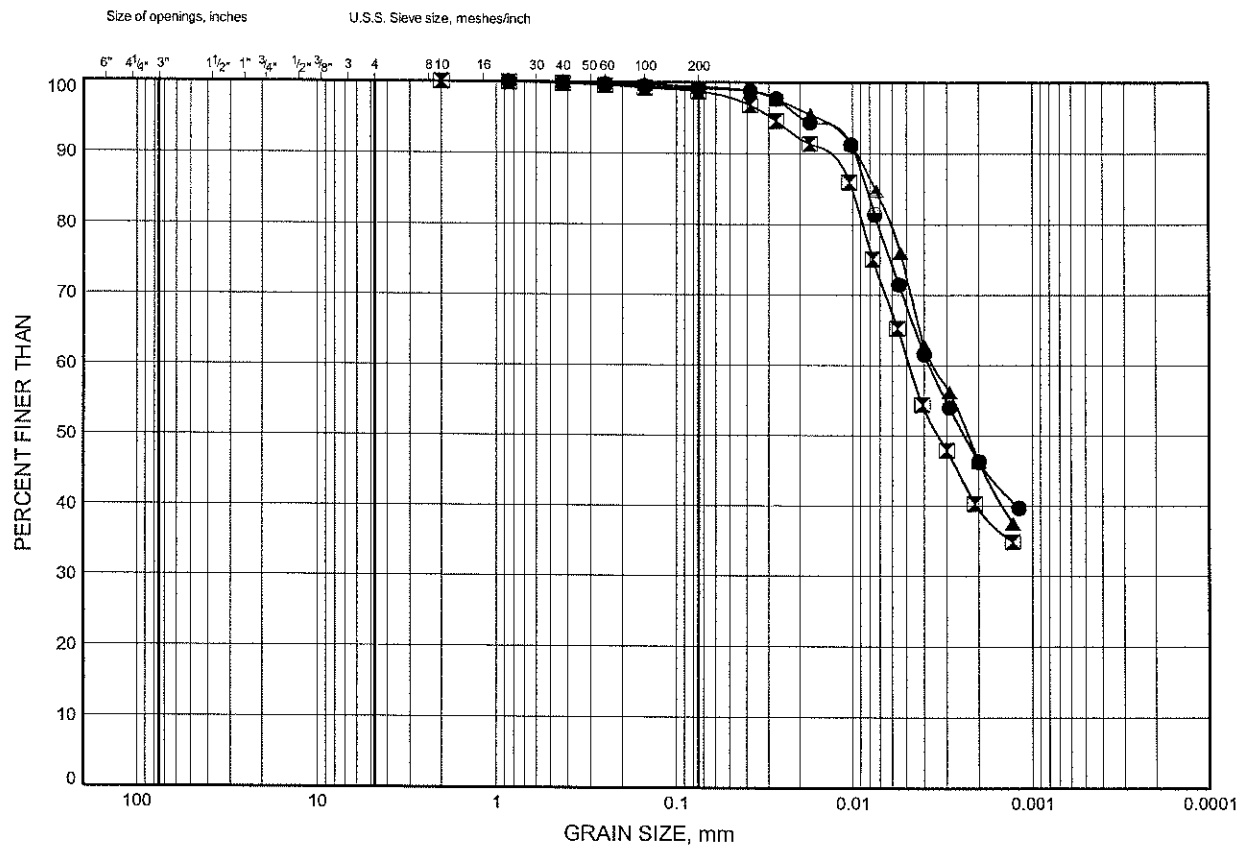
Prep'd WM

Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE D3

Silty Clay

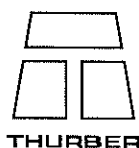


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	10+510 R18.75	4.88	
◻	10+522.5 R4.0	9.45	
▲	10+547.5 R50	3.35	

Date November 2004

Project 480-93-00



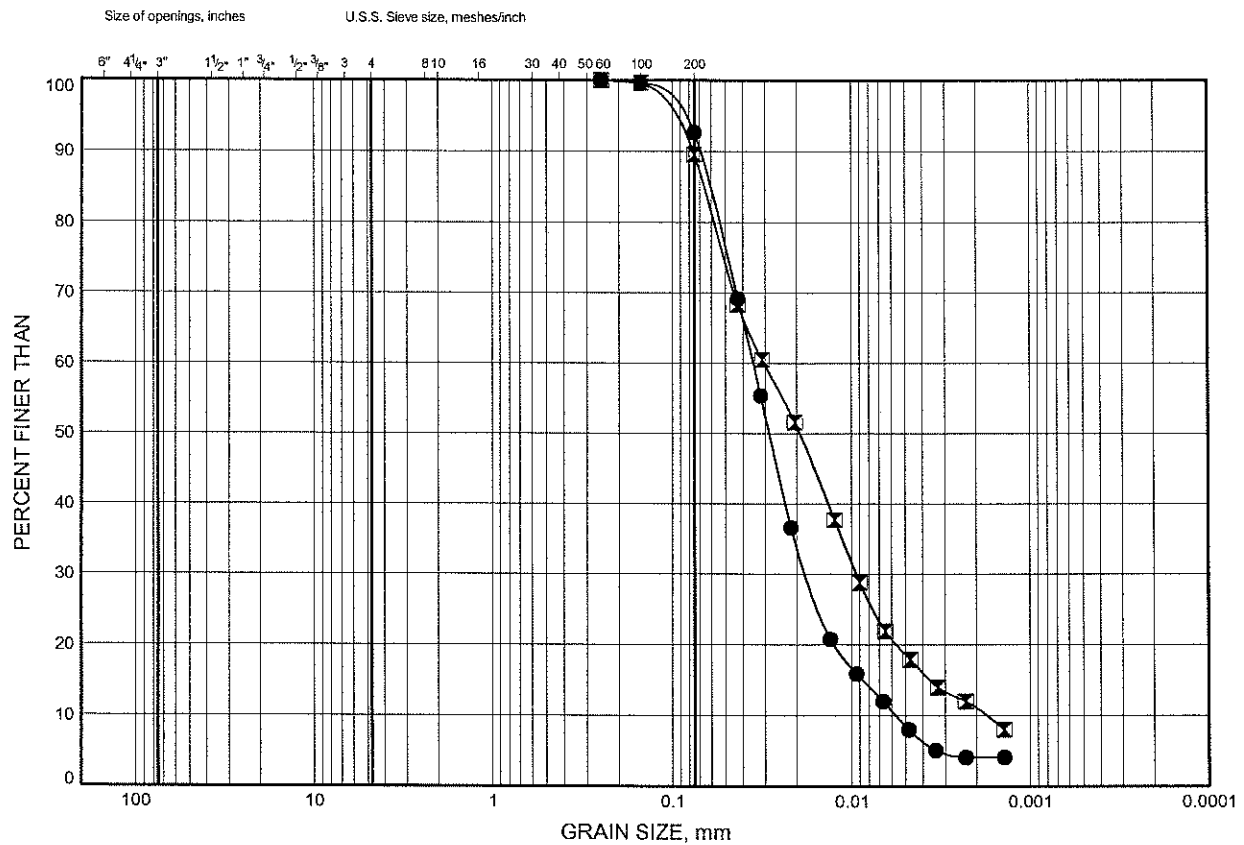
Prep'd WM

Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

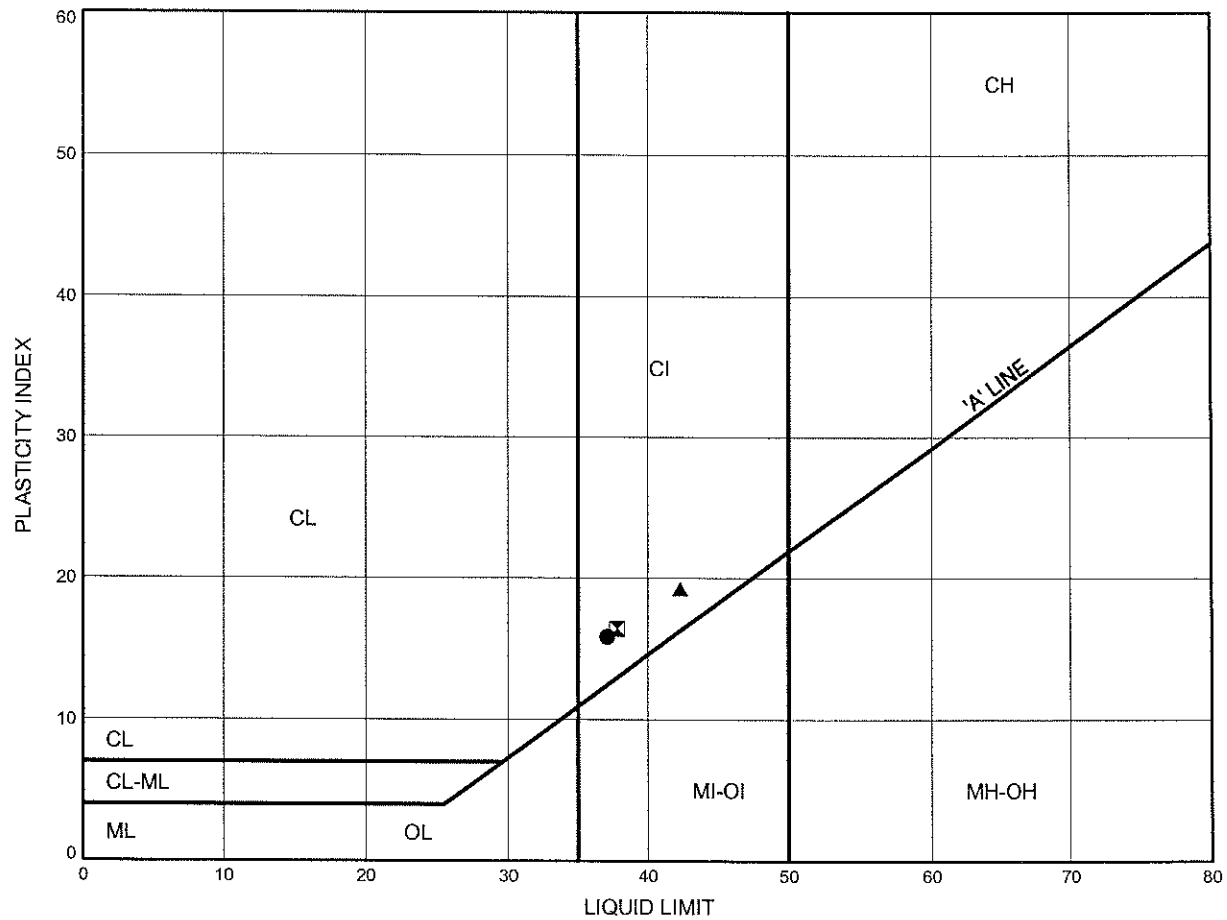
FIGURE D4

Silt



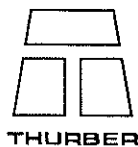
Hwy 11 Katrine ATTERBERG LIMITS TEST RESULTS

FIGURE D5

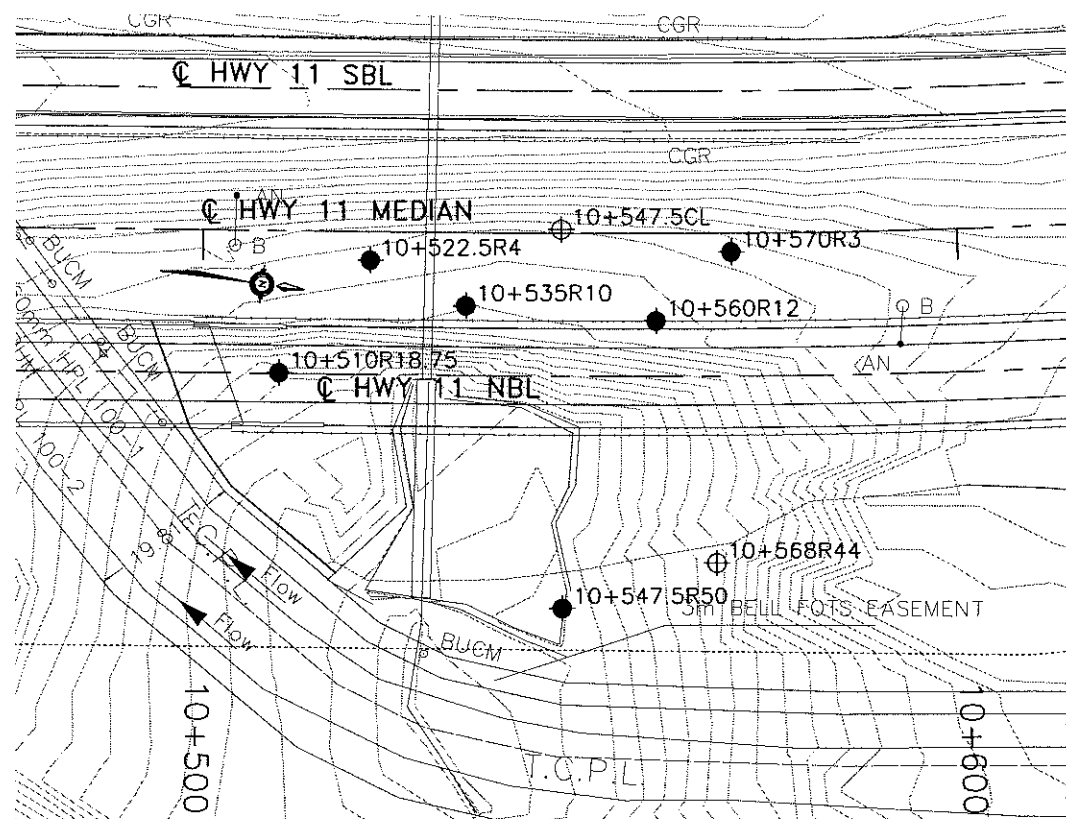


SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	10+510 R18.75	4.88	
⊠	10+522.5 R4.0	9.45	
▲	10+547.5 R50	3.35	

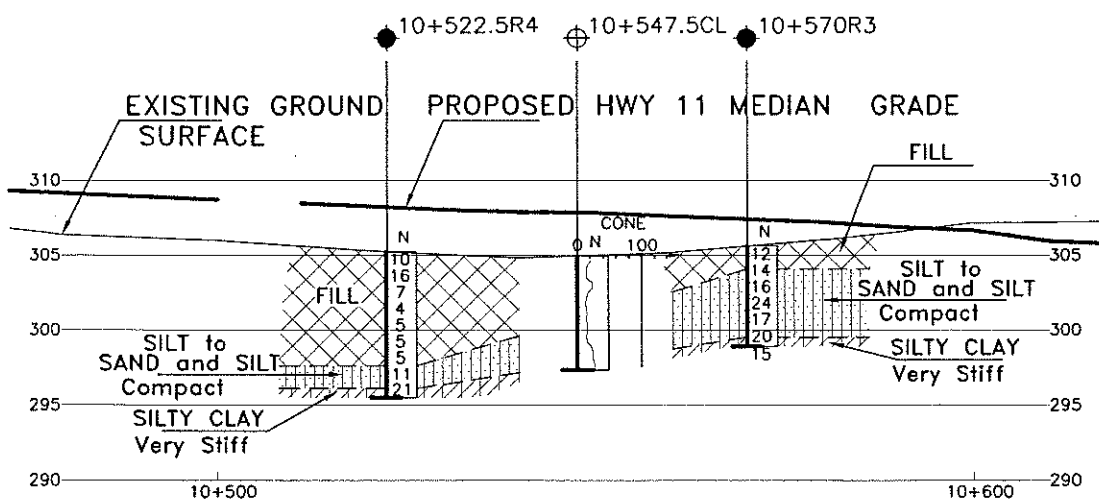
Date November 2004
Project 480-93-00



Prep'd WM
Chkd. MA

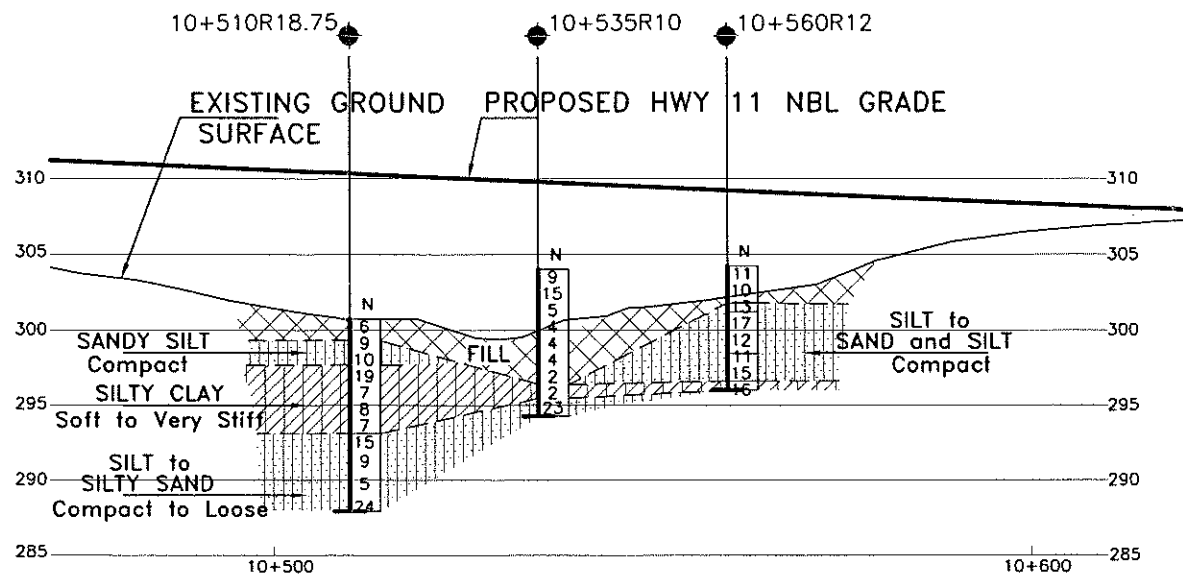


PLAN
0 10 20m



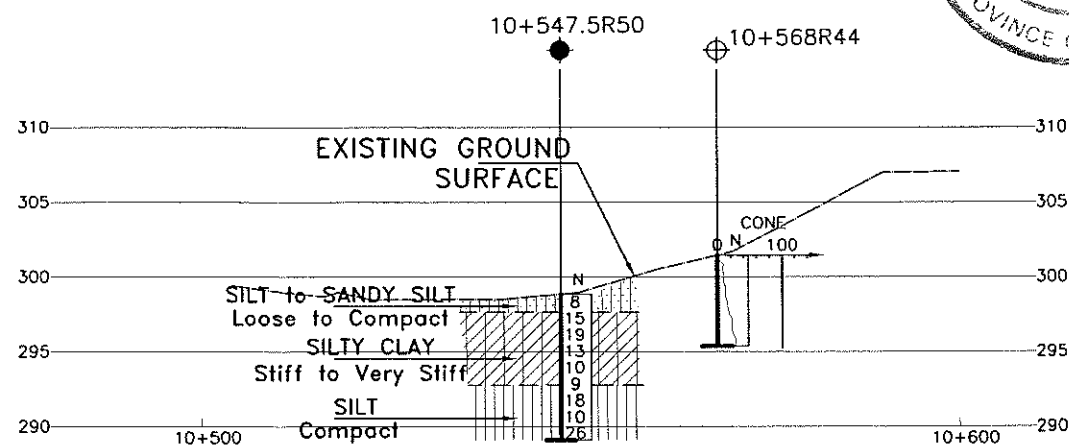
PROFILE @ HWY 11 MEDIAN

0 10 20m HOR
2.5 0 5 10m VERT



PROFILE @ HWY 11 NBL

0 10 20m HOR
2.5 0 5 10m VERT

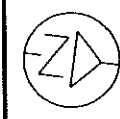


PROFILE TOE OF HWY 11 NBL

0 10 20m HOR
2.5 0 5 10m VERT

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

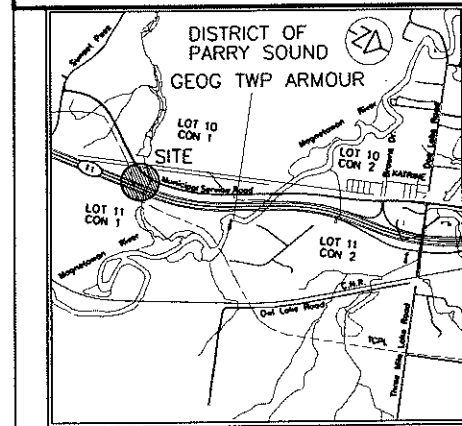


HIGHWAY 11 MAIN LINE
ARMOUR TOWNSHIP
STATION 10+510 TO 10+570
MEDIAN CL, NBL CL, RIGHT TOE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.
THURBER



KEYPLAN
0 500m 1km

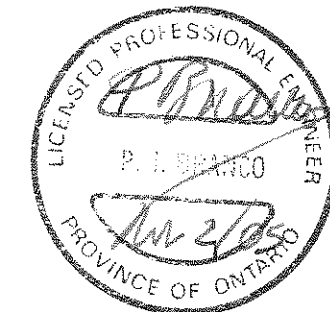
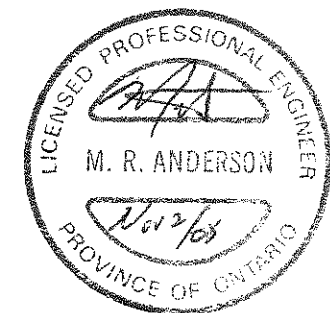
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊗ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
10+510R18.75	10+510	R18.75
10+522.5R4	10+522.5	R4
10+535R10	10+535	R10
10+547.5CL	10+547.5	CL
10+547.5R50	10+547.5	R50
10+560R12	10+560	R12
10+568R44	10+568	R44
10+570R3	10+570	R3

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
JAN. 05	SP	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT
			SCHEME
			DWG 01

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix E

Municipal Service Road, Station 7+500 to 7+720

RECORD OF BOREHOLE No MSR 7+497 R3 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+497, O/S R3 ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 06.07.04 - 06.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	Silty SAND, mixed with topsoil Loose Grey Wet		1	SS	6												
0.8	SILT, trace sand Compact Grey Wet		2	SS	21												
			3	SS	12												0 5 89 6
			4	SS	11												
3.0	Clayey SILT, trace sand Stiff Grey Wet		5	SS	10												0 1 78 21
4.6	Silty CLAY, trace sand Stiff to Very Stiff Grey		6	SS	10												
			7	SS	15												
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 6.71 m AND WATER LEVEL AT 6.1 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

W.P.	480-93-00	LOCATION	Municipal Service Road, ST. 7+512.5, O/S L20	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	WM
DATUM	Geodetic	DATE	06.07.04 - 06.07.04	CHECKED BY	MA



[illegible]

RECORD OF BOREHOLE No MSR 7+520 R18

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+520, O/S R18 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 07.07.04 - 07.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
							20 40 60 80 100	20 40 60							
0.0	SAND, trace silt, trace rootlets and organics		1	SS	2										
0.3	Very Loose Dark Brown PEAT, fibrous Very Loose Dark Brown		2	SS	2										
1.5	Sandy SILT Loose Grey Wet		3	SS	9									0 34 62 4	
2.3	Silty CLAY, trace sand, occasional sand seams Stiff to Very Stiff Grey		4	SS	8										
			5	SS	8										
			6	SS	8										
			7	SS	10									0 1 50 49	
			8	SS	15										
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m AND WATER LEVEL AT 5.79 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.														

ONTMT4 2316.GPJ 30/01/05

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+525 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+525, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 07.07.04 - 07.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
								20 40 60 80 100	20 40 60						
0.0	PEAT, fibrous Very Loose Dark Brown		1	SS	2								100		
0.6	SAND, some silt, fine grained Loose Grey Wet		2	SS	4										
1.5	Silty CLAY, trace sand, occasional sand seams Stiff to Firm Grey		3	SS	13									0 3 62 35	
			4	SS	4										
			5	SS	4										
			1	TW	PH										
			6	SS	11										
	Becoming Very Stiff		7	SS	20										
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE OPEN TO 8.23 m AND WATER LEVEL AT 0.91 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS:														

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+525 CL 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+525, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 07.07.04 - 07.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	DATE DEPTH (m)													
	07.07.04 5.01													
	08.07.04 2.64													
	28.02.05 3.91													

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No MSR 7+537.5 L25 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+537.5, O/S L25 ORIGINATED BY GA
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 07.07.04 - 07.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100		W _p W W _L	WATER CONTENT (%)			
								SHEAR STRENGTH kPa						

ONTMT4 2316.GPJ 30/01/05

RECORD OF BOREHOLE No MSR 7+537.5 R18.5 1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+537.5, O/S R18.5 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 07.07.04 - 07.07.04 CHECKED BY MA






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	20
0.0	DCPT from surface.																	
7.6	END OF DCPT AT 7.62 m.																	

RECORD OF BOREHOLE No MSR 7+550 R4.0

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+550, O/S R4 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE														
								20	40	60	80	100										
0.0	PEAT, fibrous Dark Brown		1	SS	6																	
0.3	SAND, some silt, occasional organics and rootlets Loose to Very Loose Grey-Brown Wet		2	SS	8																	
			3	SS	2																	
2.3	Silty CLAY, trace sand Firm to Stiff Grey varved		4	SS	6																	
			5	SS	6																	
			6	SS	5																	
			7	SS	14																	
7.6	SILT, some clay, trace sand Layered Compact Grey Wet		8	SS	16																	
9.1	SILT, some sand Compact Grey Wet		9	SS	27																	
9.8	END OF BOREHOLE AT 9.75 m.																					

Continued Next Page

+³ × 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+550 R4.0 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+550, O/S R4 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.14 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.															

RECORD OF BOREHOLE No MSR 7+562.5 L27 1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+562.5, O/S L27 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 30.06.04 - 30.06.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100	20 40 60 80 100	W _p	W		
0.0	DCPT from surface.												
9.1	END OF DCPT AT 9.14 m.												

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+562.5 R19 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+562.5, O/S R19 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	Sandy SILT, trace silt, occasional iron oxide staining Loose Brown Wet		1	SS	5												
0.8	(FILL) SILT, trace sand, trace clay, occasional iron oxide staining Loose Brown becoming clayey, stiff		2	SS	6												0 3 90 7
			3	SS	9												
2.3	Silty CLAY, trace sand, occasional sand seams Firm to Stiff Grey		4	SS	6												
			5	SS	6												
			6	SS	7												0 1 46 54
			7	SS	9												
			8	SS	14												
			9	SS	23												
9.1	SILT, some clay Layered Very Stiff Grey																
9.8	END OF BOREHOLE AT 9.75 m.																

Continued Next Page

+ 3 . x 3 : Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+562.5 R19 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+562.5, O/S R19 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20 40 60 80 100	20 40 60 80 100	W _p W W _L	20 40 60		
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.14 m UPON COMPLETION. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 08.07.04 5.92 28.02.05 4.94												

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No MSR 7+574 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+574, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
							20 40 60 80 100	20 40 60 80 100							
0.0	SAND, trace silt, occasional organics, occasional iron oxide staining Loose Brown Silty CLAY, trace sand, occasional sand seams Stiff to Firm Grey		1	SS	6										
0.3			2	SS	7										
			3	SS	4										
			4	SS	5										
			5	SS	7										
			6	SS	6										
			1	TW	PH										
7.6			SILT, some clay Layered, occasional clay seams Very Stiff Grey Wet		7	SS	18								
	8	SS			25										
9.8	END OF BOREHOLE AT 9.75 m.														

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+574 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+574, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 08.07.04 - 08.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT 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			SHEAR STRENGTH kPa	W _p	W	W _L			
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 7.32 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.													

RECORD OF BOREHOLE No MSR 7+610 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+610, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 29.06.04 - 29.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							20 40 60 80 100					WATER CONTENT (%)					
0.0	TOPSOIL																
0.1	Silty CLAY Stiff to Soft Grey Wet		1	SS	2												
			2	SS	9												
			3	SS	8												0 1 41 58
			4	SS	2												
			5	SS	3												
	Becoming Firm		6	SS	7												0 0 59 40
			7	SS	5												
7.3	SILT, some clay, trace sand Compact Grey Moist		8	SS	25												0 0 84 15
8.2	END OF BOREHOLE AT 8.23 m. BOREHOLE BACKFILLED WITH QUICK GEL BENTONITE GROUT.																

ONTMT4 2316.GPJ 30/01/05

+ ³, × ³: Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+622.5 L20.5 1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+622.5, O/S 20.5L ORIGINATED BY SL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 07.12.04 - 07.12.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
0.0	DCPT from surface. Probable Peat to 1.0 m.							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60					
6.1	END OF DCPT AT 6.1 m. BOREHOLE GROUTED WITH BENTONITE HOLE PLUG.													

ONTMT4 2316.GPJ 30/01/05

RECORD OF BOREHOLE No MSR 7+635 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+635, CL ORIGINATED BY WRW
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 29.06.04 - 29.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
0.0	TOPSOIL													
0.2	SAND and SILT Very Loose to Loose Light Grey Wet		1	SS	2						○			
			2	SS	7						○			0 23 57 20
1.1	SILT, some clay to clayey, some sand to sandy Firm Grey Wet													
1.5	Silty CLAY Firm to Stiff Grey Wet		3	SS	4						○			
			4	SS	6						○			
			5	SS	4									0 1 39 60
			1	TW	PH									
			6	SS	8						○			
			7	SS	24						○			
9.1	SILT, trace to some clay, trace sand Compact Grey Wet		8	SS	16						○			0 0 89 10

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+635 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+635, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 29.06.04 - 29.06.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa		WATER CONTENT (%)			
						20 40 60 80 100	20 40 60 80 100	20 40 60					
			9	SS	30								
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE OPEN TO 11.28 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH 28.02.05 (m) 5.74												

RECORD OF BOREHOLE No MSR 7+647.5 R14 1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+647.5, O/S 14R ORIGINATED BY SL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 07.12.04 - 07.12.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60					
6.1	END OF DCPT AT 6.1 m. BOREHOLE GROUTED WITH BENTONITE HOLE PLUG.												

ONTMT4 2316.GPJ 30/01/05

RECORD OF BOREHOLE No MSR 7+660 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+660, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 28.06.04 - 28.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P	W	W _L		
0.0	TOPSOIL							20 40 60 80 100						
0.1	Silty CLAY Firm to Stiff Grey Moist to Wet		1	SS	7			20 40 60 80 100						
			2	SS	8									
			3	SS	6									0 0 51 49
			4	SS	6									
			5	SS	14									
6.1	SILT, some clay, trace sand Compact to Loose Grey Wet		6	SS	17									0 1 86 13
			7	SS	9									
9.1	SILT, some sand Very Loose Grey Moist		8	SS	3									0 18 79 3

Continued Next Page

+³, x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+660 CL 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+660, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 28.06.04 - 28.06.04 CHECKED BY MA


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20	40	60						80	100	20
							○ UNCONFINED + FIELD VANE											
							● QUICK TRIAXIAL × LAB VANE											
							20	40	60	80	100	20	40	60				
10.8	Spoon bouncing at 10.77 m. Continued augering to 13.72 m		9	SS	50/ .100													
13.7	END OF BOREHOLE AT 13.72 m. BOTTOM 4.5 m OF AUGERS BROKE OFF WHEN PROBABLE BEDROCK OR BOULDER WAS CONTACTED. BOREHOLE BACKFILLED WITH QUICK GEL BENTONITE GROUT.																	

SITE 6		RECORD OF BOREHOLE No 7+662				1 OF 1		METRIC										
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 906.2; E 316 864.5				ORIGINATED BY A.J.												
DIST 52 HWY 11		BOREHOLE TYPE Solid Stem Augers & Hollow Stem Augers				COMPILED BY G.T.												
DATUM Geodetic		DATE 31.05.01				CHECKED BY Z.O.												
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	20
302.0	Ground Surface																	
0.0	100 mm Topsoil SILT with silt and clayey silt layers, frequent decayed vegetation and organics to 0.7 m, grey	very loose ----- stiff	1	SS	0	*												
			2	SS	12													
300.4																		
1.6	SILTY CLAY laminated, firm to stiff, grey		3	SS	5													17.4
			4	SS	5													17.1
298.7			5	TW	PH													
3.3	CLAYEY SILT laminated, firm to stiff, grey		6	SS	9													
			7	SS	7													
			8	SS	9													
			9	SS	5													
295.4																		
6.6	SILT laminated, loose, grey, wet		10	SS	8													
			11	SS	6													
292.9			12	SS	-	**												**Bouncing spoon
9.1	End of borehole. Auger refusal possibly on bedrock *Water level not measured																	

RECORD OF BOREHOLE No MSR 7+672.5 L25 1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+672.5, O/S 25L ORIGINATED BY SL
 HWY 11 BOREHOLE TYPE Probe Rod COMPILED BY WM
 DATUM Geodetic DATE 07.12.04 - 07.12.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
								20	40	60	80	100					
0.0	ORGANICS (150 mm of moss)																
0.2	END OF BOREHOLE AT 0.15 m. REFUSAL AT 0.15 m ON PROBABLE BEDROCK.																

RECORD OF BOREHOLE No MSR 7+672.5 R24 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+672.5, O/S R24 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 27.06.04 - 27.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
							20 40 60 80 100	20 40 60 80 100	20 40 60					GR SA SI CL	
0.0 0.1	TOPSOIL SAND, fine grained, trace silt Very Loose to Loose Light Brown Moist		1	SS	3										
			2	SS	4										
1.7	Silty CLAY Firm to Stiff Grey		3	SS	5										
			4	SS	6										
			5	SS	5									0 1 55 44	
			6	SS	8										
			7	SS	5										
7.3	SILT, trace sand, trace clay Compact Grey Wet		8	SS	23										
			9	SS	8									0 5 86 9	
9.6	Clayey SILT, trace sand Stiff														

Continued Next Page

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+672.5 R24 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+672.5, O/S R24 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 27.06.04 - 27.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Grey Wet																
10.5	Sandy SILT, trace clay Compact Grey Wet		10	SS	13												
11.3	END OF SAMPLING AT 11.28 m. DCPT STARTED AT 11.28 m.																
13.4	END OF DCPT AT 13.41 m. BOREHOLE BACKFILLED WITH QUICK GEL BENTONITE GROUT.																

SITE 6		RECORD OF BOREHOLE No 7+675				1 OF 1		METRIC	
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 919.1; E 316 866.2				ORIGINATED BY A.J.			
DIST 52 HWY 11		BOREHOLE TYPE Solid Stem Augers & Hollow Stem Augers				COMPILED BY G.T.			
DATUM Geodetic		DATE 01.06.01				CHECKED BY Z.O.			

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
301.6	Ground Surface													
0.0	100 mm Topsoil		1	SS	6									
	SANDY SILT/SILTY FINE SAND with decayed vegetation and organics, dark brown to 0.7 m, grey below, wet loose very loose loose		2	SS	7									
			3	SS	1									
			4	SS	8									
298.7														
2.9	CLAYEY SILT/SILTY CLAY laminated, grey, wet firm frequent silt seams stiff to very stiff		5	SS	4									
			6	SS	4									
			7	TW	PH									
			8	SS	12									
295.0				9	SS	17								
6.6	SILT with some sandy silt and silty fine sand seams, grey, wet loose very loose loose		10	SS	7									
			11	SS	3									
			12	SS	9									
289.0				13	SS	5								
	very loose													
			14	SS	3									
12.6	End of borehole Hole open to 8.5 m on completion *Piezometer installed at 8.2 m Water level on: June 05/2001 - 3.3 m June 07/2001 - 3.3 m													

RECORD OF BOREHOLE No MSR 7+685 CL 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+685, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 27.06.04 - 27.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	TOPSOIL													
0.2	SAND, fine grained, some silt, mixed with topsoil, occasional wood fibers Very Loose Dark Brown		1	SS	2									
0.9	SILT, some clay, mixed with topsoil Very Loose Light Grey Wet		2	SS	1									
1.5	Sandy SILT, trace clay Very Loose to Loose Light Grey Wet		3	SS	1									
			4	SS	5									
			5	SS	2									
4.6	SILT, trace sand Loose Light Grey Wet		6	SS	8									
			7	SS	5									
	occasional sand seams		8	SS	6									
	Becoming Compact		9	SS	20									

Continued Next Page

+ ³ × ³ : Numbers refer to
Sensitivity

20
15 ϕ 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+685 CL 2 OF 2 METRIC

W.P. 480-83-00 LOCATION Municipal Service Road, ST. 7+685, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 27.06.04 - 27.06.04 CHECKED BY MA

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100					
10.7	END OF BOREHOLE AT 10.72 m. AUGER REFUSAL AT 10.72 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH QUICK GEL BENTONITE GROUT.													

SITE 6		RECORD OF BOREHOLE No 7+685				1 OF 2		METRIC			
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 929.0; E 316 867.0				ORIGINATED BY A.J.					
DIST 52 HWY 11		BOREHOLE TYPE D.C.P.T.				COMPILED BY G.T.					
DATUM Geodetic		DATE 07.06.01				CHECKED BY Z.O.					
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa	W P W W L		
299.5 0.0	Ground Surface						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				
	Dynamic Cone Penetration Test (D.C.P.T.)					299 298 297 296 295 294 293 292 291 290 289 288 287 286 285					

284.5
15.0

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

SITE 6		RECORD OF BOREHOLE No 7+685				2 OF 2		METRIC	
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 929.0; E 316 867.0				ORIGINATED BY A.J.			
DIST 52 HWY 11		BOREHOLE TYPE D.C.P.T.				COMPILED BY G.T.			
DATUM Geodetic		DATE 07.06.01				CHECKED BY Z.O.			

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	20	40
284.5							284												
15.0							283												
							282												
281.0							281												
18.5	End of D.C.P.T.																		

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No MSR 7+697.5 L25 1 OF 1 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+697.5, O/S 25L ORIGINATED BY SL
 HWY 11 BOREHOLE TYPE Probe Rod COMPILED BY WM
 DATUM Geodetic DATE 07.12.04 - 07.12.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
							20	40	60	80	100	W _p	W	W _L		
0.0	ORGANICS (300 mm of moss)															
0.3	END OF BOREHOLE AT 0.30 m. REFUSAL AT 0.30 m ON BEDROCK.															

ONTMT4 2316.GPJ 09/03/05

W.P.	<u>480-93-00</u>	LOCATION	<u>Municipal Service Road, ST. 7+697.5, O/S R23</u>	ORIGINATED BY	<u>WRW</u>
HWY	<u>11</u>	BOREHOLE TYPE	<u>Dynamic Cone Penetration Test (DCPT)</u>	COMPILED BY	<u>WM</u>
DATUM	<u>Geodetic</u>	DATE	<u>28.06.04 - 28.06.04</u>	CHECKED BY	<u>MA</u>

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	Liquid Limit W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		WATER CONTENT (%)			
0.0	DCPT from surface.												

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

ONTMT4 2316.GPJ 30/01/05

RECORD OF BOREHOLE No MSR 7+697.5 R23 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+697.5, O/S R23 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 28.06.04 - 28.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y 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 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	W _p	W	W _L		
12.2	END OF DCPT AT 12.19 m.												

SITE 6		RECORD OF BOREHOLE No 7+704				1 OF 1		METRIC									
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 948.0; E 316 867.5				ORIGINATED BY A.J											
DIST 52 HWY 11		BOREHOLE TYPE Solid Stem Augers				COMPILED BY G.T											
DATUM Geodetic		DATE 11.06.01				CHECKED BY Z.O											
ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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
			NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
299.2	Ground Surface		1	SS	0		299										
0.0	FILL:: mixed silt, clay and organics, very loose, dark brown, moist																
298.5																	
0.7	SILT trace organics, compact, brown, moist		2	SS	11		298										
			3	SS	11												
297.1							297										
2.1	SILTY CLAY laminated, trace organics, grey		4	SS	14												
			5	SS	10		296										
			6	SS	5		295										
294.6																	
			7	SS	66/6												
4.6	End of borehole. Auger refusal probably on bedrock. *Hole dry (water level not stabilized) and open to full depth on completion. 0.7 m fill added to provide access for drilling. Borehole elevation adjusted																0 1 80 19 **Split spoon refusal

RECORD OF BOREHOLE No MSR 7+710 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+710, CL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 26.06.04 - 26.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
								WATER CONTENT (%)									
								20 40 60									
0.0	TOPSOIL																
0.1	SAND, fine grained, some organics Very Loose to Loose Dark Brown Moist		1	SS	2												
			2	SS	7												
1.4	END OF BOREHOLE AT 1.45 m. AUGER REFUSAL AT 1.45 m ON PROBABLE BEDROCK OR BOULDER. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO SURFACE. NOTE: Moved 1.5 m north and re-augered to confirm refusal depth.																

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

SITE 6		RECORD OF BOREHOLE No 7+711				1 OF 1		METRIC	
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 045 955.0; E 316 867.4				ORIGINATED BY A.J.			
DIST 52 HWY 11		BOREHOLE TYPE D.C.P.T.				COMPILED BY G.T.			
DATUM Geodetic		DATE 11.06.01				CHECKED BY Z.O.			

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y 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 (%)					
299.5 0.0	Ground Surface						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div> <div style="display: flex; justify-content: space-between;"> ○ UNCONFINED + FIELD VANE </div> <div style="display: flex; justify-content: space-between;"> ● QUICK TRIAXIAL x LAB VANE </div>	<div style="display: flex; justify-content: space-between;"> W P W W L </div>						
294.8	End of D.C.P.T.													
4.7														

+³ . x³ : Numbers refer to
Sensitivity

20
15
10
5
0

(%) STRAIN AT FAILURE

1 OF 2

METRIC

W.P.	480-93-00	LOCATION	Municipal Service Road, ST. 7+720, O/S R21	ORIGINATED BY	GA
HWY	11	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	WM
DATUM	Geodetic	DATE	06.07.04 - 06.07.04	CHECKED BY	MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								20 40 60 80 100										
0.0	Sandy SILT, mixed with topsoil, trace rootlets Compact Dark Brown Moist		1	SS	10													
0.6	SILT, some clay, trace sand, occasional rootlets Compact Mottled Brown-Grey Moist		2	SS	27													
1.5	Silty CLAY, trace sand Stiff to Very Stiff Grey		3	SS	15													
			4	SS	8									0 1 35 64				
			5	SS	10													
	Varved		6	SS	13													
6.1	SILT, some clay Very Stiff Grey Wet		7	SS	19									0 0 81 19				
7.6	SILT, some sand to sandy Loose to Compact Grey Wet		8	SS	6													
			9	SS	17													

+ 3, x 3: Numbers refer to Sensitivity

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No MSR 7+720 R21 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+720, O/S R21 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 06.07.04 - 06.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
								○ UNCONFINED		+	FIELD VANE						
								● QUICK TRIAXIAL		x	LAB VANE						
								20	40	60	80	100					
									</								

RECORD OF BOREHOLE No MSR 7+720 L25

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+720, O/S L25 ORIGINATED BY SL
HWY 11 BOREHOLE TYPE COMPILED BY WM
DATUM Geodetic DATE 06.12.04 - 06.12.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa	WATER CONTENT (%)	W _p	W		
0.0	BEDROCK AT GROUND SURFACE.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60					

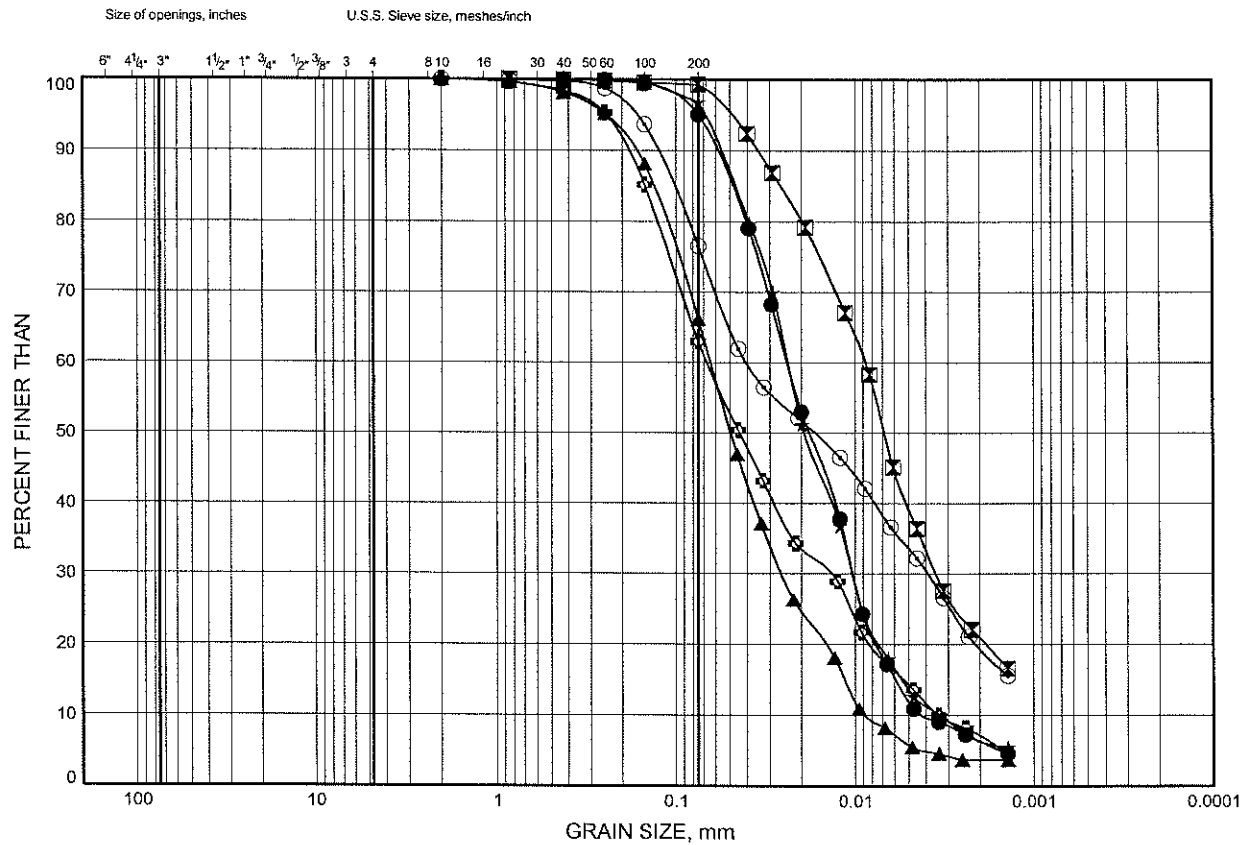
SITE 6		RECORD OF BOREHOLE No 7+723				1 OF 1		METRIC	
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 967.0; E 316 866.7				ORIGINATED BY A.J.			
DIST 52 HWY 11		BOREHOLE TYPE Solid Stem Augers & D.C.P.T.				COMPILED BY G.T.			
DATUM Geodetic		DATE 11.06.01				CHECKED BY Z.O.			

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 Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
303.6	Ground Surface													
0.0	FILL: mixed sand, silt and topsoil, with rootlets and wood pieces, very loose, dark brown, moist		1	SS	2									
0.7	SILT sandy to 2.0 m, brown to 1.4 m, grey below, compact, moist		2	SS	29									
			3	SS	25									
300.9	trace fine gravel		4	SS	24									
2.7	End of borehole. Auger refusal probably on bedrock													** Cone deflecting at 2.6 m probably on bedrock.
300.4														
3.2	End of D.C.P.T. *Hole dry (water level not stabilized) and open to full depth on completion Dynamic Cone Penetration Test performed 1.0 m east of borehole from 0 to 3.2 m**. 0.7 m fill added to provide access for drilling. Borehole elevation adjusted.													

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE E1

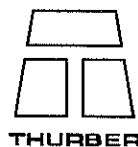
SILT, Sandy SILT, Clayey SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+497 R3	1.83	
⊠	MSR 7+497 R3	3.35	
▲	MSR 7+520 R18	1.83	
★	MSR 7+562.5 R19	1.07	
⊙	MSR 7+635 CL	0.91	
⊗	MSR 7+685 CL	2.59	

Date January 2005
Project 480-93-00

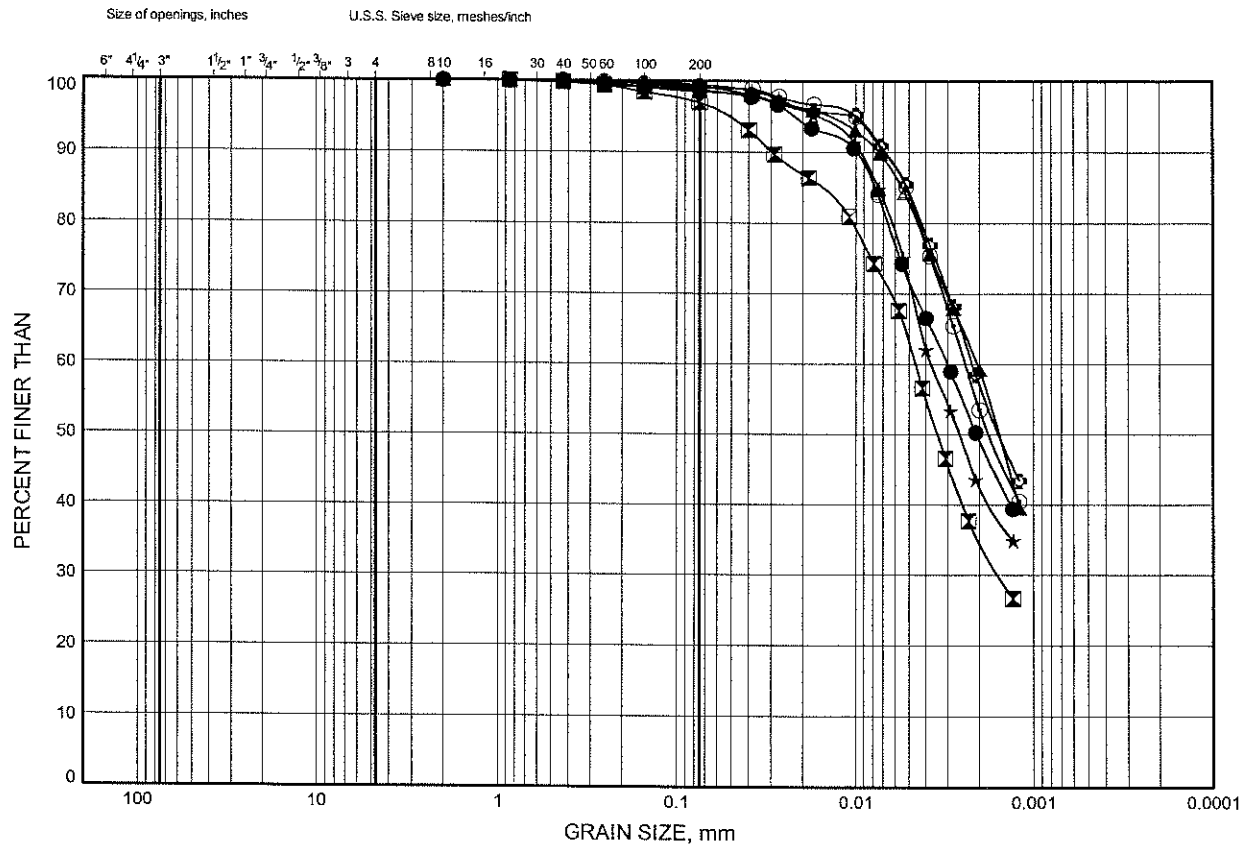


Prep'd WM
Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE E2

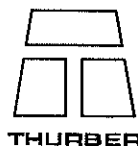
Silty CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+520 R18	6.40	
⊠	MSR 7+525 CL	1.83	
▲	MSR 7+537.5 L25	3.35	
★	MSR 7+550 R4.0	4.88	
⊙	MSR 7+562.5 R19	4.88	
⊕	MSR 7+574 CL	3.35	

Date January 2005
Project 480-93-00

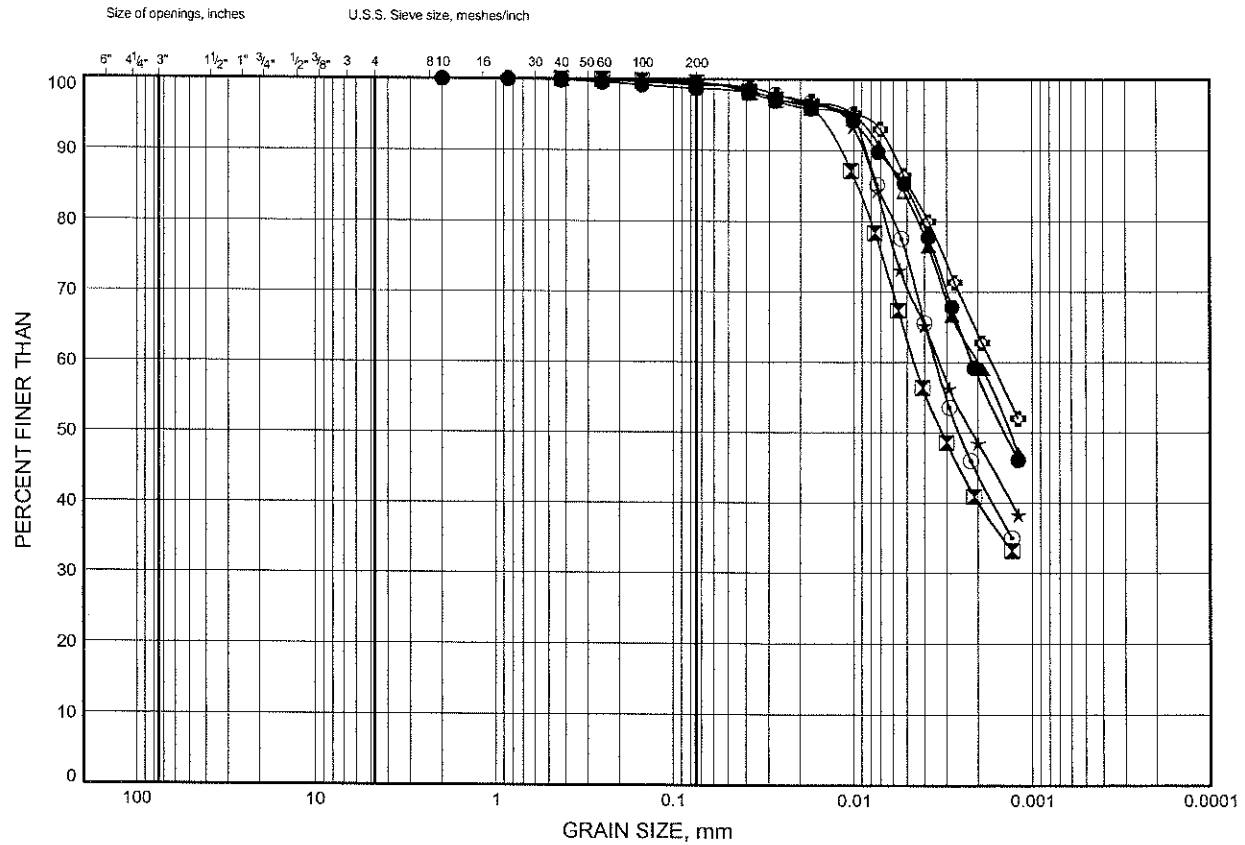


Prep'd WM
Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE E3

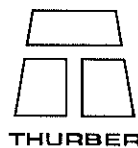
Silty CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+610 CL	1.83	
⊠	MSR 7+610 CL	4.88	
▲	MSR 7+635 CL	3.35	
★	MSR 7+660 CL	2.59	
⊙	MSR 7+672.5 R24	3.35	
⊛	MSR 7+720 R21	2.59	

Date March 2005
Project 480-93-00

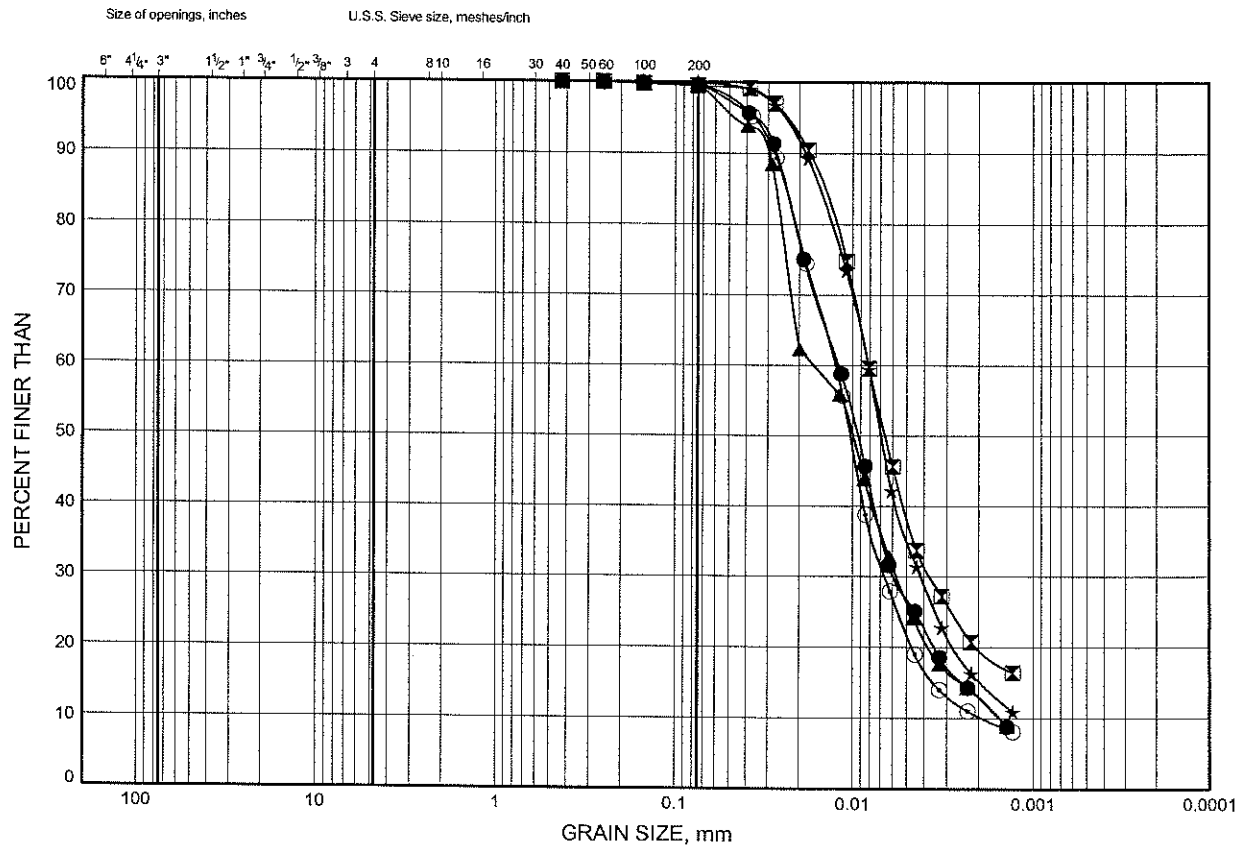


Prep'd WM
Chkd. MA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE E4

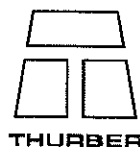
Lower SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+537.5 L25	7.92	
⊠	MSR 7+550 R4.0	7.92	
▲	MSR 7+574 CL	9.45	
★	MSR 7+610 CL	7.92	
⊙	MSR 7+635 CL	9.45	

Date January 2005
Project 480-93-00

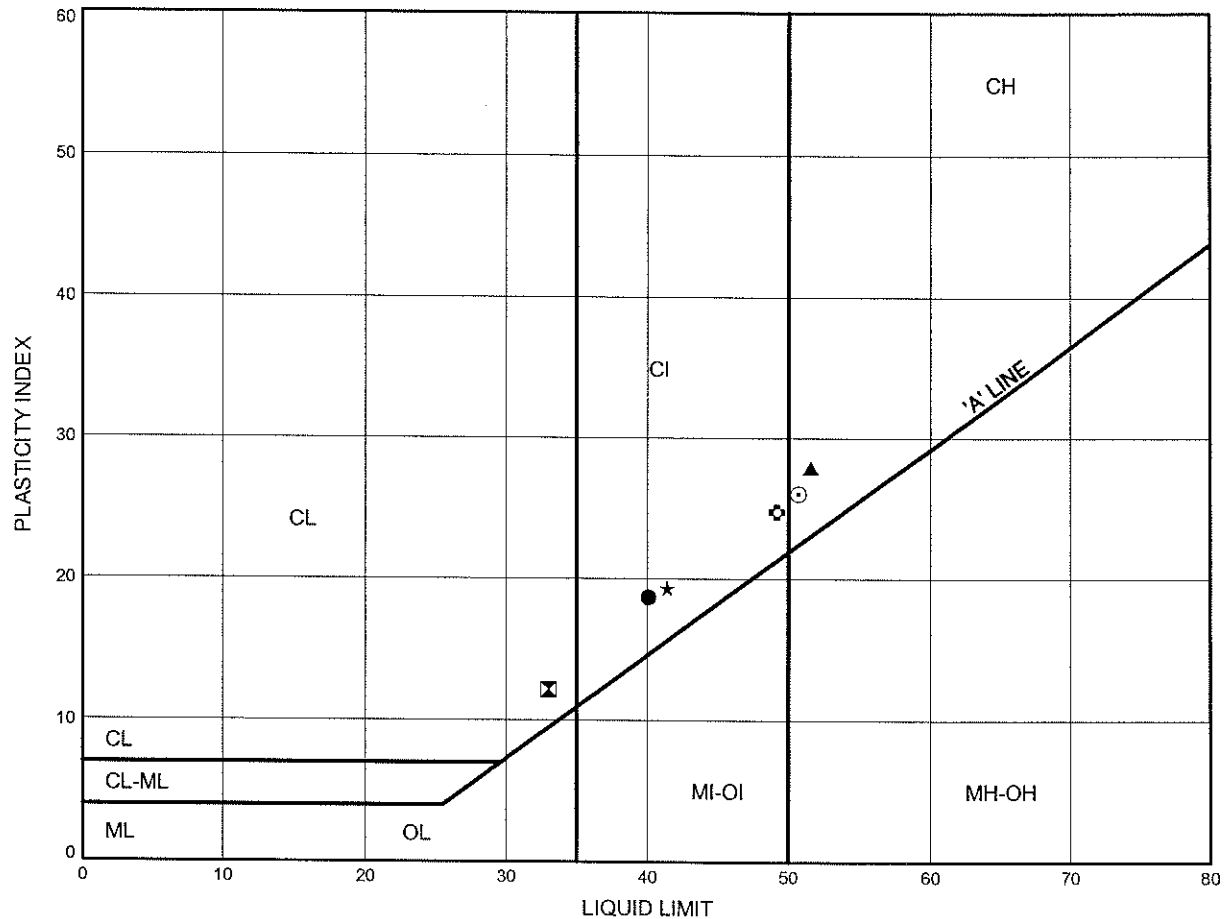


Prep'd WM
Chkd. MA

Hwy 11 Katrine

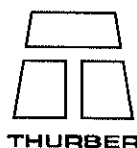
ATTERBERG LIMITS TEST RESULTS

FIGURE E6



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+520 R18	6.40	
⊠	MSR 7+525 CL	1.83	
▲	MSR 7+537.5 L25	3.35	
★	MSR 7+550 R4.0	4.88	
⊙	MSR 7+562.5 R19	4.88	
⊛	MSR 7+574 CL	3.35	

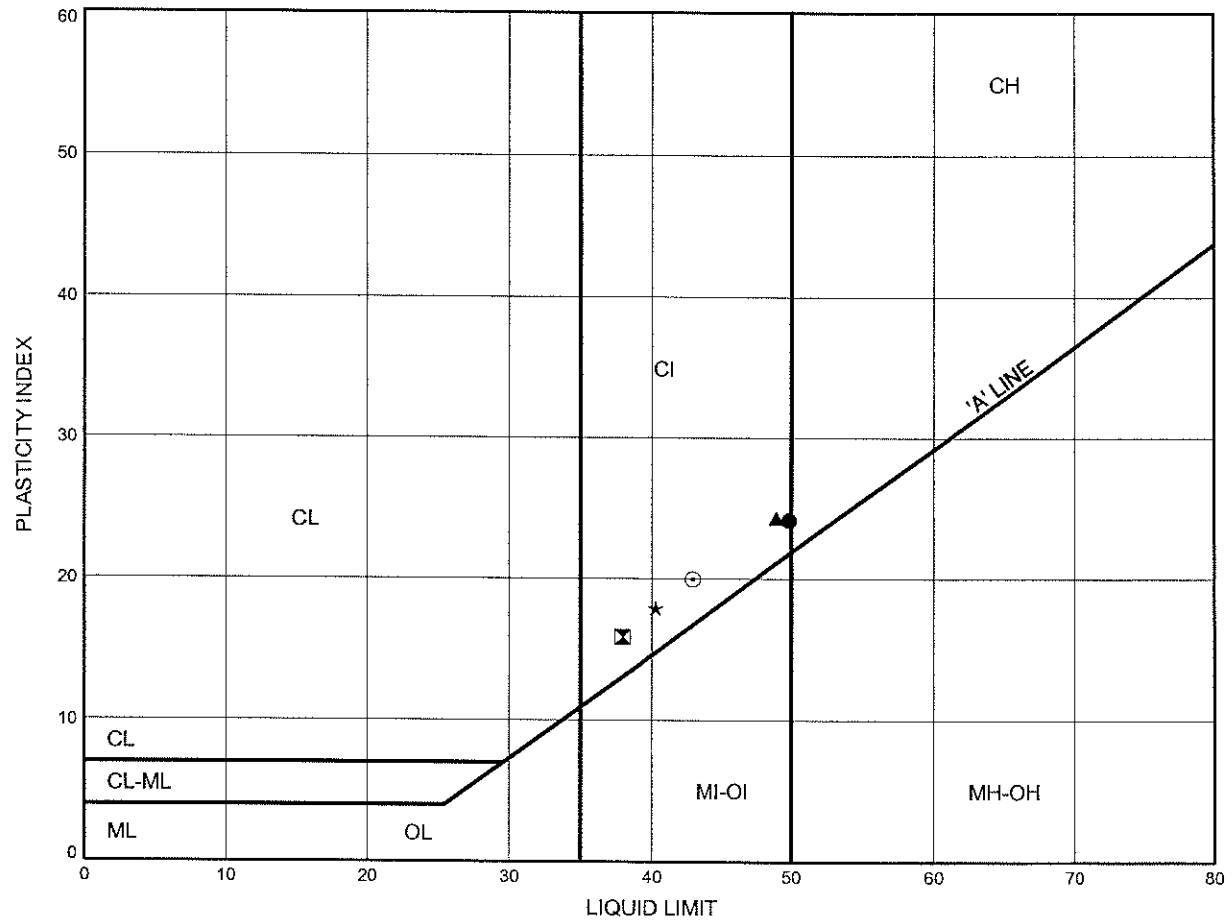
Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

Hwy 11 Katrine ATTERBERG LIMITS TEST RESULTS

FIGURE E7



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	MSR 7+610 CL	1.83	
⊠	MSR 7+610 CL	4.88	
▲	MSR 7+635 CL	3.35	
★	MSR 7+660 CL	2.59	
⊙	MSR 7+672.5 R24	3.35	

Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-112	Sample Number	-
Borehole Number	E MSR 7+635 CL	Sample Depth, m	4.6-5.2

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	9		
Date Started	11/17/2004		
Date Completed	11/28/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.92	Unit Weight, kN/m ³	17.85
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m ³	12.74
Area, cm ²	31.52	Specific Gravity, measured	2.78
Volume, cm ³	60.36	Solids Height, cm	0.895
Water Content, %	40.16	Volume of Solids, cm ³	28.20
Wet Mass, g	109.87	Volume of Voids, cm ³	32.16
Dry Mass, g	78.39	Degree of Saturation, %	97.9

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t ₉₀ sec	cv. cm ² /s	mv m ² /kN	k cm/s
0.00	1.915	1.141	1.915				
4.87	1.903	1.127	1.909	129	5.99E-03	1.29E-03	7.55E-07
9.55	1.896	1.119	1.900	28	2.73E-02	7.81E-04	2.09E-06
19.50	1.887	1.109	1.892	43	1.76E-02	4.72E-04	8.17E-07
38.82	1.874	1.095	1.881	34	2.20E-02	3.51E-04	7.59E-07
77.80	1.859	1.078	1.867	23	3.21E-02	2.01E-04	6.32E-07
155.39	1.841	1.058	1.850	23	3.15E-02	1.21E-04	3.75E-07
310.70	1.813	1.027	1.827	28	2.53E-02	9.41E-05	2.33E-07
620.36	1.746	0.952	1.780	17	3.95E-02	1.13E-04	4.37E-07
1242.27	1.629	0.821	1.688	76	7.94E-03	9.82E-05	7.65E-08
2483.99	1.539	0.720	1.584	60	8.87E-03	3.78E-05	3.29E-08
1242.27	1.551	0.734	1.545				
310.70	1.577	0.763	1.564				
77.80	1.609	0.799	1.593				
19.50	1.649	0.843	1.629				
4.87	1.688	0.887	1.669				

Notes:

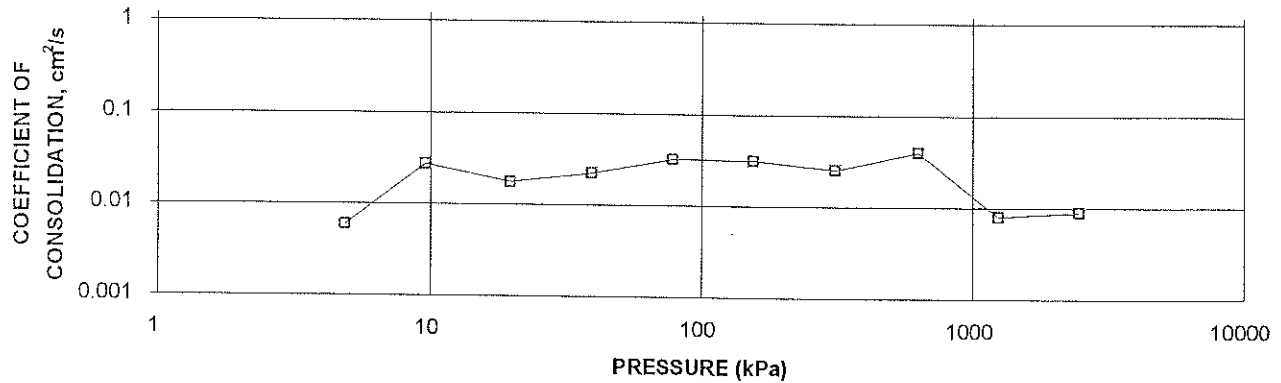
k calculated using cv based on $\dot{\epsilon}_0$ values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

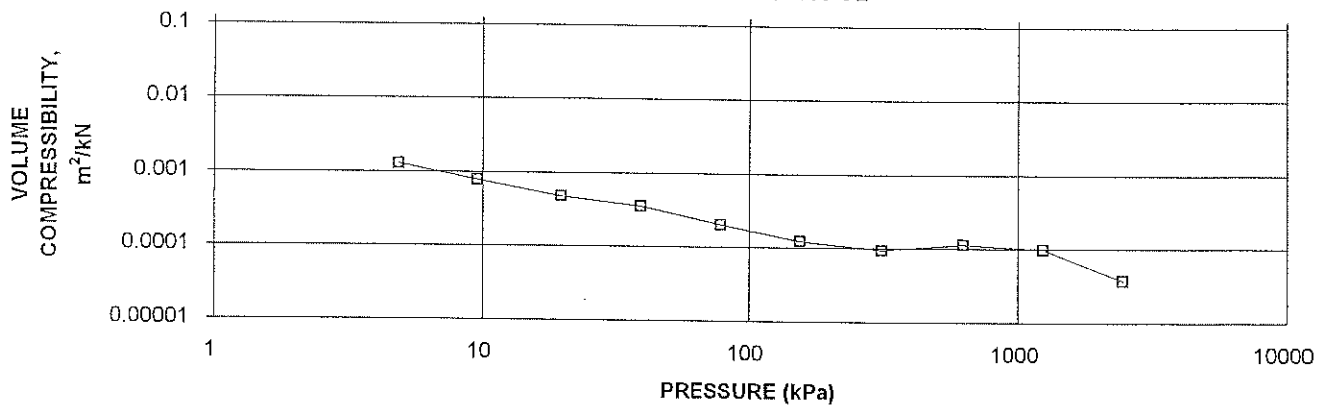
Sample Height, cm	1.69	Unit Weight, kN/m ³	19.14
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m ³	14.45
Area, cm ²	31.52	Specific Gravity, measured	2.78
Volume, cm ³	53.21	Solids Height, cm	0.895
Water Content, %	32.50	Volume of Solids, cm ³	28.20
Wet Mass, g	103.87	Volume of Voids, cm ³	25.01
Dry Mass, g	78.39		

OEDOMETER CONSOLIDATION SUMMARY

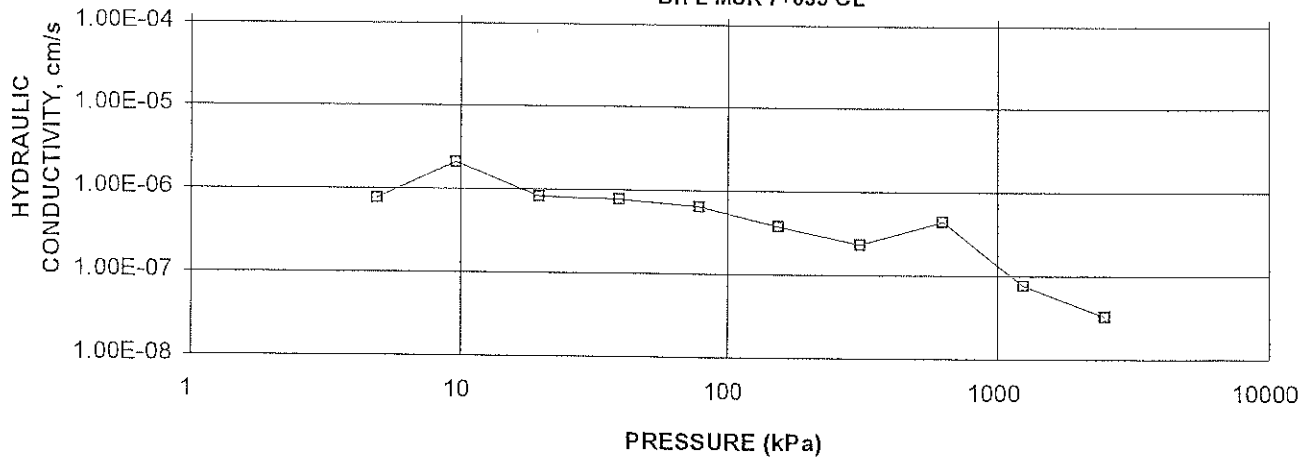
CONSOLIDATION TEST
CV cm²/s VS PRESSURE (kPa)
BH E MSR 7+635 CL



CONSOLIDATION TEST
MV m²/kN vs PRESSURE (kPa)
BH E MSR 7+635 CL



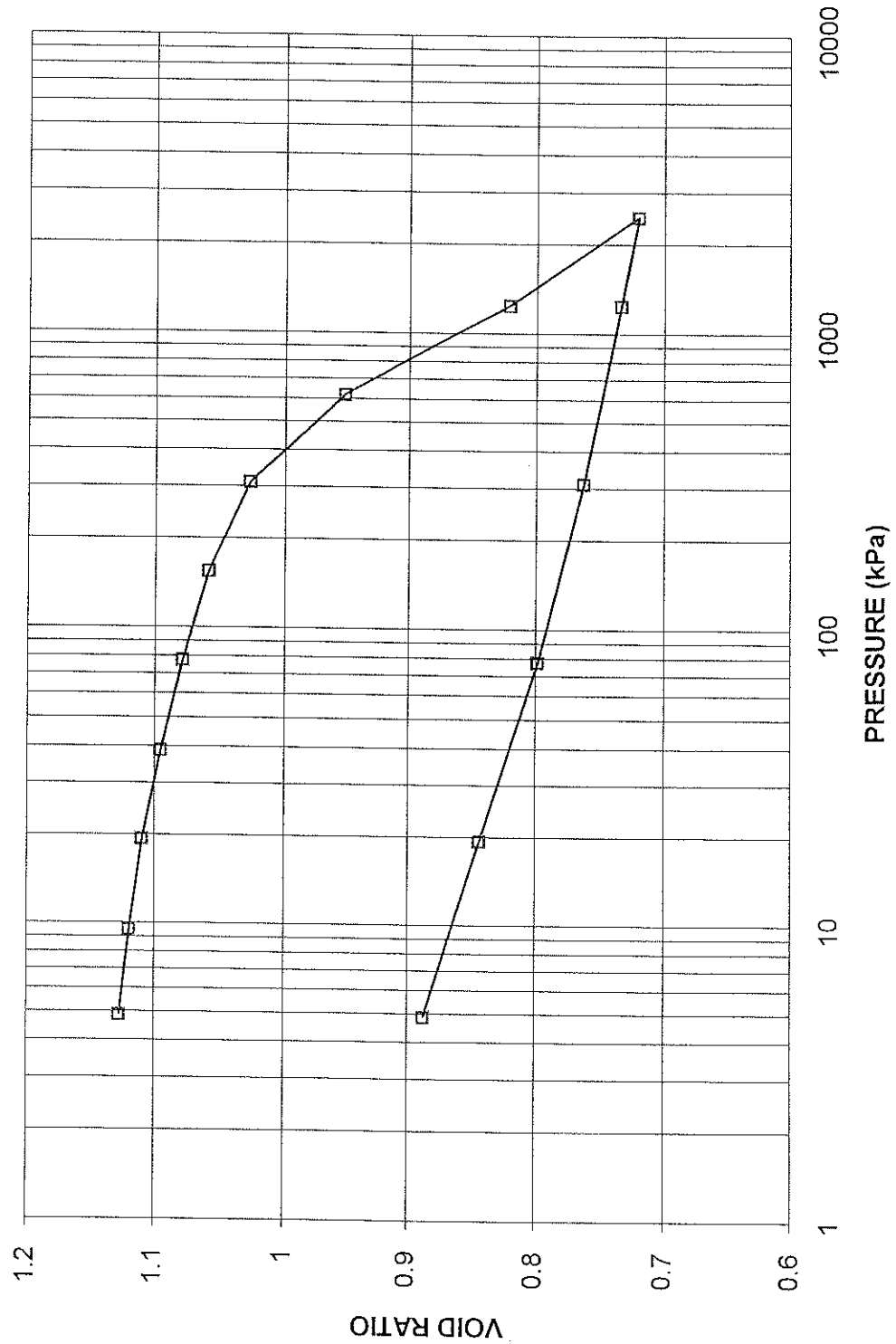
CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH E MSR 7+635 CL

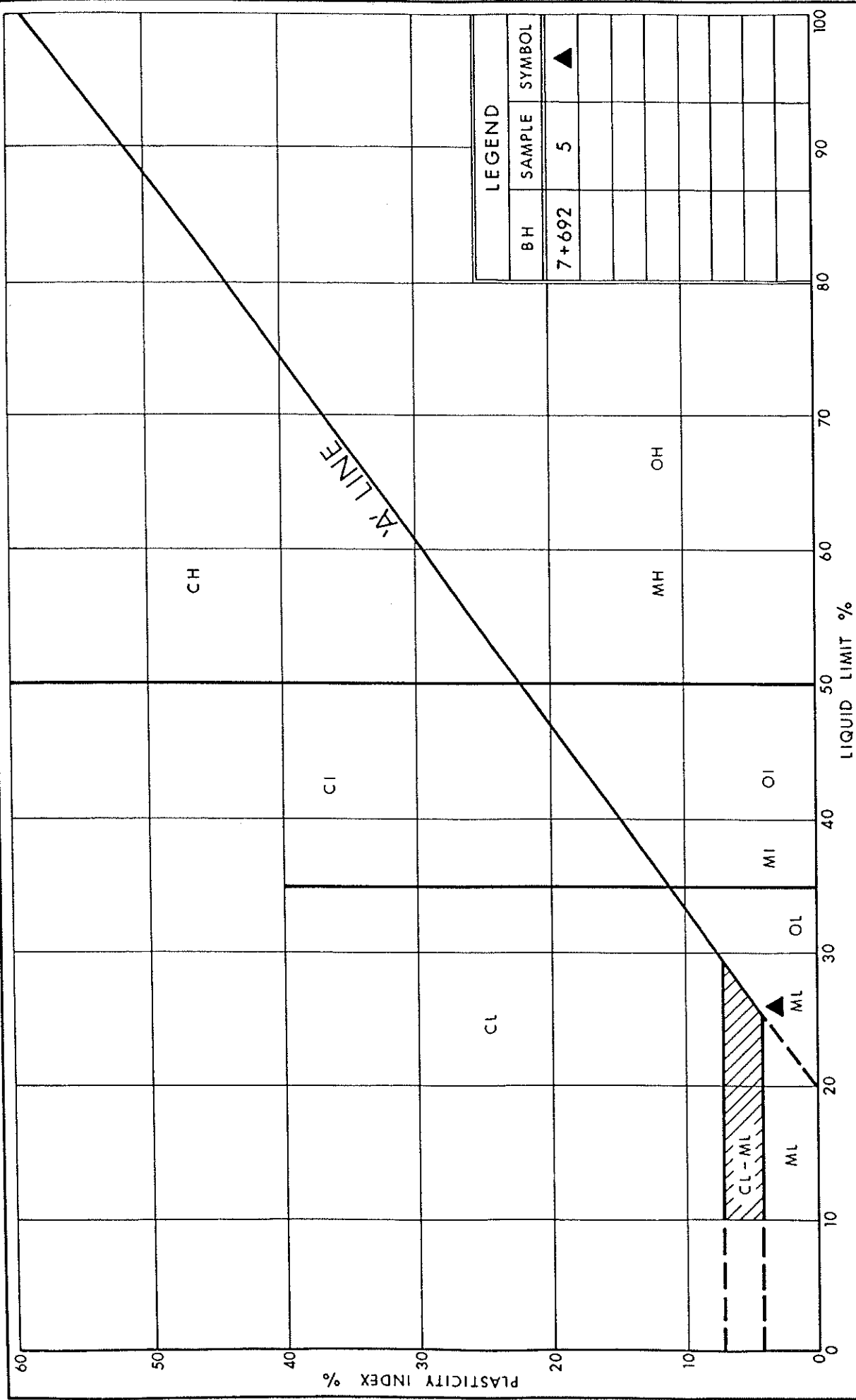


CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

FIGURE

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH E MSR 7+635 CL

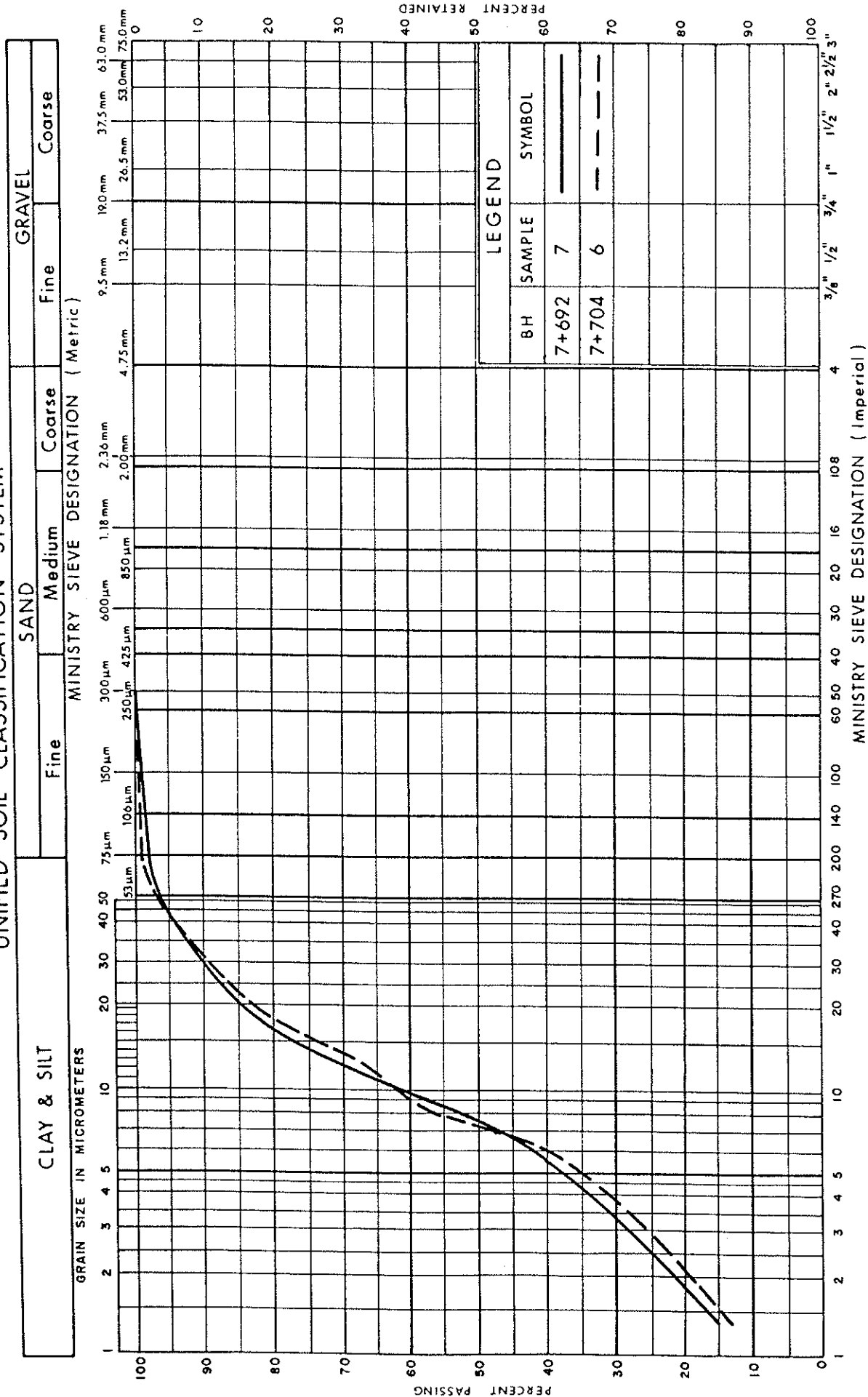




LEGEND		
BH	SAMPLE	SYMBOL
7+692	5	▲

PLASTICITY CHART
Upper SILT (Alluvium)

FIG No B6-1
W P 314-99-00
SPT 1010F

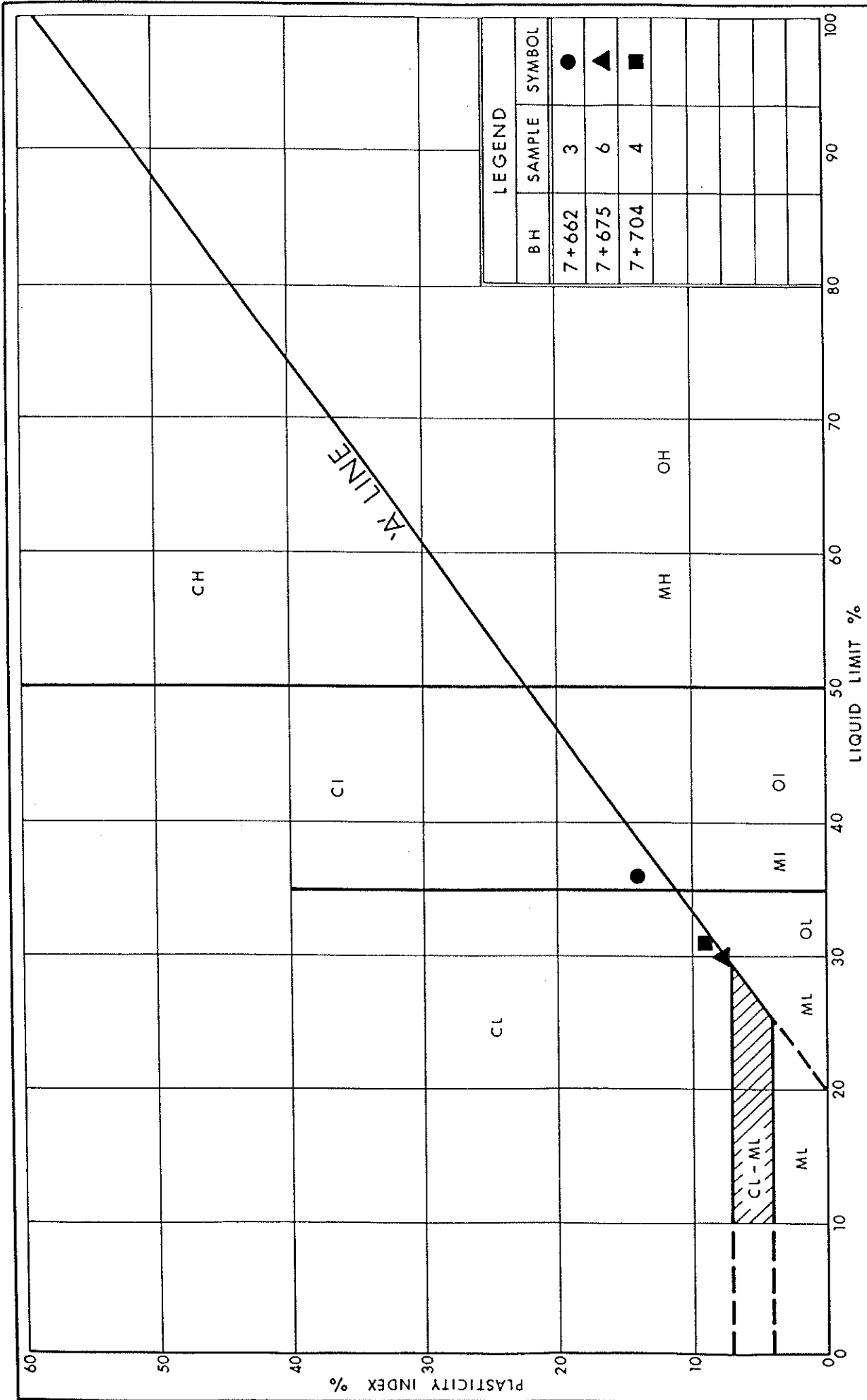
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION CLAYEY SILT / SILTY CLAY

FIG No B6-2

W P 314-99-00

SPT 1010F



PLASTICITY CHART
CLAYEY SILT/SILTY CLAY

FIG No B6-3

W P 314-99-00

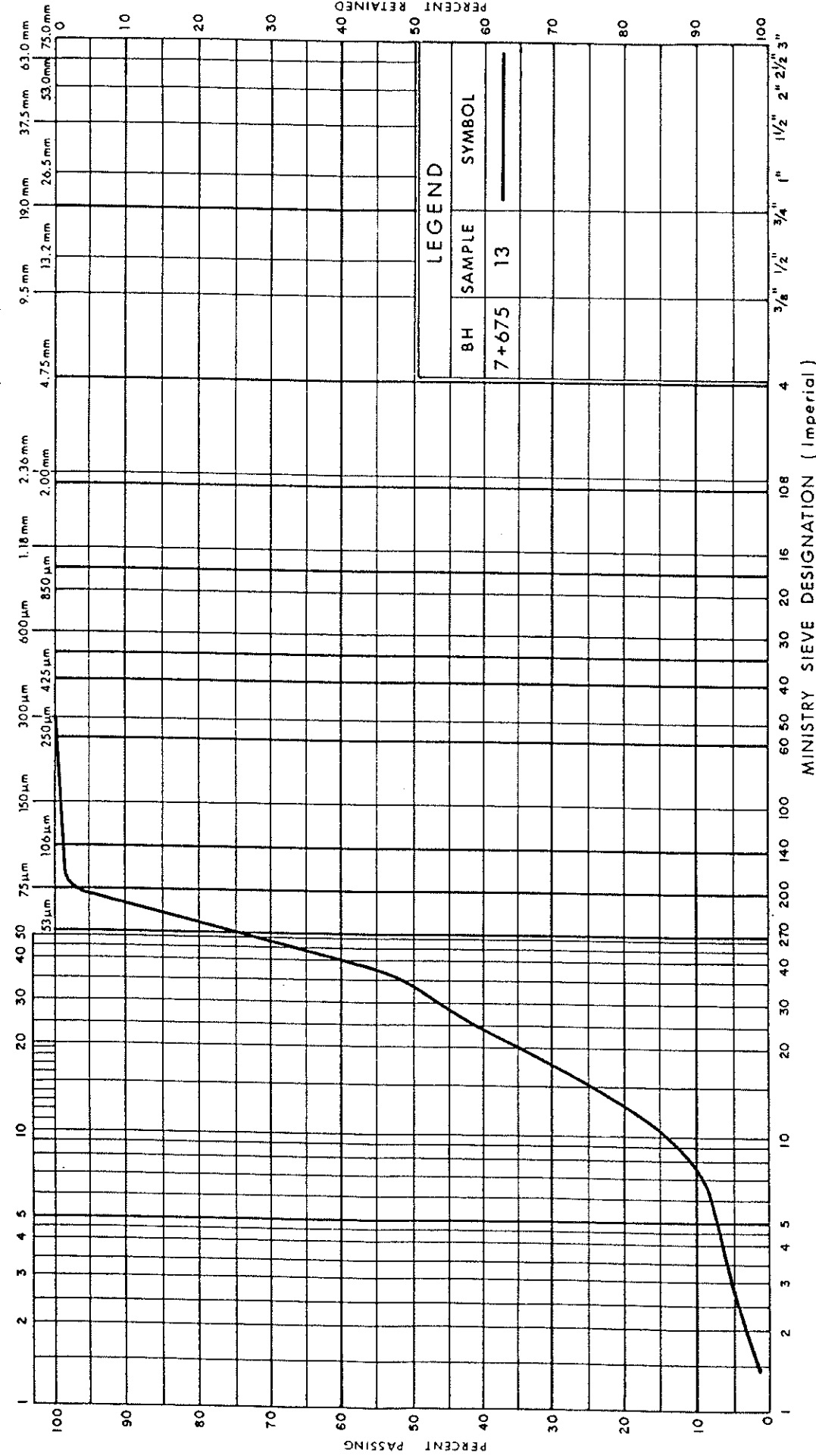
SPT 1010F

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)



Ministry of
Transportation



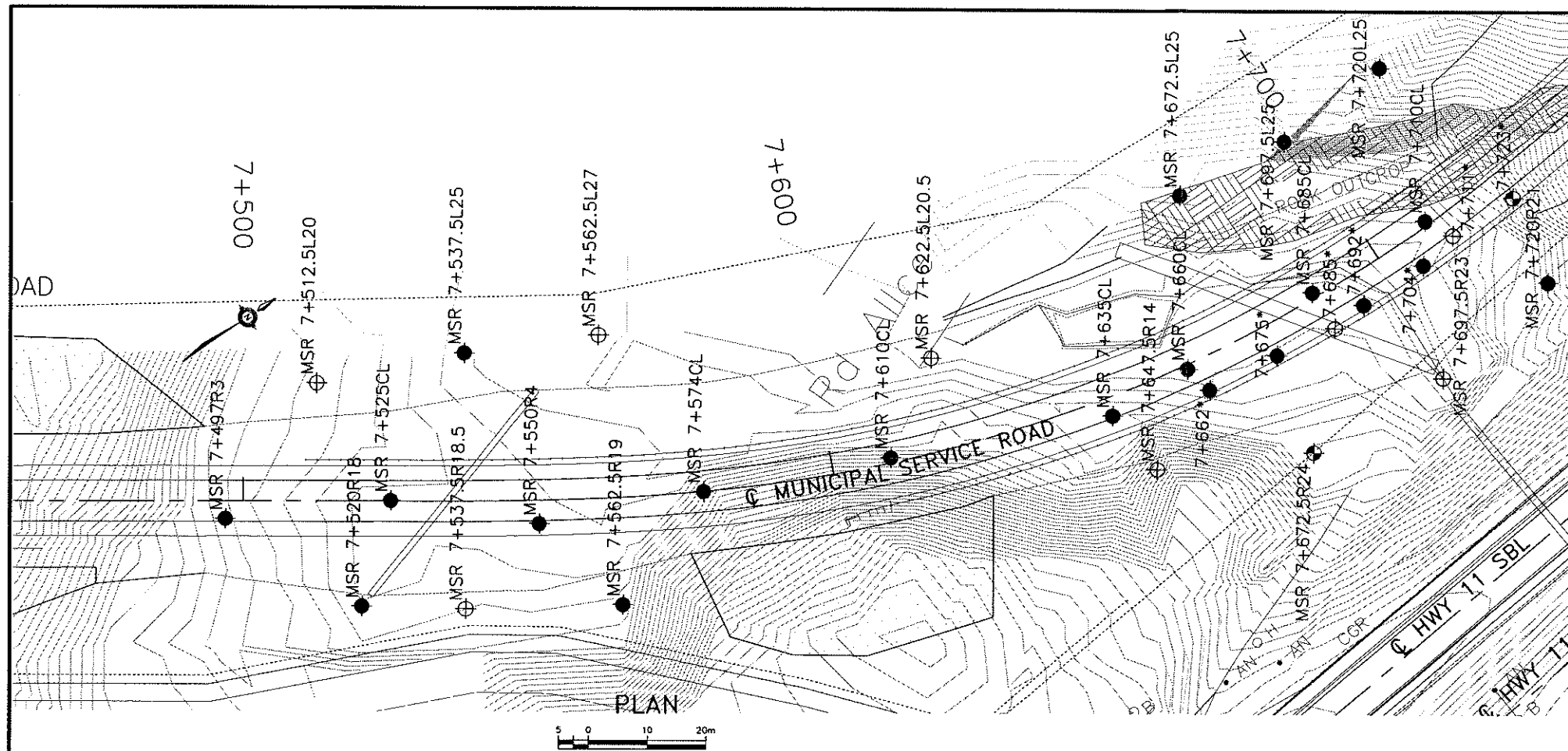
GRAIN SIZE DISTRIBUTION

Lower SILT

FIG No B6-4

W P 314-99-00

SPT 1010F



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

HWY 11

CONT No

WP No 480-93-00

MUNICIPAL SERVICE ROAD

STATION 7+500 TO 7+720

CENTRELINE

BOREHOLE LOCATIONS AND SOIL STRATA

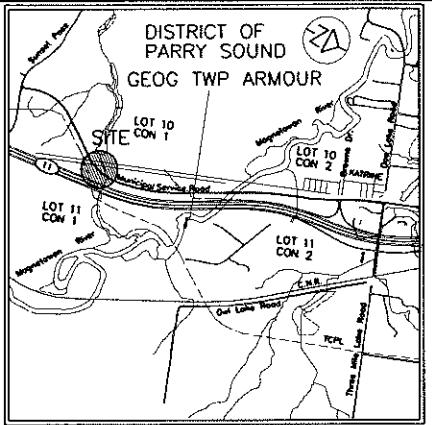
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

NO	STATION	OFFSET FROM CL
MSR 7+610 CL	7+610	CL
MSR 7+622.5 L20.5	7+622.5	L20.5
MSR 7+635 CL	7+635	CL
MSR 7+647.5 R14	7+647.5	R14
MSR 7+660 CL	7+660	CL
MSR 7+672.5 R24	7+672.5	R24
MSR 7+672.5 L25	7+672.5	L25
MSR 7+685 CL	7+685	CL
MSR 7+697.5 R23	7+697.5	R23
MSR 7+697.5 L25	7+697.5	L25
MSR 7+710 CL	7+710	CL
MSR 7+720 R21	7+720	R21
MSR 7+720 L25	7+720	L25

NO	ELEVATION	NORTH	EAST
7+662*	302.0	5046906.2	316864.5
7+675*	301.6	5046919.1	316866.2
7+692*	298.6	5046936.0	316867.4
7+704*	299.2	5046948.0	316867.5
7+723*	303.6	5046967.0	316866.7

* Borehole by Shaheen & Peaker Limited



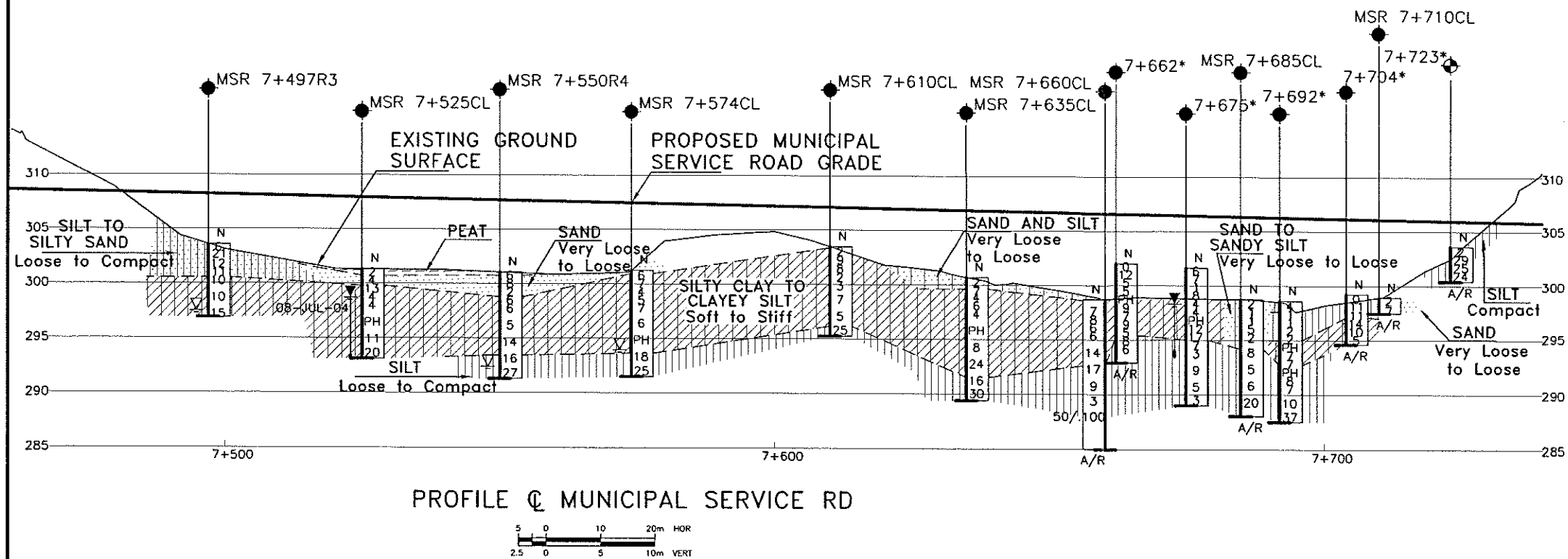
LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (cone) or Probe Hole
- Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM CL
MSR 7+497 R3	7+497	R3
MSR 7+512.5 L20	7+512.5	L20
MSR 7+520 R18	7+520	R18
MSR 7+525 CL	7+525	CL
MSR 7+537.5 R18.5	7+537.5	R18.5
MSR 7+537.5 L25	7+537.5	L25
MSR 7+550 R4.0	7+550	R4.0
MSR 7+562.5 R19	7+562.5	R19
MSR 7+562.5 L27	7+562.5	L27
MSR 7+574 CL	7+574	CL

NOTE

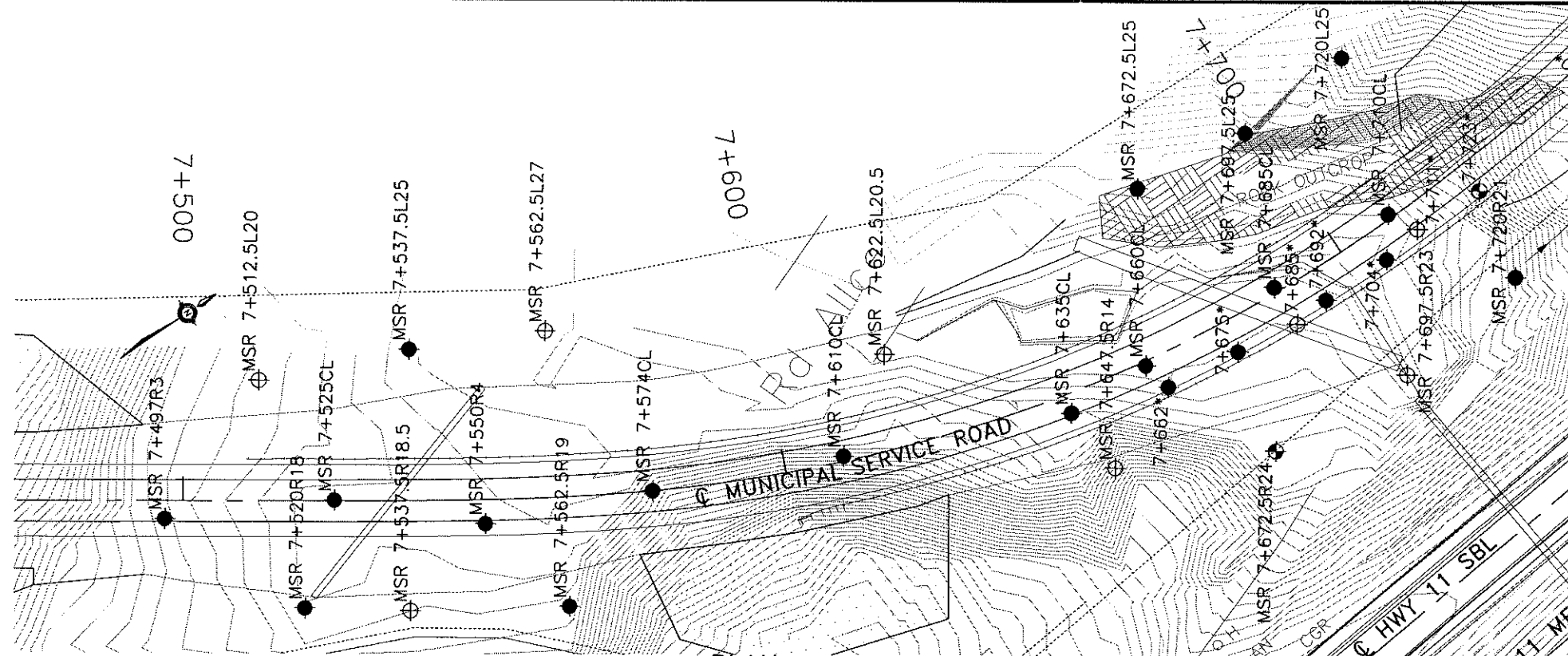
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



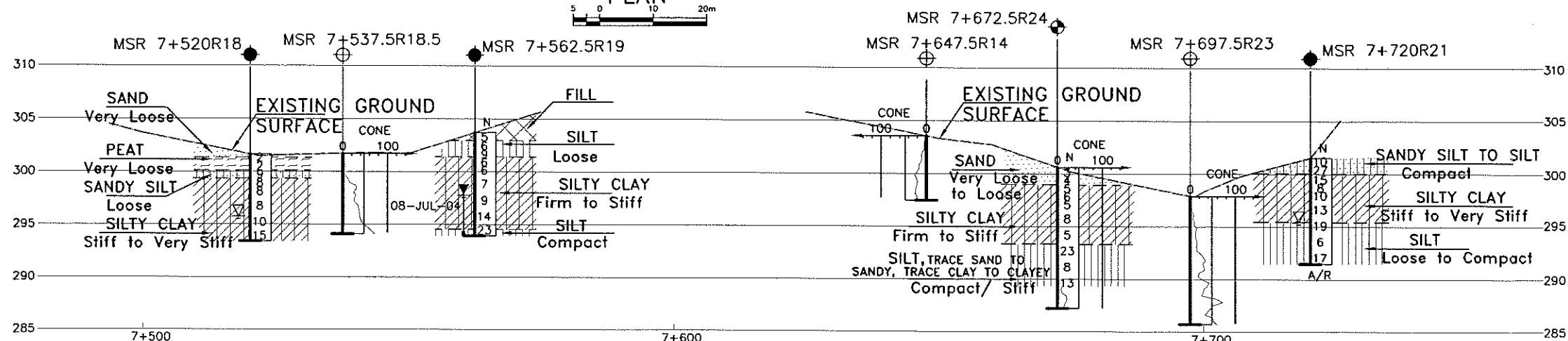
PROFILE @ MUNICIPAL SERVICE RD

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT
			SCHEME
			DWG E1

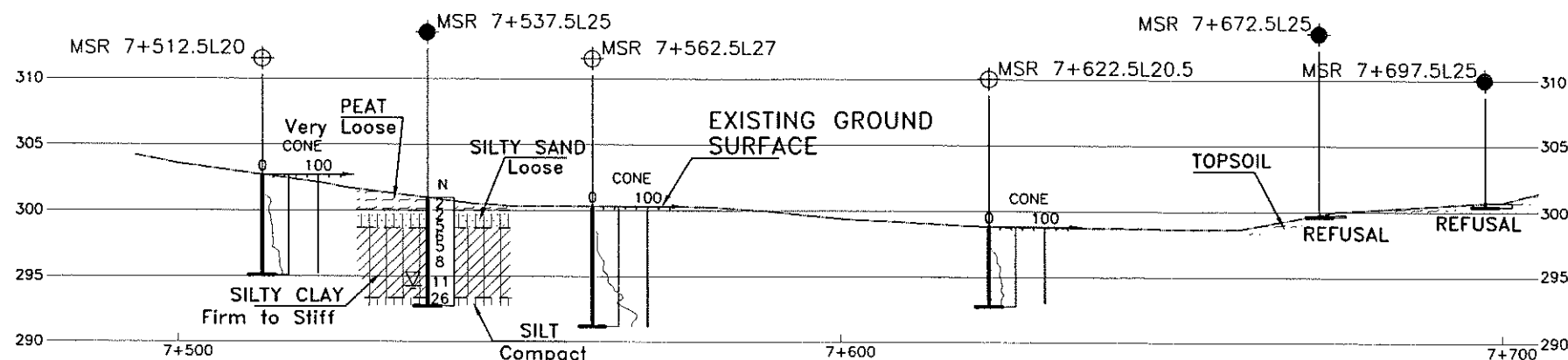


PLAN
0 10 20m



PROFILE TOE OF MUNICIPAL SERVICE RD RIGHT

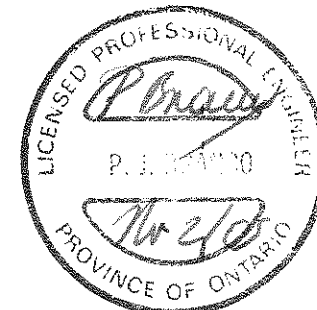
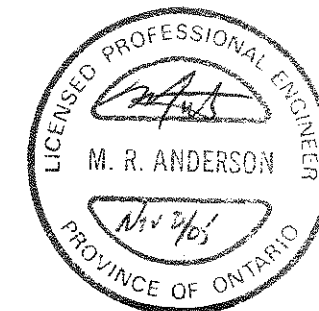
0 10 20m HOR
0 2.5 5 10m VERT



PROFILE TOE OF MUNICIPAL SERVICE RD LEFT

0 10 20m HOR
0 2.5 5 10m VERT

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



HWY 11
CONT No
WP No 480-93-00

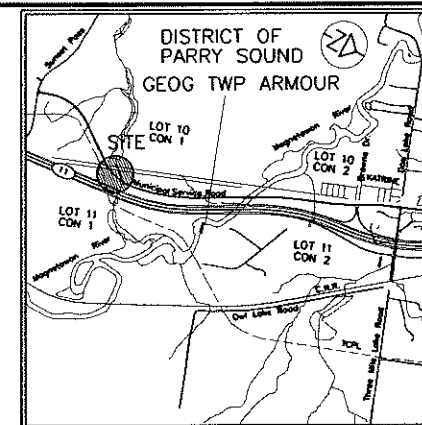


MUNICIPAL SERVICE ROAD
STATION 7+500 TO 7+720
RIGHT TOE AND LEFT TOE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.
THURBER



KEYPLAN

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
MSR 7+497 R3	7+497	R3
MSR 7+512.5 L20	7+512.5	L20
MSR 7+520 R18	7+520	R18
MSR 7+525 CL	7+525	CL
MSR 7+537.5 R18.5	7+537.5	R18.5
MSR 7+537.5 L25	7+537.5	L25
MSR 7+550 R4.0	7+550	R4.0
MSR 7+562.5 R19	7+562.5	R19
MSR 7+562.5 L27	7+562.5	L27
MSR 7+574 CL	7+574	CL

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NO	STATION	OFFSET FROM CL
MSR 7+610 CL	7+610	CL
MSR 7+622.5 L20.5	7+622.5	L20.5
MSR 7+635 CL	7+635	CL
MSR 7+647.5 R14	7+647.5	R14
MSR 7+660 CL	7+660	CL
MSR 7+672.5 R24	7+672.5	R24
MSR 7+672.5 L25	7+672.5	L25
MSR 7+685 CL	7+685	CL
MSR 7+697.5 R23	7+697.5	R23
MSR 7+697.5 L25	7+697.5	L25
MSR 7+710 CL	7+710	CL
MSR 7+720 R21	7+720	R21
MSR 7+720 L25	7+720	L25

NO	ELEVATION	NORTH	EAST
7+662*	302.0	5046906.2	316864.5
7+675*	301.6	5046919.1	316866.2
7+692*	298.6	5046936.0	316867.4
7+704*	299.2	5046948.0	316867.5
7+723*	303.6	5046967.0	316866.7

* Borehole by Shoheen & Peaker Limited

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

DATE	BY	DESCRIPTION
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW
DATE	BY	DESCRIPTION
DESIGN MA	CHK AEG	CODE CHBDC
DRAWN HS	CHK MA	SITE
LOAD	STRUCT	SCHEME
DATE JAN, 2005		DWG E2

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix F

Municipal Service Road, Station 7+750 to 7+880

SITE 7		RECORD OF BOREHOLE No 7+750				1 OF 1		METRIC							
W.P. 314-99-00		LOCATION Municipal Service Road - Katrine, ON - Coords: N 5 046 994.4; E 316 867.5				ORIGINATED BY A.J									
DIST 52 HWY 11		BOREHOLE TYPE Solid Stem Augers & D.C.P.T.				COMPILED BY G.T									
DATUM Geodetic		DATE 12.06.01				CHECKED BY Z.O									
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					
313.6	Ground Surface														
0.0	SILTY FINE SAND: with organics, very loose moist		1	SS	1	*									**bouncing spoon probably on
312.6			2	SS	60/8	**									bedrock
312.5	End of borehole. Auger refusal														
1.1	End of D.C.P.T. Dynamic Cone Penetration Test performed 5.0 m East of borehole from 0 to 1.1 m. *Hole dry (water level not stabilized) and open to full depth on completion														***bouncing cone probably on bedrock

RECORD OF BOREHOLE No MSR 7+760 L20

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+760, O/S L20 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE NQ Coring COMPILED BY WM
 DATUM Geodetic DATE 26.06.04 - 26.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+800 L24

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+800, O/S L24 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE NQ Coring COMPILED BY WM
 DATUM Geodetic DATE 25.06.04 - 25.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
							20 40 60 80 100	20 40 60							



0.0	TOPSOIL Fresh, light grey, strong to very strong GNEISS		1	RUN									3	RUN 1# TCR=100%, SCR=100%, RQD=96%, UCS=102MPa	
0.1														0	
														0	
														0	
														0	
														0	
														1	RUN 2# TCR=98%, SCR=98%, RQD=97%, UCS=159.9MPa
														0	
														1	
														2	RUN 3# TCR=100%, SCR=100%, RQD=88%, UCS=115.9MPa
3.7	END OF BOREHOLE AT 3.66 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 30.06.04 3.12														

RECORD OF BOREHOLE No MSR 7+850 L13

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+850, O/S L13 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE NQ Coring COMPILED BY WM
 DATUM Geodetic DATE 25.06.04 - 25.06.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20	40	60	80	100								
								○ UNCONFINED	+	FIELD VANE										
								● QUICK TRIAXIAL	x	LAB VANE										
								20	40	60	80	100	20	40	60					
0.0	SAND and COBBLES (FILL) Fresh, grey, strong to very strong GNEISS		1	RUN													FI	RUN 1# TCR=100%, SCR=98%, RQD=95%, UCS=110.9MPa		
0.2																				
			2	RUN														2	RUN 2# TCR=100%, SCR=100%, RQD=100%, UCS=139.6MPa	
			3	RUN														0	RUN 3# TCR=100%, SCR=100%, RQD=93%, UCS=192.8MPa	
																			0	
																			0	
																			0	
																			0	
4.2	END OF BOREHOLE AT 4.24 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m)																			

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No MSR 7+875 L20

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Municipal Service Road, ST. 7+875, O/S L20 ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY WM
 DATUM Geodetic DATE 25.06.04 - 25.06.24 CHECKED BY MA

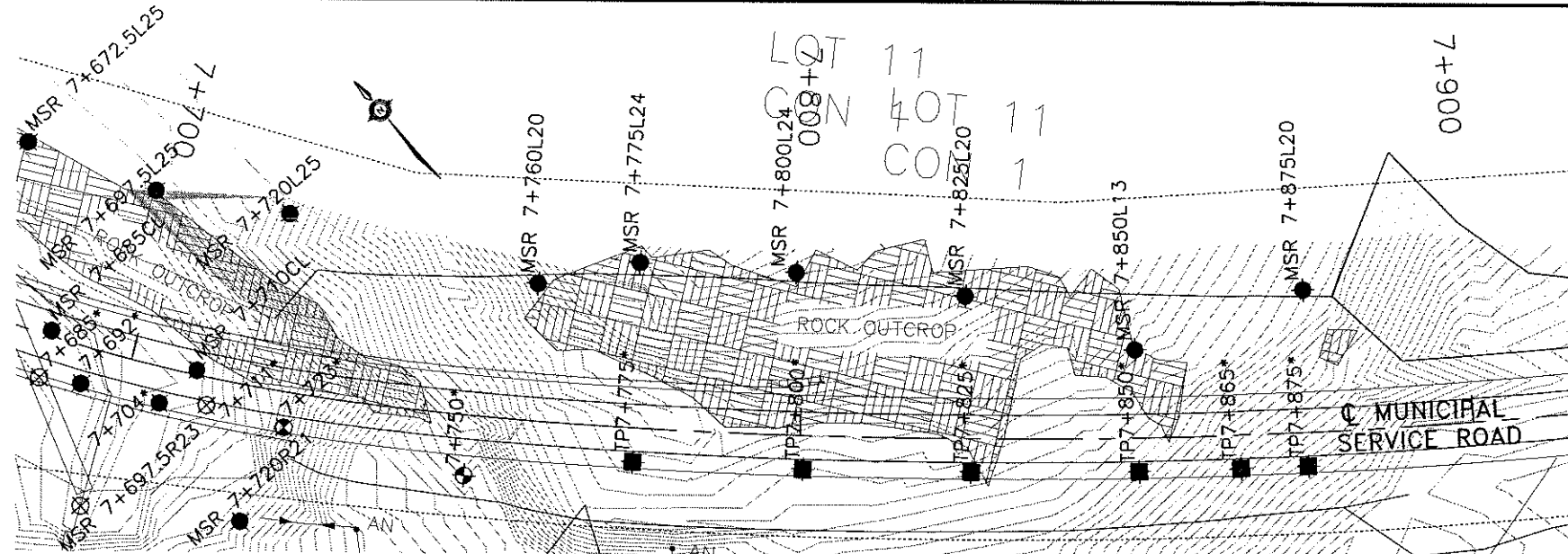
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20 40 60 80 100									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							WATER CONTENT (%) 20 40 60										
0.0	TOPSOIL																
0.1	SAND, fine grained, mixed with topsoil, trace rootlets, trace gravel Loose Brown		1	SS	4												
0.8	Moist Fresh to slightly weathered, grey, strong to very strong GNEISS		1	RUN													
			2	RUN													
			3	RUN													
4.4	END OF BOREHOLE AT 4.37 m. BOREHOLE GROUTED TO SURFACE.																

ONTMT4 2316.GPJ 10/03/05

APPENDIX A7

RECORD OF TEST PITS – SITE 7

Station/Offset	Approximate Test Pit Elevation	Soil Profile
7+775 centerline	322.5	0-100 mm Topsoil 0.1-3.2 m Sand Refusal @ 3.2 m probable bedrock
7+800 centerline	320.4	0 – 1.4 m Sand (organic rich to 0.75 m) Refusal @ 1.4 m probable bedrock
7+825 centerline	318.7	0 – 300 mm Topsoil Refusal @ 0.3 m on bedrock
7+850 centerline	316.6	0 – 0.6 m Silty sand some organics and cobbles 0.6 – 0.9 m Gravelly sand Refusal @ 0.9 m on bedrock
7+865 centerline	312.6	0 – 0.5 m Silty sand some organics and cobbles Refusal @ 0.5 m on bedrock
7+875 centerline	309.2	0 – 0.3 m Sandy Topsoil with cobbles Refusal @ 0.3 m on bedrock
7+905 centerline	307.2	0 – 0.3 Sandy Topsoil 0.3 – 3.3 m Silt/Clayey Silt/ Silty Clay



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

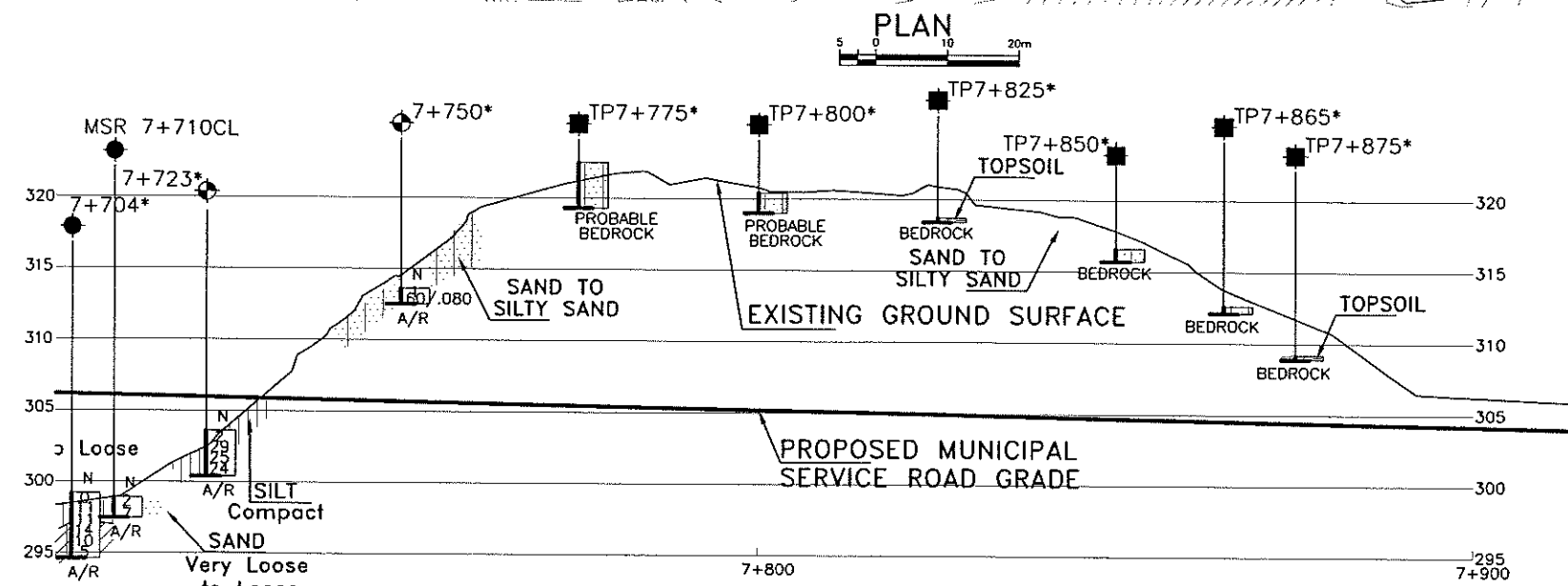
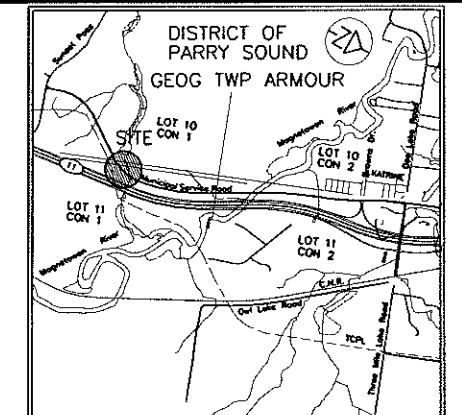
MUNICIPAL SERVICE ROAD
STATION 7+750 TO 7+880
CENTRELINE AND LEFT TOP OF CUT
BOREHOLE LOCATIONS AND SOIL STRATA



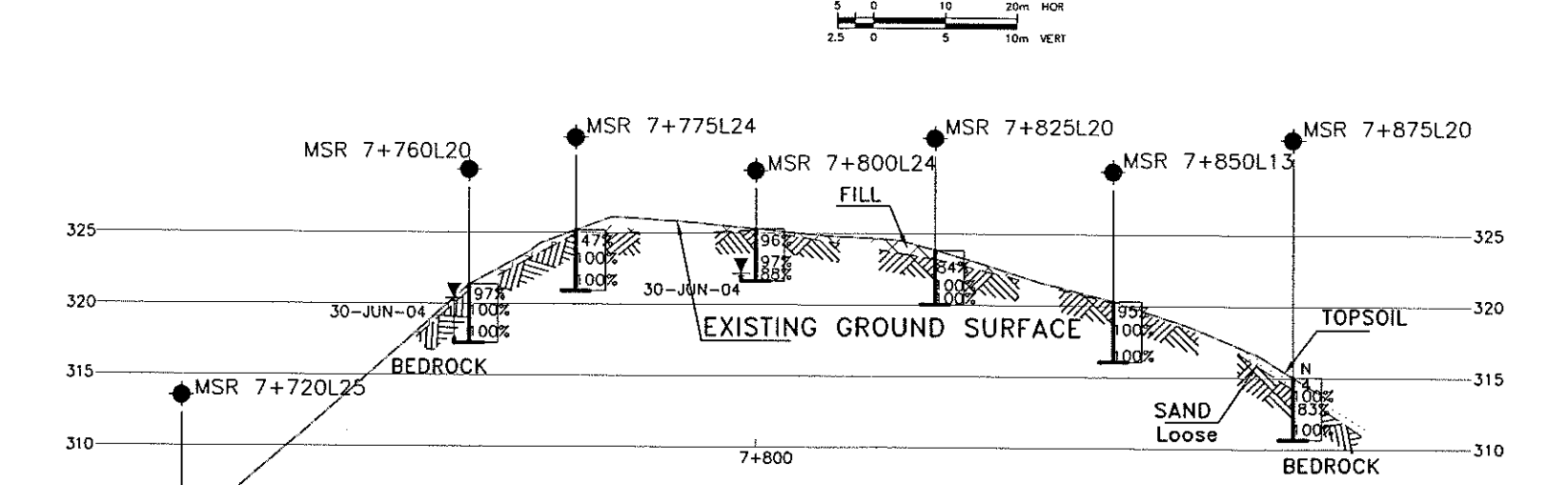
THURBER ENGINEERING LTD.

NO	ELEVATION	NORTH	EAST
7+723*	303.6	5046967	316866.7
7+750*	313.6	5046994.4	316867.5
TP7+775*	322.5	5047018.5	316859.7
TP7+800*	320.4	5047043.1	316855
TP7+825*	318.7	5047067.5	316849.7
TP7+850*	316.6	5047091.8	316843.8
TP7+865*	312.6	5047106.3	316839.9
TP7+875*	309.2	5047115.9	316837.2

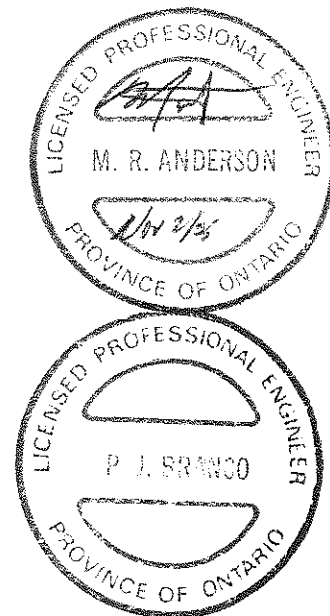
* Borehole or Test Pit by Shaheen & Pecker Limited



PROFILE C MUNICIPAL SERVICE RD



PROFILE TOP OF CUT OF MUNICIPAL SERVICE RD LEFT



LEGEND		
	Bore Hole	
	Dynamic Cone Penetration Test (cone) or Probe Hole	
	Bore Hole & Cone	
	Blows/0.3m (Std pen Test, 475J/blow)	
	Blows/0.3m (60' Cone, 475J/blow)	
	Pressure, Hydraulic	
	WL in Piezometer at Time of Investigation (Date)	
	Head Artesian Water	
	Piezometer	
	WL in Open Borehole Upon Completion of Drilling	
	90% Rock Quality Designation (RQD)	
	A/R Auger Refusal	
	C/R Cone Refusal	

NO	STATION	OFFSET FROM CL
MSR 7+720 L25	7+720	L25
MSR 7+760 L20	7+760	L20
MSR 7+775 L24	7+775	L24
MSR 7+800 L24	7+800	L24
MSR 7+825 L20	7+825	L20
MSR 7+850 L13	7+850	L13
MSR 7+875 L20	7+875	L20

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		DATE		BY		DESCRIPTION	
JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW					
DESIGN	MA	CHK AEG	CODE CHBDC	LOAD		DATE JAN. 2005	
DRAWN	HS	CHK MA	SITE	STRUCT	SCHEME	DWG F1	

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix G

Highway 11, Station 11+950 to 12+030

RECORD OF BOREHOLE No 11+950 L18.75

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S L18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100		
0.0	TOPSOIL						SHEAR STRENGTH kPa						
0.2	Brown Sandy SILT, occasional iron oxide staining Loose to Compact Brown Dry to Moist		1	SS	8		○ UNCONFINED + FIELD VANE						
			2	SS	26		● QUICK TRIAXIAL × LAB VANE						
1.4	SILT, some clay, trace sand, occasional iron oxide staining Compact to Loose Brown Wet		3	SS	23		WATER CONTENT (%)						
			4	SS	8		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
			5	SS	10		W P W W L						
			6	SS	18								
6.1	Silty CLAY, trace sand Stiff to Firm Grey		7	SS	9								
	Varved		8	SS	8								
			9	SS	6								

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+950 L18.75 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S L18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
								20 40 60 80 100							
								3.7 +							
10.7	SILT, trace to some sand Loose to Compact Grey Wet		10	SS	6										
			11	SS	25										
12.8	END OF BOREHOLE AT 12.80 m. BOREHOLE OPEN TO 12.80 m AND WATER LEVEL AT 11.58 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.														

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No 11+950 R18.75

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE						
							20 40 60 80 100		20 40 60						
0.0	TOPSOIL														
0.2	Brown SILT, some clay, trace sand Loose to Compact Grey Wet		1	SS	7										
			2	SS	9										
			3	SS	8									0 4 83 12	
			4	SS	9										
		5	SS	14											
4.0	Silty CLAY, occasional sand seams Stiff Grey		6	SS	8								0 5 61 34		
			7	SS	6										
			8	SS	8										
			9	SS	8										
	Varved														

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+950 R18.75

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W P W W L				
								20 40 60 80 100									
10.7	SILT, trace sand Compact Grey Wet		10	SS	24												
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE OPEN TO 11.28 m AND WATER LEVEL AT 10.97 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

RECORD OF BOREHOLE No 11+960 SBL

1 OF 1

METRIC

W.P. 314-99-00

LOCATION Highway 11- Katrine, ON - Coords N 5 048 278.7; E 316 466.5

ORIGINATED BY S.O

DIST 52 HWY 11


BOREHOLE TYPE Solid Stem Augers

COMPILED BY G.T

DATUM Geodetic

DATE 22.04.01

CHECKED BY Z.O

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE										
297.9	Ground Surface						20 40 60 80 100	20 40 60 80 100	20 40 60									
0.0	100 mm Topsoil		1	SS	4													
	SILT Sandy		2	SS	6													
	trace clay and sand, brown to 1.4 m, grey below, some clayey silt layers below 1.4 m, very loose to loose, moist to wet		3	SS	2													
			4	SS	5													
			5	SS	5													
293.5			6	SS	4													
4.4	occasional silt lenses		7	TW	PH													
	SILTY CLAY very soft to stiff, grey, moist to wet		8	SS	3													
			9	SS	2													
289.8			10	SS	2													
8.1	End of borehole *Water level at 0.6 m (not stabilized) and hole open to 6.8 m on completion																	

+ 3, × 3: Numbers refer to 20
Sensitivity 15-5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+960 NBL

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Highway 11- Katrine, ON - Coords N 5 048 287.9; E 316 499.3 ORIGINATED BY S.O.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 19.04.01 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
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		
297.1	Ground Surface													
0.0	150 mm Topsoil		1	SS	8		297							
			2	SS	11		296							
	SILT trace clay and sand, brown becoming grey at 1.4 m, loose to compact, wet		3	SS	9		295							
			4	SS	10		294							
			5	SS	11		293							
293.4			6	SS	6		292							
3.7			7	SS	6		291							
	SILTY CLAY laminated, occasional silt and fine sand seams soft to stiff, grey		8	TW	PH		290							
			9	SS	2		289							
			10	SS	5		288							
288.5			11	SS	9		287							
8.6	SILT grey, wet	occasional clay partings stiff compact					286							
286.0			12	SS	15		285							
11.1	End of borehole *Water level at 3.4 m (not stabilized) and hole open to 8.8 m on completion						284							

+ 3 . X 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+962.5 L50

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+962.5, O/S L50 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						
							20	40	60	80	100							
0.0	TOPSOIL																	
0.2	Dark Brown SILT, trace to some sand, occasional iron oxide staining Compact Brown Moist to Wet		1	SS	11													
			2	SS	18													
			3	SS	9													
	Becoming Grey		4	SS	17											0 7 83 11		
			5	SS	15													
4.6	Silty CLAY, occasional sand seams Firm to Stiff Grey		6	SS	6													
	Varved		1	TW	PH													
			7	SS	7											0 0 54 46		
			8	SS	9													

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+962.5 L50

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+962.5, O/S L50 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					W _p	W	W _L		
						20	40	60	80	100	20	40	60				
10.7	SILT, trace sand Compact Grey Wet		9	SS	26												
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE OPEN TO 11.28 m AND WATER LEVEL AT 10.36 m. BOREHOLE GROUTED TO SURFACE.																

RECORD OF BOREHOLE No 11+962.5 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+962.5, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
0.0	DCPT from surface.															
7.6	END OF DCPT AT 7.62 m.															

RECORD OF BOREHOLE No 11+962.5 R55

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+962.5, O/S R55 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P	W	W _L		
0.0	TOPSOIL							20 40 60 80 100						
0.2	Brown SILT, trace sand, occasional iron oxide staining Compact Grey Wet		1	SS	9			20 40 60 80 100						
			2	SS	12									
			3	SS	14									
			4	SS	11									
3.0	Silty CLAY, occasional sand seams Firm to Stiff Grey		5	SS	6									
			6	SS	7									
			7	SS	6									
	Varved		8	SS	8									
9.1	SILT, some clay, trace sand Compact Grey Wet		9	SS	25									
9.8	END OF BOREHOLE AT 9.75 m.													

ONTMT4 2316.GPJ 09/03/05

Continued Next Page

+³, x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+962.5 R55

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+962.5, O/S R55 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L												
	<p>BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.14 m UPON COMPLETION.</p> <p>Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 slotted screen.</p> <p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> </tr> </thead> <tbody> <tr> <td>22.07.04</td> <td>1.34</td> </tr> <tr> <td>20.08.04</td> <td>0.42</td> </tr> <tr> <td>19.01.05</td> <td>0.61</td> </tr> <tr> <td>28.02.05</td> <td>0.59</td> </tr> </tbody> </table>	DATE	DEPTH (m)	22.07.04	1.34	20.08.04	0.42	19.01.05	0.61	28.02.05	0.59											
DATE	DEPTH (m)																					
22.07.04	1.34																					
20.08.04	0.42																					
19.01.05	0.61																					
28.02.05	0.59																					

RECORD OF BOREHOLE No 11+975 L18.75

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+975, O/S L18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W P	W	W L		
0.0	TOPSOIL							20 40 60 80 100									
0.2	Brown SILT, trace sand, occasional iron oxide staining Loose to Compact Brown Wet Becoming Grey		1	SS	6			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
			2	SS	12												
			3	SS	12												0 5 85 10
			4	SS	10												
3.0	Silty CLAY, trace sand Firm to Stiff Grey Varved		5	SS	6			3.25 +									
			6	SS	5												
			7	SS	4			2.8 +									0 0 49 51
			8	SS	7												
9.1	SILT, trace clay, trace sand Compact to Loose Grey Wet		9	SS	13												

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+975 L18.75

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+975, O/S L18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

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	20	40	60						
			10	SS	7									0 4 92 4												
			11	SS	14																					
12.8	<p>END OF BOREHOLE AT 12.80 m. BOREHOLE OPEN TO 12.80 m AND WATER LEVEL AT 3.66 m UPON COMPLETION.</p> <p>Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> </tr> </thead> <tbody> <tr> <td>22.07.04</td> <td>2.48</td> </tr> <tr> <td>20.08.04</td> <td>0.64</td> </tr> <tr> <td>07.10.04</td> <td>1.54</td> </tr> <tr> <td>19.01.05</td> <td>0.64</td> </tr> <tr> <td>28.02.05</td> <td>0.61</td> </tr> </tbody> </table>	DATE	DEPTH (m)	22.07.04	2.48	20.08.04	0.64	07.10.04	1.54	19.01.05	0.64	28.02.05	0.61													
DATE	DEPTH (m)																									
22.07.04	2.48																									
20.08.04	0.64																									
07.10.04	1.54																									
19.01.05	0.64																									
28.02.05	0.61																									

RECORD OF BOREHOLE No 11+975.0 R18.75 1 OF 2 METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							20	40	60	80	100	20	40	60			
0.0	TOPSOIL		1	SS	6												
0.2	Brown SILT, some clay, trace sand, occasional iron oxide staining Loose to Compact Grey Moist to Wet		2	SS	11												
			3	SS	15												
			4	SS	10												
			5	SS	10												
4.6	Silty CLAY, occasional sand seams Varved Firm to Stiff Grey		6	SS	4												
		7	SS	4													
		8	SS	6													
		9	SS	7													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+975.0 R18.75 2 OF 2 METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+950, O/S R18.75 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) w _p w w _L			
						20	40	60	80	100						
10.7	SILT, some sand, trace clay Compact Grey Wet		10	SS	25											
11.3	END OF BOREHOLE AT 11.28 m. BOREHOLE OPEN TO 11.28 m. BOREHOLE GROUTED TO SURFACE.															

RECORD OF BOREHOLE No 11+978 SBL

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Highway 11- Katrine, ON - Coords N 5 048 295.2; E 316 459.7 ORIGINATED BY R.A.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 19.04.01 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
297.0	Ground Surface						297							GR SA SI CL
0.0	75 mm Topsoil SILT with clayey silt and silty fine sand seams brown/moist ----- grey/wet	loose sandy compact loose	1	SS	7		297							
			2	SS	12		296							
			3	SS	10		295							
			4	SS	7		294							
294.1			5	SS	5		293							
2.9			6	SS	5		292							
	SILTY CLAY soft to stiff, grey		7	SS	3		291							
			8	SS	3		290							
			9	SS	3		289							
			10	SS	6		288							
288.4														
8.6	SILT some sand, compact, grey, moist		11	SS	13									
287.4														
9.6	End of borehole *Water level at 3.5 m (not stabilized) and hole open to 8.1 m on completion													

RECORD OF BOREHOLE No 11+987.5 L50

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+987.5, O/S L50 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 15.07.04 - 15.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)						
						20	40	60	80	100	20	40	60				
0.0	DCPT from surface.																
7.6	END OF DCPT AT 7.62 m.																

ONTMT4 2318.GPJ 31/01/05

RECORD OF BOREHOLE No 11+987.5 CL

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+987.5, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.07.04 - 19.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
0.0	TOPSOIL															
0.2	Dark Brown SILT, some clay, trace sand, occasional iron oxide staining Loose to Compact Grey Wet	1	SS	7												
		2	SS	14												
		3	SS	10												0 6 83 12
		4	SS	9												
3.0	Silty CLAY, occasional sand seams Firm to Stiff Grey	5	SS	5												
	Varved	6	SS	4												
		7	SS	6												0 0 54 45
		8	SS	4												
9.1	SILT, trace sand Compact Grey Wet	9	SS	24												
9.8	END OF BOREHOLE AT 9.75 m.															

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No 11+987.5 CL

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+987.5, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 19.07.04 - 19.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L	WATER CONTENT (%)			
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 8.53 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.													

ONTMT4 2316.GPJ 09/03/05

+³, ×³; Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+992 R44

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 11+992, O/S R44 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

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 Y 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 (%)					
0.0	DCPT from surface.													
7.6	END OF DCPT AT 7.62 m.													

RECORD OF BOREHOLE No 11+995 SBL

1 OF 1

METRIC

W.P. 314-89-00 LOCATION Highway 11-Katrine, On - Coords: N 5 048 312.5; E 316 459.0 ORIGINATED BY S.O
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers COMPILED BY GT
DATUM Geodetic DATE 02.04.01 CHECKED BY Z.O

SOIL PROFILE		STRAT PLOT	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		NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB VANE								
296.2	Ground Surface							20 40 60 80 100									
0.0	75 mm Topsoil		1	SS	8		296							21.0			
	SILT trace to some clay, brown to 1.7 m, grey below, loose		2	SS	9		295							19.6			
294.1			3	SS	8									19.3			
2.1			4	SS	2		294										
	SILTY CLAY soft to stiff grey		5	TW	PH		293										
			6	SS	1		292										
			7	SS	2		291							16.9			
			8	SS	2		290							17.3			
			9	SS	2												
 frequent silt layers						289										
288.1			10	SS	7									18.3			
8.1	End of borehole *Water added to hole to counter balance hydrostatic uplift. Water level not stabilized and borehole open to 7.2 m on completion.																

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11+995 NBL

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Highway 11- Katrine, ON - Coords N 5 048 323.5; E 316 493.8 ORIGINATED BY S.O.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers. COMPILED BY G.T.
DATUM Geodetic DATE 18.04.01 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	×						
								● QUICK TRIAXIAL	×	LAB VANE						
296.3	Ground Surface						20 40 60 80 100									
0.0	150 mm Topsoil		1	SS	4		296									
			2	SS	13		295									
	SILT trace clay and sand, brown to 1.9 m, grey below, loose to compact wet		3	SS	14		294									
			4	SS	7		293									
			5	SS	5		292									
292.6			6	SS	6		291									
3.7			7	SS	5		290									
	SILTY CLAY soft to stiff, grey		8	TW	PH		289									
			9	SS	2		288									
	----- occasional silt layers		10	SS	5		287									
287.7			11	SS	15		286									
8.6	SILT laminated, compact, grey, wet		12	SS	13											
	occasional clay partings															
285.2																
11.1	End of borehole *Water level at 3.0 m (not stabilized) and hole open to 3.7 m on completion															

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

METRIC

[illegible]

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+004 L50

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+004, O/S L50 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 16.07.04 - 16.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	BOREHOLE OPEN TO 9.75 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 20.08.04 0.67 07.10.04 0.72 19.01.05 2.45 28.02.05 2.43																

ONTMT4 2316.GPJ 09/03/05

RECORD OF BOREHOLE No 12+009 CL

1 OF 1

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+009, CL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 16.07.04 - 16.07.04 CHECKED BY MA

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	20 40 60					
9.1	END OF DCPT AT 9.14 m.												

ONTMT4 2316.GPJ 31/01/05

RECORD OF BOREHOLE No 12+015 R44

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+015, O/S R44 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20 40 60 80 100						
0.0	TOPSOIL													
0.2	Dark Brown SILT, trace sand, some to trace clay, occasional sand seams, trace iron oxide staining Compact Brown Moist to Wet		1	SS	11									
			2	SS	18									
			3	SS	13									
			4	SS	15									0 5 82 13
			5	SS	10									
4.3	Silty CLAY, occasional sand seams Varved Firm to Stiff Grey Wet		6	SS	6									0 2 61 38
			1	TW	PH									
			7	SS	10									
9.1	SILT, trace to some clay Compact Grey		8	SS	21									
9.8	END OF BOREHOLE AT 9.75 m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+015 R44

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+015, O/S R44 ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P W 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						
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.45 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.										

RECORD OF BOREHOLE No TML-1

1 OF 2

METRIC

W.P. 475-93-01 LOCATION N 5048323.4 E 316490.7 Three Mile Lake Road NBL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WMHS
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA/AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								20 40 60 80 100							
								20 40 60 80 100							
							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L								
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
295.8													GR SA SI CL		
0.0	SILT, trace sand, trace rootlets Brown		1	SS	6										
0.2	SILT, trace to some clay, trace sand, occasional sand seams, occasional iron oxide staining Loose to Compact Brown Moist to Wet		2	SS	7										
			3	SS	9								0 5 82 13		
			4	SS	13										
			5	SS	7								0 10 71 20		
291.2															
4.6	Silty CLAY, occasional sand seams Varved Stiff Grey		6	SS	8										
			7	SS	9								0 1 51 48		
			8	SS	7										
286.7															
9.1	SILT, trace sand Compact Grey Moist		9	SS	23										
286.0															
9.8	END OF BOREHOLE AT 9.75 m.														

Continued Next Page

+ 3, x 3 : Numbers refer to
Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-1

2 OF 2

METRIC

W.P. 475-93-01 LOCATION N 5048323.4 E 316490.7 Three Mile Lake Road NBL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM/HS
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA/ AEG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	w _p	w			w _L														
	<p>BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 8.69 m UPON COMPLETION.</p> <p>Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.</p> <p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> <th>ELEVATION (m)</th> </tr> </thead> <tbody> <tr> <td>21-JUL-04</td> <td>0.7</td> <td>295.1</td> </tr> <tr> <td>22-JUL-04</td> <td>0.2</td> <td>295.6</td> </tr> <tr> <td>07-AUG-04</td> <td>0.0</td> <td>295.8</td> </tr> <tr> <td>07-OCT-04</td> <td>0.4</td> <td>295.4</td> </tr> </tbody> </table>	DATE	DEPTH (m)	ELEVATION (m)	21-JUL-04	0.7	295.1	22-JUL-04	0.2	295.6	07-AUG-04	0.0	295.8	07-OCT-04	0.4	295.4															
DATE	DEPTH (m)	ELEVATION (m)																													
21-JUL-04	0.7	295.1																													
22-JUL-04	0.2	295.6																													
07-AUG-04	0.0	295.8																													
07-OCT-04	0.4	295.4																													

+ ³ , × ³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-5

1 OF 2

METRIC

W.P. 476-93-01 LOCATION N 5048310.9 E 316449.1 Three Mile Lake Road SBL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM/HS
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA/AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE											
								● QUICK TRIAXIAL	× LAB VANE											
296.3							20	40	60	80	100	20	40	60						
0.0	SILT, trace clay, occasional rootlets (TOPSOIL)		1	SS	7															
296.0	Brown SILT, trace sand, occasional iron oxide staining Loose to Compact Brown Moist to Wet		2	SS	14															
0.3																				
			3	SS	14															
			4	SS	6															
293.3																				
3.0	Silty CLAY Varved Firm Grey Wet		5	SS	6															
			6	SS	4											0 1 47 52				
			7	SS	4															
			8	SS	4															
287.2																				
9.1	SILT, trace sand, trace clay Compact Grey Wet		9	SS	24											0 1 91 8				
286.6																				
9.8	END OF BOREHOLE AT 9.75 m.																			

Continued Next Page

+³ x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-5

2 OF 2

METRIC

W.P. 476-93-01 LOCATION N 5048310.9 E 316449.1 Three Mile Lake Road SBL ORIGINATED BY GA
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM/HS
 DATUM Geodetic DATE 21.07.04 - 21.07.04 CHECKED BY MA/AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60	20 40 60	20 40 60					
	BOREHOLE OPEN TO 9.75 m AND WATER LEVEL AT 9.45 m UPON COMPLETION. BOREHOLE GROUTED TO SURFACE.																

ONTM14S TMLS.GPJ 02/02/05

+³ ×³: Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TMS4

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Katrine - Three Mile Lake Road - Co-ords: N 5 048 327.5; E 316 446.6 ORIGINATED BY G.I.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 02.04.01 CHECKED BY Z.O.

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								20 40 60		
								SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	×						LAB VANE		
295.8	Ground Surface																	
0.0	300 mm Peat (frozen) SILT some sand, trace to some clay, firm to stiff, brown		1	SS	5		295						19.6	0 17 78 5				
			2	SS	9													
293.7	Clayey, firm		3	SS	8		294											
2.1			4	SS	4		293											
	SILTY CLAY very soft to firm, brown to 2.6 m, grey below		5	SS	3		292											
			6	TW	PH													
			7	SS	1		291											
			8	SS	2		290											
			9	SS	2		289											
	----- with silt zones		10	SS	6		288											
287.3																		
8.5	SILTY SAND trace of organics, loose, grey, wet, dilatant		11	SS	6		287											
286.2																		
9.6	End of borehole *Water level at 5.7 m (not stabilized) and hole caved at 7.0 m upon completion																	

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TMN4

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Katrine - Three Mile Lake Road - Co-ords: N 5 048 343.0; E 316 484.0 ORIGINATED BY G.I.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 03.04.01 CHECKED BY Z.O.

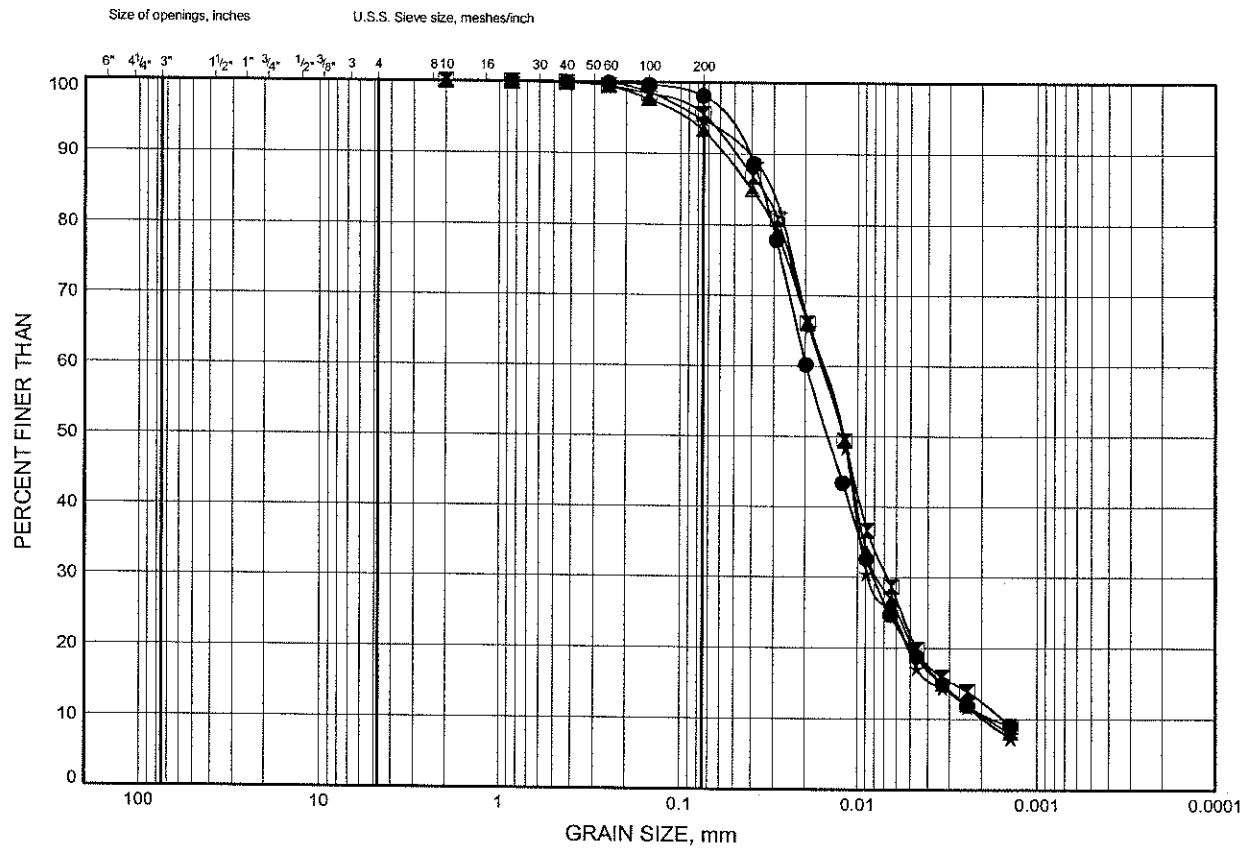
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
295.8	Ground Surface							20 40 60 80 100						
0.0	200 mm Topsoil SANDY SILT some silty sand layers, trace rootlets, loose, brown, moist		1	SS	9	▽	295						19.8	0 12 76 12
294.3			2	SS	8		295						19.9	
1.5			3	SS	8		294						19.8	
			4	SS	6		293						19.5	
	SILTY CLAY layered, soft to stiff, grey, moist		5	SS	5		292						18.9	
			6	TW	PH		291						16.4	
			7	SS	2		290						17.0	
			8	SS	2		289							
			9	SS	2		288							
			10	SS	4		287							
286.8														
9.0	SILT: Sandy, compact, grey, wet		11	SS	13									
286.2														
9.6	End of borehole * Water level at 3.3 m on completion (not stabilized)													

+³ . x³ : Numbers refer to Sensitivity 20 15 10 (% STRAIN AT FAILURE

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE G1

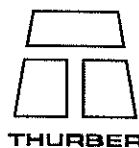
SILT



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+950 L18.75	2.59	
⊠	11+950 R18.75	1.83	
▲	11+962.5 L50	2.59	
★	11+975 L18.75	1.83	

Date January 2005
Project 480-93-00

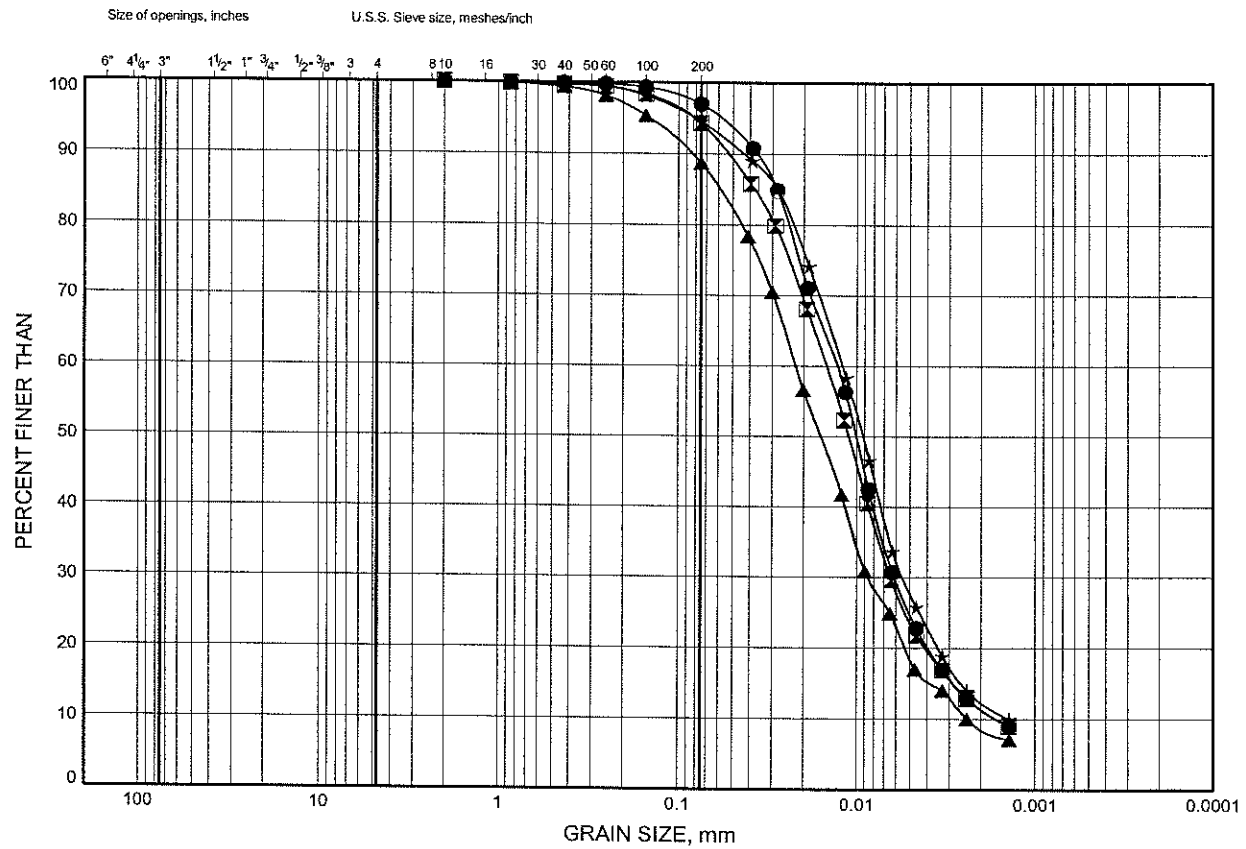


Prep'd WM
Chkd. GA

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE G2

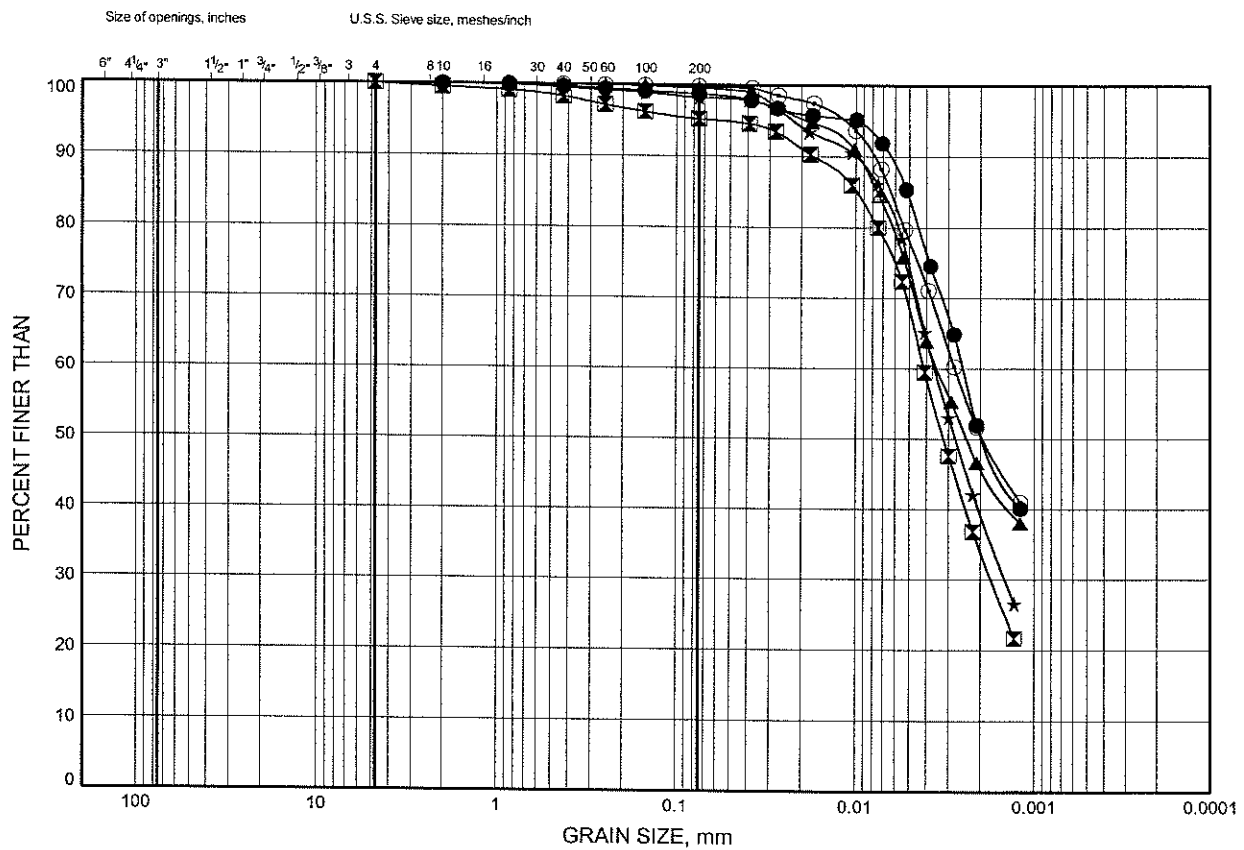
SILT



Hwy 11 Katrina GRAIN SIZE DISTRIBUTION

FIGURE G3

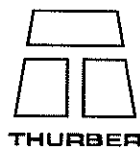
Silty CLAY



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+950 L18.75	7.92	
⊠	11+950 R18.75	4.88	
▲	11+962.5 L50	7.92	
★	11+962.5 R55	4.88	
⊙	11+975 L18.75	6.40	

Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

FIGURE G4

Size of openings, inches

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

PERCENT FINER THAN

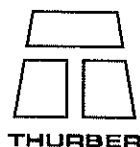
GRAIN SIZE, mm

Grain Size (mm)	Percent Finer Than (Squares)	Percent Finer Than (Circles)	Percent Finer Than (Triangles)	Percent Finer Than (Crosses)
100	100	100	100	100
10	100	100	100	100
1	100	100	100	100
0.1	100	100	98	98
0.05	100	100	95	95
0.02	98	95	85	85
0.01	90	85	65	65
0.005	60	55	40	40
0.002	45	40	25	25
0.001	35	30	18	28

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+975.0 R18.75	7.92	
⊠	11+987.5 CL	6.40	
▲	12+004 L50	3.35	
★	12+015 R44	4.88	

Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

FIGURE G5

Size of openings, inches

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


PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Percent Finer Than (Solid Circles)	Percent Finer Than (Crosses)
100	100	100
40	100	100
20	100	100
10	100	100
7.5	100	100
6	100	100
4.75	100	100
3.75	100	100
3	100	100
2.5	100	100
2	100	100
1.5	100	100
1.18	100	100
0.85	100	100
0.75	100	100
0.6	100	100
0.425	100	100
0.3	100	100
0.25	100	100
0.2	100	100
0.15	100	100
0.125	100	100
0.106	100	100
0.085	100	100
0.075	100	100
0.06	95	95
0.05	82	82
0.0425	65	65
0.0375	51	51
0.03	36	36
0.025	25	25
0.02	19	19
0.015	13	13
0.0125	7	7
0.0106	4	4
0.0085	3	3
0.0075	2	2
0.006	1	1
0.005	1	1
0.00425	1	1
0.00375	1	1
0.003	1	1
0.0025	1	1
0.002	1	1
0.0015	1	1
0.00125	1	1
0.00106	1	1
0.00085	1	1
0.00075	1	1
0.0006	1	1
0.0005	1	1
0.000425	1	1
0.000375	1	1
0.0003	1	1
0.00025	1	1
0.0002	1	1
0.00015	1	1
0.000125	1	1
0.000106	1	1
0.000085	1	1
0.000075	1	1
0.00006	1	1
0.00005	1	1
0.0000425	1	1
0.0000375	1	1
0.00003	1	1
0.000025	1	1
0.00002	1	1
0.000015	1	1
0.0000125	1	1
0.0000106	1	1
0.0000085	1	1
0.0000075	1	1
0.000006	1	1
0.000005	1	1
0.00000425	1	1
0.00000375	1	1
0.000003	1	1
0.0000025	1	1
0.000002	1	1
0.0000015	1	1
0.00000125	1	1
0.00000106	1	1
0.00000085	1	1
0.00000075	1	1
0.0000006	1	1
0.0000005	1	1
0.000000425	1	1
0.000000375	1	1
0.0000003	1	1
0.00000025	1	1
0.0000002	1	1
0.00000015	1	1
0.000000125	1	1
0.000000106	1	1
0.000000085	1	1
0.000000075	1	1
0.00000006	1	1
0.00000005	1	1
0.0000000425	1	1
0.0000000375	1	1
0.00000003	1	1
0.000000025	1	1
0.00000002	1	1
0.000000015	1	1
0.0000000125	1	1
0.0000000106	1	1
0.0000000085	1	1
0.0000000075	1	1
0.000000		

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

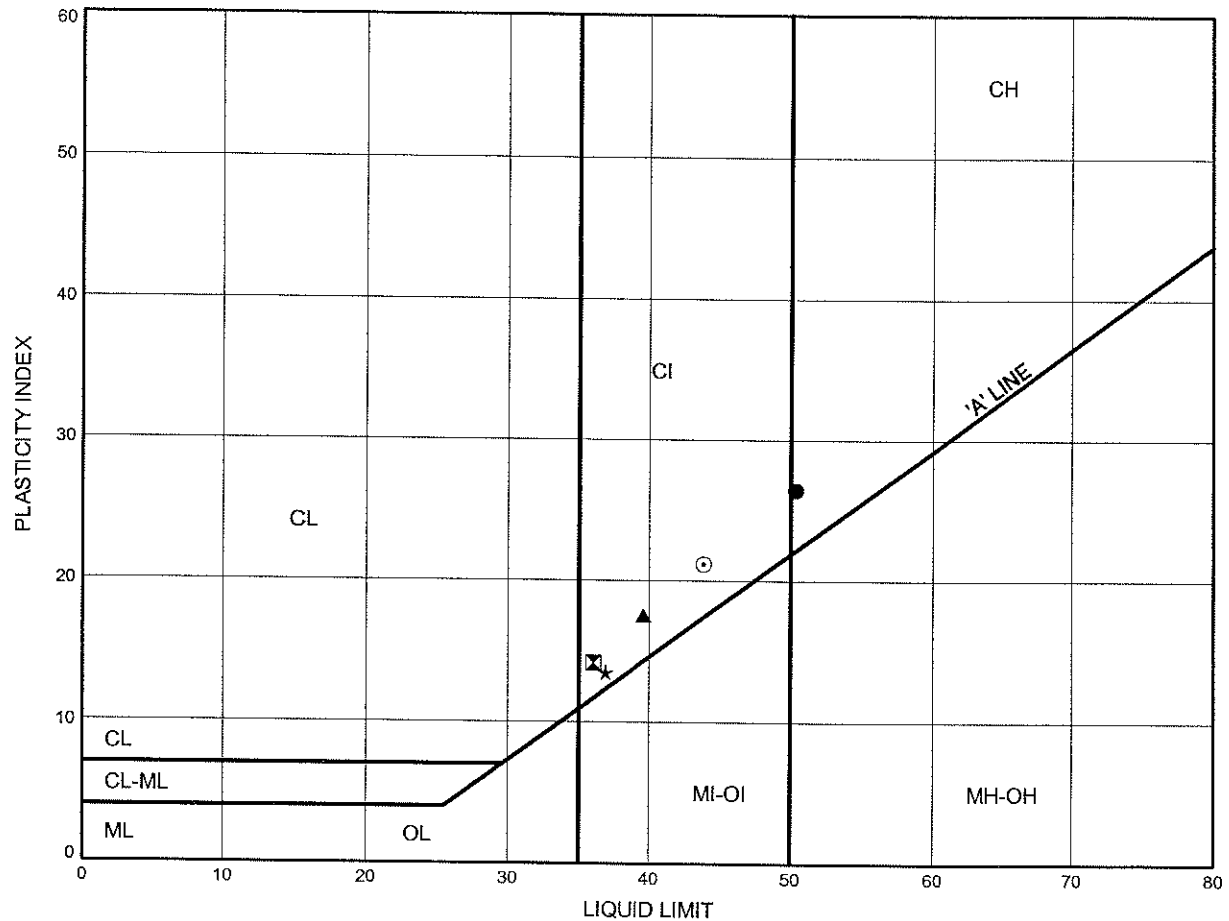
SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+962.5 R55	9.45	
⊠	11+975 L18.75	10.97	



Chkd. **MA**

Hwy 11 Katrine ATTERBERG LIMITS TEST RESULTS

FIGURE G6



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+950 L18.75	7.92	
⊠	11+950 R18.75	4.88	
▲	11+962.5 L50	7.92	
★	11+962.5 R55	4.88	
⊙	11+975 L18.75	6.40	

Date January 2005
Project 480-93-00

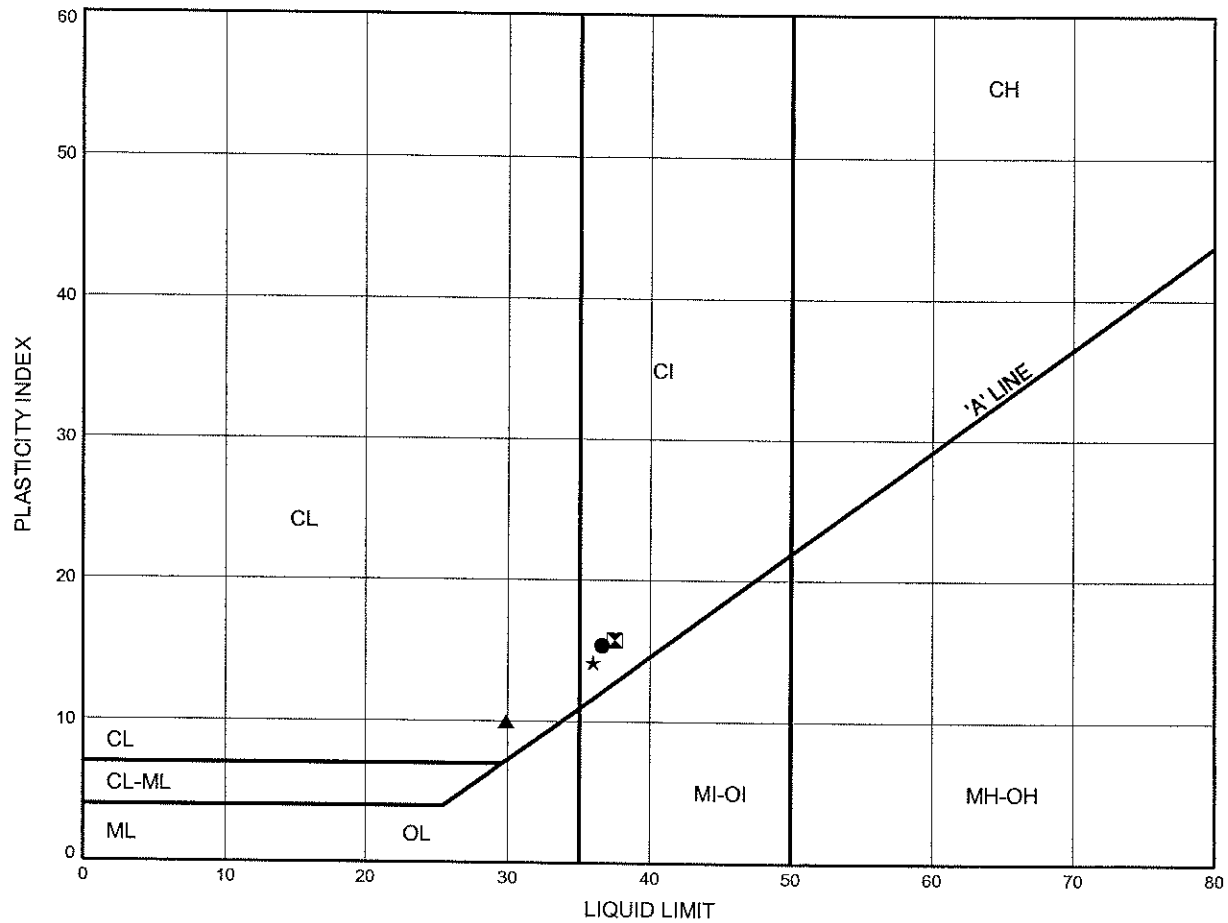


Prep'd WM
Chkd. MA

Hwy 11 Katrine

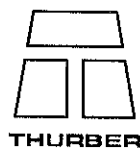
ATTERBERG LIMITS TEST RESULTS

FIGURE G7



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	11+975.0 R18.75	7.92	
⊠	11+987.5 CL	6.40	
▲	12+004 L50	3.35	
★	12+015 R44	4.88	

Date January 2005
Project 480-93-00



Prep'd WM
Chkd. MA

OEDOMETER CONSOLIDATION SUMMARY

SAMPLE IDENTIFICATION

Project Number	04-1116-112	Sample Number	-
Borehole Number	G 12+015 R44	Sample Depth, m	6.1-6.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	5		
Date Started	11/16/2004		
Date Completed	11/27/2004		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.91	Unit Weight, kN/m ³	17.05
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m ³	11.62
Area, cm ²	31.65	Specific Gravity, measured	2.75
Volume, cm ³	60.45	Solids Height, cm	0.823
Water Content, %	46.77	Volume of Solids, cm ³	26.04
Wet Mass, g	105.10	Volume of Voids, cm ³	34.41
Dry Mass, g	71.61	Degree of Saturation, %	97.3

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t ₉₀ sec	cv. cm ² /s	mv m ² /kN	k cm/s
0.00	1.910	1.321	1.910				
4.70	1.904	1.315	1.907	12	6.43E-02	6.24E-04	3.93E-06
9.54	1.904	1.314	1.904	21	3.66E-02	6.49E-05	2.33E-07
19.29	1.897	1.306	1.900	21	3.65E-02	3.65E-04	1.30E-06
38.71	1.883	1.289	1.890	23	3.29E-02	3.77E-04	1.22E-06
77.44	1.866	1.268	1.875	68	1.10E-02	2.30E-04	2.47E-07
154.67	1.839	1.235	1.853	46	1.58E-02	1.83E-04	2.84E-07
309.47	1.786	1.171	1.813	19	3.67E-02	1.79E-04	6.44E-07
617.21	1.641	0.994	1.714	211	2.95E-03	2.47E-04	7.13E-08
1235.98	1.535	0.866	1.588	165	3.24E-03	8.97E-05	2.85E-08
2473.16	1.437	0.747	1.486	141	3.32E-03	4.15E-05	1.35E-08
1235.98	1.446	0.757	1.442				
309.47	1.474	0.792	1.460				
77.44	1.512	0.838	1.493				
19.29	1.556	0.891	1.534				
4.70	1.593	0.936	1.575				

Notes:

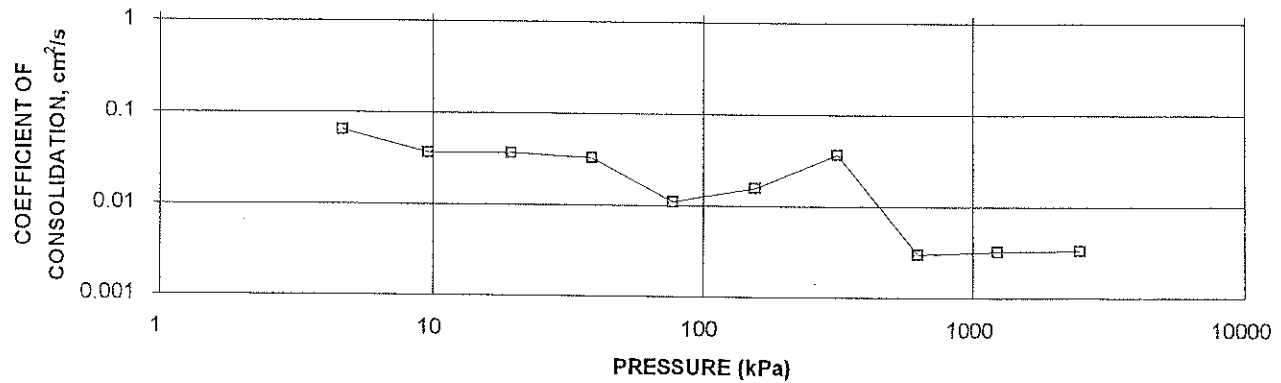
k calculated using cv based on t₉₀ values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

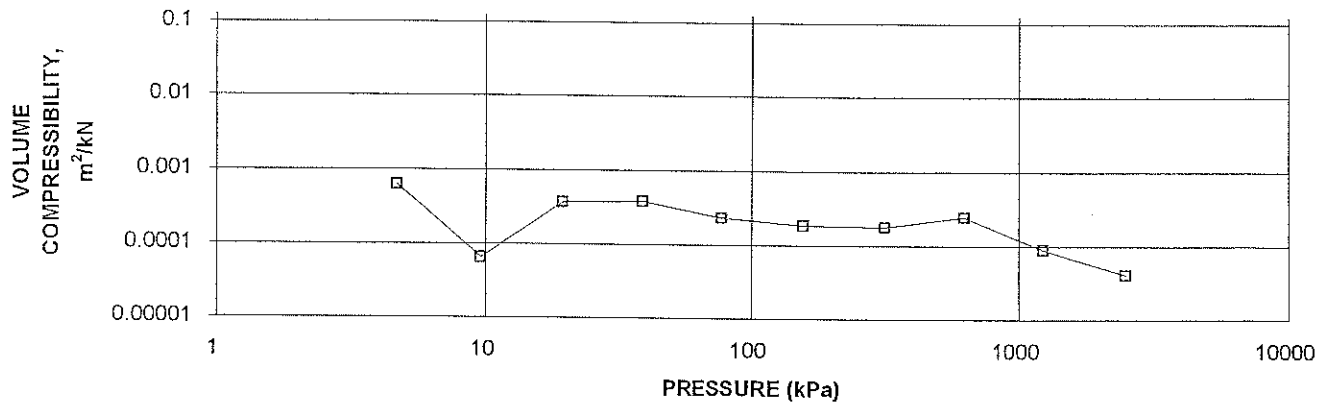
Sample Height, cm	1.59	Unit Weight, kN/m ³	18.83
Sample Diameter, cm	6.35	Dry Unit Weight, kN/m ³	13.93
Area, cm ²	31.65	Specific Gravity, measured	2.75
Volume, cm ³	50.42	Solids Height, cm	0.823
Water Content, %	35.21	Volume of Solids, cm ³	26.04
Wet Mass, g	96.82	Volume of Voids, cm ³	24.38
Dry Mass, g	71.61		

OEDOMETER CONSOLIDATION SUMMARY

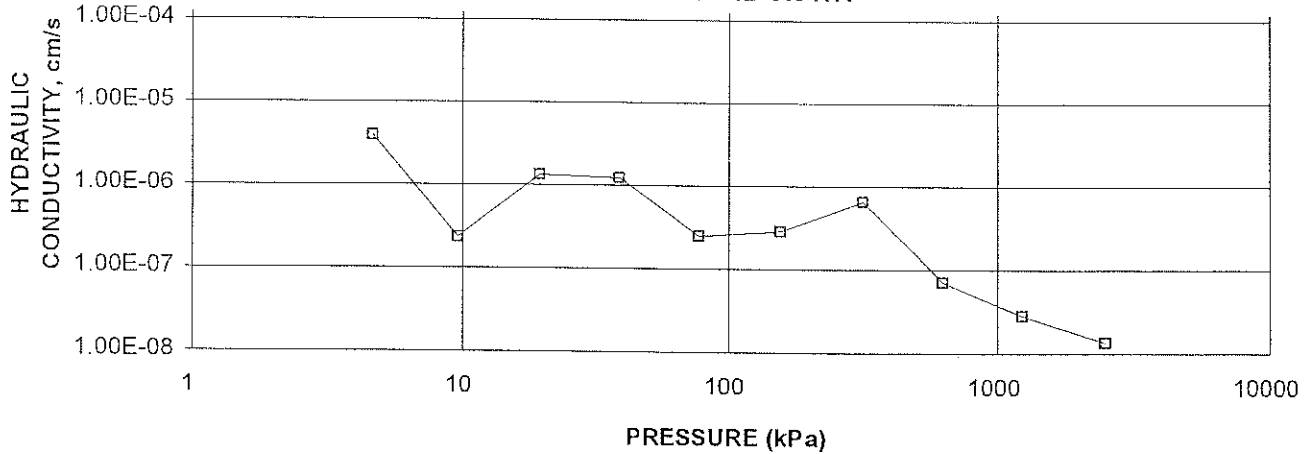
CONSOLIDATION TEST
CV cm²/s VS PRESSURE (kPa)
BH G 12+015 R44



CONSOLIDATION TEST
MV m²/kN vs PRESSURE (kPa)
BH G 12+015 R44



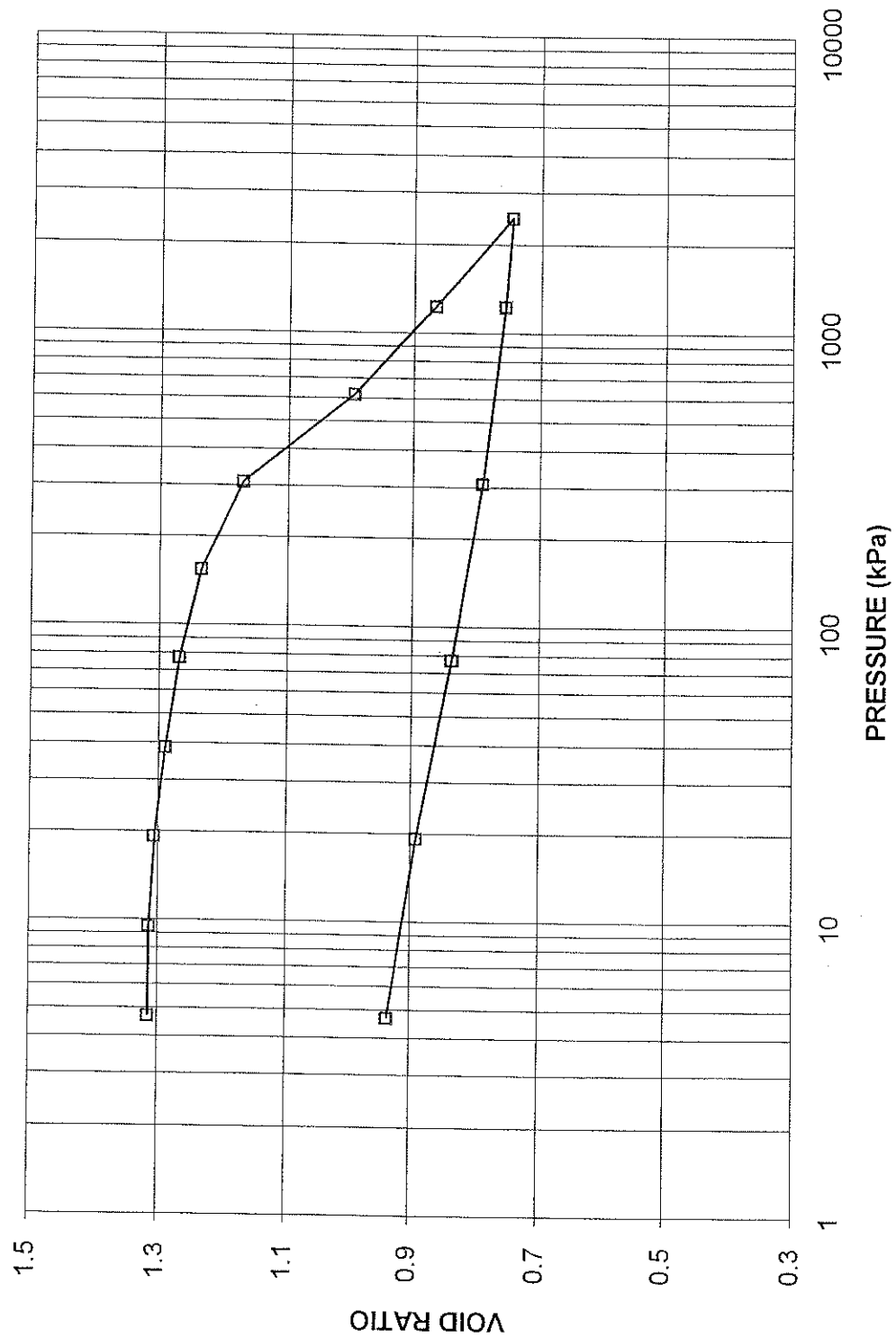
CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH G 12+015 R44



CONSOLIDATION TEST
VOID RATIO VS. LOG PRESSURE

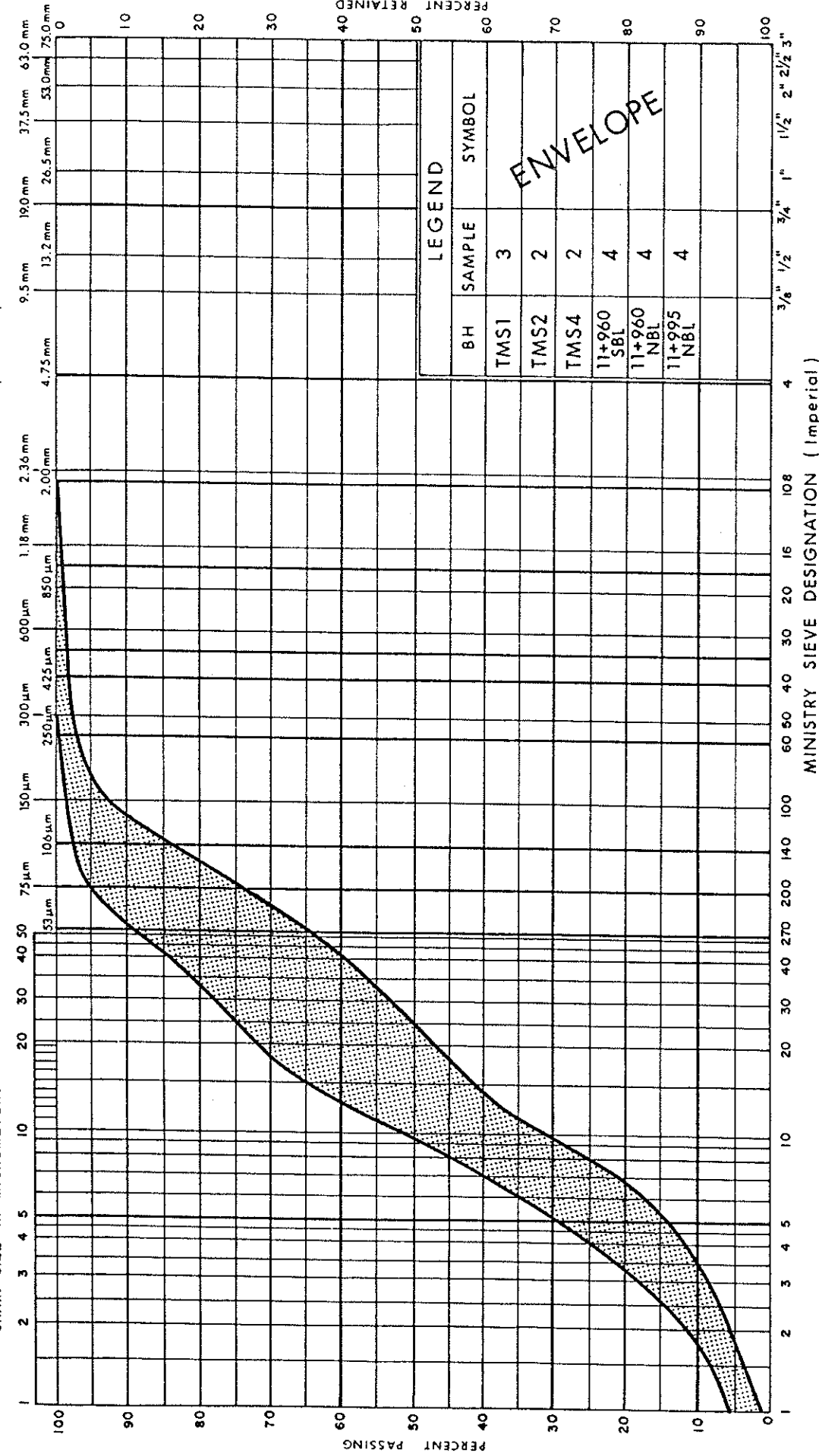
FIGURE

CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH G 12+015 R44



UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	
GRAIN SIZE IN MICROMETERS		MINISTRY SIEVE DESIGNATION (Metric)					
1	100	53µm	75µm	106µm	150µm	250µm	4.75mm
2	50					300µm	9.5mm
3	25					425µm	13.2mm
4	12.5					600µm	19.0mm
5	6.3					850µm	26.5mm
						1.18mm	37.5mm
						2.00mm	53.0mm
						2.36mm	75.0mm



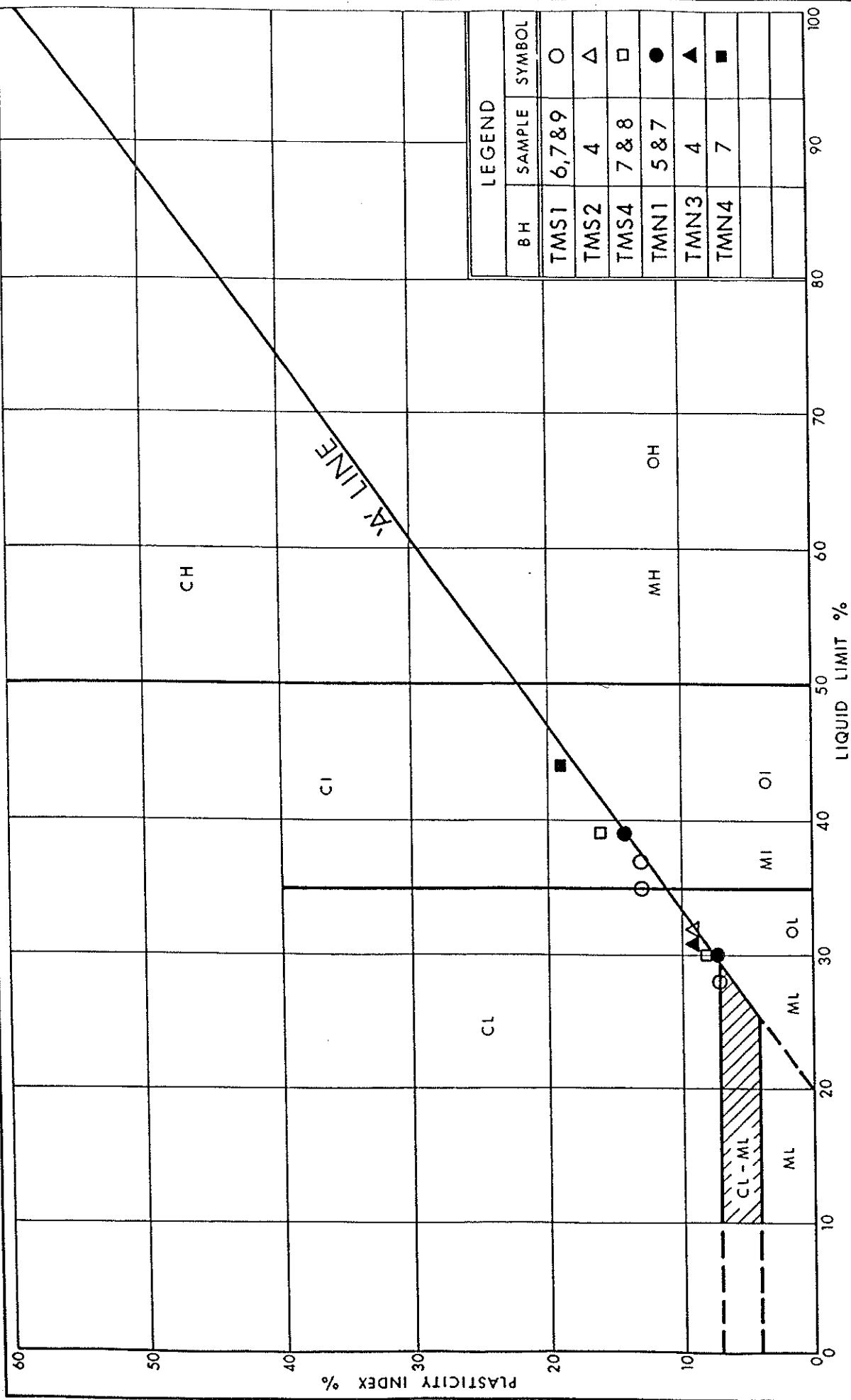


FIG No B1-4

W P 314-99-00

SPT 1010F

PLASTICITY CHART

SILTY CLAY

Ministry of
Transportation



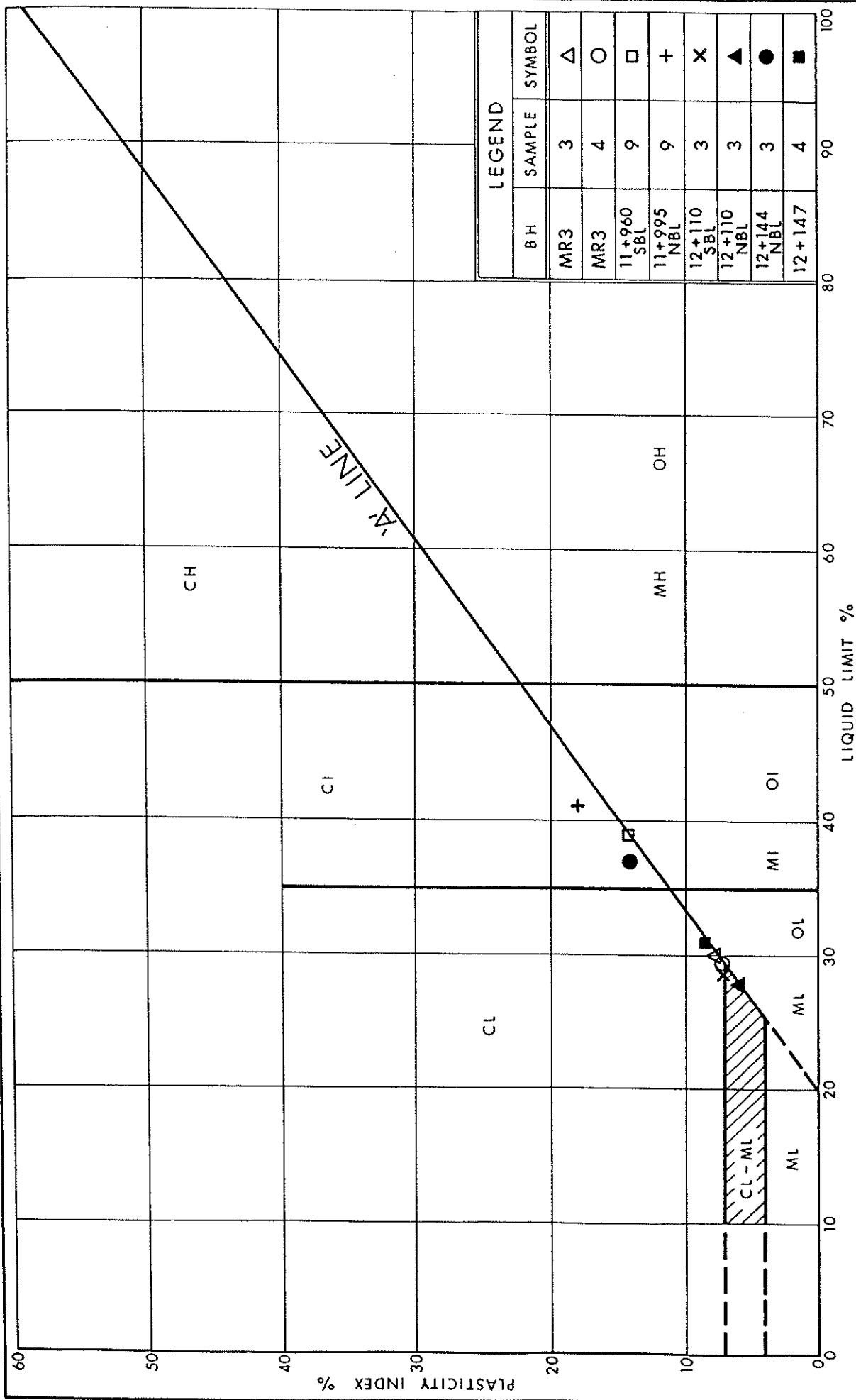


FIG No B1-5

PLASTICITY CHART

Ministry of
Transportation



W P 314-99-00

SILTY CLAY

SPT 1010F

Project: Hwy 11, Alignment Review
Katrine, Ontario. WP 314-99-00
Date: 27 May 2001 BH#: 11+960 SBL
SPT 1010F

Fig. No. B1-7

Depth(m): 4.80
Sample TW 7

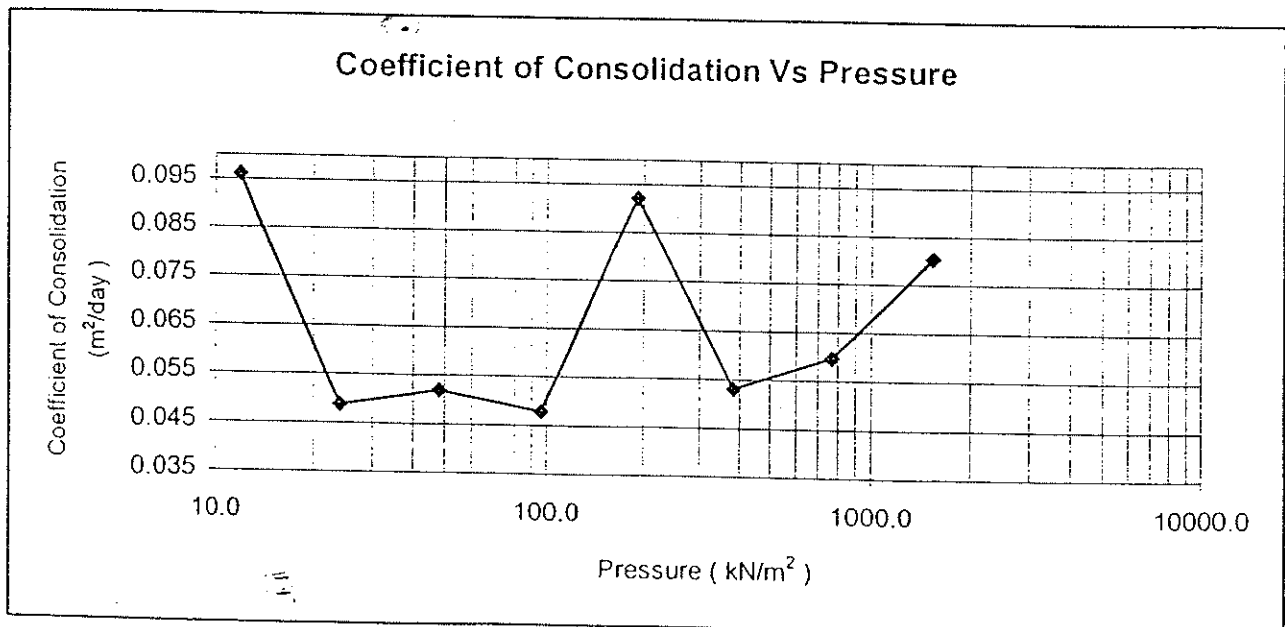
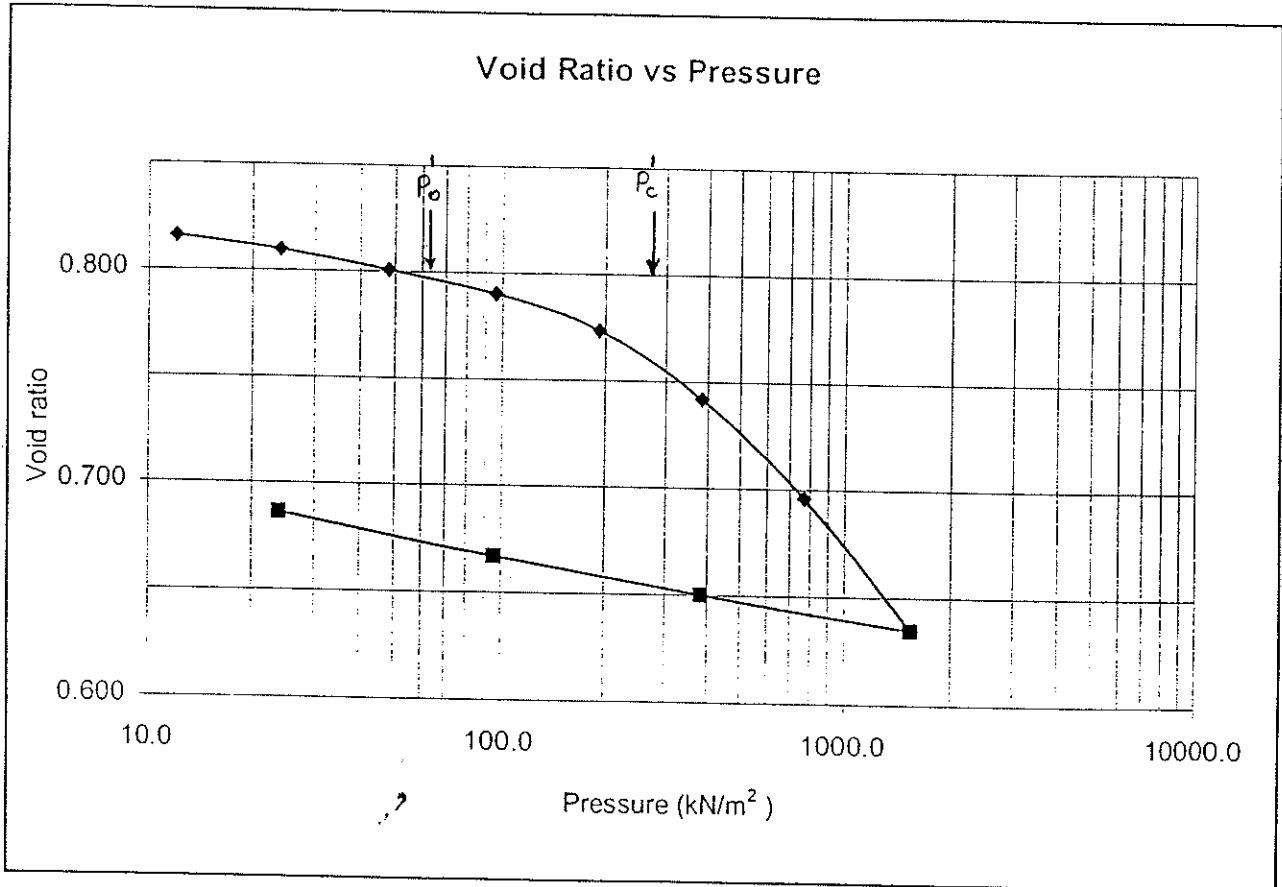
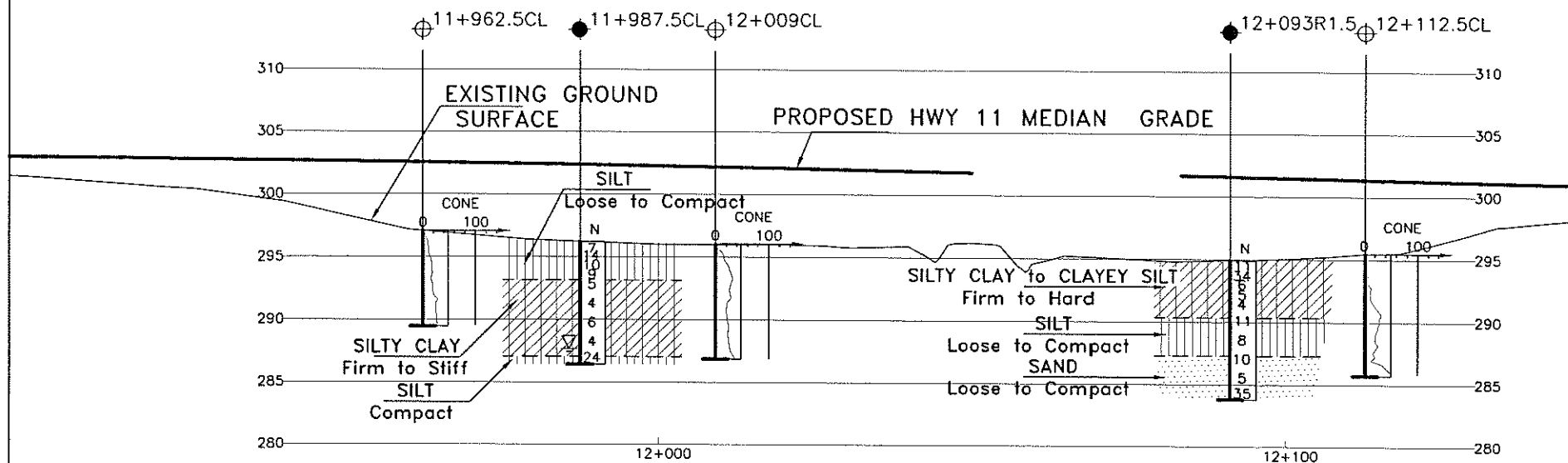
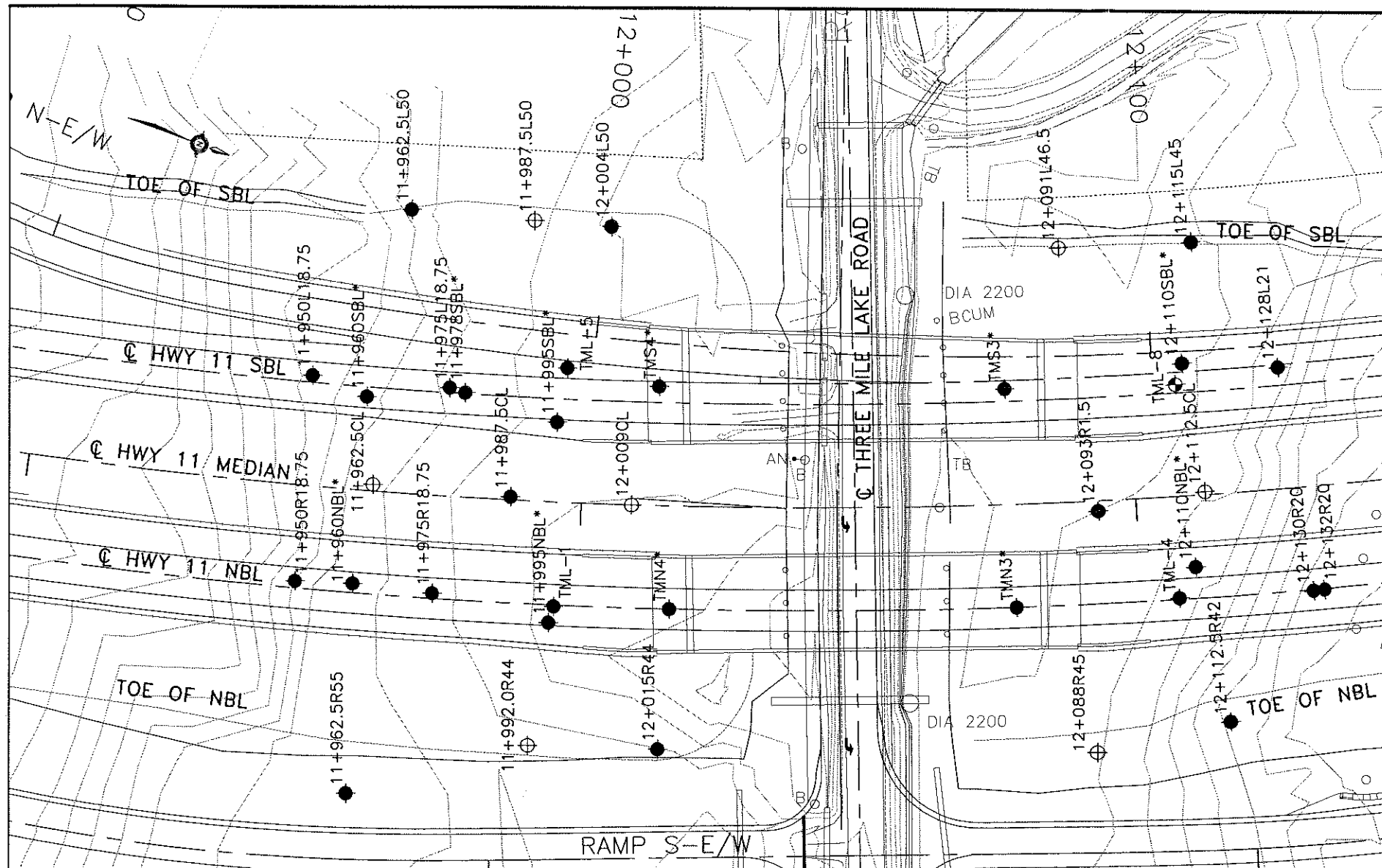
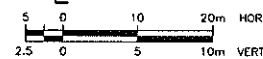


Fig No B1-7



PROFILE @ HWY 11 MEDIAN



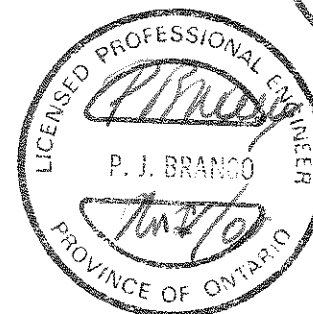
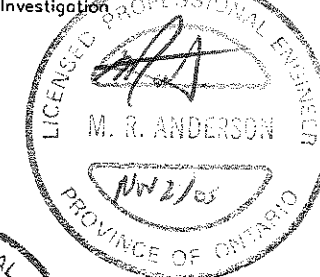
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shoenert & Peaker
for Preliminary Investigation

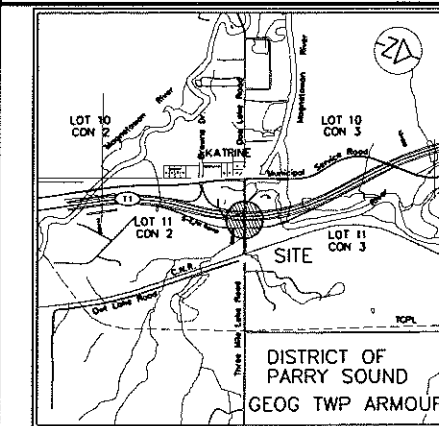
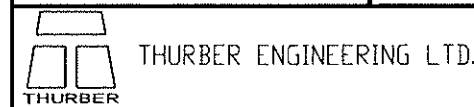


HWY 11
CONT No
WP No 480-93-00



SHEET

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
MEDIAN CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA



KEYPLAN

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

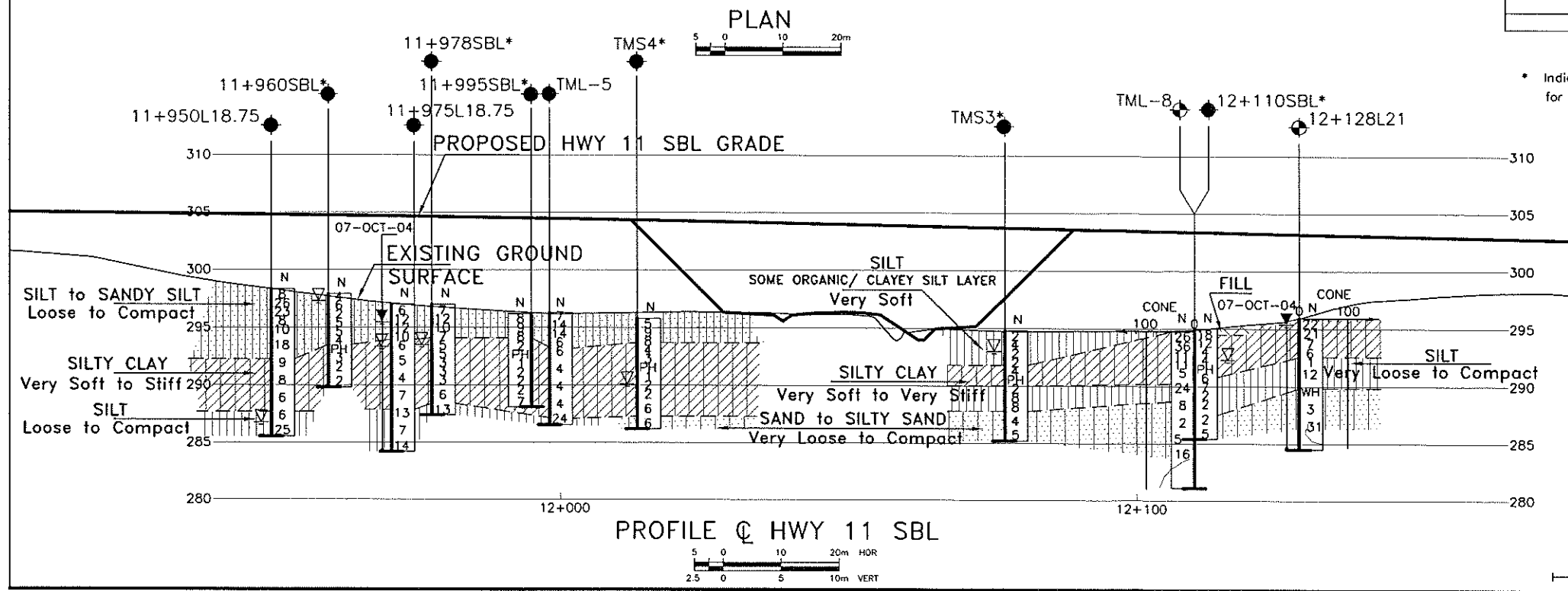
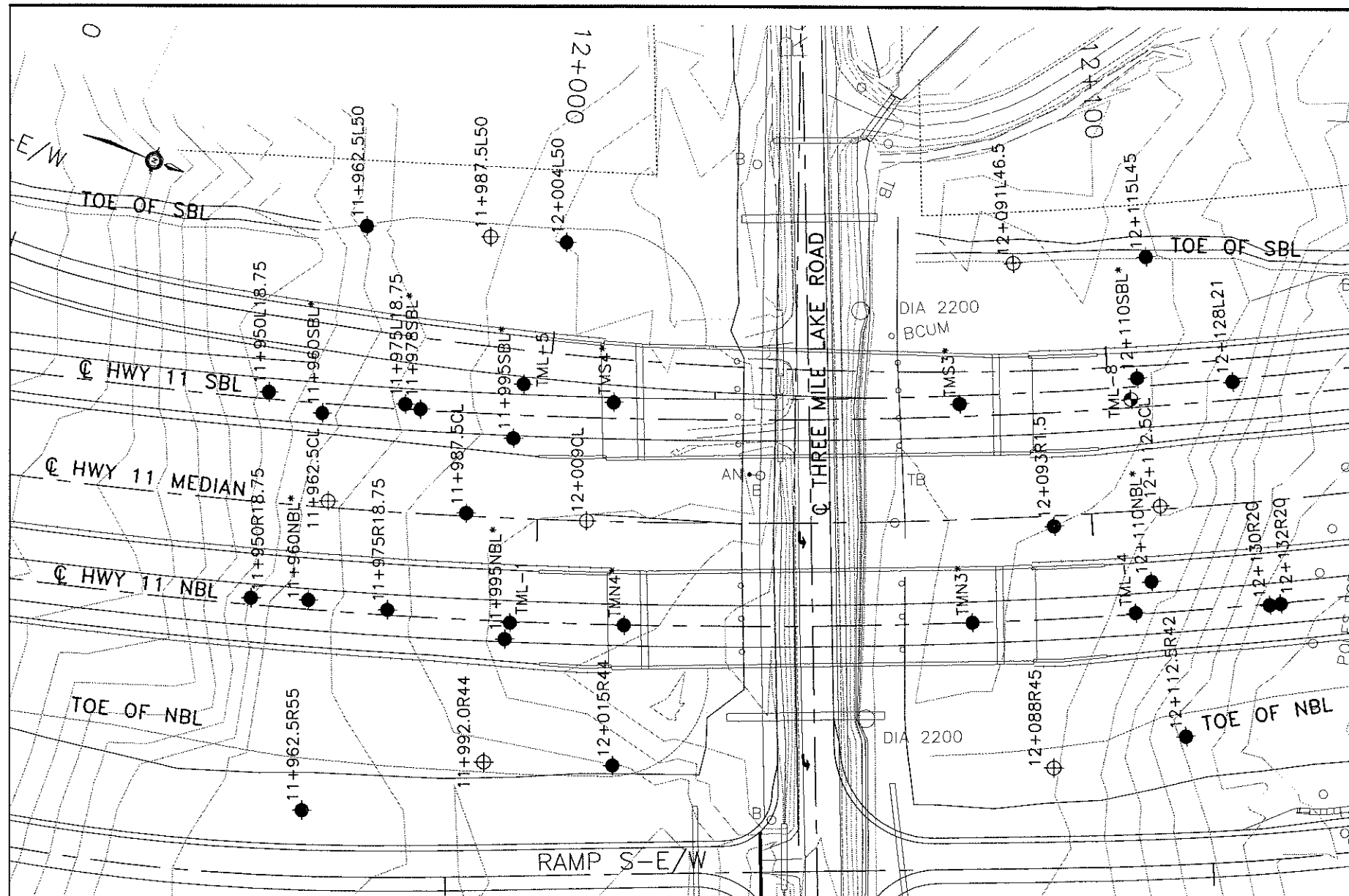
NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
JAN, 05	MA		ISSUED AS DRAFT FOR REVIEW
DESIGN	MA	CHK AEG	CODE CHBDC
DRAWN	HS	CHK MA	SITE
			LOAD
			STRUCT
			SCHEME
			DWG G/H/1

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
SBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

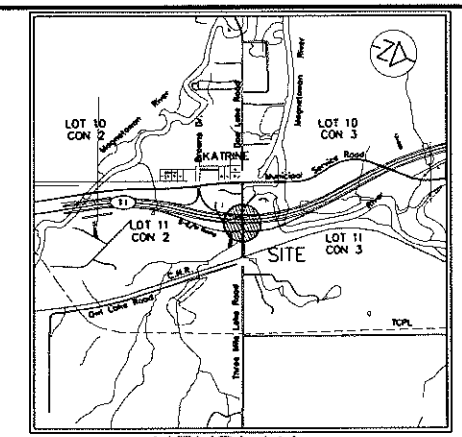
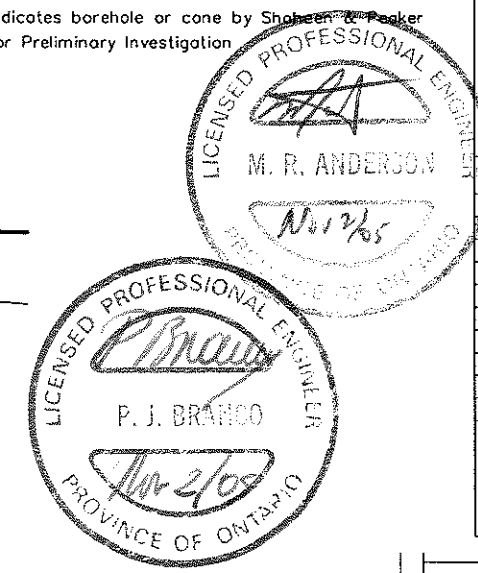
THURBER ENGINEERING LTD.
THURBER

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316466.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shoenberger & Pecker for Preliminary Investigation



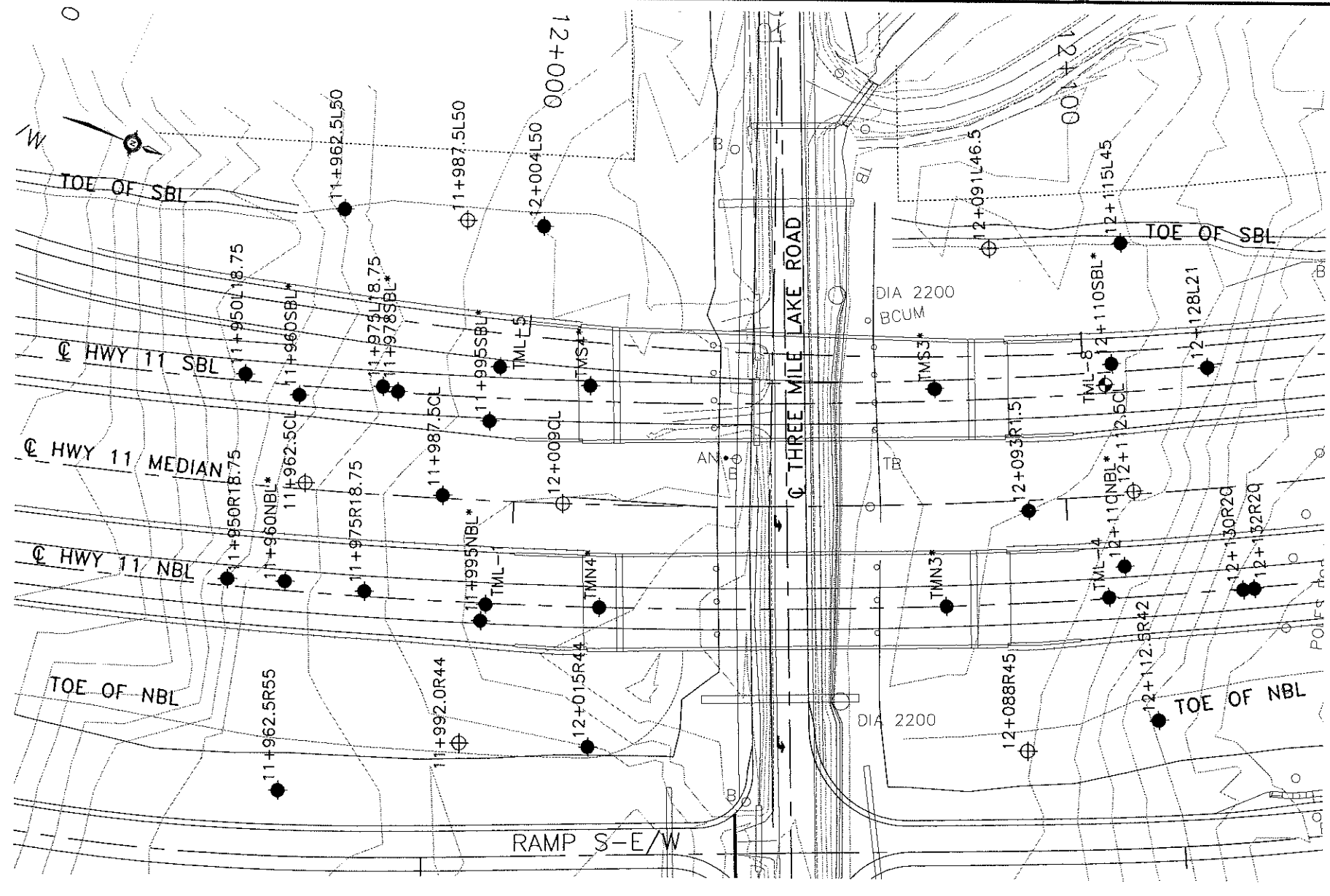
LEGEND		
●	Bore Hole	
⊕	Dynamic Cone Penetration Test (cone) or Probe Hole	
⊙	Bore Hole & Cone	
N	Blows/D.3m (Std pen Test, 475J/blow)	
CONE	Blows/D.3m (60° Cone, 475J/blow)	
PH	Pressure, Hydraulic	
↓	WL in Piezometer at Time of Investigation (Date)	
↑	Head Artesian Water	
↑	Piezometer	
↓	WL in Open Borehole Upon Completion of Drilling	
90%	Rock Quality Designation (RQD)	
A/R	Auger Refusal	
C/R	Cone Refusal	

NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		DATE		BY		DESCRIPTION		DATE	
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW							
DESIGN MA	CHK AEG	CODE CHBDC	LOAD						
DRAWN HS	CHK MA	SITE	STRUCT	SCHEME	IDWG G/H2				

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
SOUTHBOUND TOE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

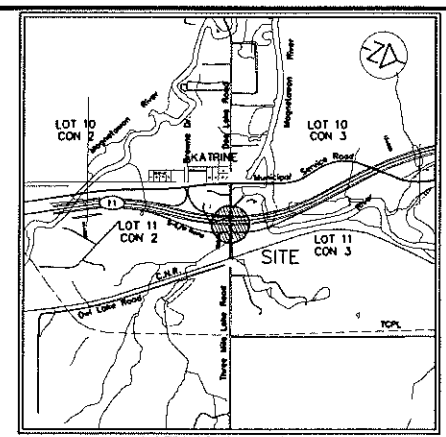
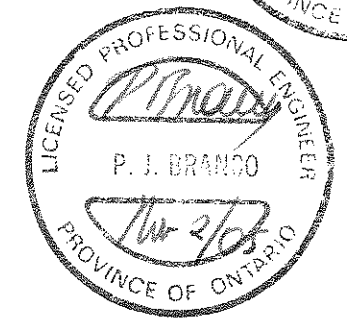
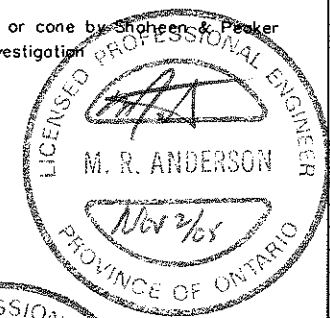
SHEET

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shoenberger & Pecker for Preliminary Investigation



KEYPLAN

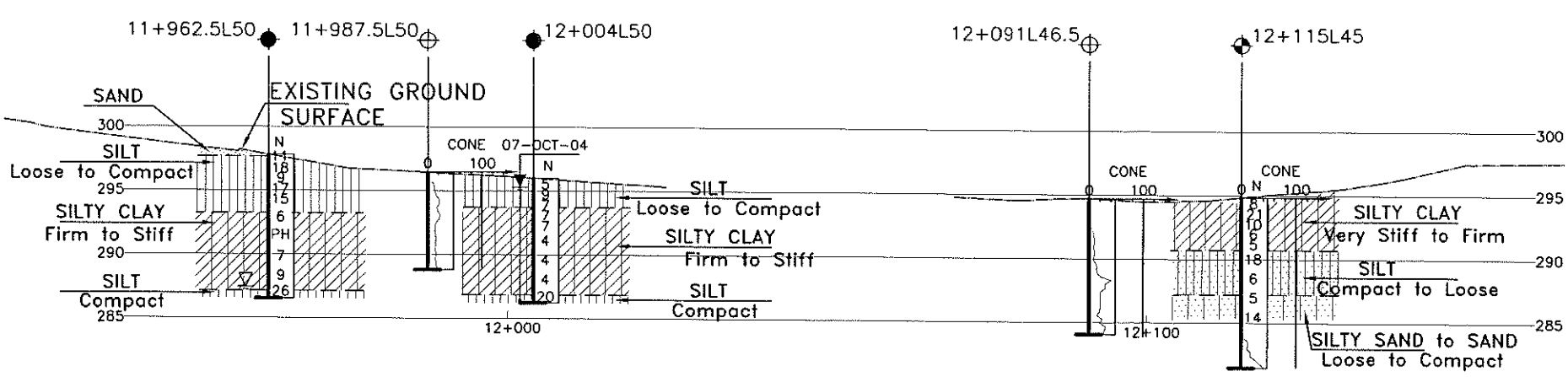
LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60" Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

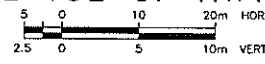
NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

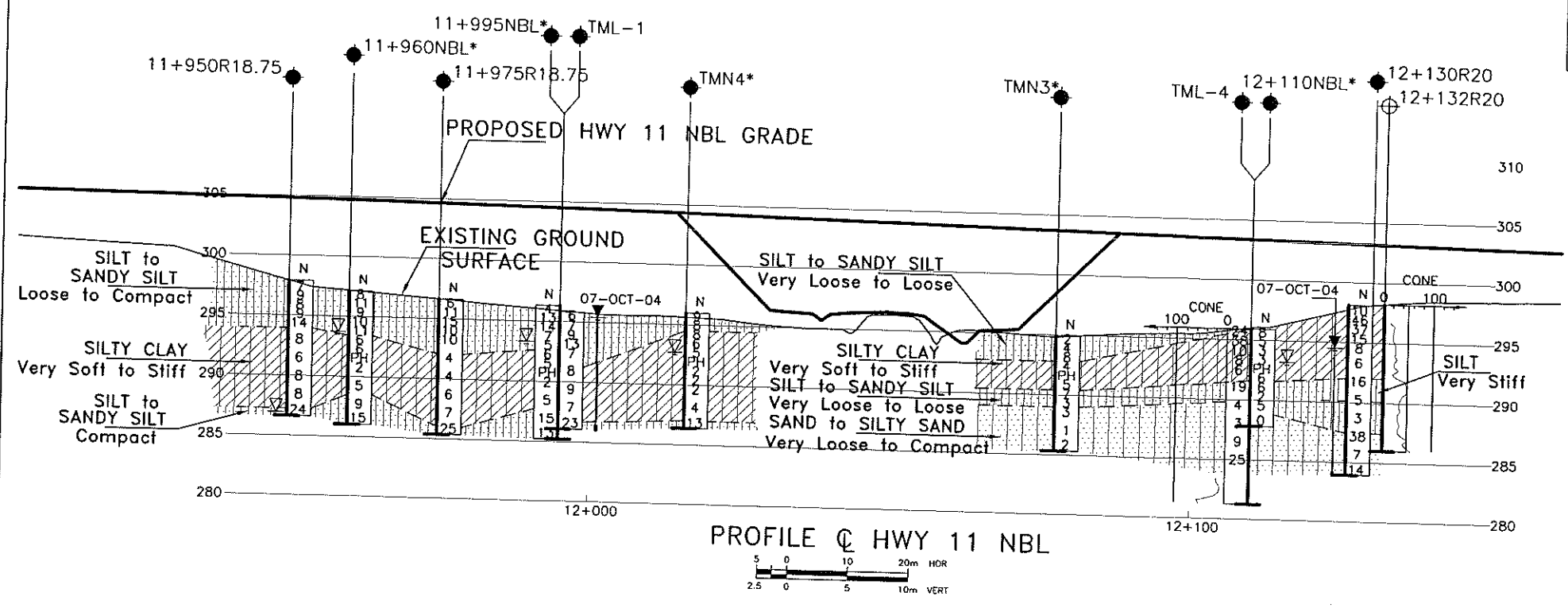
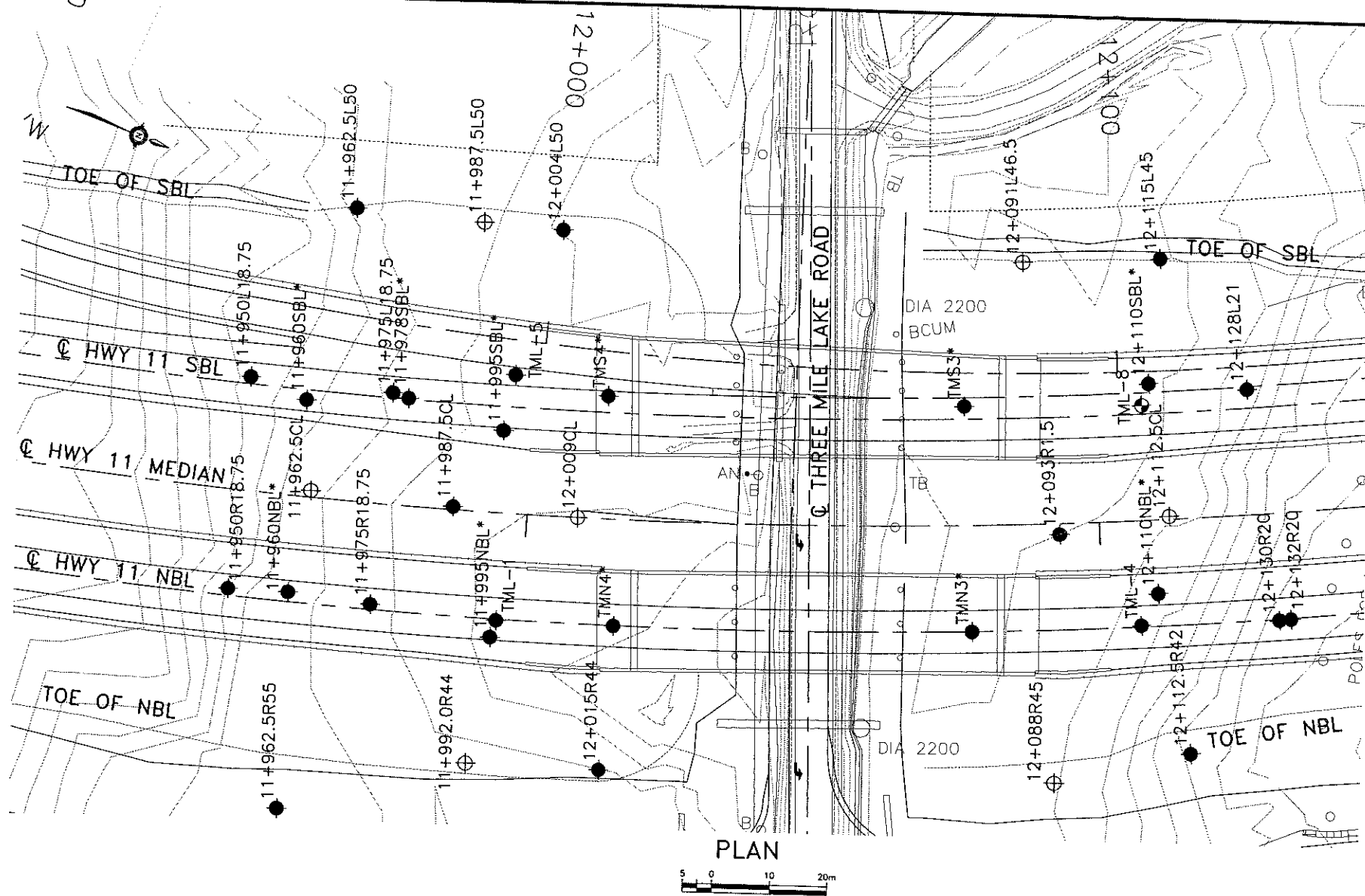


PROFILE TOE OF HWY 11 SBL



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
JAN, 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHBDC	LOAD
DRAWN HS	CHK MA	ISITE	STRUCT
			SCHEME
			DWG G/H3



METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

11
2

SHEET

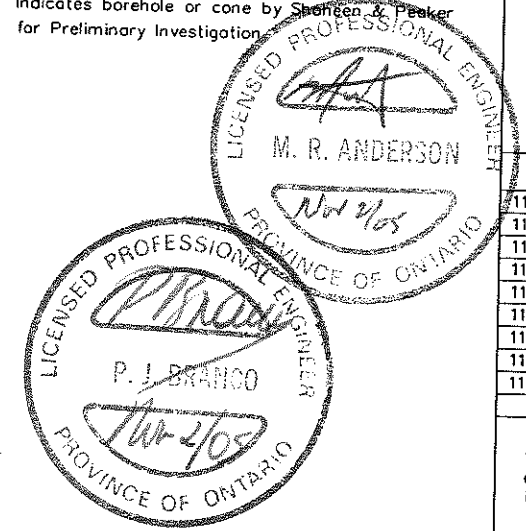
HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

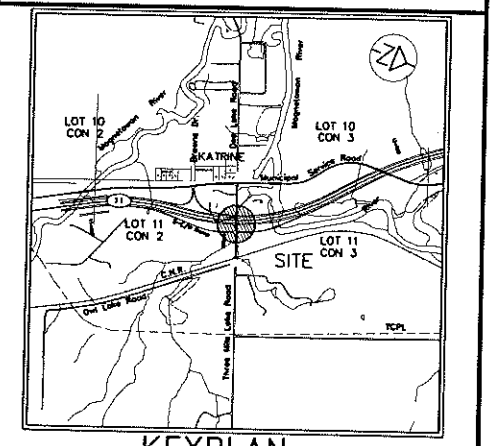
NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shoenen & Peaker
for Preliminary Investigation



Marshall Macklin Monaghan
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THURBER



LEGEND

●

Bore Hole

⊕

Dynamic Cone Penetration Test (cone) or Probe Hole

⊙

Bore Hole & Cone

N

Blows/0.3m (Std pen Test, 475J/blow)

CONE

Blows/0.3m (60' Cone, 475J/blow)

PH

Pressure, Hydraulic

W

WL in Piezometer at Time of Investigation (Date)

W

Head Artesian Water

W

Piezometer

W

WL in Open Borehole Upon Completion of Drilling

90%

Rock Quality Designation (RQD)

A/R

Auger Refusal

C/R

Cone Refusal

NO

STATION

OFFSET FROM
MEDIAN CL

11+950 L18.75

11+950

L18.75

11+950 R18.75

11+950

R18.75

11+962.5 CL

11+962.5

CL

11+962.5 L50

11+962.5

L50

11+962.5 R55

11+962.5

R55

11+975 L18.75

11+975

L18.75

11+975 R18.75

11+975

R18.75

11+987.5 CL

11+987.5

CL

11+987.5 L50

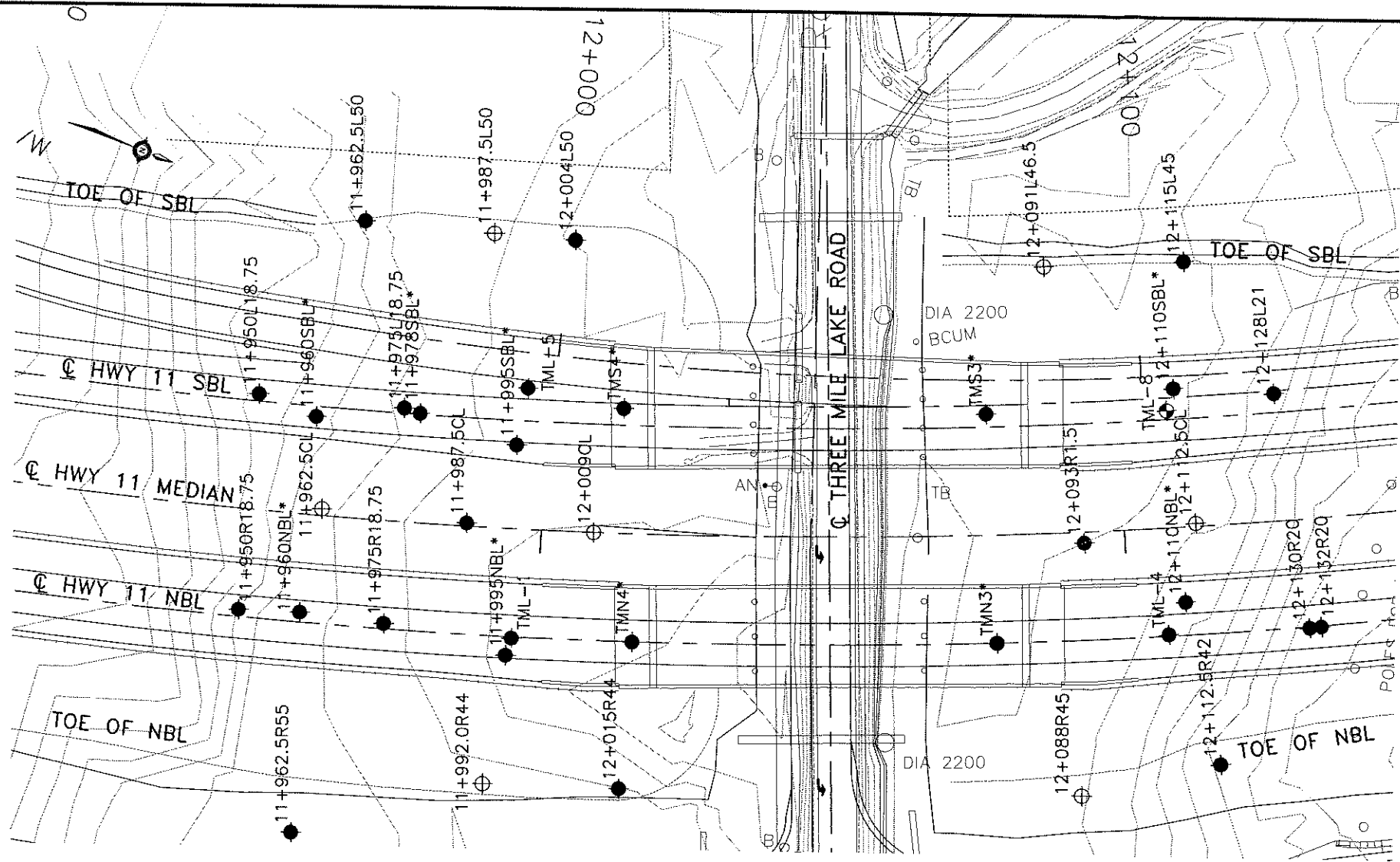
11+987.5

L50

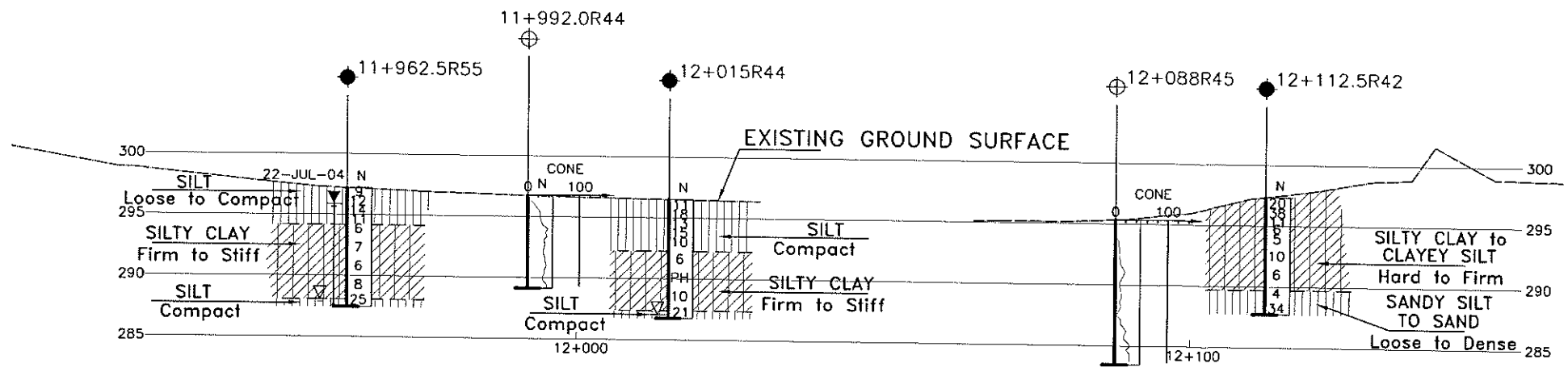
NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW	
DATE	BY		
DESIGN MA	CHK AEG	CODE CHEDC	LOAD
DRAWN HS	CHK MA	ISIT	ISIT

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



PLAN
5 0 10 20m



PROFILE TOE OF HWY 11 NBL
2.5 0 5 10 20m HOR
5 10m VERT

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

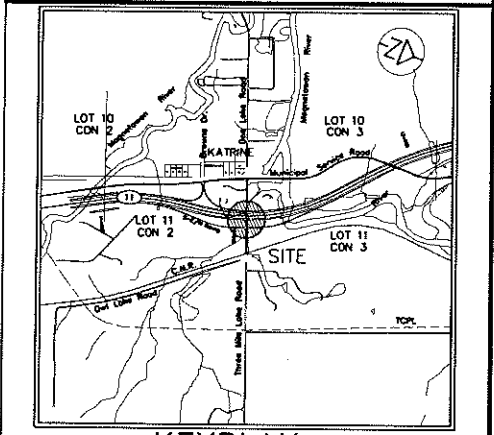


HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
NORTHBOUND TOE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.



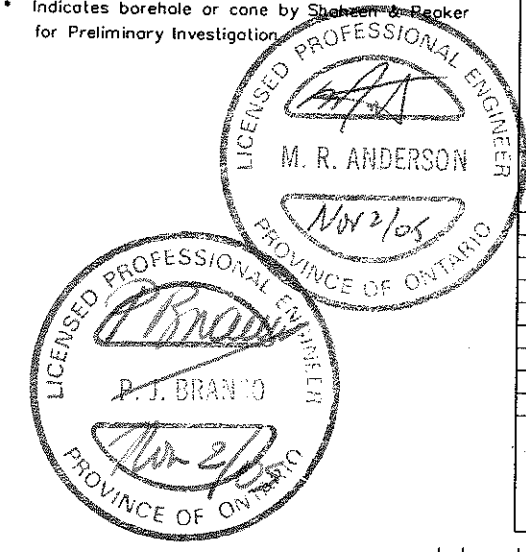
KEYPLAN

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Sheehan & Becker for Preliminary Investigation



LEGEND		
●	Bore Hole	
⊕	Dynamic Cone Penetration Test (cone) or Probe Hole	
⊕	Bore Hole & Cone	
N	Blows/0.3m (Std pen Test, 475J/blow)	
CONE	Blows/0.3m (60' Cone, 475J/blow)	
PH	Pressure, Hydraulic	
↓	WL in Piezometer at Time of Investigation (Date)	
↑	Head Artesian Water	
↑	Piezometer	
↓	WL in Open Borehole Upon Completion of Drilling	
90%	Rock Quality Designation (RQD)	
A/R	Auger Refusal	
C/R	Cone Refusal	

NO	STATION	OFFSET FROM
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		ISSUED AS DRAFT FOR REVIEW		DESCRIPTION	
DATE	BY	DATE	BY	DATE	DESCRIPTION
JAN. 05	MA				
DESIGN MA	CHK PJB	CODE CHBDC	LOAD	DATE JAN. 2005	
DRAWN HS	CHK MA	SITE	STRUCT	SCHEME	DWG G/H5

Highway 11: Highway 518 West to Highway 520
High Fills, Deep Cuts and Swamp Crossings

Appendix H

Highway 11, Station 12+070 to 12+140

RECORD OF BOREHOLE No TMS3

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Katrine -Three Mile Lake Road - Co-ords: N 5 048 385.9; E 316 425.4 ORIGINATED BY G.I
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T
DATUM Geodetic DATE 30.03.01 CHECKED BY Z.O

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			SHEAR STRENGTH kPa					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE		
294.8	Ground Surface						20	40	60	80	100		
0.0	150 mm Topsoil SILT some clay and sand some organics, brown, very soft, (possible fill)		1	SS	2	☞							
			2	SS	4								
293.0			3	SS	2								
1.8	ORGANIC SILT & CLAYEY SILT very soft, dark grey/black												
292.5													
2.3	SILT some sand and clay, rootlets & organics, very soft, grey		4	SS	2								
291.8													
3.0	SILTY CLAY layered very soft to stiff grey		5	SS	4								
			6	TW	PH								
290.0			7	SS	2								
4.8	SILT some clay seams, loose, grey, wet, dilatant		8	SS	8								
			9	SS	8								
287.8													
7.0	Silty												
	FINE SAND some silt, very loose to loose grey, wet		10	SS	4								
285.2			11	SS	5								
9.6	End of borehole *Water level at 1.8 m (not stabilized) and hole caved at 3.0 m upon completion												

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TMN3

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Katrine - Three Mile Lake Road - Co-ords: N 5 048 401.7; E 316 461.9 ORIGINATED BY G.I.
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
DATUM Geodetic DATE 30.03.01 CHECKED BY Z.O.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE							
294.9	Ground Surface						20	40	60	80	100					
0.0	100 mm Topsoil SANDY SILT some rootlets, very loose to loose, moist		1	SS	2											
			2	SS	4											
			3	SS	8											
292.8	brown to 1.2 m, grey below															
2.1	SILTY CLAY firm to stiff, grey		4	SS	4											
			5	TW	PH											
			6	SS	5											
290.4																
4.5	SILT Sandy loose to very loose, grey, wet		7	SS	7											
			8	SS	3											
289.0																
5.9	organic odor ----- silty ----- FINE SAND some silt, very loose, grey wet		9	SS	3											
			10	SS	1											
			11	SS	2											
285.3																
9.6	End of borehole Sand rising in borehole (quick condition) from 6.0 m onwards. *Water added to hole for counter-balancing hydrostatic pressure; water level not stabilized upon completion															

RECORD OF BOREHOLE No 12+088 R45

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+088, O/S R45 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
0.0	AUGERED TO 1.52 m.													
1.5	DCPT started at 1.52 m.													

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+088 R45

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+088, O/S R45 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	WATER CONTENT (%)			
11.9	END OF DCPT AT 11.89 m.													

RECORD OF BOREHOLE No 12+091 L46.5

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+091, O/S L46.5 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
0.0	AUGERED TO 1.52 m.													
1.5	DCPT started at 1.52 m.													

Continued Next Page

+ ³ , × ³ : Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+091 L46.5

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+091, O/S L46.5 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

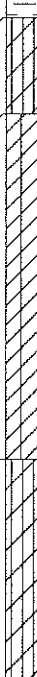
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA Si CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
10.7	END OF DCPT AT 10.67 m.													

RECORD OF BOREHOLE No 12+093 R1.5

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+093, O/S R1.5 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								20	40	60	80	100					GR SA SI CL	
0.0	TOPSOIL, some rootlets		1	SS	11													
0.1	Dark Brown																	
	Clayey SILT, trace to some sand, occasional rootlets																	
	Stiff																	
0.8	Brown		2	SS	34													
	Silty CLAY, trace sand, occasional iron oxide staining																	
	Hard to Firm																	
	Brownish Grey		3	SS	6												0 0 59 40	
			4	SS	5													
3.0	Clayey SILT, trace sand		5	SS	4													
	Firm																	
	Grey																	
4.6	SILT, trace sand, trace clay		6	SS	11													
	Compact to Loose																	
	Grey																	
	Wet		7	SS	8												0 7 88 5	
7.6	SAND, fine to medium grained, some silt to silty		8	SS	10													
	Compact to Loose																	
	Brownish Grey																	
	Wet		9	SS	5												0 75 25 (SI+CL)	

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+093 R1.5

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+093, O/S R1.5 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 05.10.04 - 05.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL						x LAB VANE		
								20	40	60	80	100								
	Becoming Dense		10	SS	35															
11.1	END OF BOREHOLE AT 11.13 m. BOREHOLE GROUTED TO SURFACE.																			

+³, x³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-4

1 OF 2

METRIC

W.P. 475-93-01 LOCATION N 5048428.8 E 316450.0 Three Mile Lake Road NBL ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM/HS
 DATUM Geodetic DATE 07.10.04 - 07.10.04 CHECKED BY MA/AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
295.9							20	40	60	80	100							
0.0	TOPSOIL (100mm)																	
0.1	Silty CLAY, trace sand, occasional oxide staining Very Stiff to Hard Brown		1	SS	24													
			2	SS	38													
	Becoming Stiff to Firm		3	SS	10													
	Becoming Grey		4	SS	8													
			5	SS	6													
291.5																		
4.4	SILT, some clay, trace sand Very Stiff Grey Wet		6	SS	19													
289.8																		
6.1	SAND, fine to medium grained, trace to some silt Loose to Very Loose Grey Wet		7	SS	4													
	occasional iron oxide staining Becoming Brown		8	SS	3													
			9	SS	9													
																</		

Continued Next Page

+ 3, × 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-4

2 OF 2

METRIC

W.P. 475-93-01 LOCATION N 5048428.8 E 316450.0 Three Mile Lake Road NBL ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM/HS
 DATUM Geodetic DATE 07.10.04 - 07.10.04 CHECKED BY MA/ AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W P W W L	20 40 60			
284.8	Becoming Compact		10	SS	25		285							
11.1	END OF SAMPLING AT 11.13 m. AUGERED TO 12.19 m.						284							
283.7	DCPT started at 12.19 m.						283							
12.2							282							
281.3														
14.6	END OF BOREHOLE AT 14.63 m. BOREHOLE GROUTED TO SURFACE.													

ONTMT4S TMLN.GPJ 02/02/05

RECORD OF BOREHOLE No TML-8

1 OF 2

METRIC

W.P. 476-93-01 LOCATION N 5048414.6 E 316413.9 Three Mile Lake Road SBL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM/HS
 DATUM Geodetic DATE 12.10.04 - 12.10.04 CHECKED BY MA/AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
294.8								20 40 60 80 100	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
0.0 0.1	TOPSOIL (50 mm) Silty CLAY, trace sand, occasional iron oxide staining Very Stiff to Hard Brown-Grey		1	SS	26								
			2	SS	36								
	Becoming Stiff, Wet		3	SS	11								
			4	SS	11								
	Becoming Firm, Grey		5	SS	5								
290.2													
4.6	SILT, trace sand Compact Grey Wet		6	SS	24								
288.7													
6.1	SAND, fine grained, trace silt Loose to Very Loose Grey Wet		7	SS	8								
			8	SS	2								
			9	SS	5								

Continued Next Page

+³ × 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TML-8

2 OF 2

METRIC

W.P. 476-93-01 LOCATION N 5048414.6 E 316413.9 Three Mile Lake Road SBL ORIGINATED BY WRW
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM/HS
 DATUM Geodetic DATE 12.10.04 - 12.10.04 CHECKED BY MA/AEG

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								
283.7	Becoming Compact		10	SS	16								
11.1	END OF SOIL SAMPLING AT 11.13 m. DCPT started at 11.13 m.												
281.1													
13.7	END OF DCPT AT 13.72 m. BOREHOLE OPEN TO 6.1 m. BOREHOLE GROUTED TO SURFACE.												

ONT/MT4S TMLS.GPJ 02/02/05

RECORD OF BOREHOLE No 12+110 SBL

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Highway 11- Katrine, ON - Coords N 5 048 414.4; E 316 409.9 ORIGINATED BY S.O
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers. COMPILED BY G.T
DATUM Geodetic DATE 16.03.01 CHECKED BY Z.O

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L
295.0	Ground Surface						20	40	60	80	100		
0.0	SAND AND GRAVEL (FILL) with organics, compact, dark brown, moist		1	SS	18								
294.5													
0.5													
	SILTY CLAY brown to 3.0 m, grey below, moist		2	SS	12								
			3	SS	4								
			4	SS	4								
			5	TW	PH								
			6	SS	6								
290.8			7	SS	7								
4.2	SILT laminated, grey, wet		8	SS	2								
			9	SS	2								
287.5			10	SS	2								
7.5	SILTY FINE SAND grey, wet												
			11	SS	5								
285.4													
9.6	End of borehole *Water level at 2.7 m (not stabilized) and hole open to 5.9 m upon completion												

RECORD OF BOREHOLE No 12+110 NBL

1 OF 1

METRIC

W.P. 314-99-00 LOCATION Highway 11- Katrine, ON - Coords N 5 048 429.5; E 316 443.7 ORIGINATED BY S.O
DIST 52 HWY 11 BOREHOLE TYPE Solid Stem Augers and Hollow Stem Augers COMPILED BY G.T
DATUM Geodetic DATE 16.03.01 CHECKED BY Z.O

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE										● QUICK TRIAXIAL × LAB VANE					
								20	40	60	80	100						20	40	60	20	40	60
295.9	Ground Surface																						
0.0	50 mm Topsoil trace organics -----		1	SS	8										19.6	0 43 55 2							
			2	SS	5												18.1						
	SILTY CLAY laminated, brown to 0.7 m, grey below soft to stiff		3	SS	3												17.1						
			4	SS	3																		
			5	TW	PH																		
	frequent silt seams		6	SS	6																		
291.6			7	SS	6																		
4.3	SANDY SILT Sandy zones grey, wet loose ----- very loose loose		8	SS	2																		
			9	SS	5																		
288.8																							
7.1	SILTY FINE SAND very loose, grey, wet															** low blow count probably due to quick condition							
287.8			10	SS	0	**																	
8.1	End of borehole *Water level at 2.7 m (not stabilized) and hole open to 7.2 m on completion																						

METRIC

W.P.	480-93-00	LOCATION	Armour Township, ST. 12+112.5, CL	ORIGINATED BY	JL
HWY	11	BOREHOLE TYPE	Dynamic Cone Penetration Test (DCPT)	COMPILED BY	WM
DATUM	Geodetic	DATE	05.10.04 - 05.10.04	CHECKED BY	MA

[illegible]

ONTMT4 2316.GPJ 27/01/05

+³, ×³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+112.5 R42

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+112.5, O/S R42 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	TOPSOIL (50 mm)													
0.1	Clayey SILT, trace sand Very Stiff Brown		1	SS	20									
0.6	Moist Silty CLAY, trace sand Hard to Stiff Brownish Grey		2	SS	38									
			3	SS	11									0 2 43 55
	Becoming Firm, wet		4	SS	6									
			5	SS	5									
4.6	Clayey SILT, trace sand Stiff to Firm Grey Wet		6	SS	10									0 0 78 21
			7	SS	6									
7.6	Sandy SILT, trace clay Loose Grey Wet		8	SS	4									0 25 70 4
9.1	SAND, medium grained, trace silt Dense Grey		9	SS	34									
9.6	Wet END OF BOREHOLE AT 9.60 m.													

ONTMT4 2316.GPJ 27/01/05

Continued Next Page

+ 3, x 3; Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+112.5 R42

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+112.5, O/S R42 ORIGINATED BY JL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
	BOREHOLE GROUTED TO SURFACE.																

ONTMT4 2316.GPJ 27/01/05

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+115 L45

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+115, O/S L45 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								20 40 60 80 100							
0.0	TOPSOIL, some rootlets Dark Brown		1	SS	8										
0.5	Silty CLAY, trace sand, occasional oxide staining Very Stiff to Stiff Brown		2	SS	21										
			3	SS	10										
	Becoming Firm, Grey		4	SS	6										
			5	SS	5										
4.1	SILT, trace to some clay, trace to some sand Compact to Loose Grey Wet		6	SS	18										
			7	SS	6										
7.6	Silty SAND, fine grained, trace clay Loose Grey Wet		8	SS	5										
9.1	SAND, medium grained, trace silt Compact Brown		9	SS	14										
9.6	Wet END OF SAMPLING AT 9.60 m.														

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+115 L45

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+115, O/S L45 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W _P W W _L WATER CONTENT (%)				
	AUGERED TO 10.67 m.							20 40 60 80 100	○ UNCONFINED + FIELD VANE					
10.7	DCPT started at 10.67 m.							20 40 60 80 100	● QUICK TRIAXIAL × LAB VANE					

RECORD OF BOREHOLE No 12+128 L21

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+128, O/S L21 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 06.10.04 - 06.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)			
0.0	TOPSOIL (100 mm)																			
0.1	Loose Brown Silty CLAY, trace sand, occasional silt layers Very Stiff to Firm Brownish Grey		1	SS	22															
			2	SS	21															
			3	SS	7											0 1 50 49				
			4	SS	6															
	Becoming Soft, Grey		5	SS	1															
3.4	SILT, trace to some clay, trace to some sand Loose to Compact Grey																			
			6	SS	12											0 1 84 15				
6.1	SAND, some silt to silty, trace clay Very Loose Grey Wet		7	SS	WH															
			8	SS	3											0 85 15 (SI+CL)				
	Becoming Dense		9	SS	31															
9.6	END OF SAMPLING AT 9.60 m. DCPT started at 9.60 m.																			

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+128 L21

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+128, O/S L21 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 06.10.04 - 06.10.04 CHECKED BY MA

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								
11.4	END OF DCPT AT 11.43 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 7.10.04 0.55 19.01.05 1.00 28.02.05 0.96												

RECORD OF BOREHOLE No 12+130 R20

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+130, O/S R20 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Continued Next Page

+ 3 . × 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+130 R20

2 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+130, O/S R20 ORIGINATED BY JL
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
10.7	SAND, fine to medium grained, some silt to silty Dense to Loose Brown Wet		10	SS	38									
			11	SS	7									0 74 26 (SI+CL)
			12	SS	14									
14.2	END OF BOREHOLE AT 14.17 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 3.05 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) 4.10.04 3.90 7.10.04 3.60 19.01.05 4.21 28.02.05 4.15													

RECORD OF BOREHOLE No 12+132 R20

1 OF 2

METRIC

W.P. 480-93-00 LOCATION Armour Township, ST. 12+132, O/S R20 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
0.0	AUGERED TO 1.52 m.													
1.5	DCPT started at 1.52 m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 12+132 R20

2 OF 2

METRIC

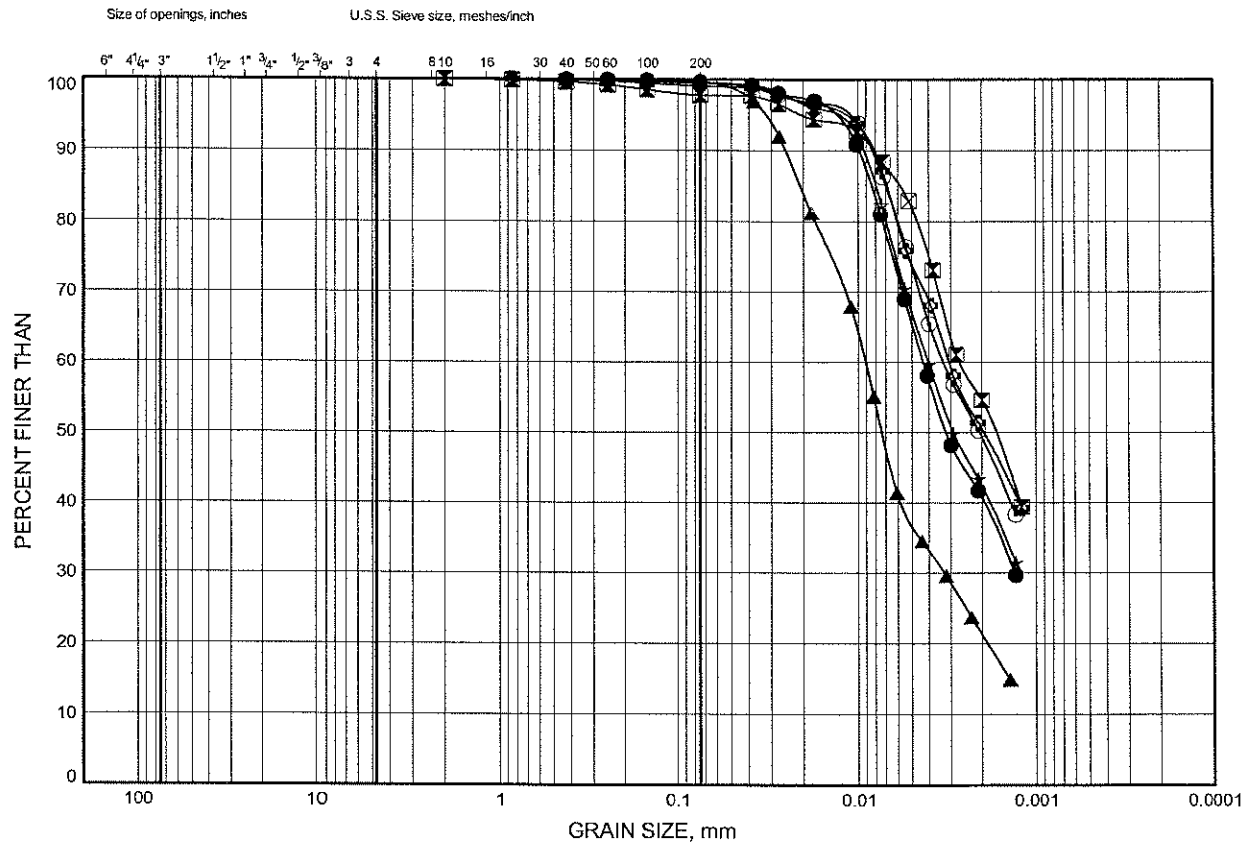
W.P. 480-93-00 LOCATION Armour Township, ST. 12+132, O/S R20 ORIGINATED BY JL
 HWY 11 BOREHOLE TYPE Dynamic Cone Penetration Test (DCPT) COMPILED BY WM
 DATUM Geodetic DATE 04.10.04 - 04.10.04 CHECKED BY MA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L				
12.2	END OF DCPT AT 12.19 m.													

Hwy 11 Katrine GRAIN SIZE DISTRIBUTION

FIGURE H1

Silty CLAY to Clayey SILT

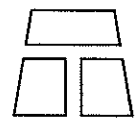


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	12+093 R1.5	1.75	
⊠	12+112.5 R42	1.75	
▲	12+112.5 R42	4.80	
★	12+115 L45	2.51	
⊙	12+128 L21	1.75	
⊕	12+130 R20	3.35	

Date January 2005

Project 480-93-00



THURBER

Prep'd WM

Chkd. MA

FIGURE H3

Size of openings, inches

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


PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Percent Finer Than (Series 1: Circles)	Percent Finer Than (Series 2: Triangles)	Percent Finer Than (Series 3: Crosses)
100	100	100	100
4.75	100	100	100
2.0	100	100	100
0.85	100	100	100
0.6	95	95	95
0.425	88	88	88
0.3	68	50	41
0.25	25	15	7
0.15	10	5	3
0.075	5	2	1
0.06	4	1	0
0.05	3	0	0
0.04	2	0	0
0.03	1	0	0
0.02	0	0	0
0.015	0	0	0
0.01	0	0	0
0.0075	0	0	0
0.006	0	0	0
0.005	0	0	0
0.004	0	0	0
0.003	0	0	0
0.002	0	0	0
0.0015	0	0	0
0.001	0	0	0
0.00075	0	0	0
0.0006	0	0	0
0.0005	0	0	0
0.0004	0	0	0
0.0003	0	0	0
0.0002	0	0	0
0.0001	0	0	0

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	12+093 R1.5	9.37	
⊠	12+115 L45	9.37	
▲	12+128 L21	7.85	

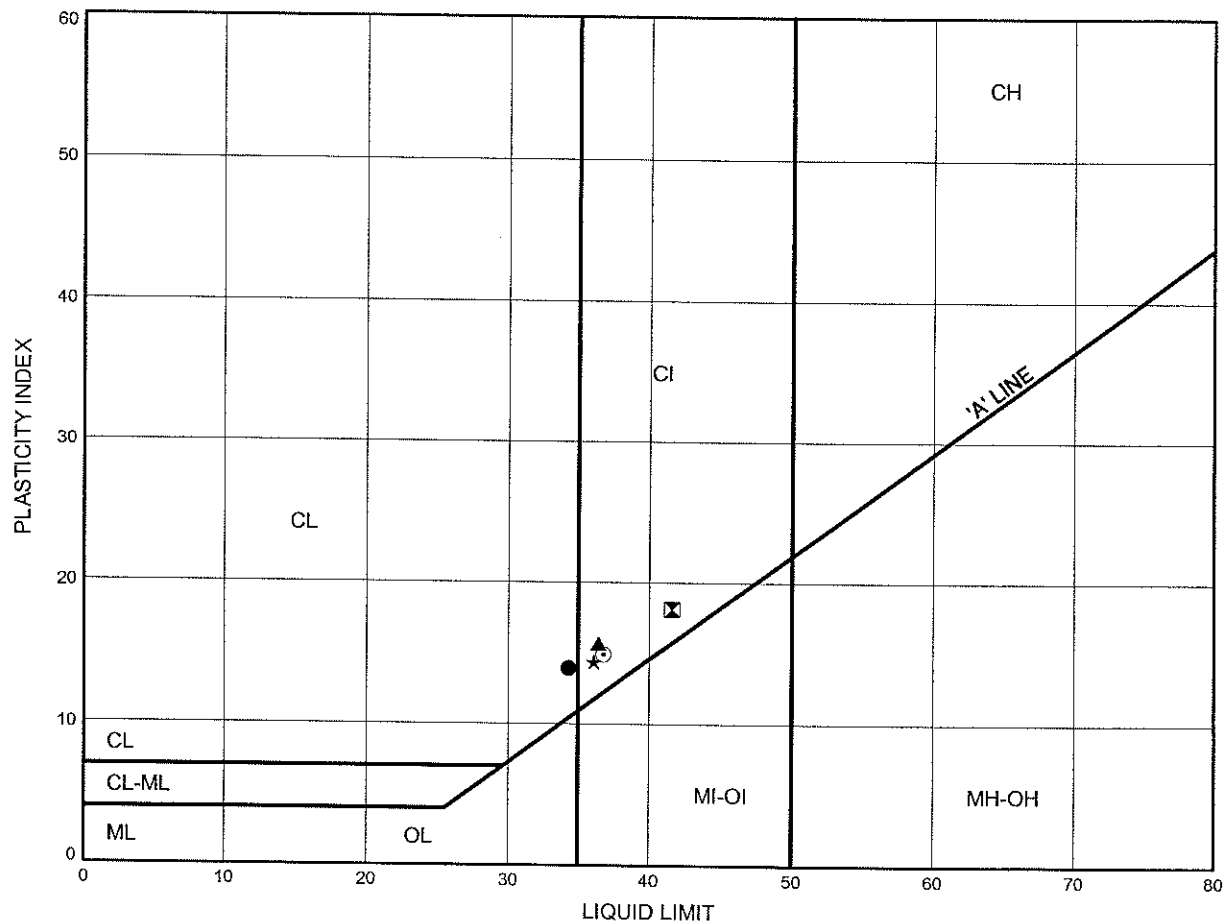


THURBER

Chkd. MA

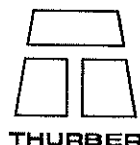
Hwy 11 Katrine ATTERBERG LIMITS TEST RESULTS

FIGURE H4

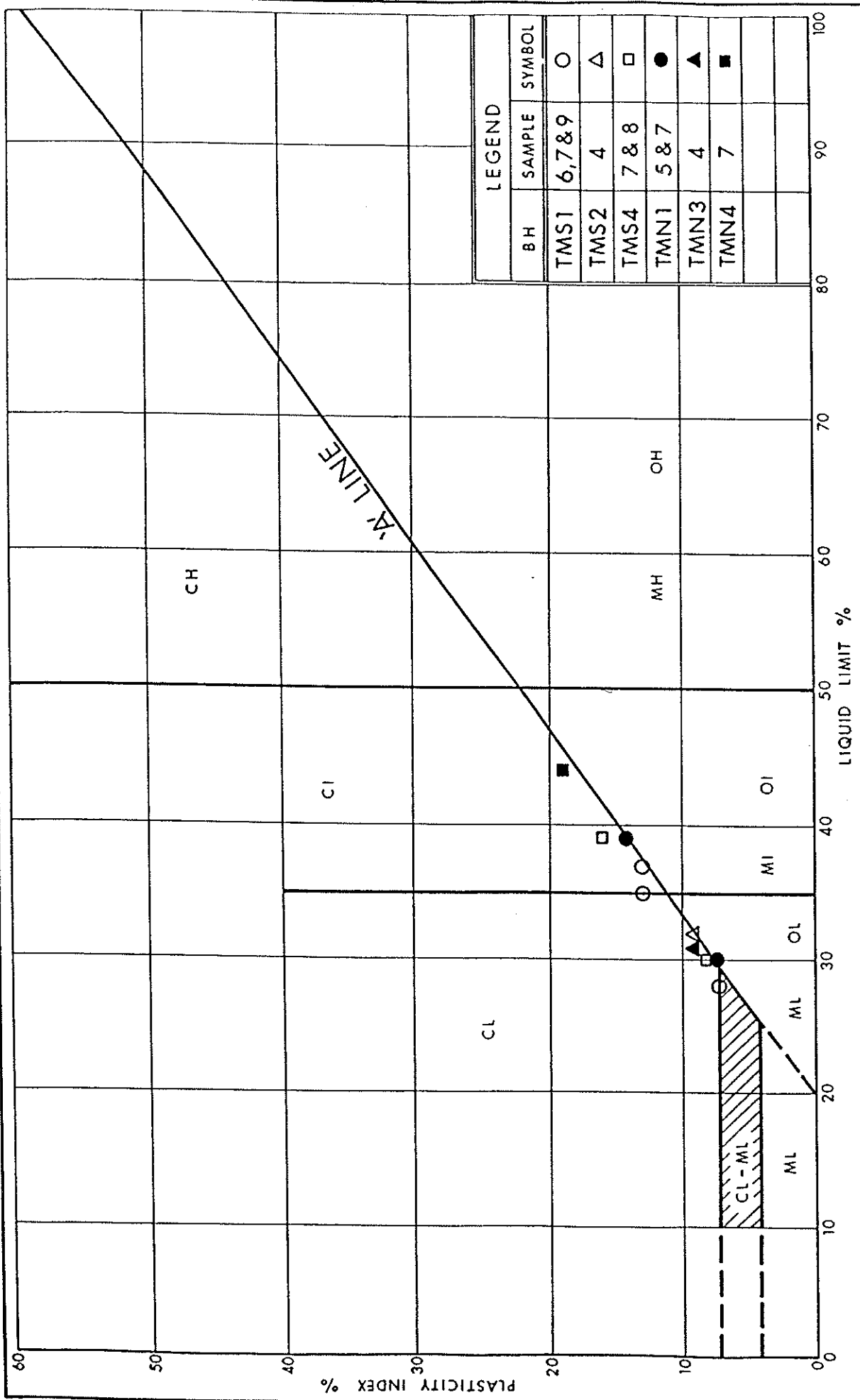


SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	12+093 R1.5	1.75	
⊠	12+112.5 R42	1.75	
▲	12+115 L45	2.51	
★	12+128 L21	1.75	
⊙	12+130 R20	3.35	

Date January 2005
Project 480-93-00



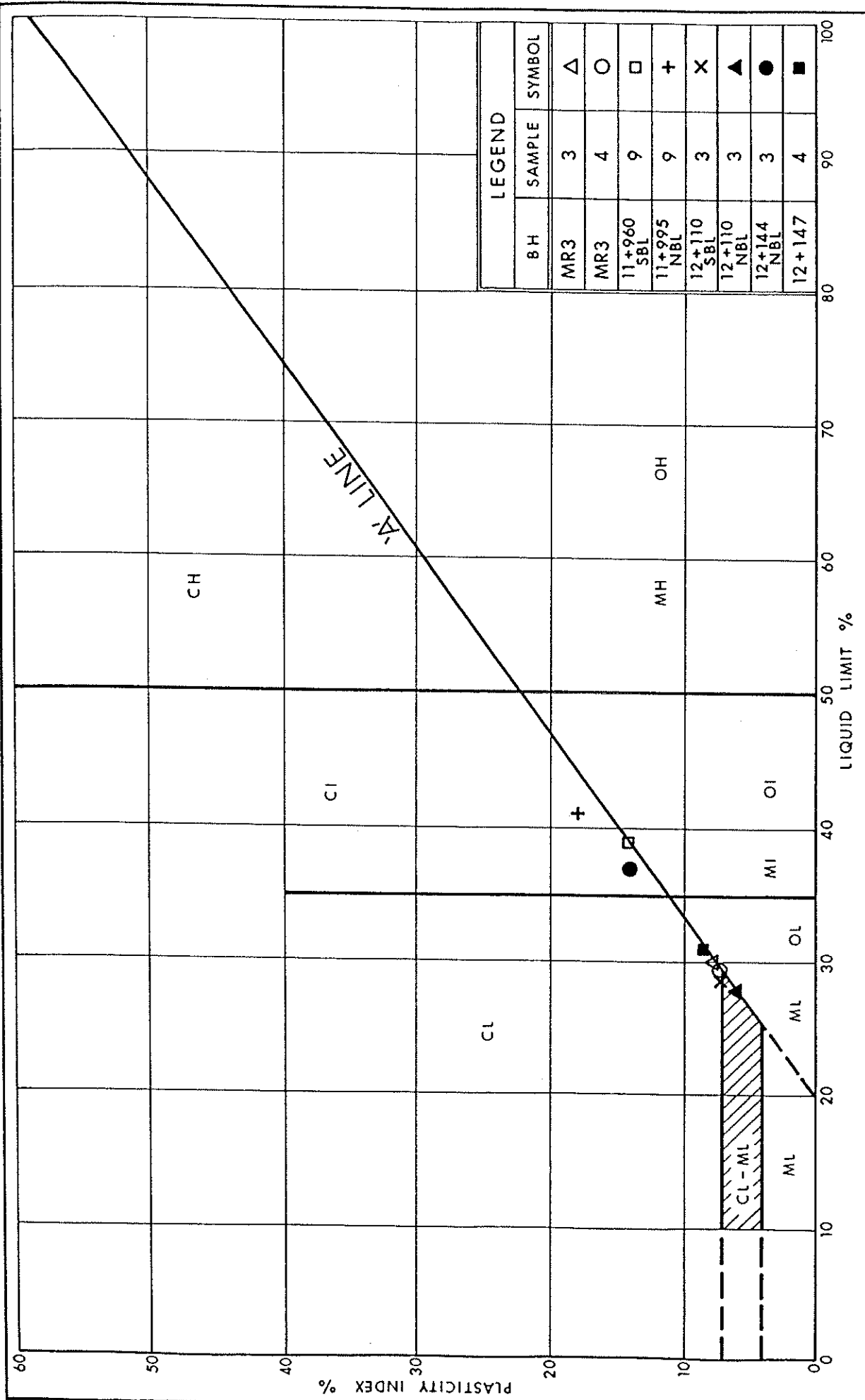
Prep'd WM
Chkd. MA



LEGEND		
BH	SAMPLE	SYMBOL
TMS1	6,7&9	○
TMS2	4	△
TMS4	7 & 8	□
TMN1	5 & 7	●
TMN3	4	▲
TMN4	7	■

PLASTICITY CHART
SILTY CLAY

FIG No B1-4
W P 314-99-00
SPT 1010F



PLASTICITY CHART

SILTY CLAY

FIG No B1-5

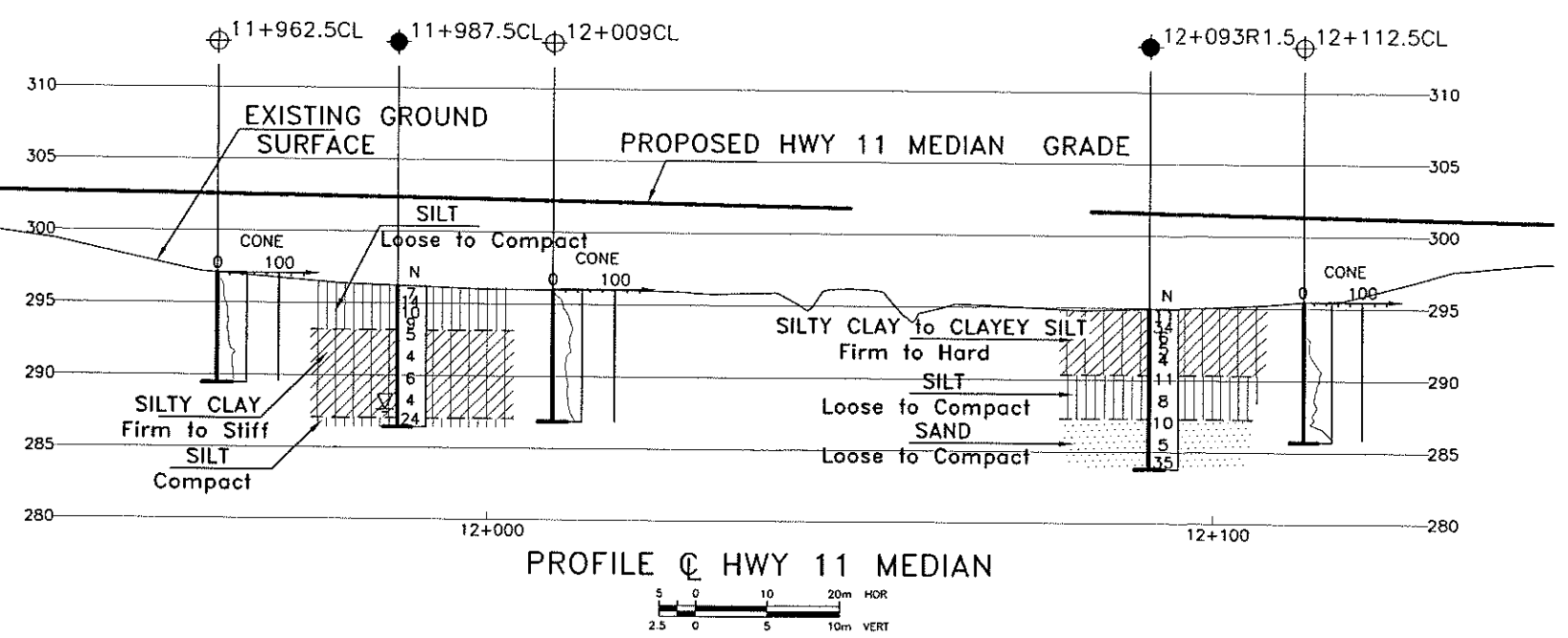
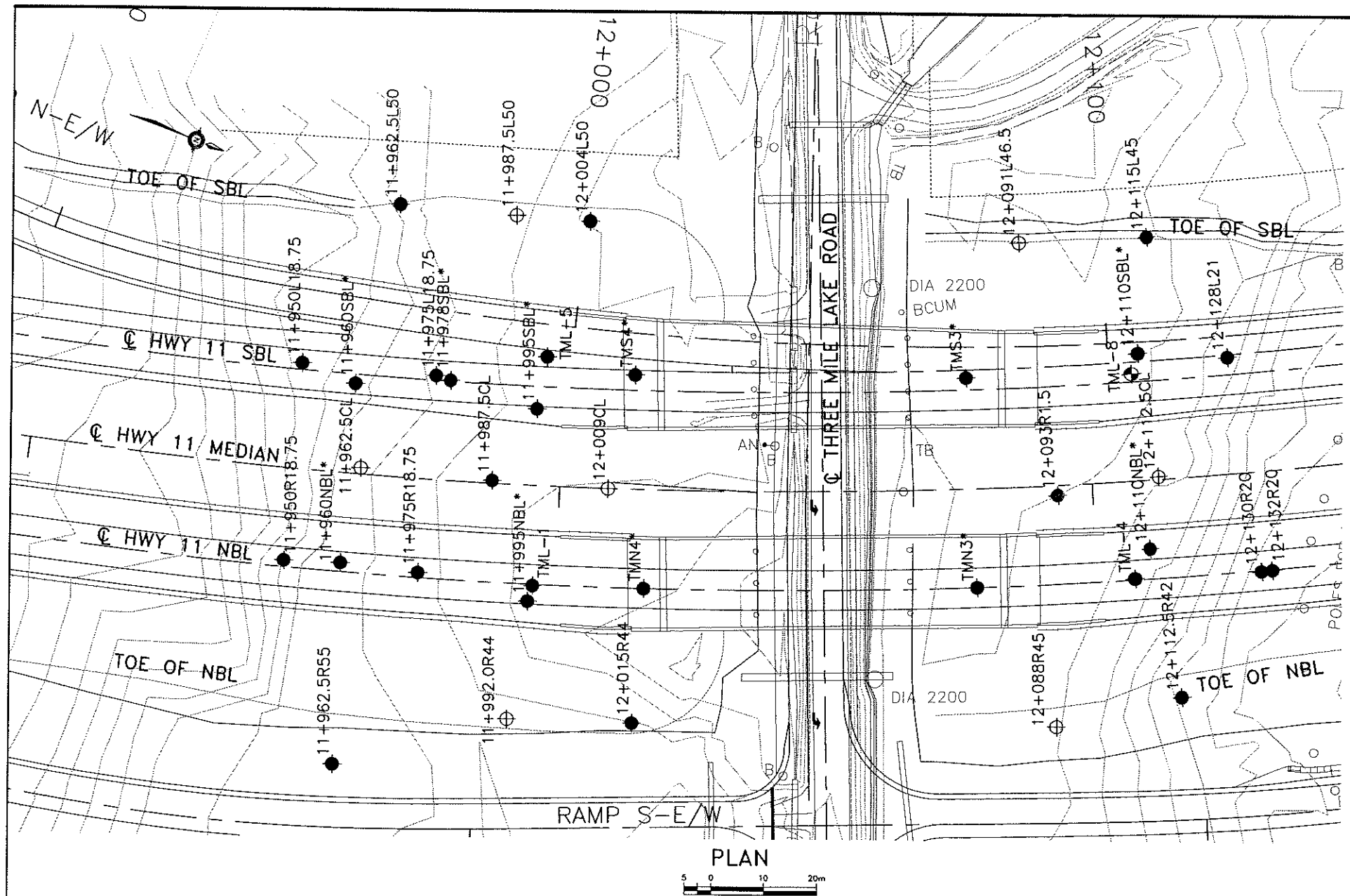
W P 314-99-00

SPT 1010F

Ministry of
Transportation



Ontario



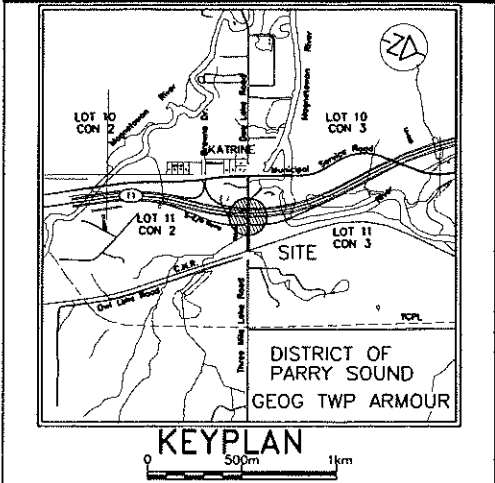
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HWY 11
CONT No
WP No 480-93-00

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
MEDIAN CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.

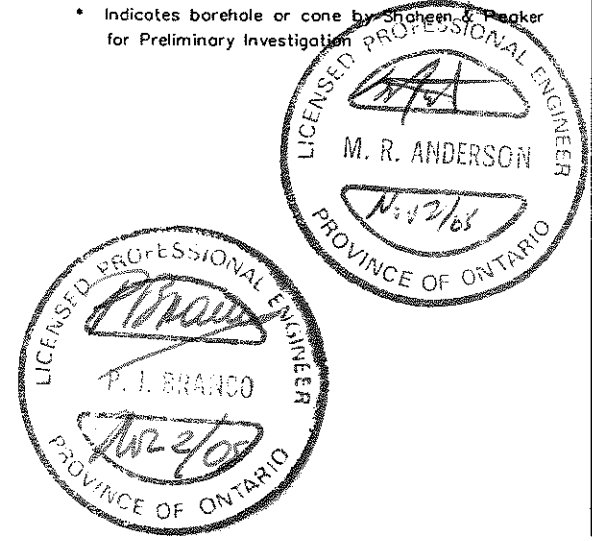


NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shaheen & Lecker for Preliminary Investigation



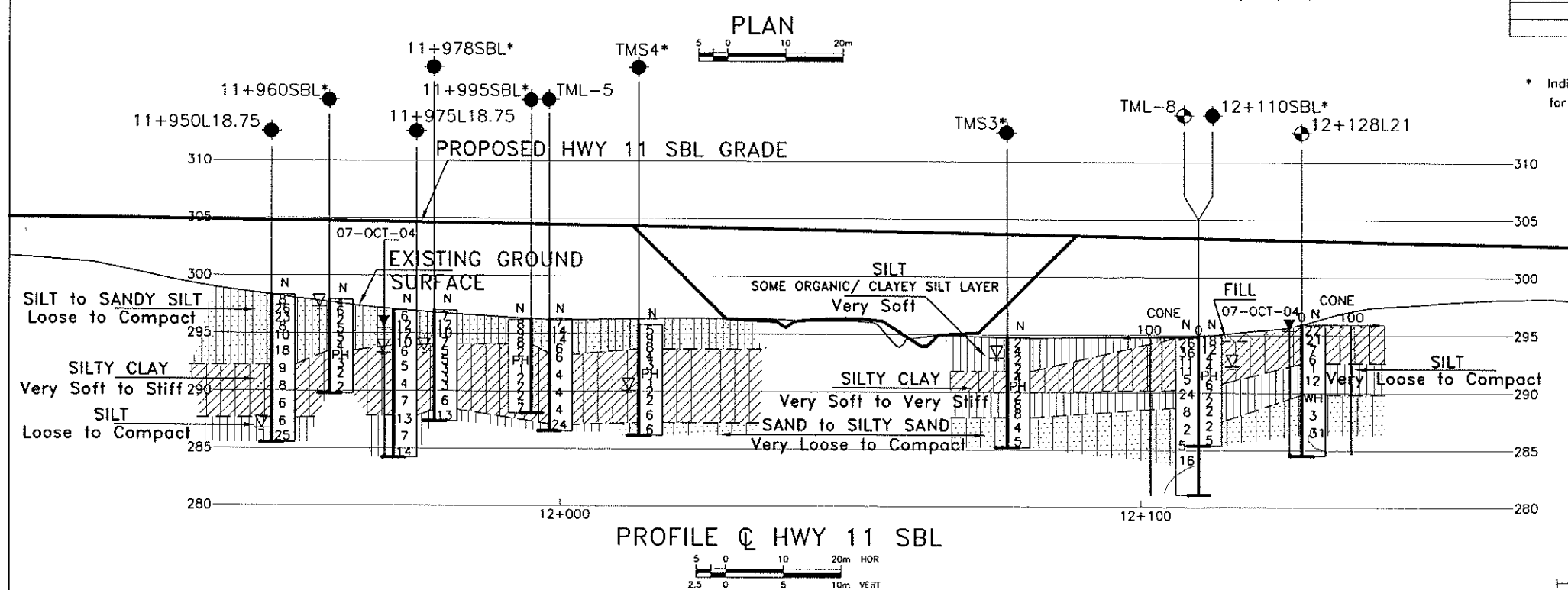
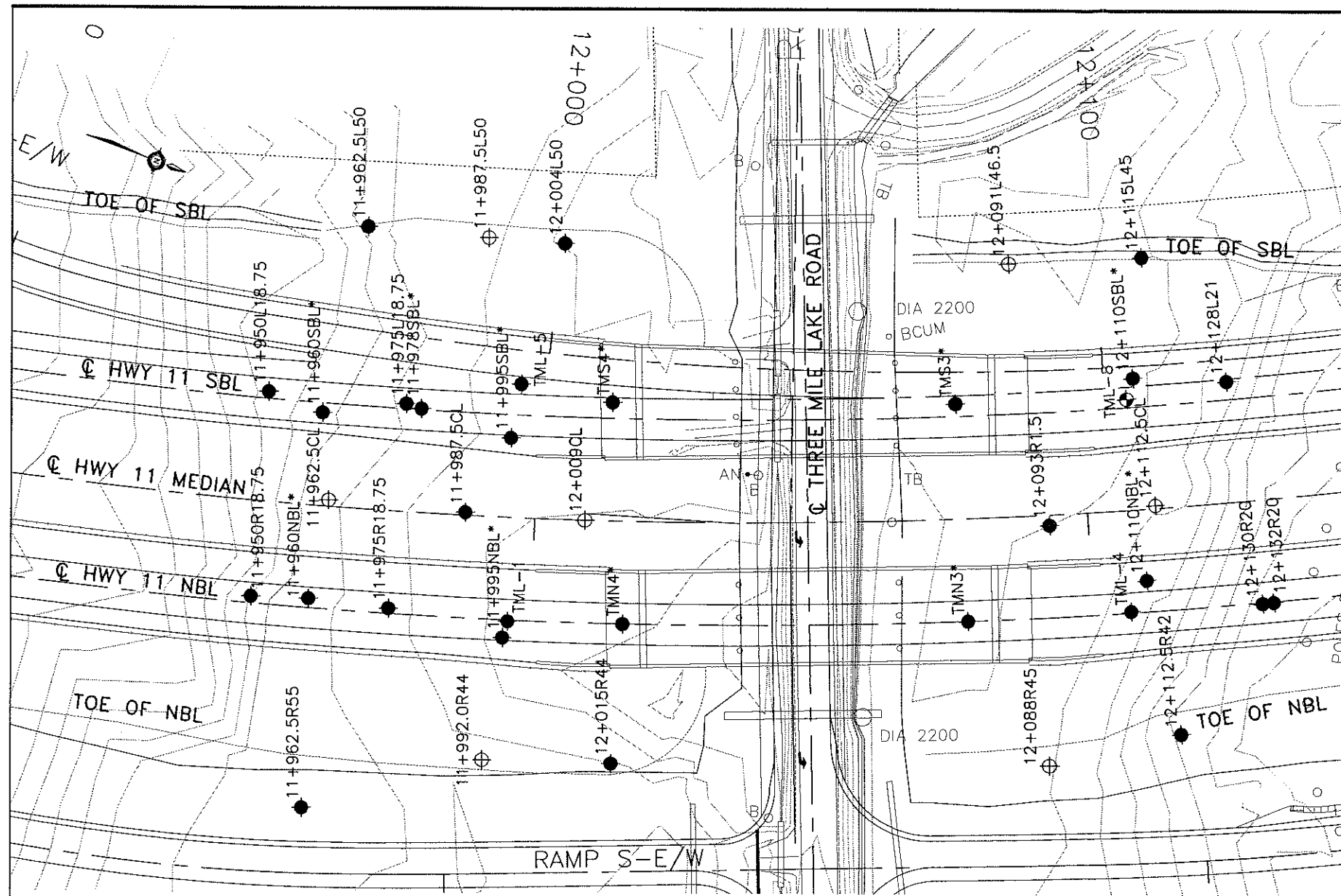
- LEGEND**
- Bore Hole
 - Dynamic Cone Penetration Test (cone) or Probe Hole
 - Bore Hole & Cone
 - N
 - Blows/0.3m (Std pen Test, 475J/blow)
 - CONE
 - Blows/0.3m (60' Cone, 475J/blow)
 - PH
 - Pressure, Hydraulic
 - WL in Piezometer at Time of Investigation (Date)
 - Head Artesian Water
 - Piezometer
 - WL in Open Borehole Upon Completion of Drilling
 - 90%
 - Rock Quality Designation (RQD)
 - A/R
 - Auger Refusal
 - C/R
 - Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN	MA	CHK AEG	CODE CHBDC
DRAWN	HS	CHK MA	SITE
LOAD			DATE JAN, 2005
STRUCT			SCHEME
IDWG	G/H1		

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



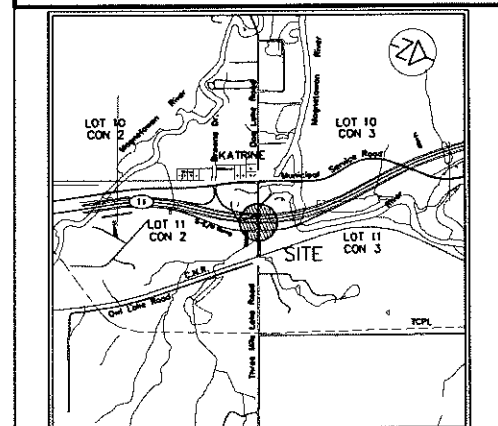
METRIC
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AND/OR MILLIMETRES
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HWY 11
CONT No
WP No 480-93-00

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
SBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

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THURBER

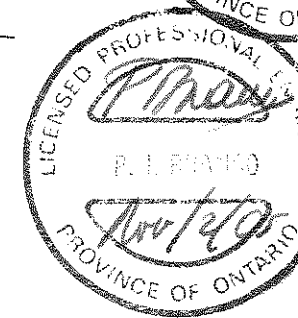
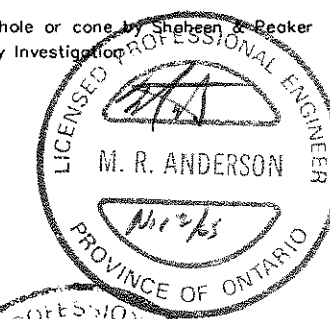


NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
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11+995SBL*	296.2	5048312.5	316459
TML-4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TML-3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Sheheen & Reaker for Preliminary Investigation



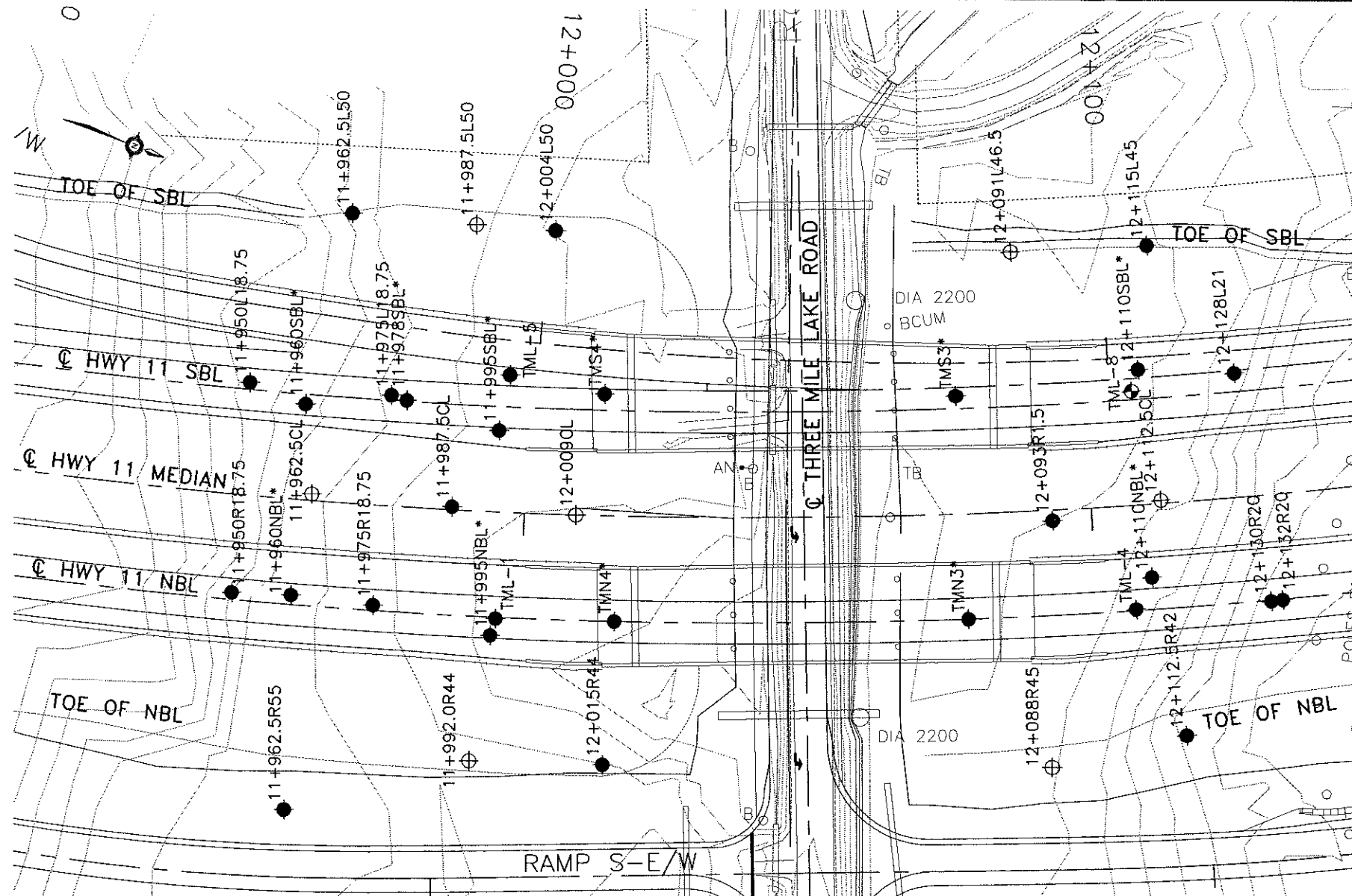
LEGEND	
●	Bore Hole
⊕	Dynamic Cone Penetration Test (cone) or Probe Hole
⊗	Bore Hole & Cone
N	Blows/0.3m (Std pen Test, 475J/blow)
CONE	Blows/0.3m (60' Cone, 475J/blow)
PH	Pressure, Hydraulic
WL	WL in Piezometer at Time of Investigation (Date)
HA	Head Artesian Water
PZ	Piezometer
WL	WL in Open Borehole Upon Completion of Drilling
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal
C/R	Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

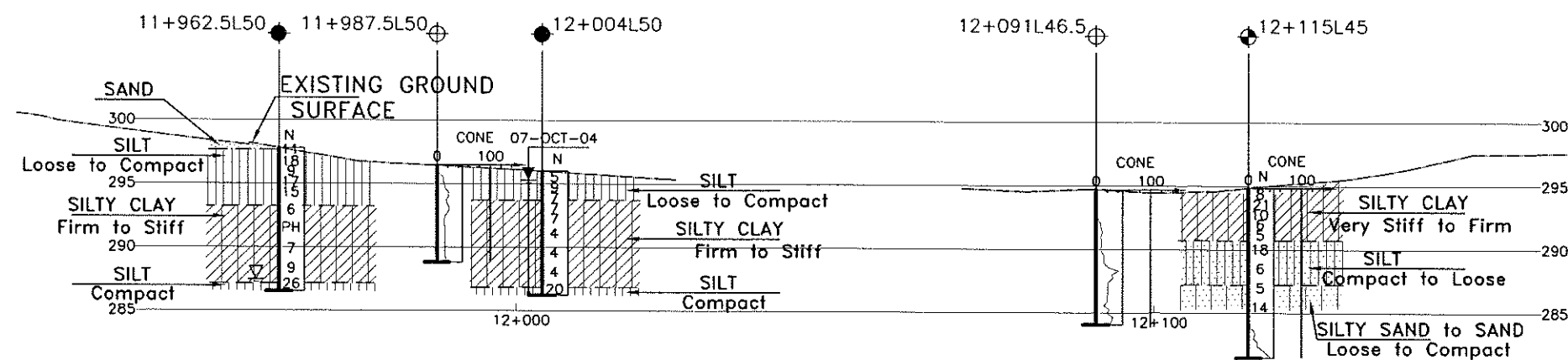
NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	MA	ISSUED AS DRAFT FOR REVIEW	DESCRIPTION
JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW		
DESIGN MA	CHK AEG	CODE CHBDC	LOAD	DATE JAN. 2005
DRAWN HS	CHK MA	SITE	STRUCT	SCHEME
				DWG G/H2



PLAN
0 10 20m



PROFILE TOE OF HWY 11 SBL

0 10 20m HOR
2.5 0 5 10m VERT

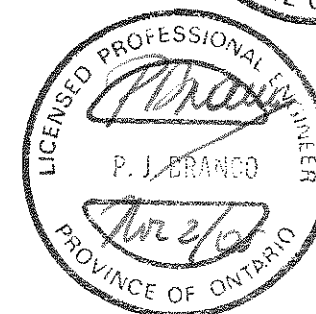
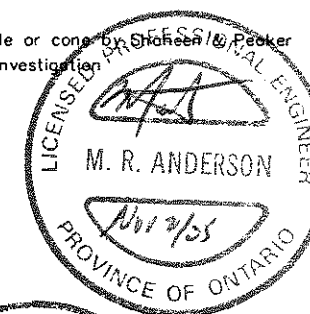
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
12+093 R1.5	12+093	R1.5
12+112.5 CL	12+112.5	CL
12+112.5 R42	12+112.5	R42
12+115 L45	12+115	L45
12+128 L21	12+128	L21
12+130 R20	12+130	R20
12+132 R20	12+132	R20

NO	ELEVATION	NORTH	EAST
TML-1	295.8	5048323.4	316490.7
TML-4	295.9	5048428.8	316450.0
TML-5	296.3	5048310.9	316449.1
TML-8	294.8	5048414.6	316413.9

NO	ELEVATION	NORTH	EAST
11+960NBL*	297.1	5048287.9	316499.3
11+960SBL*	297.9	5048278.7	316466.5
11+978SBL*	297.0	5048295.2	316459.7
11+995NBL*	296.3	5048323.5	316493.8
11+995SBL*	296.2	5048312.5	316459
TMN4*	295.8	5048343	316484
TMS4*	295.8	5048327.5	316446.6
TMN3*	294.9	5048401.7	316461.9
TMS3*	294.8	5048385.9	316425.4
12+110NBL*	295.9	5048429.5	316443.7
12+110SBL*	295.0	5048414.4	316409.9

* Indicates borehole or cone by Shreehan/Pecker
for Preliminary Investigation



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

HWY 11
CONT No
WP No 480-93-00

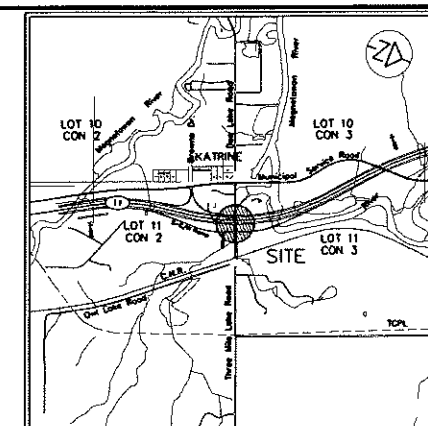


SHEET

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
SOUTHBOUND TOE
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.
THURBER



KEYPLAN

LEGEND

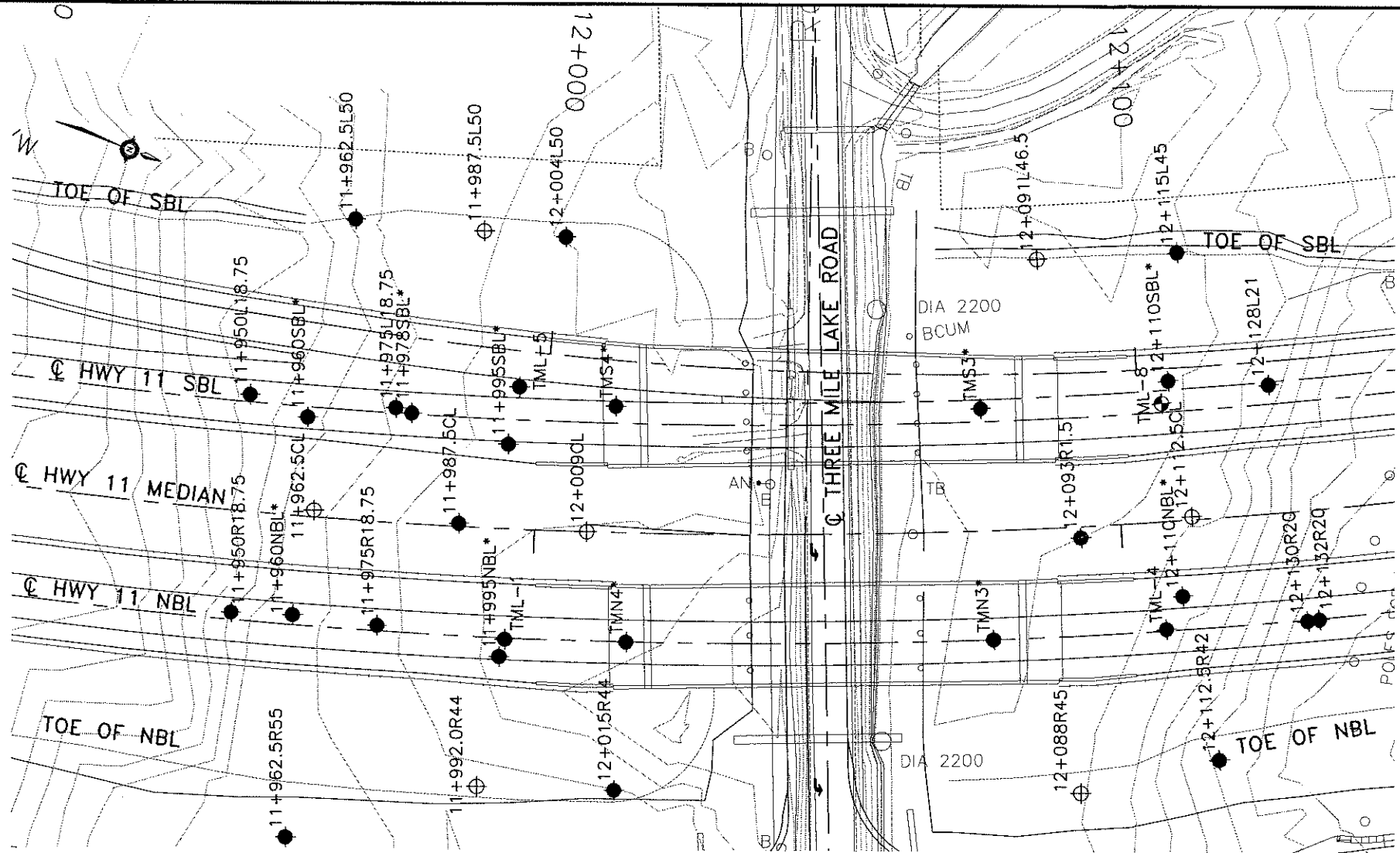
- Bore Hole
- ⊕ Dynamic Cone Penetration Test (cone) or Probe Hole
- ⊗ Bore Hole & Cone
- N Blows/0.3m (Std pen Test, 475J/blow)
- CONE Blows/0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- WL in Piezometer at Time of Investigation (Date)
- Head Artesian Water
- Piezometer
- WL in Open Borehole Upon Completion of Drilling
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal
- C/R Cone Refusal

NO	STATION	OFFSET FROM MEDIAN CL
11+950 L18.75	11+950	L18.75
11+950 R18.75	11+950	R18.75
11+962.5 CL	11+962.5	CL
11+962.5 L50	11+962.5	L50
11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

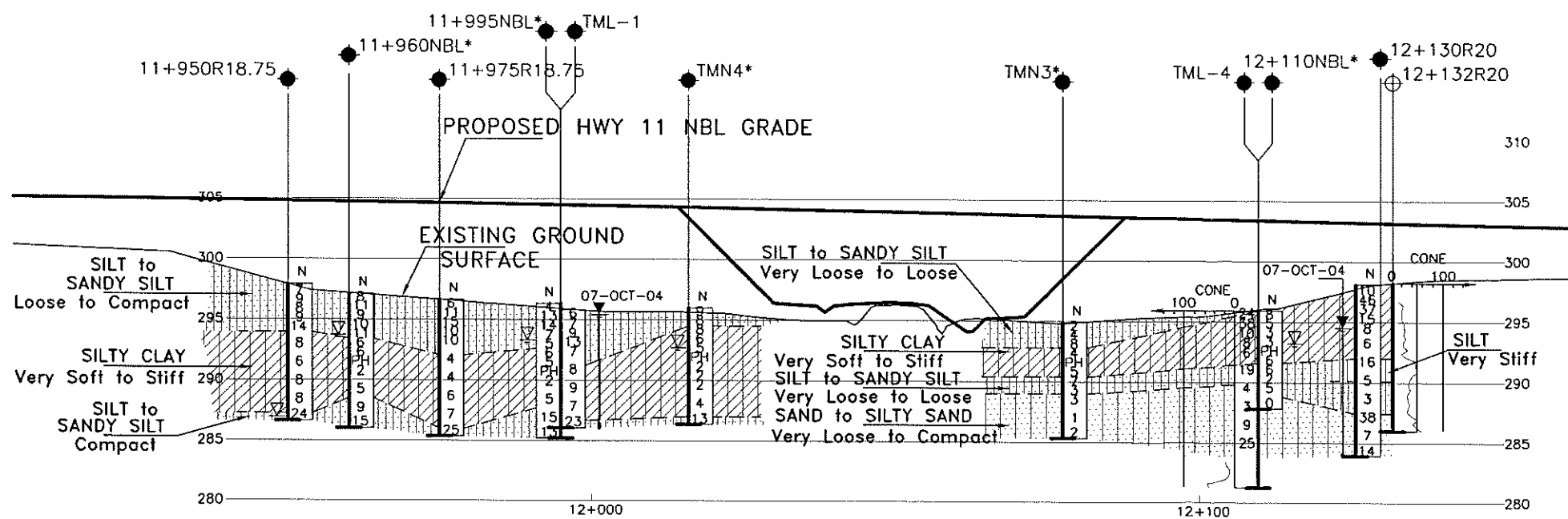
NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION
JAN 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN	MA	CHK AEG	CODE CHBDC
DRAWN	HS	CHK MA	SITE
LOAD		STRUCT	
SCHEME			
DATE	JAN, 2005		
DWG	G/H3		



PLAN



PROFILE @ HWY 11 NBL

2.5 0 5 10 20m HOR
10m VERT

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

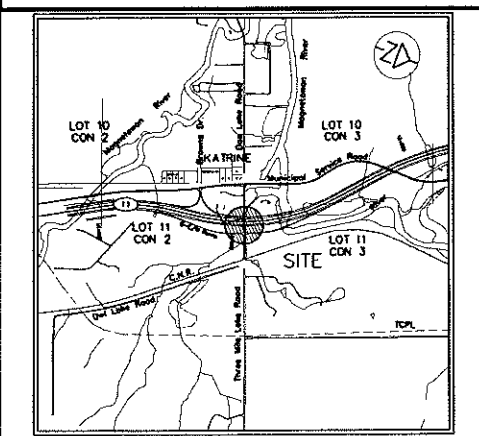
HWY 11
CONT No
WP No 480-93-00

HIGHWAY 11 MAINLINE
ARMOUR TOWNSHIP
STATION 11+950 TO 12+140
NBL CENTRELINE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall Macklin Monaghan
CONSULTING ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.



KEYPLAN

NO	STATION	OFFSET FROM MEDIAN CL
11+992 R44	11+992	R44
12+004 L50	12+004	L50
12+009 CL	12+009	CL
12+015 R44	12+015	R44
12+088 R45	12+088	R45
12+091 L46.5	12+091	L46.5
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* Indicates borehole or cone by Shofeen & Pedder for Preliminary Investigation

LICENSED PROFESSIONAL ENGINEER
M. R. ANDERSON
No 2/05
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
P. J. BRANCO
No 2/05
PROVINCE OF ONTARIO

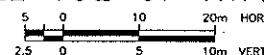
LEGEND	
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11+962.5 R55	11+962.5	R55
11+975 L18.75	11+975	L18.75
11+975 R18.75	11+975	R18.75
11+987.5 CL	11+987.5	CL
11+987.5 L50	11+987.5	L50

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REVISIONS	DATE	BY	DESCRIPTION
JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW	
DESIGN MA	CHK AEG	CODE CHDC	LOAD
DRAWN HS	CHK MA	SITE	STRUCT
			SCHEME
			DATE JAN. 2005
			DWG G/H4



REVISIONS									
	JAN. 05	MA	ISSUED AS DRAFT FOR REVIEW						
	DATE	BY	DESCRIPTION						
DESIGN MA	CHK PJB	CODE	CHBDC	LOAD	DATE JAN. 2005				
DRAWN HS	CHK MA	SITE	STRUCT	SCHEME	DWG G/H				