

**FOUNDATION INVESTIGATION REPORT**  
**HIGH FILL EMBANKMENTS, DEEP CUTS AND SWAMP CROSSINGS**  
**HIGHWAY 11/17 FOUR-LANING FROM 1.0 KM WEST OF**  
**HODDER AVENUE/COPENHAGEN ROAD EASTERLY FOR 5.8 KM**  
**W.P. 334-94-00**

**Geocres Number: 52A-146**

**Report to**

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June 2, 2010  
File: 19-1351-156

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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 11/17 in Thunder Bay, Ontario.

The proposed works to widen Highway 11/17 include twinning of the existing highway, construction of a new interchange and grade separation structure at Hodder Avenue/Copenhagen Road, and realignment of the Terry Fox Access 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 previous investigations 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 the investigation as a sub-consultant to McCormick Rankin Corporation, under the Ministry of Transportation Ontario (MTO) Agreement Number 6008-E-0005.

**2 SITE DESCRIPTION**

The project site lies at the northeast limit of the City of Thunder Bay and extends from 1.0 km west of Hodder Avenue/Copenhagen Road to 1.0 km east of Highway 527. Highway 11/17 is presently a two-lane undivided highway, and will be upgraded to a four lane divided section. Hodder Avenue/ Copenhagen Road and Highway 527 are two-lane undivided roadways.

Highway grades are broadly undulating, and slope down to the Current River at the west project limits. The surrounding lands are typically forested. A swampy area is present north of Highway 11/17 at Copenhagen Road. The Terry Fox Monument is located on an elevated rock outcrop on

the north side of the highway near the centre of the project. A works yard is located at the northwest corner Highway 527 intersection and a seasonal trailer park is located south of Highway 11/17 east of Highway 527.

The locations and existing conditions at each section of high fill, deep cut and swamp crossing investigated during the current investigation are summarized below:

**Highway 11/17 EBL, Sta. 26+200 to 27+100** – The existing highway is located above an embankment slope on the south side. The embankment height decreases from approximately 20 m at the west limit to about 4 m at the east end, corresponding to the descending grade of the highway. Fill has been placed on the south side of the highway in the west part of the section, increasing the distance between the highway and slope crest. The ground surface generally rises on the north side of the highway, with approximate 10 to 12 m high rock outcrops near Station 26+400 (Terry Fox monument) and 26+700.

**Highway 11/17 EBL, Sta. 29+400 to 29+900** - The south side of Highway 11/17 typically consists of an embankment up to 8.5 m high with the Ishkibibble Creek running east to west along the toe of the embankment slope. The lands to the south consist of a seasonal trailer park and low scrubland. A low rock outcrop is present on the south side of the highway near Station 29+725.

**Highway 11/17 WBL, Sta. 29+460 to 30+000** – The ground surface on the north side of the highway typically rises in elevation and is undulating with intermittent rock outcrops. A low, wet area is present near Station 29+500. These lands are heavily treed.

**Copenhagen Road, Station 9+540 to 9+955** – The lands adjacent to Copenhagen Road are generally low, flat, wet and densely vegetated with brush and small trees. Savigny Creek crosses the roadway near the north end of the section.

**Hodder Avenue E-N/S Ramp, Station 10+540 to 10+780** – The lands in the northeast quadrant of the Highway 11/17 – Hodder Avenue intersection are generally flat to slightly undulating, wet and vegetated by brush and trees. Areas of fill are evident.

**Hodder Avenue S-E Ramp, Station 10+000 to 10+650** – The lands in the southeast quadrant of the Highway 11/17 – Hodder Avenue intersection rise to the south and are heavily treed with the exception of the cleared Hydro corridor running parallel to the highway. Low rock outcrops are present along the south side of Highway 11/17.

**Hodder Avenue N-E Ramp, Station 10+050 to 10+200** – The lands in the southwest quadrant of the Highway 11/17 – Hodder Avenue intersection rise to the south and are heavily treed with the exception of the cleared Hydro corridor running parallel to the highway.

**Hodder Avenue W-N/S Ramp, Station 10+060 to 10+260** – The lands along the proposed ramp alignment rise to the south and east, and are heavily treed with the exception of the cleared Hydro corridor running parallel to the Highway 11/17.



Geologically, the site area is located within the physiographic region known as the Canadian Shield, characterized by Pre-Cambrian bedrock typically occurring as rounded knobs and ridges where exposed. The bedrock consists of the Gunflint Formation, a sequence of limestone, graphitic shale, tuff, taconite, chert-carbonite and chert. Intrusions/sills of diorite are present locally. The bedrock is overlain by a discontinuous layer of glacial till comprising a heterogeneous mixture of clayey silt, silt, sand and gravel.

### **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 during the period June 26, 2009 to January 31, 2010. The site investigation consisted of drilling and sampling boreholes supplemented by dynamic cone penetration testing (DCPT). A series of six test pits were also excavated on the existing embankment opposite the Terry Fox monument.

A summary of the locations and depths of the boreholes and test pits carried out in each of the study areas is provided in Table A1, Appendix A. The approximate locations of the boreholes, DCPT tests and test pits are shown on the Borehole Locations and Soil Strata Drawings in Appendices B to I.

The borehole locations (stations and offsets from centreline) were established by Thurber relative to centreline staking by J.D. Barnes Limited. Where boreholes were drilled for concurrent foundation investigations at structure locations, the borehole locations and offsets were provided by J.D. Barnes Limited. Prior to the start of drilling, utility clearances and property access were obtained.

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). At several locations, BQ and NQ rock coring was used to prove bedrock or penetrate bouldery material.

Standpipe piezometers were installed in selected 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 in Appendices B to I and summarized in Table A2, Appendix A.

Boreholes not containing piezometers were backfilled with drill cuttings and/or 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 laboratory.

In addition to the borehole data obtained during the current investigation, select factual data from the preliminary investigation was incorporated into the assignment (Preliminary Foundation

Investigation and Design Report, High Fill and Deep Cuts, Peto MacCallum Ltd., June 18, 2007, Geocres No. 52A-131).

#### **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. The results of this testing are shown on the Record of Borehole sheets in Appendices B to I. Selected samples were also subjected to gradation analysis and Atterberg Limits testing where appropriate. The results of this testing program are shown on the Record of Borehole sheets and figures contained in Appendices B to I.

Point load testing was conducted on rock core samples retrieved from the boreholes. The results of the point load tests are shown on the borehole logs in the appendices.

#### **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

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 I of this report. The stratigraphy recorded in the test pits excavated on the embankment opposite the Terry Fox monument is presented in Table B1 included in Appendix B.

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 specific conditions encountered at individual sites vary. Generalized descriptions of the individual strata at each fill, cut or swamp area are presented below.

##### **5.1 Highway 11/17 EBL, Station 26+200 to 27+100 (Appendix B)**

###### **General**

In general, the site stratigraphy consists of surficial embankment fill and/or peat underlain by sand and silt till. Bedrock, probable bedrock or boulders were encountered at depths of 0.3 to 6.2 m.

###### **Fill**

Fill was encountered in all boreholes and test pits drilled on the existing highway embankment. The fill was described as sand to sand and silt with gravel, cobbles and boulders. Rock fill and silty clay fill were encountered in Test Pit 09-1. Surficial organic material was identified on the fill surface in the test pits.

The fill was typically brown, locally dark brown. In addition to rock fragments, minor amounts of roots, rootlets, wood fragments, and "organic specs" were noted in the fill.

The thickness of the fill layer ranged from 1.0 to 4.7 m where the lower boundary was encountered or refusal to auger/excavate was met. Test Pits 4 to 6 were terminated in the fill at depths of 3.5 to 3.8 m.

The results of laboratory grain size distribution tests carried out on samples of the fill are shown on the borehole logs and also presented in Figure B1, Appendix B for the current investigation. The results were as follows:

Gravel (%)	10 to 51	
Sand (%)	35 to 57	
Silt (%)	15 to 45	
Clay (%)	1 to 9	(14 to 42 silt & clay)

SPT 'N' values obtained in the fill ranged from 5 to 40 blows/0.3 m, indicating a loose to dense condition. Typically, the 'N' values were in the order of 8 to 18 blows/0.3 m (loose to compact).

The moisture content of the fill ranged from 9 to 23%.

#### **Peat and Topsoil**

Peat or topsoil was encountered surficially in all boreholes drilled near the toe of the existing embankment slope. The thickness of the organic layer ranged from 0.1 to 1.2 m at the borehole locations.

A moisture content of 150% was recorded in a sample of the peat during the preliminary investigation.

#### **Sand and Silt Till**

A till deposit variously described as sand, silty sand, sand and silt, and locally a mixture of rock fragments, gravel, sand and silt was encountered below the organic layer in all but two boreholes (boreholes 102 and 103) drilled near the toe of the embankment slope, and below the fill in two boreholes drilled on the embankment (boreholes 10-97 and 3).

The identification of this material as till on the borehole sheets is not consistent from the various stages of investigation. Portions of the deposit were not described as till and may represent glaciofluvial or alluvial deposits. Clear differentiation between the deposits is not always possible based on the existing data, and for the purposes of this report, all of the undisturbed native soil has been grouped together in this section.

In the boreholes drilled near the toe of the embankment slope, the upper boundary of the till/sand/silt was encountered at depths of 0.1 to 1.2 m. In boreholes 10-97 and 3 located above the slope, the upper boundary was at 4.7 and 1.5 m depth, respectively. Bedrock or auger refusal was met below the deposit at depths of 1.1 to 6.2 m in all but one borehole.

Borehole 115 was terminated in the till at 6.9 m depth. The thickness of this deposit ranged from 0.2 to 6.0 m.

The results of laboratory grain size distribution tests carried out on samples of the till/sand/silt during the current investigation are presented in Figures B2 and B3, Appendix B. The results from the current and previous investigations were as follows:

	<u>Current and 2005 Studies</u>	<u>1991 Study</u>
Gravel (%)	0 to 17	59
Sand (%)	45 to 79	22
Silt (%)	24 to 48*	19 (silt & clay)
Clay (%)	2 to 10	

\* 4% in one sample

SPT 'N' values obtained in the till deposit varied widely from 2 blows/0.3 m to 100 blows/0.05 m, indicating a very loose to very dense condition. The values less than 30 blows/0.3 m (loose to compact) were obtained in the upper 1.5 to 2.1 m of the deposit, in approximately half of the boreholes.

The moisture content of samples from this deposit ranged from 6 to 21%, typically 9 to 19%.

### **Refusal and Bedrock**

Bedrock or refusal to further penetration on probable bedrock or boulders was encountered in all boreholes except borehole 115. The depth to bedrock or refusal ranged from 0.3 to 6.2 m.

Eight boreholes were advanced 0.3 to 1.4 m into bedrock by augering. Based on the auger cuttings, the bedrock was described as black shale. SPT 'N' values obtained in the rock ranged from 38 blows/0.3 m to 50 blows/0.05 m.

Boreholes 10-96 to 10-98, 3 and 4 were extended 2.2 to 5.7 m into the underlying bedrock by coring. The bedrock recovered in the cores was described as the Chert Iron Formation in the 1991 boreholes and chert carbonate limestone of the Gunflint Formation in the current study. Core recovery was between 92 and 100%, and RQD values ranged from 37 to 93%, indicating poor to excellent rock quality. The unconfined compressive strength of the rock, estimated from the results of point load tests, ranges between 27 and 100 MPa, indicating a medium strong to strong intact rock.

### **Groundwater**

The depths to groundwater observed in the boreholes upon completion of drilling are shown in Table 5.1.

**Table 5.1 – Observed Depths to Groundwater**

Borehole	Date	Depth to Water (m)	Event
09-79	16-Jul-09	3.1	Upon completion
09-80	16-Jul-09	0.9	Upon completion
105	14-Dec-05	0.6	Upon completion
107	14-Dec-05	0.7	Upon completion
109	14-Dec-05	0.3	Upon completion
113	13-Dec-05	1.2	Upon completion
115	13-Dec-05	1.5	Upon completion

The above water levels reflect the conditions in the boreholes upon completion of drilling. The observations are very short-term and seasonal fluctuations of the groundwater level are to be expected.

## **5.2 Highway 11/17 EBL, Station 29+400 to 29+900 (Appendix C)**

### **General**

In general, the site stratigraphy consists of surficial embankment fill and/or peat underlain by sand and silts, overlying a discontinuous gravelly sand layer. Auger refusal was met on probable bedrock or boulders at depths of 1.4 to 10.9 m.

### **Fill**

Boreholes 10-105, 10-115, 10-118 and 10-121 were drilled on the shoulder of existing Highway 11/17 and encountered the existing pavement structure overlying embankment fill. The existing pavement structure consisted of 75 to 100 mm of asphalt overlying 0.8 to 1.4 m of sand and gravel. The underlying embankment fill consisted primarily of silt in borehole 10-118 and sand in the other boreholes. The sand/silt fill was 0.8 to 2.6 m thick with a lower boundary at depths of 2.3 to 4.1 m.

Fill was also encountered in boreholes 10-104 and 10-122 drilled at the toe of the embankment slope. The fill comprised sand and gravel in borehole 10-104 and silty sand in borehole 10-122. The fill was brown to dark brown with organics, and was 0.8 m thick.

The results of laboratory grain size distribution tests carried out on two samples of sand fill and one sample of silt fill are presented in Figure C1, Appendix C. The results were as follows:

	<u>Sand Fill</u>	<u>Silt Fill</u>
Gravel (%)	21 to 22	0
Sand (%)	57 to 59	11
Silt (%)		84
Clay (%)	20 to 21	5

SPT 'N' values of 16 blows/0.3 m to 100 blows/0.125 m were obtained in the fill, indicating a compact to very dense condition.

The moisture content of the pavement granular material and embankment fill ranged from 3 to 20%, typically 6 to 11%. Moisture contents of 30 and 31% were measured in fill samples from the toe of the embankment slope (boreholes 10-104 and 10-122), indicative of the organic content.

### **Peat**

Peat was encountered surficially in boreholes 10-116, 10-117 and 10-123, and below the fill in borehole 10-122. The peat thickness ranged from 1.5 to 2.3 m, and the lower boundary was encountered at depths of 1.5 to 2.6 m. A 0.8 m thick layer of sand mixed with peat was encountered below the peat in borehole 10-116, extending to 2.3 m depth.

SPT 'N' values of 0 to 6 blows/0.3 m were recorded in the peat and underlying sand/peat layer, indicating a loose to very loose condition.

Moisture contents of 68 to 500% were recorded in the peat. A moisture content of 34% was measured in the mixed sand/peat layer.

### **Sands and Silts**

A deposit grading from sand with trace silt to silt with some sand was encountered at the ground surface in two boreholes and below the fill and peat in all other boreholes. The upper boundary of the sand/silt was encountered at depths of up to 4.1 m. Auger refusal was met in or below the sand/silt deposit at depths of 1.4 to 5.1 m in six boreholes, and the lower boundary was encountered at depths of 4.6 to 10.7 m in five boreholes. The thickness of this deposit ranged from 0.6 to 6.6 m.

The results of laboratory grain size distribution tests carried out on samples of the sands and silts are presented in Figures C2 and C3, Appendix C. The results were as follows:

	<u>Sand to Silty Sand</u>	<u>Silt to Sandy Silt</u>
Gravel (%)	0 to 12	0 to 1
Sand (%)	65 to 95	17 to 32
Silt (%)		62 to 77
Clay (%)	5 to 32	3 to 5

SPT 'N' values obtained in the sands and silts typically varied from 4 to 20 blows/0.3 m, indicating a loose to compact condition. Several values ranging from 35 blows/0.3 m to 100 blows/0.125 m were also recorded, indicating very dense zones and/or cobbles and boulders.

The moisture content of samples from this deposit generally ranged from 5 to 22%, with several values of 26 to 31% recorded.

### **Gravelly Sand**

A layer of gravelly sand was encountered below the sands and silts in boreholes 10-115, 10-116, 10-118 and 10-121 at depths of 4.6 to 10.7 m. Auger refusal was encountered within or at the base of this material at depths of 6.5 to 10.9 m, indicating a thickness of at least 0.2 to 5.9 m.

The results of laboratory grain size distribution tests carried out on three samples of the gravelly sand are shown in Figure C4, Appendix C. The results are summarized below.

Gravel (%)	14 to 31
Sand (%)	64 to 72
Silt % Clay (%)	5 to 15

‘N’ values of 26 blows/0.3 m to 100 blows/0.125 m were recorded in the gravelly sand in boreholes 10-115, 10-116 and 10-118, indicating a compact to very dense condition. ‘N’ values of 0 to 19 blows/0.3 m were obtained in borehole 10-121; these lower values may reflect hydraulic disturbance during sampling.

Moisture contents in the gravelly sand ranged from 8 to 18%.

### **Silty Sand Till**

An isolated layer very dense silty sand till was encountered below the sand in borehole 10-122. The till is dark grey and contains some gravel. Auger refusal was met in/below the till at 9.9 m depth, indicating a thickness of at least 0.8 m.

The results of a laboratory grain size distribution test carried out on a sample of the till are illustrated in Figure C5, Appendix C. The results are summarized below.

Gravel (%)	15
Sand (%)	50
Silt (%)	31
Clay (%)	4

An SPT ‘N’ value of 100 blows/0.2 m and moisture content of 7% were obtained in the till.

### **Refusal**

Refusal to further penetration by the augers was met on probable bedrock or boulders in all boreholes at depths of 1.4 to 10.9 m.

### **Groundwater**

The depths to groundwater observed in the boreholes upon completion of drilling and subsequently measured in the piezometers are shown in Table 5.2.

**Table 5.2 – Groundwater Depths**

Borehole	Date	Depth to Water (m)	Event
10-115	21-Jan-10	4.2	Upon completion
10-116	27-Jan-10	1.7	Upon completion
10-117	28-Jan-10	1.3	Upon completion
	31-Jan-10	0.7	In piezometer
	01-Mar-10	0.7	In piezometer
10-118	21-Jan-10	3.8	Upon completion
10-119	28-Jan-10	2.8	Upon completion
10-120	29-Jan-10	4.2	Upon completion
10-121	26-Jan-10	4.1	Upon completion
10-122	28-Jan-10	3.8	Upon completion
	31-Jan-10	1.4	In piezometer
	01-Mar-10	1.5	In piezometer

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

### 5.3 Highway 11/17 WBL, Station 29+460 to 30+000 (Appendix D)

#### General

In general, the site stratigraphy consists of surficial peat or topsoil layer underlain by sands and silts. Auger refusal was met on probable bedrock or boulders at depths of 0.7 to 15.9 m.

#### Fill

A 0.7 m thick layer of crushed rock was encountered in borehole 10-106 and a 0.8 m thick layer of silty sand fill was encountered in borehole 10-107A. 'N' values of 52 and 17 blows/0.3 m were obtained in the crushed rock and silty sand fill, respectively. Auger refusal was met at the base of the fill.

#### Peat and Topsoil

A 0.6 to 1.9 m thick layer of peat was encountered surficially in boreholes 10-108 to 10-110. SPT 'N' values of 5 to 9 blows/0.3 m recorded in the peat are believed to reflect a frozen condition. Moisture contents of 77 to 610% were recorded.

A 0.8 m thick layer of topsoil was encountered in borehole 10-112. An 'N' value of 3 blows/0.3 m and moisture content of 143% were obtained in the topsoil layer.



### **Sands and Silts**

A deposit typically grading from sand with some gravel and silt, to silt with trace sand was encountered at the ground surface or below the peat in all other boreholes except boreholes 10-106 to 10-107A. Zones of this deposit also graded to gravely sand or sand and gravel locally in boreholes 10-108 to 10-110. Auger refusal was met in or below the sand/silt deposit at depths of 2.2 to 15.9 m.

The sand and silt was generally described as brown to dark brown in the upper part of the boreholes and becoming grey with depth.

The results of laboratory grain size distribution tests carried out on samples of the sands and silts are presented in Figures D1 to D4, Appendix D. The results were as follows:

	<u>Sand to Silty Sand</u>	<u>Sand and Silt</u>	<u>Silt to Sandy Silt</u>
Gravel (%)	0 to 29	0	0 to 2
Sand (%)	53 to 90	58	2 to 34
Silt (%)			60 to 93
Clay (%)	10 to 27	42	6 to 11

SPT 'N' values obtained in the sands and silts ranged from 4 to 76 blows/0.3 m, typically from 10 to 41 blows/0.3 m. These values indicate that the sands and silts are typically compact to dense with zones of loose and very dense material. Several values of 100 blows for less than 0.3 m were recorded at the base of three boreholes, believed to reflect the presence of probable bedrock or boulders.

The moisture content of samples from this deposit ranged from 5 to 69%. Three samples indicating a moisture content of 35 to 69% were obtained immediately below the upper boundary of this deposit and probably reflect an organic component. The moisture contents typically ranged from about 8 to 20%.

### **Refusal**

Refusal to further penetration by the augers was met on probable bedrock or boulders in all boreholes at depths of 0.7 to 15.9 m. Borehole 10-107 was located on a bedrock outcrop.

### **Groundwater**

The depths to groundwater observed in the boreholes upon completion of drilling and subsequently measured in the piezometers are shown in Table 5.3.

**Table 5.3 – Groundwater Depths**

Borehole	Date	Depth to Water (m)	Event
10-108	08-Jan-10	0.8	Upon completion
10-109	31-Jan-10	1.0	In piezometer
	01-Mar-10	1.1	
10-110	07-Jan-10	2.3	Upon completion
10-111	07-Jan-10	6.3	Upon completion
10-112	31-Jan-10	1.5	In piezometer
10-113	06-Jan-10	7.8	Upon completion

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

#### **5.4 Copenhagen Road, Station 9+540 to 9+955 (Appendix E)**

##### **General**

In general, the site stratigraphy consists of a surficial topsoil layer or 0.3 to 1.2 m of peaty organics underlain by a discontinuous layer of clayey silt to silty clay, overlying silty sand till. Auger refusal was met on probable bedrock or boulders at depths of 0.5 to 5.4 m.

##### **Fill**

Road embankment fill was encountered in borehole 09-64 drilled on existing Copenhagen Road at the north limit of the investigation. The fill consisted of gravely sand to 1.1 m depth, and clayey silt from 1.1 to 1.6 m depth. An SPT 'N' value of 7 blows/0.3 m indicates that the clayey silt fill is firm.

The results of a laboratory grain size distribution analysis carried out on a sample of the gravely sand fill are shown in Figure E1 in Appendix E. Measured moisture contents were 4% and 9% in the sand fill and 50% in the clayey silt fill.

##### **Peat and Topsoil**

A 0.3 to 2.0 m thick layer of peaty organics was encountered in all boreholes excluding four boreholes near the centre of the study area (Nos. 09-52 to 09-55 at Sta. 9+750 to 9+825), and one borehole near the north end (No.09-62A). In borehole 09-64 at the north end, the peat was buried below road fill, between 1.6 and 2.2 m depth. Moisture contents in the peat varied from 63 to 323%.

A 50 to 200 mm thick layer of topsoil was encountered in the boreholes where peat was not identified.

### Clayey Silt to Silty Clay

In all but three boreholes where peat was encountered, the peat was underlain by a deposit of clayey silt to silty clay. This cohesive layer was typically 0.4 to 1.5 m thick, with a lower boundary at depths of 1.4 to 3.1 m. A 0.2 m thick layer of loose, grey sand was encountered between the peat and clay in borehole 09-64. The colour of the silt/clay was described as dark brown, brown or grey.

In two boreholes (Nos. 09-57 and 10-63B), the silt deposit was non- to slightly plastic and thicker than in the other boreholes. In these boreholes, the total thickness of the silt and silty clay was 3.0 and 2.9 m, and the lower boundary was at depths of 3.8 and 4.9 m.

The results of a laboratory grain size distribution tests carried out on samples of the silt/clay are illustrated in Figure E2, Appendix E. The results of Atterberg Limits testing are presented in Figure E6. The results were as follows:

Gravel (%)	0 to 5
Sand (%)	1 to 19
Silt (%)	57 to 88
Clay (%)	11 to 22
Liquid Limit	27 to 33
Plastic Limit	18 to 20

The above results indicate that the clayey silt to silty clay is of low plasticity with a group symbol of CL.

The silt/clay is very soft to firm, with SPT 'N' values of 1 to 8 blows/0.3 m, typically 1 to 5 blows/0.3 m. Below 1.4 m depth in borehole 09-57, the silt is stiff with 'N' values of 9 to 11 blows/0.9 m. The silt in borehole 10-63B is loose to compact with 'N' values of 16 and 8 blows/0.3 m.

The moisture content of samples from this deposit ranged from about 15 to 49%.

Auger refusal was encountered in/below the silt/clay at depths of 1.4 and 3.1 m in boreholes 09-51 and 09-64, respectively.

### Silty Sand Till

A glacial till deposit consisting of silty sand, grading locally to sand and silt or clayey silt and sand, was encountered below the peat, topsoil, clayey silt and silty clay layers in all boreholes except 09-51 and 09-64. The upper boundary of this deposit was at depths of 0.1 to 4.9 m. The till is typically brown, locally grey and dark brown, and contains gravel, cobbles and boulders.

Auger refusal was met in/below the till in all but two boreholes (09-57 and 09-59) where the till was encountered, at depths of 0.7 to 3.8 m. The till thickness penetrated by the boreholes prior to refusal ranged from 0.3 to 2.4 m. Boreholes 09-57 and 09-59 were terminated in the till at depths of 4.8 and 5.6 m, indicating layer thicknesses of at least 1.0 and 3.4 m.

The results of laboratory grain size distribution tests carried out on samples of the till are illustrated in Figures E3 to E5, Appendix E. The results are summarized below. An additional sample indicating a gravel content of 39% (borehole 09-59) is omitted from the summary.

Gravel (%)	1 to 13
Sand (%)	34 to 59
Silt (%)	23 to 48
Clay (%)	4 to 14

SPT 'N' values obtained in the till varied from 4 to 66 blows/0.3 m, indicating a loose to very dense condition. 'N' values of 50 or 100 blows for less than 0.3 m of penetration were obtained at the base of many boreholes where sampling commenced immediately above the refusal depths.

The moisture content of samples from this deposit ranged from about 8 to 19%, with one sample indicating 31%.

### **Refusal**

Refusal to further penetration by the augers or DCPT was met on probable bedrock or boulders in all boreholes except boreholes 09-57 and 09-59. The depth to refusal ranged from 0.5 to 5.4 m.

### **Groundwater**

The depths to groundwater observed in the boreholes upon completion of drilling and subsequently measured in the piezometers are shown in Table 5.4.

**Table 5.4 – Groundwater Depths**

Borehole	Date	Depth to Water (m)	Event
09-49	23-Nov-09	0.6	In piezometer
09-57	11-Jul-09	0.9 ags*	Upon completion
09-58	13-Jul-09	0.6	Upon completion
09-59	23-Nov-09	1.4	In piezometer
	01-Mar-10	1.2	In piezometer
09-61	13-Jul-09	2.2	Upon completion
09-62A	13-Jul-09	0.8	Upon completion
10-62C	31-Jan-10	1.4	Upon completion
09-63	13-Jul-09	1.4	Upon completion
10-63B	31-Jan-10	0.7	Upon completion

\* above ground surface (artesian)

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

## **5.5 Hodder Avenue E-N/S Ramp, Station 10+540 to 10+780 (Appendix F)**

### **General**

In general, the site stratigraphy consists of surficial fill, peaty organics and/or topsoil to depths of up to 2.2 m, underlain by a discontinuous layer of clayey silt to silty clay, overlying silty sand to sandy silt till. Auger refusal was met on probable bedrock or boulders at depths of 0.2 to 5.1 m.

### **Fill**

Fill was encountered surficially in 12 boreholes drilled between Station 10+580 and 10+755. The fill consisted primarily of sand and locally silty clay, clayey silt, and sand and silt. The fill contains gravel, cobbles, rock fragments and asphalt pieces. The surficial 75 to 300 mm of fill in the majority of the boreholes contained organics and was described as topsoil. The fill thickness at the borehole locations ranged from 0.3 to 1.4 m.

SPT 'N' values of 6 blows/0.3 m were obtained in the fill at two locations, indicating a loose condition. 'N' values of 51 to 70 blows/0.3 m obtained in three boreholes are believed to reflect the presence of cobbles and asphalt chunks in the fill. 'N' values of 100 blows for less than 0.3 m of penetration were obtained at the base of two boreholes where sampling commenced immediately above the refusal depths.

The moisture content of fill samples ranged from 3 to 22%.

### **Peat and Topsoil**

A 0.1 to 1.6 m thick layer of peaty organics was encountered surficially or below the fill in 12 boreholes. The lower boundary of the organic layer was encountered at depths of 0.8 to 2.2 m. SPT 'N' values of 1 to 6 blows/0.3 m and moisture contents of 100 to 314% (44% in one sample) were recorded in the peat.

In addition to the organic layer encountered at the ground surface in fill areas, a 50 to 200 mm thick layer of topsoil was documented in seven other boreholes where fill and/or peat were not encountered.

### **Clayey Silt to Silty Clay**

In eight boreholes, the fill, peat or topsoil were underlain by a layer of clayey silt to silty clay. This cohesive layer was 0.3 to 1.6 m thick, with a lower boundary at depths of 1.0 to 3.0 m. Auger refusal was encountered in/below the silt/clay in five of these boreholes. The colour of the silt/clay was described as dark brown, brown or grey.

The results of laboratory grain size distribution tests carried out on two samples of the clayey silt to silty clay are presented in Figure F1, Appendix F. The results were as follows:

Gravel (%)	0 to 1
Sand (%)	21 to 26
Silt (%)	53 to 60
Clay (%)	18 to 20

The silt/clay is very soft to stiff, with SPT 'N' values of 2 to 9 blows/0.3 m recorded.

The moisture content of samples from this deposit ranged from 20 to 36%.

### **Sand, Sand and Silt**

A 0.6 m thick sand layer was encountered below the peaty organics in borehole 09-38. An 'N' value of 20 blows/0.3 m (compact) and moisture content of 28% were obtained in the sand.

A sand and silt deposit was encountered below the topsoil in borehole 09-46. Auger refusal was met at 1.4 m depth in this borehole, indicating a layer thickness of 1.3 m. An 'N' value of 10 blows/0.3 m (compact) and moisture content of 17% were obtained. The results of a laboratory grain size distribution tests carried out on a sample of the sand and are presented in Figure F2, Appendix F.

### **Silty Sand to Sandy Silt Till**

A glacial till deposit consisting of silty sand to sandy silt was encountered below the topsoil and other layers in 12 of 22 boreholes drilled in this section. The till is typically brown, locally grey and dark brown, and contains gravel, cobbles and boulders.

Auger refusal was met in/below the till in all boreholes where the till was encountered, at depths of 0.8 to 5.1 m. The till thickness penetrated by the boreholes prior to refusal ranged from 0.4 to 2.6 m.

The results of laboratory grain size distribution tests carried out on samples of the till are illustrated in Figures F3 and F4, Appendix F. The results are summarized below.

Gravel (%)	2 to 21
Sand (%)	42 to 58
Silt (%)	22 to 45
Clay (%)	4 to 10

SPT 'N' values obtained in the till varied from 4 blows/0.3 m to 100 blows/0.025 m, indicating a loose to very dense condition. The 'N' values typically increase with depth.

The moisture content of samples from this deposit ranged from 6 to 31%, typically 10 to 22%.

#### Refusal

Refusal to further penetration by the augers or DCPT was met on probable bedrock or boulders in all boreholes at depths of 0.2 to 5.1 m.

#### Groundwater

The depths to groundwater observed in the boreholes upon completion of drilling and subsequently measured in the piezometers are shown in Table 5.5.

**Table 5.5 – Groundwater Depths**

Borehole	Date	Depth to Water (m)	Event
09-28	08-Jul-09	0.7	Upon completion
09-29	08-Jul-09	0.4	Upon completion
09-30	23-Nov-09	1.7	In piezometer
09-33	08-Jul-09	1.7	Upon completion
09-36	07-Jul-09	0.9	Upon completion
09-38	07-Jul-09	2.1	Upon completion
09-40	23-Nov-09	1.8	In piezometer
	01-Mar-10	1.9	In piezometer
09-41	07-Jul-09	0.3	Upon completion

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

## **5.6 Hodder Avenue S-E Ramp, Station 10+000 to 10+650 (Appendix G)**

### **General**

In general, the site stratigraphy consists of surficial topsoil layer overlying silty sand till. Auger refusal was met on probable bedrock or boulders at depths of 1.4 to 5.5 m.

### **Topsoil**

A 100 to 200 mm thick layer of topsoil was encountered surficially in boreholes 09-06 to 09-16 drilled along the ramp centreline.

### **Silty Sand Till**

A glacial till deposit consisting of silty sand, grading locally to sand and silt or sandy clayey silt, was encountered below the topsoil in all boreholes drilled in this section. The till is typically brown, locally grey and dark brown, and contains gravel, cobbles and boulders.

Auger refusal was met in/below the till in all boreholes at depths of 1.4 to 5.5 m. The till thickness penetrated by the boreholes prior to refusal ranged from 1.2 to 5.5 m.

The results of laboratory grain size distribution tests carried out on samples of the till are presented in Figures G1 to G3, Appendix G. The results are summarized below.

Gravel (%)	1 to 16
Sand (%)	26 to 58
Silt (%)	25 to 57
Clay (%)	4 to 16

The results of Atterberg limits testing conducted on a sample of the till grading to clayey silt are plotted on Figure G4, Appendix G. A liquid limit of 31 and plastic limit of 19 classifies this material as low plastic.

SPT 'N' values obtained in the till varied significantly from 7 blows/0.3 m to 100 blows/0.05 m, indicating a loose to very dense condition, locally firm to very stiff. The 'N' values typically increase with depth.

The moisture content of samples from this deposit ranged from 3 to 31%, typically 8 to 15%.

### **Sand and Gravel**

Auger refusal was encountered at depths of 2.9 and 3.3 m in boreholes 10-70 and 10-72, and the boreholes were continued using coring equipment. Observation of the wash water during coring and examination of the limited core recovery indicates that the coring extended through very dense silty sand and gravel with cobbles and boulders. The lower



boundary of the sand and gravel was encountered at depths of 5.8 and 8.5 m, indicating a thickness of 2.9 and 5.2 m in boreholes 10-70 and 10-72, respectively.

### **Refusal**

Refusal to further penetration by the augers was met on probable bedrock or boulders in all boreholes. The depth to refusal ranged from 1.4 to 5.5 m. As noted above, two boreholes were advanced below the refusal depth and encountered sand and gravel above the bedrock surface, encountered at 5.8 and 8.5 m depth.

Boreholes 10-70 and 10-72 were extended 2.7 and 3.1 m into the underlying bedrock. The bedrock recovered in the cores was described as calcareous grainstone of the Gunflint Formation. Core recovery was between 72 and 100%, and RQD values ranged from 32 to 100%, indicating poor to excellent rock quality. The unconfined compressive strength of the rock, estimated from the results of point load tests, ranges between 84 and 185 MPa, indicating a strong to very strong intact rock.

### **Groundwater**

Groundwater was not observed in the boreholes during or upon completion of drilling. The depths to groundwater subsequently measured in the piezometers are shown in Table 5.6.

**Table 5.6 – Groundwater Depths**

<b>Borehole</b>	<b>Date</b>	<b>Depth to Water (m)</b>	<b>Event</b>
09-12	23-Nov-09	Dry	In piezometer
09-16	23-Nov-09	Dry	In piezometer
10-70	01-Mar-10	4.3	In piezometer
10-72	01-Mar-10	6.3	In piezometer

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

## **5.7 Hodder Avenue N-E Ramp, Station 10+050 to 10+200 (Appendix H)**

### **General**

In general, the site is underlain by a discontinuous topsoil, fill and/or sand/silt layers overlying glacial till consisting of silty sand to silt and sand. Sand and gravel as well as bedrock were encountered below the till.

### **Fill**

Silty sand fill was encountered in borehole 09-20 drilled adjacent to Highway 11/17. The fill was 1.4 m thick. An SPT 'N' value of 10 blows/0.3 m was obtained in the fill,

indicating a loose to compact condition. The moisture content ranged from 4 to 8%. The results of a grain size analysis conducted on the fill are shown in Figure H1, Appendix H

#### **Silty Clay to Clayey Silt Till**

A 0.6 and 1.4 m thick stratum of cohesive till was encountered surficially in boreholes 09-17 and 09-19. The till consisted of silty clay to clayey silt, sandy, trace gravel.

An 'N' value of 14 blows/0.3 m was recorded in the clayey silt till, indicating a stiff consistency. Moisture contents ranged from 18 to 27%.

The results of laboratory grain size distribution tests carried out on two samples of the cohesive till are presented in Figure H2, Appendix H. Atterberg Limits test results from one of the samples are plotted on Figure H4. The results are summarized below.

Gravel (%)	4 to 5
Sand (%)	32 to 38
Silt (%)	38 to 49
Clay (%)	15 to 20

Liquid Limit	33
Plastic Limit	21

The above results show that the silty clay till is of low plasticity with a group symbol of CL.

#### **Sand**

A 0.5 m thick layer of sand was encountered below the clay till in borehole 09-17. An 'N' value of 100 blows/0.05 m was recorded, indicating a very dense condition. A moisture content of 4% was determined in the sand.

#### **Silty Sand to Sand and Silt Till**

A glacial till deposit grading from silty sand to sand and silt was encountered surficially or below the fill and clay/silt till in boreholes 09-18 to 09-20. The till is brown and contains trace to some gravel and frequent cobbles and boulders.

Auger refusal was met in the till at depths of 2.0 and 1.9 m in boreholes 09-19 and 09-20. These boreholes were advanced by coring a further 2.9 and 0.8 m in the till prior to encountering bedrock at depths of 4.9 and 2.7 m. In borehole 09-18, the till was underlain by bedrock at 1.5 m depth. The total thickness of the sand/silt till ranged from 1.3 to 3.5 m.

The results of laboratory grain size distribution tests carried out on a sample of the silty sand till are presented in Figure H3, Appendix H. The results are summarized below.

Gravel (%)	4
Sand (%)	53
Silt (%)	33
Clay (%)	10

Prior to encountering refusal, SPT 'N' values of 17 blows/0.3 m (compact), 104 blows/0.3 m (very dense) and 100 blows/0.2 m (very dense) were recorded in the till.

The moisture content of samples from this deposit ranged from 11 to 29%.

### **Bedrock**

Bedrock was encountered and proved by coring in all boreholes. The depth to bedrock ranged from 1.1 to 4.9 m.

A 1.4 to 1.6 m length of rock core was recovered from the boreholes. The bedrock recovered in the cores was described as chert carbonate of the Gunflint Formation. The bedrock is thinly bedded and fresh to moderately weathered. The colour is charcoal grey.

Core recovery in the bedrock was between 67 and 100%. RQD values varied from 10 to 93% indicating very poor to excellent rock quality.

Unconfined compressive strength values estimated from the results of point load tests conducted on the core samples ranged from 158 to 305 MPa, indicating a very strong to extremely strong intact rock. The point load test results are included on the borehole logs in Appendix H.

### **Groundwater**

Groundwater was not observed in the boreholes during drilling. Water was introduced into all boreholes as part of the coring operation and therefore water levels were not recorded upon completion.

The groundwater level measured in the piezometer in borehole 09-20 on November 23, 2009 was at 2.2 m below the ground surface.

The measured water level reflects the piezometric head at the level of the piezometer tip at the time of the reading. The measurement is a short-term observation and seasonal fluctuations of the groundwater level are to be expected.

## **5.8 Hodder Avenue W-N/S Ramp, Station 10+060 to 10+260 (Appendix I)**

### **General**

In general, the site is underlain by discontinuous topsoil, fill and/or sand/silt layers overlying glacial till consisting of silty sand to silt and sand. Sand and gravel as well as bedrock were encountered below the till.

### **Fill**

Fill was encountered in boreholes 10-86 and 10-90. The fill consisted of clayey silt, silt, and sandy silt with trace to some gravel and organics. The fill was described as brown in borehole 10-86 and brown to black in borehole 10-90. The fill was 2.1 and 1.8 m thick in boreholes 10-86 and 10-90, respectively.

SPT 'N' values of 3 to 11 blows/0.3 m obtained in the fill indicate a firm or very loose to compact condition. The moisture content ranged from 12 to 22% in borehole 10-86, and was 43% in borehole 10-90.

### **Topsoil**

A 1.1 and 0.2 m thick layer of topsoil was encountered surficially in boreholes 09-01 and 09-88, respectively.

### **Sand to Sandy Silt**

A relatively thin layer of sand to sandy silt was encountered below the topsoil in boreholes 09-01 and 09-88, and surficially in boreholes 09-02, 10-87 and 10-89. The sand/silt layer was 0.3 to 1.4 m thick with a lower boundary at elevation 258.9 to 263.0 m.

'N' values of 8 to 21 blows/0.3 m were recorded in the sand/silt, indicating a loose to compact condition. Moisture contents ranged from 9 to 22%.

### **Silty Sand to Silt and Sand Till**

A glacial till deposit grading from silty sand to silt and sand was encountered surficially or below the fill and topsoil in all boreholes drilled in this section. The till is brown and contains trace to some gravel and frequent cobbles and boulders.

Auger refusal was met in or below the till in all boreholes at depths of 2.7 to 5.9 m. Refusal at these depths was encountered on bedrock in three of the boreholes and on very dense sand and gravel in three boreholes. Boreholes 09-02, 09-03 and 09-86 were cored 1.4 to 3.2 m in sand/silt till prior to encountering bedrock or sand and gravel, and borehole 09-01 was cored from 5.3 to 9.3 m depth without encountering either. Where penetrated, the lower boundary of the sand/silt till deposit was encountered at depths of 2.7 to 7.6 m (elevation 249.6 to 263.8 m, rising to the east), indicating a till thickness of 1.3 to 7.6 m.

The results of laboratory grain size distribution tests carried out on samples of the till are presented in Figures I1 to I3, Appendix I. The results for all but one sample are summarized below. A piece of gravel was included in the sample tested from borehole 10-85, resulting in a higher gravel content of 39%.

Gravel (%)	2 to 15
Sand (%)	30 to 57
Silt (%)	26 to 52
Clay (%)	5 to 15

The till is typically dense to very dense with SPT 'N' values ranging from 34 blows/0.3 m to 100 blows/0.125 m. The upper 0.8 to 3.0 m of this unit was loose to compact in six boreholes, with 'N' values ranging from 16 to 29 blows/0.3 m and locally 5 to 9 blows/0.3 m in the upper 0.8 to 1.5 m of boreholes 09-03 and 09-04.

The moisture content of samples from this deposit ranged from 7 to 30%, typically 9 to 19%.

### **Sand and Gravel**

Auger refusal was encountered at depths of 2.7 to 5.8 m in boreholes 10-85, 10-87 and 10-90, and the boreholes were continued using coring equipment. NW casing and coring equipment with SPT sampling were used to advance borehole 09-88 below the refusal depth. Observation of the wash water return and examination of the limited recovery indicates that very dense silty sand and gravel with cobbles was encountered below 7.0 m depth in borehole 09-88 and below the refusal depths in the remaining boreholes.

Borehole 09-88 was terminated in the sand and gravel at 15.4 m depth (elevation 246.7 m). The lower boundary of the sand and gravel in the remaining boreholes was encountered at depths of 6.9 to 14.1 m, indicating a thickness of 4.2 to 8.8 m.

The results of laboratory grain size distribution tests carried out on samples of the sand and gravel are presented in Figure I4, Appendix I. The results are summarized below.

Gravel (%)	45 to 58
Sand (%)	37 to 51
Silt & Clay (%)	4 to 5

### **Bedrock**

Bedrock was encountered and proved by coring in all boreholes except boreholes 09-01 and 09-88. The depth to bedrock ranged from 2.9 to 14.1 m, typically shallower to the east. The bedrock surface ranged from elevation 243.6 m in borehole 10-85 to elevation 263.8 m in borehole 09-04.

A 3.1 to 4.4 m length of rock core was recovered from the boreholes encountering rock. The bedrock recovered in the cores consisted of a complex interbedding of various rock types considered to be part of the Gunflint Formation. The rock was described as chert carbonate, calcareous siltstone and wackestone. Shale laminations, calcite veining, and iron-stained fractures were also noted.

The bedrock is typically described as thinly bedded and fresh to slightly weathered. The colour is dark/charcoal grey to light grey.

Core recovery in the bedrock was between 79 and 100%. RQD values typically ranged from 80 to 100% indicating good to excellent rock quality. Lower RQD values of 50 to 60% (fair quality rock) were obtained in five core runs, and RQD values of 0 and 15% (very poor quality) were recorded in the first two runs in borehole 10-89.

The unconfined compressive strength of the rock is highly variable depending upon the actual bedding layer of rock tested. Strength values estimated from the results of point load tests conducted on the core samples ranged from 31 to 337 MPa, indicating a medium strong to extremely strong intact rock. The point load test results are included on the borehole logs in Appendix I.

### Groundwater

The groundwater depths and elevations observed in the boreholes upon completion of drilling and subsequently measured in the piezometers are shown in Table 5.7.

**Table 5.7 – Groundwater Depths and Elevations**

Borehole	Date	Measured Water Level		Event
		Depth(m)	Elevation (m)	
09-02	23-Nov-09	9.2	254.5	In piezometer
	01-Mar-10	9.4	254.3	In piezometer
09-03	23-Nov-09	10.4	252.7	In piezometer
09-04	23-Nov-09	6.0	261.4	In piezometer
	01-Mar-10	6.8	260.6	In piezometer
09-88	17-Dec-09	8.0	254.1	Upon completion

Where rock coring was carried out, water was introduced into the boreholes as part of the coring operation and therefore water levels were not recorded upon completion of these boreholes.

The above water levels reflect the conditions in the boreholes upon completion of drilling or the piezometric head at the level of the piezometer tips at the time of the readings. The measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected.

## 6 MISCELLANEOUS

J.D. Barnes Limited staked the centreline alignment prior to drilling of the boreholes. The borehole locations were established by measuring offset distances from the centreline staking.

TBT Engineering Consulting Group of Thunder Bay, Ontario supplied and operated the drilling and sampling equipment for the field program. Full time supervision of the field activities, including obtaining utility clearances, was carried out by Mr. Stephane Loranger of Thurber.

Supervision of the field program, interpretation of the field data, and preparation of the report was performed by Mr. Tony Harte and Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.  
Murray R. Anderson, P.Eng., M.Eng.  
Senior Geotechnical Engineer



P.K. Chatterji, P.Eng., Ph.D.  
Review Principal



## **Appendix A**

### **Tables**



**Table A1**  
**Borehole Summary**

Borehole	Location			Total Depth (m)	Length of Core in Bedrock (m)
	Station	Offset (m)	Description		
Hwy 11/17 EBL, Sta. 26+200 to 27+100					
09-074	26+450	65 RT	New toe of slope	2.8	-
09-075	26+550	57 RT	New toe of slope	2.6	-
09-076	26+650	50 RT	New toe of slope	4.2	-
09-077	26+750	47 RT	New toe of slope	2.7	-
09-078	26+850	42 RT	New toe of slope	6.2	-
09-079	26+950	35 RT	New toe of slope	3.1	-
09-080	27+050	35 RT	New toe of slope	5.7	-
10-096	26+250	28 RT	On existing fill	4.3	2.2
10-097	26+350	29 RT	On existing fill	8.8	2.6
10-098	26+422	18 RT	On existing fill	6.9	2.3
10-099	26+400	38 RT	On existing fill	3.7	-
3	26+615.9	16.7 RT	On existing fill	4.5	2.0
4	26+637.3	16.5 RT	On existing fill	6.7	5.5
101	26+300	80 RT	New toe of slope	1.8	-
102	26+400	70 RT	New toe of slope	1.7	-
103	26+500	70 RT	New toe of slope	1.7	-
105	26+600	58.5 RT	New toe of slope	3.1	-
107	26+700	58.5 RT	New toe of slope	3.2	-
109	26+798.5	48.8 RT	New toe of slope	2.6	-
111	26+900	43 RT	New toe of slope	2.5	-
113	27+000	33 RT	New toe of slope	3.8	-
115	27+100	32 RT	New toe of slope	6.9	-
TP09-1	26+615	15 RT	On existing fill	2.8	-
TP09-2	26+575	14 RT	On existing fill	2.5	-
TP09-3	26+500	14 RT	On existing fill	2.2	-
TP09-4	26+400	16 RT	On existing fill	3.8	-
TP09-5	26+325	16 RT	On existing fill	3.7	-
TP09-6	26+250	20 RT	On existing fill	3.5	-
Hwy 11/17 EBL, Sta. 29+400 to 29+900					
10-104	29+896	46 RT	New toe of slope	1.4	-
10-105	29+929	16 RT	On existing highway	4.2	-
10-115	29+500	28 RT	On existing highway	10.9	-
10-116	29+500	47 RT	New toe of slope	8.0	-
10-117	29+550	47 RT	New toe of slope	4.4	-
10-118	29+620	29 RT	On existing highway	6.5	-
10-119	29+620	44 RT	New toe of slope	3.5	-
10-120	29+690	39 RT	New toe of slope	5.1	-
10-121	29+760	30 RT	On existing highway	10.5	-
10-122	29+760	40 RT	New toe of slope	9.9	-
10-123	29+830	45 RT	New toe of slope	2.2	-

**Table A1**  
**Borehole Summary**

Borehole	Location			Total Depth (m)	Length of Core in Bedrock (m)
	Station	Offset (m)	Description		
Hwy 11/17 WBL, Sta. 29+460 to 30+000					
10-106	29+943	0.1 LT	Proposed CL	0.7	-
10-107	29+975	35 LT	New WBL	0.0	-
10-107A	29+959	26 LT	New WBL	0.8	-
10-108	29+485	20 LT	New WBL	4.9	-
10-109	29+510	45 LT	New toe of slope	2.2	-
10-110	29+535	20 LT	New WBL	3.6	-
10-111	29+600	42 LT	Cut slope	12.0	-
10-112	29+670	48 LT	Cut slope	15.9	-
10-113	29+740	17 LT	New WBL	14.5	-
10-114	29+870	45 LT	Cut slope	3.8	-
C-001	29+510	1 LT	Proposed CL	0.9	-
Copenhagen Road, Sta. 9+540 to 9+955					
09-047	9+953.5	CL	Proposed CL	2.6	-
09-048	9+925	10 LT	Embankment toe	2.5	-
09-049	9+900	CL	Proposed CL	3.3	-
09-050	9+875	10 RT	Embankment toe	2.7	-
09-051	9+850	CL	Proposed CL	1.4	-
09-052	9+825	10 LT	Embankment toe	0.8	-
09-053	9+800	CL	Proposed CL	0.7	-
09-054	9+775	10 RT	Embankment toe	2.1	-
09-055	9+750	CL	Proposed CL	1.5	-
09-056	9+725	10 LT	Embankment toe	1.5	-
09-057	9+700	CL	Proposed CL	4.8	-
09-058	9+675	10 RT	Embankment toe	3.8	-
09-059	9+650	CL	Proposed CL	5.6	-
09-060	9+625	10 LT	Embankment toe	1.8	-
09-061	9+600	CL	Proposed CL	3.2	-
09-062A	9+578	10 RT	Embankment toe	1.5	-
09-062B	9+570	CL	Proposed CL	1.7	-
09-063	9+576	5 LT	Embankment toe	1.5	-
09-064	9+550	CL	Proposed CL	3.1	-
C-012	9+925	10 RT	Embankment toe	2.7	-
C-013	9+875	10 LT	Embankment toe	3.0	-
C-014	9+825	10 RT	Embankment toe	0.5	-
C-015	9+775	10 LT	Embankment toe	1.2	-
C-016	9+725	10 RT	Embankment toe	2.3	-
C-017	9+675	10 LT	Embankment toe	4.8	-
C-018	9+625	10 RT	Embankment toe	3.6	-
C-019	9+580	10 LT	Embankment toe	2.0	-

**Table A1**  
**Borehole Summary**

Borehole	Location			Total Depth (m)	Length of Core in Bedrock (m)
	Station	Offset (m)	Description		
Hodder Avenue E-N/S Ramp, Sta. 10+540 to 10+780					
09-027	10+543	CL	Ramp CL	1.6	-
09-028	10+555	10 LT	Ramp embankment toe	2.2	-
09-029	10+568	CL	Ramp CL	2.4	-
09-030	10+580	10 RT	Ramp embankment toe	5.1	-
09-031	10+593	CL	Ramp CL	3.7	-
09-032	10+605	10 LT	Ramp embankment toe	3.0	-
09-033	10+618	CL	Ramp CL	3.0	-
09-034	10+630	10 RT	Ramp embankment toe	1.7	-
09-035	10+643	CL	Ramp CL	2.1	-
09-036	10+655	10 LT	Ramp embankment toe	2.8	-
09-037	10+668	CL	Ramp CL	1.7	-
09-038	10+680	10 RT	Ramp embankment toe	3.8	-
09-039	10+693	CL	Ramp CL	1.4	-
09-040	10+705	10 LT	Ramp embankment toe	3.5	-
09-041	10+718	CL	Ramp CL	1.2	-
09-042	10+730	10 LT	Ramp embankment toe	1.0	-
09-043	10+743	CL	Ramp CL	1.0	-
09-044	110+755	10 RT	Ramp embankment toe	1.1	-
09-045	10+768	CL	Ramp CL	0.2	-
09-046	10+790	10 LT	Ramp embankment toe	1.4	-
09-051	9+850	CL	Ramp CL	1.4	-
09-052	9+825	10 LT	Ramp embankment toe	0.8	-
C-002	10+555	10 RT	Ramp embankment toe	4.7	-
C-003	10+580	10 LT	Ramp embankment toe	2.4	-
C-004	10+605	10 RT	Ramp embankment toe	3.4	-
C-005	10+630	10 LT	Ramp embankment toe	3.1	-
C-006	10+655	10 RT	Ramp embankment toe	1.4	-
C-007	10+680	10 LT	Ramp embankment toe	2.0	-
C-008	10+705	10 RT	Ramp embankment toe	4.8	-
C-009	10+730	10 RT	Ramp embankment toe	1.0	-
C-010	10+755	10 LT	Ramp embankment toe	1.3	-
C-011	10+785	10 RT	Ramp embankment toe	0.5	-

**Table A1**  
**Borehole Summary**

Borehole	Location			Total Depth (m)	Length of Core in Bedrock (m)
	Station	Offset (m)	Description		
Hodder Avenue S-E Ramp, Sta. 10+000 to 10+650					
09-006	10+010	CL	Ramp CL	2.7	-
09-007	10+125	CL	Ramp CL	3.3	-
09-008	10+250	CL	Ramp CL	1.7	-
09-009	10+300	CL	Ramp CL	2.8	-
09-010	10+350	CL	Ramp CL	1.4	-
09-011	10+400	CL	Ramp CL	2.2	-
09-012	10+450	CL	Ramp CL	4.9	-
09-013	10+500	CL	Ramp CL	4.5	-
09-014	10+550	CL	Ramp CL	2.8	-
09-015	10+600	CL	Ramp CL	2.6	-
09-016	10+650	CL	Ramp CL	3.6	-
10-068	10+160	15 RT	Ramp cut slope	5.5	-
10-070	10+200	17 RT	Ramp cut slope	8.5	2.7
10-071	10+240	18 RT	Ramp cut slope	3.8	-
10-072	10+280	18 RT	Ramp cut slope	11.6	3.1
10-073	10+320	17 RT	Ramp cut slope	3.8	-
Hodder Avenue N-E Ramp, Sta. 10+050 to 10+200					
09-017	10+050	CL	Ramp CL	2.6	1.5
09-018	10+100	CL	Ramp CL	2.9	1.4
09-019	10+150	CL	Ramp CL	6.5	1.6
09-020	10+240	CL	Ramp CL	4.3	1.6
Hodder Avenue W-N/S Ramp, Sta. 10+060 to 10+260					
09-001	10+100	7 RT	Ramp cut slope	9.3	-
09-002	10+138	2 RT	Ramp CL	10.8	4.3
09-003	10+124	10 RT	Ramp cut slope	10.7	3.1
09-004	10+175	2 RT	Ramp CL	7.3	3.7
09-005	10+235	CL	Ramp CL	6.7	3.8
10-085	10+075	30 RT	Ramp cut slope	14.8	3.0
10-086	10+113	9 RT	Ramp cut slope	10.9	3.6
10-087	10+150	7 RT	Ramp cut slope	10.4	3.5
09-088	10+117	2 LT	Ramp CL	15.4	-
10-089	10+128	12 LT	Ramp cut slope	9.0	4.4
10-090	10+108	7 LT	Ramp cut slope	17.7	3.6

**Table A2**  
**Piezometer Installation Details**

<b>Borehole</b>	<b>Piezometer Tip Depth (m)</b>	<b>Installation Details</b>
09-02	10.8	Piezometer with 1.5 m slotted screen installed, sand filter from 10.8 to 5.8 m, bentonite seal from 5.8 m to ground surface.
09-03	10.7	Piezometer with 1.5 m slotted screen installed, sand filter from 10.7 to 5.6 m, bentonite seal from 5.6 m to ground surface.
09-04	7.3	Piezometer with 1.5 m slotted screen installed, sand filter from 7.3 to 3.6 m, bentonite seal from 3.6 m to ground surface.
09-12	4.9	Piezometer with 1.5 m slotted screen installed, sand filter from 4.9 to 3.1 m, bentonite seal from 3.1 to 2.3 m, cuttings to ground surface.
09-16	3.6	Piezometer with 1.5 m slotted screen installed, sand filter from 3.6 to 2.3 m, bentonite seal from 2.3 to 1.0 m, cuttings to ground surface.
09-20	4.3	Piezometer with 1.5 m slotted screen installed, sand filter from 4.3 to 2.0 m, bentonite seal from 2.0 m to ground surface.
09-30	2.7	Piezometer with 1.5 m slotted screen installed, sand filter from 2.7 to 1.5 m, bentonite seal from 1.5 to 0.6 m, cuttings to ground surface.
09-32	3.0	Piezometer with 1.5 m slotted screen installed, sand filter from 3.0 to 1.5 m, bentonite seal from 1.5 to 0.3 m, cuttings to ground surface.
09-40	3.5	Piezometer with 1.5 m slotted screen installed, sand filter from 3.5 to 2.1 m, bentonite seal from 2.1 to 0.4 m, cuttings to ground surface.
09-49	3.3	Piezometer with 1.5 m slotted screen installed, sand filter from 3.3 to 2.2 m, bentonite seal from 2.2 to 1.4 m, cuttings to ground surface.
09-59	5.0	Piezometer with 1.5 m slotted screen installed, sand filter from 5.0 to 3.1 m, bentonite seal from 3.1 to 2.2 m, cuttings to ground surface.
10-70	6.1	Piezometer with 1.5 m slotted screen installed, sand filter from 6.1 to 3.1 m, bentonite seal from 3.1 m to ground surface.
10-72	8.5	Piezometer with 1.5 m slotted screen installed, sand filter from 8.5 to 5.5 m, bentonite seal from 5.5 m to ground surface.
09-78	6.2	Piezometer with 1.5 m slotted screen installed, sand filter from 6.2 to 4.9 m, bentonite seal from 4.9 to 1.8 m, cuttings to ground surface.
10-109	2.1	Piezometer with 1.5 m slotted screen installed, sand filter from 2.1 to 0.6 m, bentonite seal from 0.6 m to ground surface.
10-112	15.8	Piezometer with 1.5 m slotted screen installed, sand filter from 15.8 to 12.2 m, bentonite seal from 12.2 m to ground surface.
10-117	4.4	Piezometer with 1.5 m slotted screen installed, sand filter from 4.4 to 2.3 m, bentonite seal from 2.3 m to ground surface.
10-122	4.9	Piezometer with 1.5 m slotted screen installed, sand filter from 4.9 to 2.7 m, bentonite seal from 2.7 m to ground surface.

**Appendix B**

**Highway 11/17 EBL**

**Station 26+200 to 27+100**

**Boreholes 09-74 to 09-80, 10-96 to 10-99**

**Test Pits 09-01 to 09-06**

**Previous Boreholes 3, 4, and 101 to 115**

## 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 <sup>(1)</sup> '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


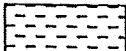



- (1) SPT 'N' Value      Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT              Dynamic Cone Penetration Test – 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
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


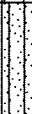
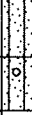

TERMS	
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered 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 09-074

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+450, 65m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.16 - 2009.07.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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						
0.0	TOPSOIL, with roots and rootlets (250mm)													
0.3	Silty SAND, trace gravel, trace roots and rootlets Dense Brown Moist		1	SS	35								○	
1.4	Silty SAND, some clay, with shale fragments Dense Brown												○	
1.8	(TILL)  GUNFLINT FORMATION (shale), highly weathered Black		2	SS	38								○	0 56 34 10
			3	SS	82/ 250								○	
2.8	END OF BOREHOLE AT 2.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 2.7m, THEN CUTTINGS TO SURFACE.													

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-075

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+550, 57m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.16 - 2009.07.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
							</							

# RECORD OF BOREHOLE No 09-076

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+650, 50m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.16 - 2009.07.16 CHECKED BY TH

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 <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100					W <sub>p</sub>	W	W <sub>L</sub>		
0.0	ORGANICS, peat Black																
0.4	Silty SAND, trace gravel, trace clay, with shale fragments Compact to Dense Brown Moist (TILL)  occasional cobbles		1	SS	17								o				3 59 34 4
			2	SS	32								o				
			3	SS	45								o				4 61 31 4
			4	SS	55								o				
3.4	GUNFLINT FORMATION (shale), weathered Black																
4.2	END OF BOREHOLE AT 4.2m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 1.8m, THEN CUTTINGS TO SURFACE.																

METRIC

G.W.P.	334-94-00	LOCATION	HWY 11/17, Sta. 26+750, 47m RT	ORIGINATED BY	SLL
HWY	11/17	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	AN
DATUM	Geodetic	DATE	2009.07.16 - 2009.07.16	CHECKED BY	TH

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 09-078

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+850, 42m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.16 - 2009.07.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
0.0	TOPSOIL, with roots and rootlets (150mm)													
0.2	Silty SAND, trace gravel, trace clay, shale fragments Loose to Very Dense Brown Moist to Wet (TILL)		1	SS	5									
			2	SS	41								6 61 30 4	
			3	SS	33									
			4	SS	41								3 57 38 2	
			5	SS	100/ .200									
6.2	END OF BOREHOLE AT 6.2m UPON AUGER REFUSAL ON PROBABLE BEDROCK. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.91m slotted screen.  WATER LEVEL READINGS: DATE      DEPTH (m)      ELEV. (m)		6	SS	100/ .050									

+<sup>3</sup>, X<sup>3</sup>; Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-079


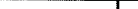
1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+950, 35m RT ORIGINATED BY SP/L  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.16 - 2009.07.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	x	LAB VANE							
								20	40	60	80	100					
0.0	TOPSOIL, with roots and rootlets (100mm)																
0.1	Silty SAND Brown Moist																
0.6	Silty SAND, trace gravel, trace clay, occasional cobbles Compact to Dense Brown Moist (TILL)		1	SS	19												
			2	SS	45												
			3	SS	35												
			4	SS	100/												4 62 31 3
3.1	END OF BOREHOLE AT 3.1m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDER. BOREHOLE OPEN AND WATER LEVEL AT 3.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 2.5m, THEN CUTTINGS TO SURFACE.				.100												

**METRIC**

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

[illegible]

ONTMT4S 1156.GPJ 3/17/10

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity








# RECORD OF BOREHOLE No 10-096

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+250 28m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.17 - 2010.01.17 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE										WATER CONTENT (%)			
								20	40	60	80	100		20	40	60		GR	SA	SI	CL
0.0	Silty <b>SAND</b> , some gravel, occasional rock fragments Compact Dark Brown Moist (FILL)																				
			1	SS	40																
			2	SS	11																
2.1	GUNFLINT FORMATION, strong (chert carbonate limestone), bluish grey to light grey, sub-horizontal planar fractures		1	RUN																	
			2	RUN																	
4.3	END OF BOREHOLE AT 4.3m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																				

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-097

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+350 29m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.17 - 2010.01.17 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	Silty SAND, some gravel, trace clay, frequent cobbles Loose to Compact Brown Moist (FILL)		1	SS	18												GR SA SI CL
			2	SS	23												
			3	SS	8												14 43 36 7
			4	SS	5												
4.7	Silty SAND, some gravel, occasional rock fragments Compact Brown Moist (TILL)		5	SS	20												11 56 28 5
			6	SS	50/												
6.2	GUNFLINT FORMATION, strong (chert carbonate limestone), fresh, laminated, blue-grey, fine grained, occasional sub-horizontal planar fractures		1	RUN	.075											FI	RUN 1# TCR=100%, SCR=96%, RQD=64% UCS=62MPa
			2	RUN												2	RUN 2# TCR=100%, SCR=90%, RQD=90% UCS=79MPa
8.8	END OF BOREHOLE AT 8.8m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.															2	

+<sup>3</sup> . X<sup>3</sup> : Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

ONTMT4S 1156.GPJ 4/15/10

# RECORD OF BOREHOLE No 10-098

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+422 18m RT ORIGINATED BY LG

HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN

DATUM Geodetic DATE 2010.01.18 - 2010.01.18 CHECKED BY TH

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 10-099

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 26+400 38m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.18 - 2010.01.18 CHECKED BY TH

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 <sup>3</sup>	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					WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>				
0.0	Silty SAND, some gravel, trace clay, occasional rock fragments Loose to Compact Brown Moist (FILL)		1	SS	6												
			2	SS	30												
3.7	END OF BOREHOLE AT 3.7m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 3

METRIC

W P 141/142-90-01 LOCATION Station 26 + 615.9m (EBL), 2.1m Lt of prop. EBL E  
DIST 19 HWY 11 & 17 BOREHOLE TYPE Solid stem auger, bicone, BQ rock core  
DATUM Geodetic DATE 91 09 11-12  
ORIGINATED BY SM  
COMPILED BY SM  
CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
245.2	Ground surface																
0.0	Sand and Silt some gravel, trace of clay, organic specs, brown, compact		1	SS	13	Dry	245							0			GR SA SI CL 14 52 33 1
243.7	(FILL)		2	SS	10		244							0			15 39 45 1
1.5	Sandy Gravel some silt, oxidized, compact		3	SS	27		243							0			59 22 (19)
243.1							242										RQD 82%
2.1	Chert Iron Formation Bedrock black-grey to olive grey, fine to medium grained, medium strong, very close to moderately close spacing, good quality		4	RC BQ	REC 100%		241										RQD 79%
240.7			5	RC BQ	REC 100%												
4.5	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 4

METRIC

W P 141/142-90-01 LOCATION Station 26 + 637.3m (EBL), 2.3m Lt of prop. EBL 8  
 DIST 19 HWY 11 & 17 BOREHOLE TYPE Solid stem auger, bicone, BQ rock core  
 DATUM Geodetic DATE 91 09 12-14  
 ORIGINATED BY SM  
 COMPILED BY SM  
 CHECKED BY SB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
244.7	Ground surface																GR SA SI CL
0.0	Sand and Silt some gravel, trace of clay, organic specs, brown, compact (FILL)		1	SS	16	Dry	244							0			20 38 (42)
243.7																	
1.0	Chert Iron Formation Bedrock black-grey to olive grey, fine to medium grained, medium strong, very close to moderately close spacing, fair to excellent quality		2	RC BQ	REC 93%		243										RQD 53%
			3	RC BQ	REC 100%		242										RQD 62%
			4	RC BQ	REC 100%		241										RQD 86%
			5	RC BQ	REC 92%		240										RQD 81%
			6	RC BQ	REC 100%		239										RQD 92%
238.0																	
6.7	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 101

1 of 1

METRIC

G.W.P. 334-94-00

LOCATION

Co-ords: 5 371 930 N; 366 225 E  
Sta. 26+300, o/s 80m Rt.

ORIGINATED BY F.P.

DIST Thunder Bay HWY 11/17

BOREHOLE TYPE Continuous Flight Hollow Stem Augers

COMPILED BY F.P.

DATUM Geodetic

DATE \_\_\_\_\_

December 14, 2005

CHECKED BY

[illegible]

RECORD OF BOREHOLE No 102

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 371 965 N; 366 326 E Sta. 26+400, o/s 70m Rt. ORIGINATED BY F.P.  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY F.P.  
DATUM Geodetic DATE December 14, 2005 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			20	40	60	80	100					
232.9 0.0	Ground Surface Topsoil		1	AS	-												
0.3	Black Shale bedrock, weathered		2	SS	80/18cm		232										Top 20cm frozen
231.2 1.7	End of borehole Refusal on probable bedrock  Borehole redrilled 1.5m north and obtained refusal at 0.3m depth.  * Borehole dry on completion of drilling		3	SS	65/18cm												



RECORD OF BOREHOLE No 103

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 371 998 N; 366 426 E  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers  
DATUM Geodetic DATE December 14, 2005

ORIGINATED BY F.P.  
COMPILED BY F.P.  
CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
231.8	Ground Surface															
0.0	Peat, fine fibrous		1	AS	-											Top 30cm frozen
231.2	Dark brown															
0.6	Black Shale bedrock weathered		2	SS	73	231										
230.1			3	SS	50/5cm											
1.7	End of borehole Refusal on bedrock															
	* Borehole dry on completion of drilling															

<div style="text-align: center;"> <b>RECORD OF BOREHOLE No 105</b>      1 of 1      <b>METRIC</b> </div>																	
G.W.P. 334-94-00		LOCATION		Co-ords: 5 372 050 N; 366 518 E Sta. 26+600, o/s 58.5m Rt.				ORIGINATED BY F.P.									
DIST Thunder Bay HWY 11/17		BOREHOLE TYPE		Continuous Flight Hollow Stem Augers				COMPILED BY F.P.									
DATUM Geodetic		DATE		December 14, 2005				CHECKED BY									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
232.4	Ground Surface																
0.0	Peat, fine fibrous		1	AS	-												Top 25cm frozen
231.8	Loose Black																
0.6	Sandy silt, trace gravel organics		2	SS	2												
	Very loose Brown Wet																
	Shale inclusions, cobbles and boulders		3	SS	16												
	Compact to dense		4	SS	50/15cm												
229.3	End of borehole																
3.1	Refusal on probable bedrock																
<p>* 2005 12 14</p> <p>▽ Water level observed during drilling</p> <p>▼ Water level measured after drilling</p>																	

**METRIC**

DATUM Geodetic DATE December 14, 2005 CHECKED BY \_\_\_\_\_

ON MOT VER3 05TF040.GPJ ON MOT.GDT 1/19/2006 9:29:21 AM

$+^7, \times^5$ : Numbers refer to Sensitivity

RECORD OF BOREHOLE No 109

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 372 156 N; 366 692 E Sta. 26+798.5, o/s 48.8m Rt. ORIGINATED BY F.P.  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY F.P.  
DATUM Geodetic DATE December 14, 2005 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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									
232.4	Ground Surface							20	40	60	80	100					
0.0	Peat, fine fibrous		1	AS	-	▼* ▼*	232										Top 30cm frozen
0.3	Black Sand and silt, trace clay, trace gravel, cobbles and boulders																
	Dense      Brown      Wet to very dense																
230.6			2	SS	50/15cm		231										
1.8	Probable Shale bedrock, weathered																
229.8							230										
2.6	End of borehole Refusal on probable bedrock																
	 *    2005   12   14  ▽    Water level observed during drilling  ▼    Water level measured after drilling  Note: Refusal encountered at original borehole location at 0.3m depth, borehole moved 1.5m westerly.																

# RECORD OF BOREHOLE No 111

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 372 213 N; 366 776 E  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers  
DATUM Geodetic DATE December 14, 2005

ORIGINATED BY F.P.

COMPILED BY F.P.

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
234.0	Ground Surface																
0.0	Peat, fine fibrous		1	AS	-												
0.3	Black Sand and silt, trace clay, trace gravel, cobbles and boulders		2	AS	-												
	Dense Brown Moist to very dense		3	SS	50/15cm												
231.5			4	SS	30/5cm												
2.5	End of borehole Refusal on probable bedrock  * Borehole dry on completion of drilling  Note: Borehole moved 1.5m north, auger refusal at 2.3m																

RECORD OF BOREHOLE No 113

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 372 272 N; 366 857 E  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers  
DATUM Geodetic DATE December 13, 2005

ORIGINATED BY F.P.

COMPILED BY F.P.

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
234.6	Ground Surface																
0.0	Peat, fine fibrous, cobbles and boulders Dark brown		1	AS	-											Top 30cm frozen	
233.4																	
1.2	Silt and sand, trace to with gravel, trace clay, cobbles Compact Grey Wet to dense (TILL)		2	SS	19												
			3	SS	38												
			4	SS	20/0cm												
230.8																	
3.8	End of borehole Refusal on probable bedrock  Sampler bouncing on boulder at 3.0m depth.  * 2005 12 13  ▽ Water level observed during drilling  ▽ Water level measured after drilling																

RECORD OF BOREHOLE No 115

1 of 1

METRIC

G.W.P. 334-94-00 LOCATION Co-ords: 5 372 324 N; 366 942 E ORIGINATED BY F.P.  
DIST Thunder Bay HWY 11/17 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY F.P.  
DATUM Geodetic DATE December 13, 2005 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
236.6	Ground Surface													
0.0	Peat, amorphous Dark brown		1	AS	-									Top 25cm frozen
235.6			2	SS	7								150	
1.0	Silty sand, trace to some gravel, trace clay, cobbles and boulders													
	Compact Brown Wet to grey (TILL)		3	SS	8									7 61 30 2
			4	SS	29									
			5	SS	47									15 46 37 2
	Dense Grey Moist to very dense		6	SS	20/8cm									
			7	SS	20/5cm									
			8	SS	50/8cm									
			9	SS	50/8cm									
229.7	End of borehole													
6.9	Sampler bouncing on cobbles from 3.8m depth.													
	* 2005 12 13													
	▽ Water level observed during drilling													
	▽ Water level measured after drilling													

**Table B1**

**Record of Test Pits**

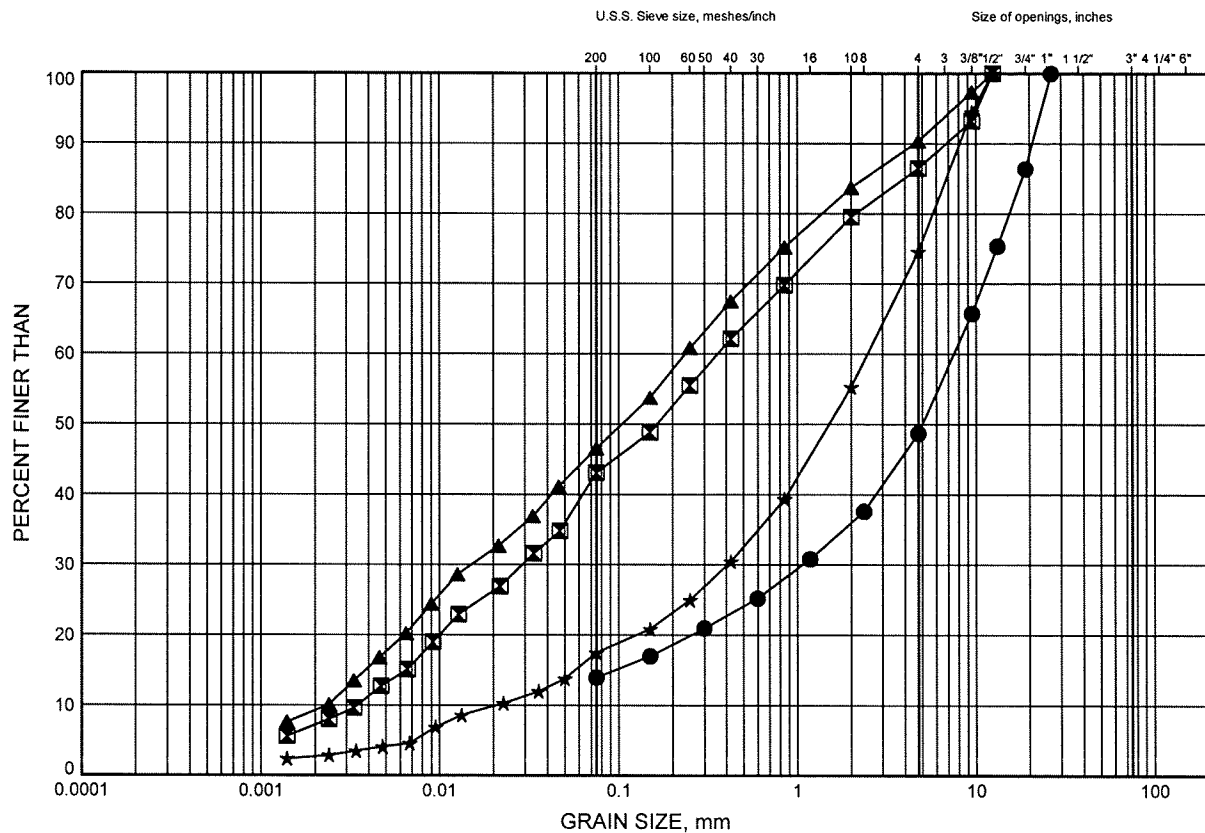
Test Pit No.	Station	Offset	Depth (m)	Soil Profile
09-1	26+615	15 m RT	0.0 - 1.0 1.0 - 2.8 2.8	Rockfill Silty Clay Fill, firm, dark brown Refusal No water observed
09-2	26+575	14 m RT	0.0 - 0.2 0.2 - 2.5 2.5	Organics Sand Fill, some silt, mixed with silty clay, with cobbles and boulders Refusal No water observed
09-3	26+500	14 m RT	0.0 - 0.2 0.2 - 2.2 2.2	Organics Sand Fill, some silt and clay, trace roots Refusal No water observed
09-4	26+400	16 m RT	0.0 - 0.2 0.2 - 1.0 1.0 - 3.8	Organics Sand Fill, some gravel, brown Sand Fill, some silt, some clay, with rootlets, dark brown No water observed
09-5	26+325	16 m RT	0.0 - 0.2 0.2 - 1.0 1.0 - 3.7	Organics Sand Fill, some gravel, brown Sand Fill, some silt, trace gravel and clay, with roots, with cobbles and boulders No water observed
09-6	26+250	20 m RT	0.0 - 0.2 0.2 - 1.1 1.1 - 3.5	Organics Sand Fill, some gravel, brown Sand Fill, some silt, trace gravel, with cobbles and boulders No water observed. Sidewalls collapsed.



# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE B1

## FILL



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

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-096	1.79	
■	10-097	2.59	
▲	10-098	1.83	
★	10-099	3.35	

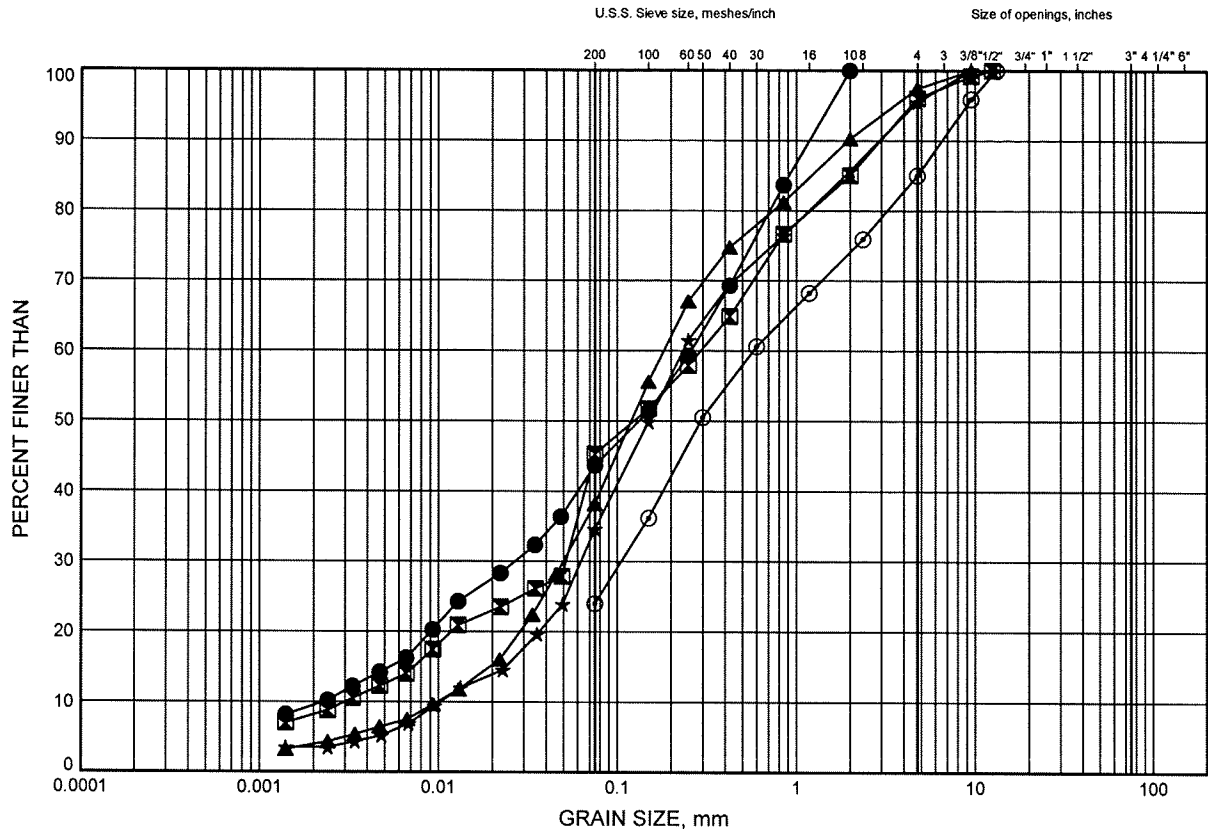


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-074	1.83	
⊠	09-075	1.07	
▲	09-076	1.07	
★	09-076	2.59	
⊙	09-077	1.07	

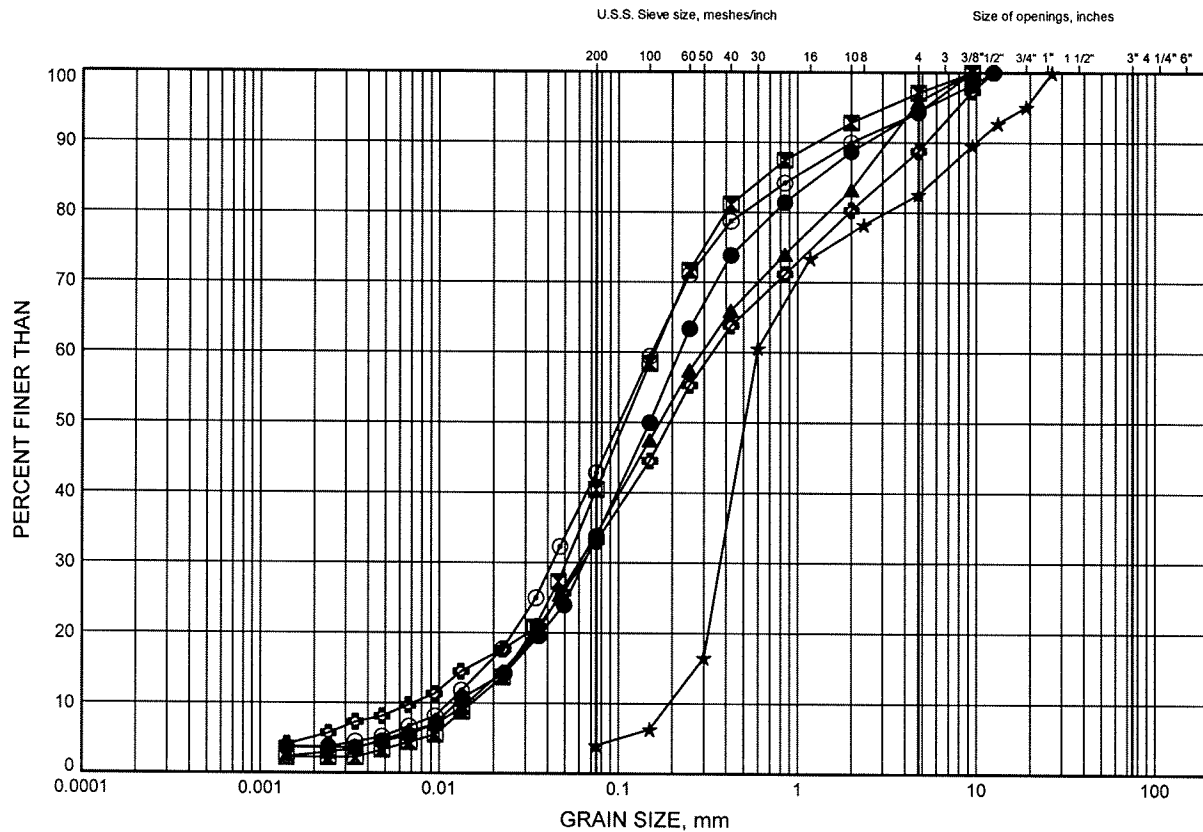


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE B3

## SAND & SILT TILL



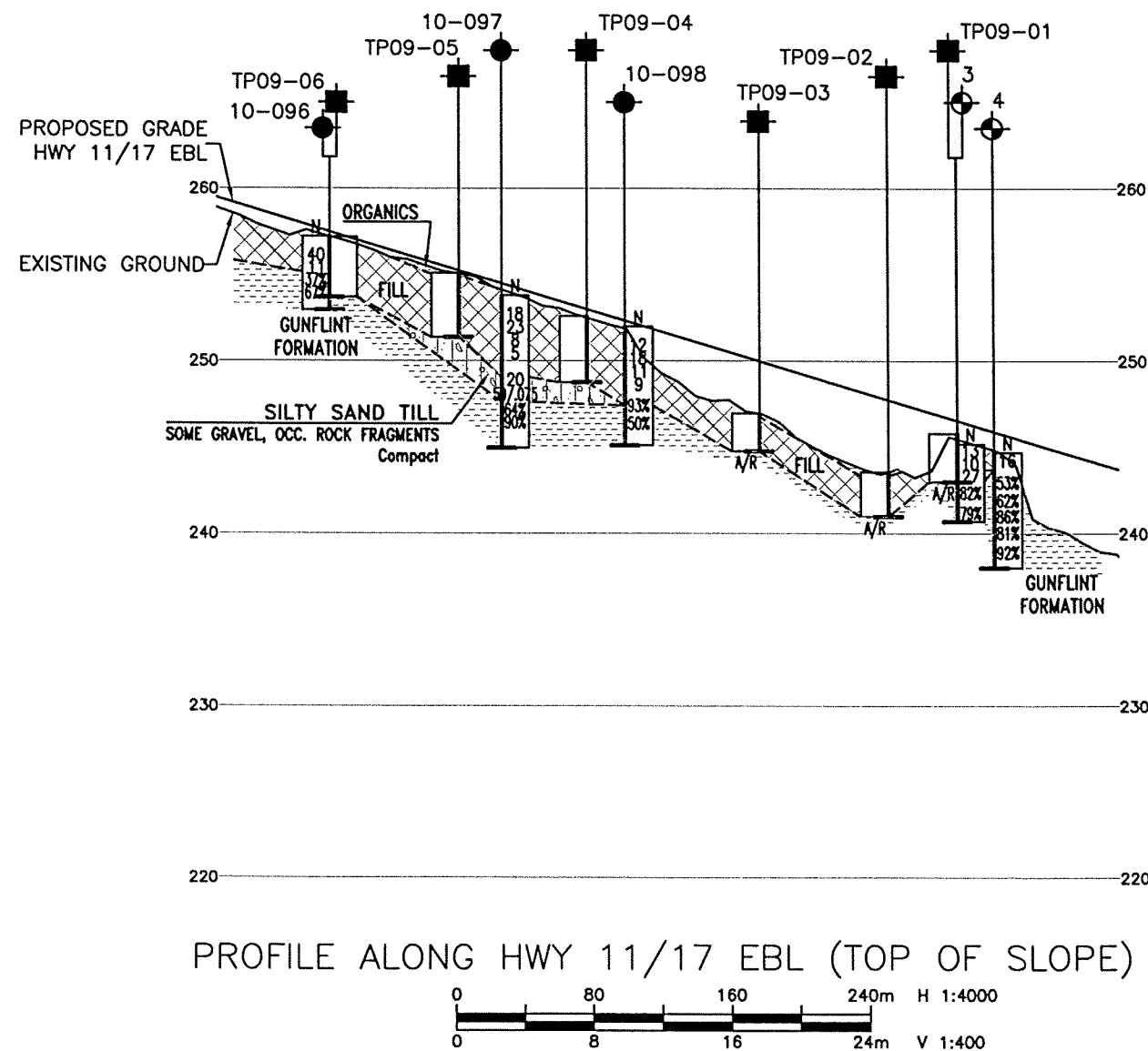
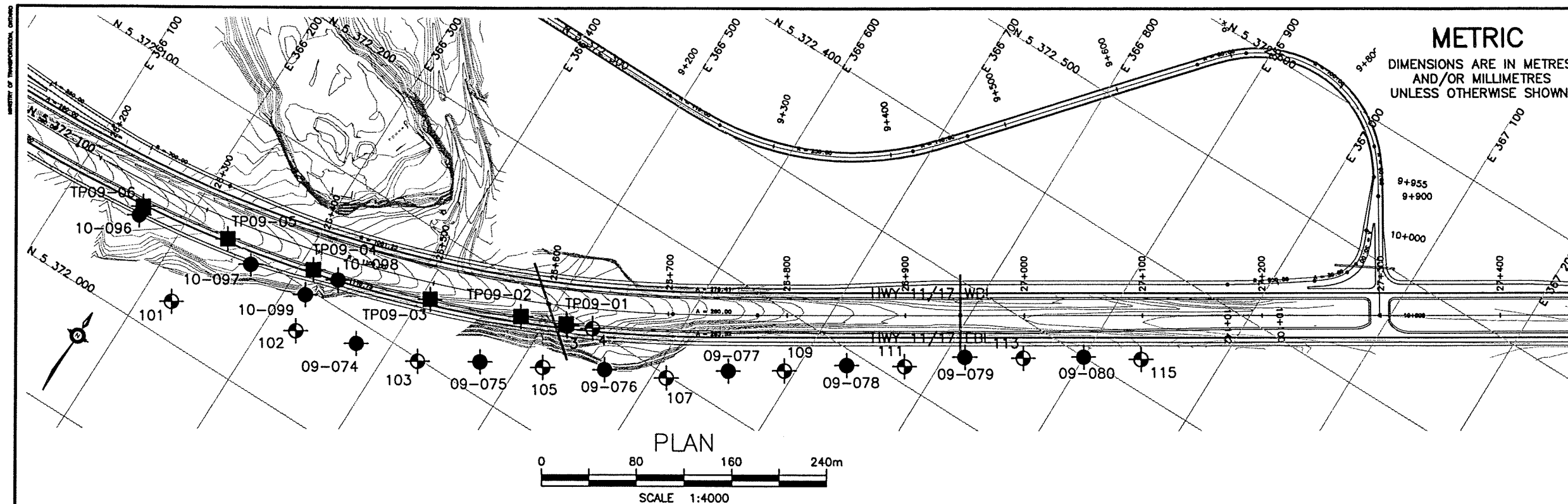
SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-078	1.83	
⊠	09-078	3.35	
▲	09-079	2.59	
★	09-080	1.83	
⊙	09-080	5.11	
⊕	10-097	4.88	



W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....



# METRIC

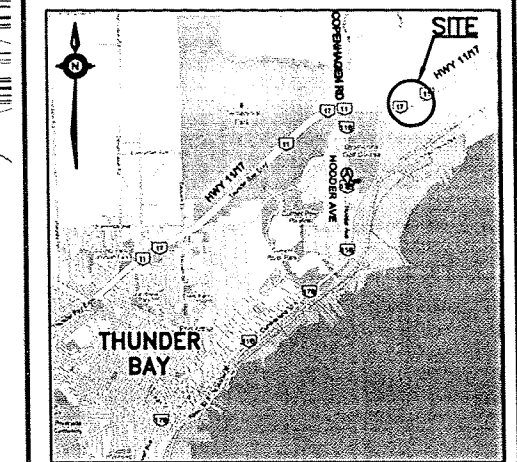
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 334-94-00

HIGHWAY 11/17  
EASTBOUND LANES  
TOP OF SLOPE  
BOREHOLE LOCATIONS AND SOIL STRATA

MRC McCORMICK RANKIN  
CORPORATION

THURBER ENGINEERING LTD.  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



## KEYPLAN

### LEGEND

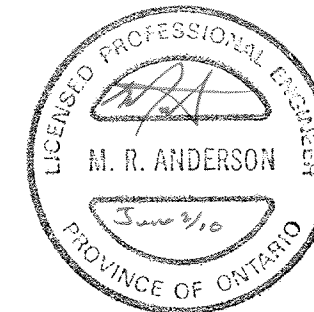
- ◆ Borehole
- ◆ Borehole by Others (1991 and 2005)
- ◆ Test Pit
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- W Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	Q OFFSET
10-096	26+250	28m RT.
10-097	26+350	29m RT.
10-098	26+422	18m RT.
10-099	26+400	38m RT.
TP09-01	26+615	15m RT.
TP09-02	26+575	14m RT.
TP09-03	26+500	14m RT.
TP09-04	26+400	16m RT.
TP09-05	26+325	16m RT.
TP09-06	26+250	20m RT.
3	26+615.9	16.7m RT.
4	26+637.3	16.5m RT.

### NOTES

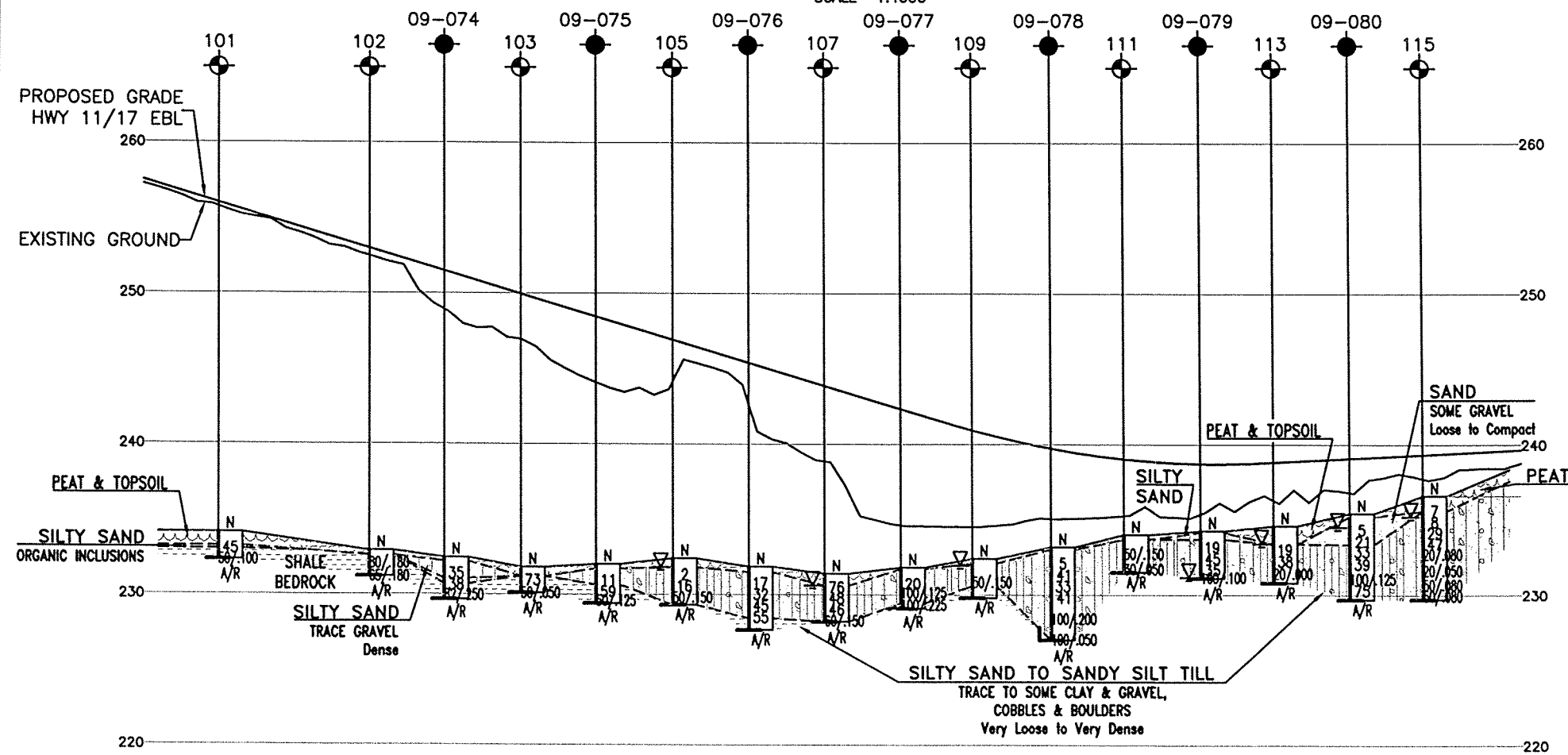
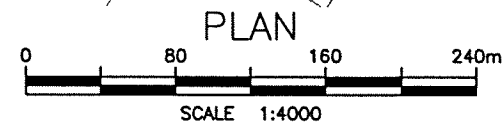
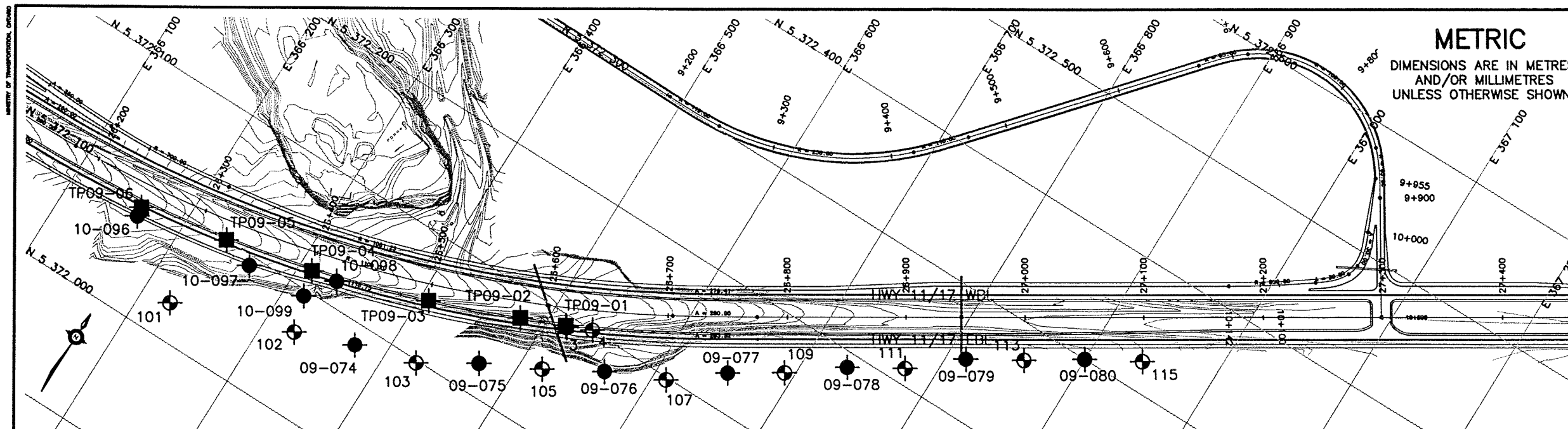
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 52A-146



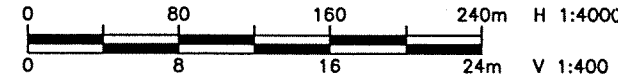
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DESIGN	MRA	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
STRUCT			
DWG			
DATE	JUN. 2010		

FILENAME: D:\Working\19\1351\150\1501156-Highway 11-17 EBL Slope (PlanProfile).dwg  
PLOTDATE: Jun 01, 2010 - 2:56pm



NO	STATION	& OFFSET
09-074	26+450	65m RT.
09-075	26+550	57m RT.
09-076	26+650	50m RT.
09-077	26+750	47m RT.
09-078	26+850	42m RT.
09-079	26+950	35m RT.
09-080	27+050	35m RT.

PROFILE ALONG HWY 11/17 EBL (TOE OF SLOPE)



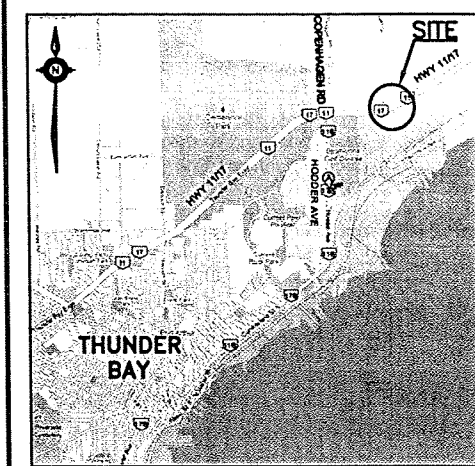
METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 334-94-00

HIGHWAY 11/17  
EASTBOUND LANES  
TOE OF SLOPE  
BOREHOLE LOCATIONS AND SOIL STRATA

MRC MCCORMICK RANKIN  
CORPORATION

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KEYPLAN  
LEGEND

- Borehole
- Borehole by Others (1991 and 2005)
- Test Pit
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- H Head Artesian Water
- P Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	234.1	5 371 930.0	366 225.0
102	232.9	5 371 965.0	366 326.0
103	231.8	5 371 998.0	366 426.0
105	232.4	5 372 050.0	366 518.0
107	231.4	5 372 098.0	366 611.0
109	232.4	5 372 156.0	366 692.0
111	234.0	5 372 213.0	366 776.0
113	234.6	5 372 272.0	366 857.0
115	236.6	5 372 324.0	366 942.0

- NOTES-
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
  - This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 52A-146

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
LOAD			
STRUCT			
OWG	B2		

FILENAME: D:\Working\19\1151\150\150\1151-17 EBL Slope (PlanProfile).dwg  
PLOTDATE: Jun 01, 2010 - 2:20pm

**Appendix C**

**Highway 11/17 EBL**

**Station 29+400 to 29+900**



**Boreholes 10-104, 10-105, and 10-115 to 10-123**

# RECORD OF BOREHOLE No 10-104

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 373 948.9 E 369 222.6 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.29 - 2010.01.29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
251.7								20	40	60	80	100		
0.0	<b>SAND</b> and <b>GRAVEL</b> , occasional cobbles, trace organics Dark Brown to Brown Frozen to Moist (FILL)		1	AS										
250.9														
0.8	Silty <b>SAND</b> , trace to some gravel, occasional cobbles, occasional roots Compact Brown		1	SS	17		251							
250.3														
1.4	END OF BOREHOLE AT 1.4m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN TO 1.4m, AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.													

+<sup>3</sup> X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-105

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 373 992.0 E 369 230.0 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.27 - 2010.01.27 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
261.3								20 40 60 80 100					
0.0 0.1	ASPHALT: (75mm)							○ UNCONFINED + FIELD VANE					
	SAND and GRAVEL Brown Frozen to Moist (FILL)		1	AS			261	● QUICK TRIAXIAL × LAB VANE					
			2	AS			260						
259.8													
1.5	SAND, some gravel, some silt Dense to Very Dense Dark Brown Moist (FILL)		1	SS	47		259						
			2	SS	55								
258.3													
3.0	Silty SAND, some gravel Very Dense Dark Brown to Brown Moist		3	SS	42		258						
257.1													
4.2	END OF BOREHOLE AT 4.2m UPON AUGER REFUSAL ON PROBABLE BEDROCK OR BOULDERS. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH SAND TO 2.4m, THEN BENTONITE TO 0.2m, THEN ASPHALT TO SURFACE.												

+<sup>3</sup> ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



## METRIC

G.W.P.	334-94-00	LOCATION	HWY 11/17, Sta. 29+500 28m RT	ORIGINATED BY	JM
HWY	11/17	BOREHOLE TYPE	Hollow Stem Augers	COMPILED BY	AN
DATUM	Geodetic	DATE	2010.01.21 - 2010.01.21	CHECKED BY	TH

[illegible]

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity

ONTMT4S 1156.GPJ 4/15/10

RECORD OF BOREHOLE No 10-115

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+500 28m RT ORIGINATED BY JM  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2010.01.21 - 2010.01.21 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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					WATER CONTENT (%) W P W W L				
	Continued From Previous Page																
10.7	Gravelly SAND, trace silt Very Dense Grey Moist to Wet		9	SS	100/												
10.9	END OF BOREHOLE AT 10.9m UPON AUGER REFUSAL. BOREHOLE OPEN TO 9.9m, AND WATER LEVEL AT 4.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 3.2m, THEN BENTONITE TO 0.15m, THEN ASPHALT TO SURFACE.				.125												

## METRIC



[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity





**METRIC**

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

[illegible]

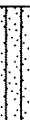


+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No 10-120

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+690 39m RT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.29 - 2010.01.29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	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	Silty <b>SAND</b> , trace to some gravel Brown Frozen to Moist		1	AS																
0.8	<b>SAND</b> , some to trace silt, trace gravel Loose to Compact Brown Moist		1	SS	4															
			2	SS	9															
			3	SS	11															
			4	SS	6															
4.6	<b>SILT</b> , some sand, trace gravel Dense Grey Moist		5	SS	37															
5.1	END OF BOREHOLE AT 5.1m UPON AUGER REFUSAL. BOREHOLE OPEN TO 4.8m, AND WATER LEVEL AT 4.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 1.5m, THEN BENTONITE TO SURFACE.																			

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-121

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+760 30m RT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.22 - 2010.01.26 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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									
0.0 0.1	ASPHALT: (75mm)																
	SAND and GRAVEL Brown Moist (FILL)		1	AS													
			1	SS	100/												
0.9	SAND, trace silt, some gravel Compact Brown Moist (FILL)				.125												
			2	SS	16												
			3	SS	21												
2.6	SAND, trace silt, trace gravel Compact Brown Moist																
			4	SS	41												
4.6	SAND, some gravel to gravelly, some silt Dark Brown Loose to Compact Wet		5	SS	4												21 64 15 (SI+CL)
	Moist to Wet Grey		6	SS	11												
			7	SS	19												14 72 14 (SI+CL)
			8	SS	0												

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 10-121

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+760 30m RT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.22 - 2010.01.26 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
	Continued From Previous Page																
10.5	END OF BOREHOLE AT 10.5m UPON AUGER REFUSAL. BOREHOLE OPEN TO 4.5m, AND WATER LEVEL AT 4.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH SAND TO 3.0m, THEN BENTONITE TO 0.15m, THEN ASPHALT TO SURFACE.																

ONTMT4S 1156.GPJ 4/15/10

## METRIC

G.W.P. <u>334-94-00</u>	LOCATION <u>HWY 11/17, Sta. 29+760 40m RT</u>	ORIGINATED BY <u>JM</u>
HWY <u>11/17</u>	BOREHOLE TYPE <u>Hollow Stem Augers</u>	COMPILED BY <u>AN</u>
DATUM <u>Geodetic</u>	DATE <u>2010.01.28 - 2010.01.28</u>	CHECKED BY <u>TH</u>

[illegible]

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-122

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+760 40m RT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.28 - 2010.01.28 CHECKED BY TH

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 <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>										
9.9	<p>Continued From Previous Page</p> <p>END OF BOREHOLE AT 9.9m. UPON AUGER REFUSAL. BOREHOLE OPEN TO 4.8m, AND WATER LEVEL AT 3.8m UPON COMPLETION.</p> <p>Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.</p> <p>WATER LEVEL READINGS:</p> <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> <th>ELEV. (m)</th> </tr> </thead> <tbody> <tr> <td>2010.01.31</td> <td>1.4</td> <td>-</td> </tr> <tr> <td>2010.03.01</td> <td>1.5</td> <td>-</td> </tr> </tbody> </table>	DATE	DEPTH (m)	ELEV. (m)	2010.01.31	1.4	-	2010.03.01	1.5	-															
DATE	DEPTH (m)	ELEV. (m)																							
2010.01.31	1.4	-																							
2010.03.01	1.5	-																							

RECORD OF BOREHOLE No 10-123

1 OF 1

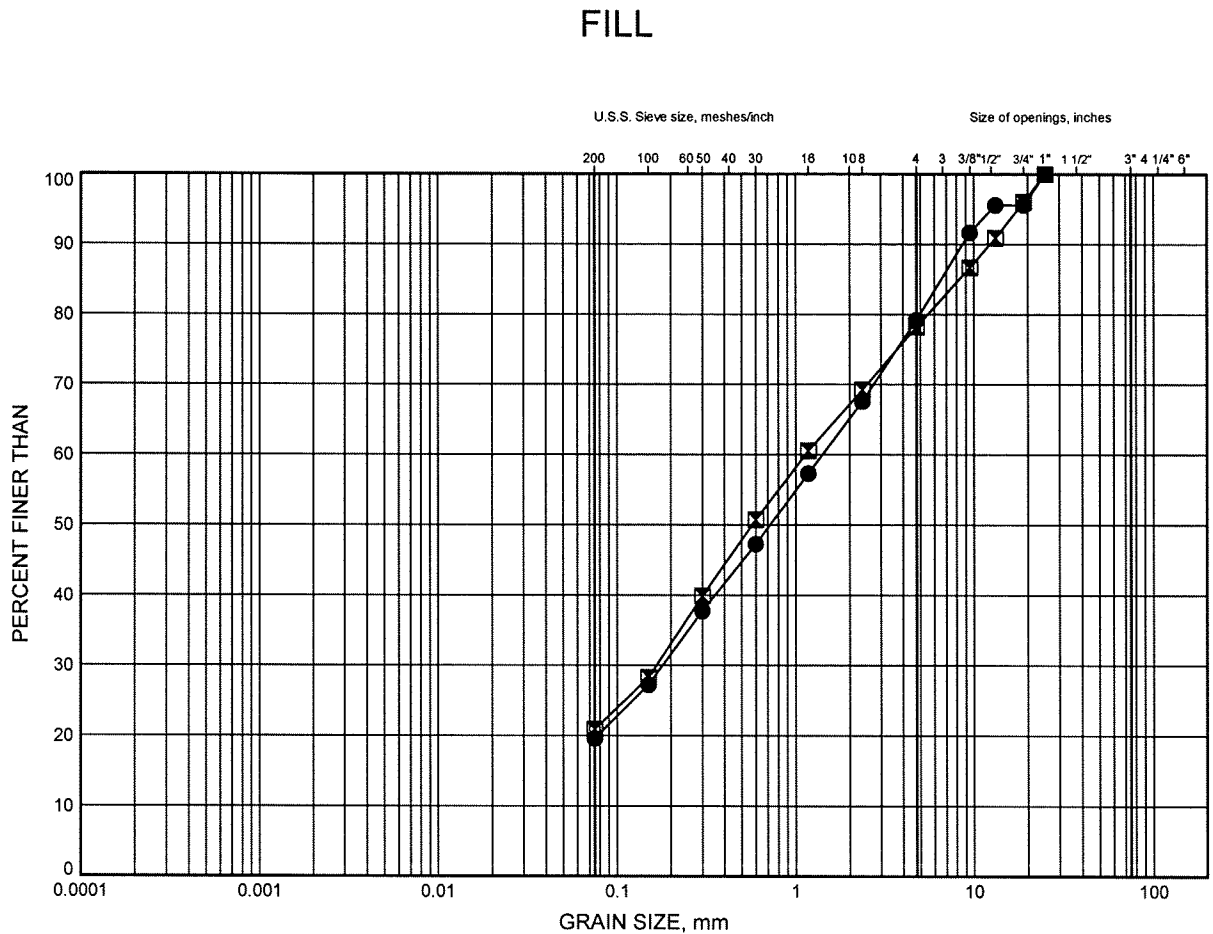
METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+830 45m RT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.28 - 2010.01.28 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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					
0.0	ORGANICS, peat, silt and sand Dark Brown Frozen to Moist		1	AS													
			1	SS	6												
1.5	SAND, some gravel, trace silt, occasional cobbles, with organics Compact Dark Brown Moist to Wet		2	SS	16												
2.2	END OF BOREHOLE AT 2.2m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE C1



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

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-105	2.59	258.71
■	10-115	1.83	

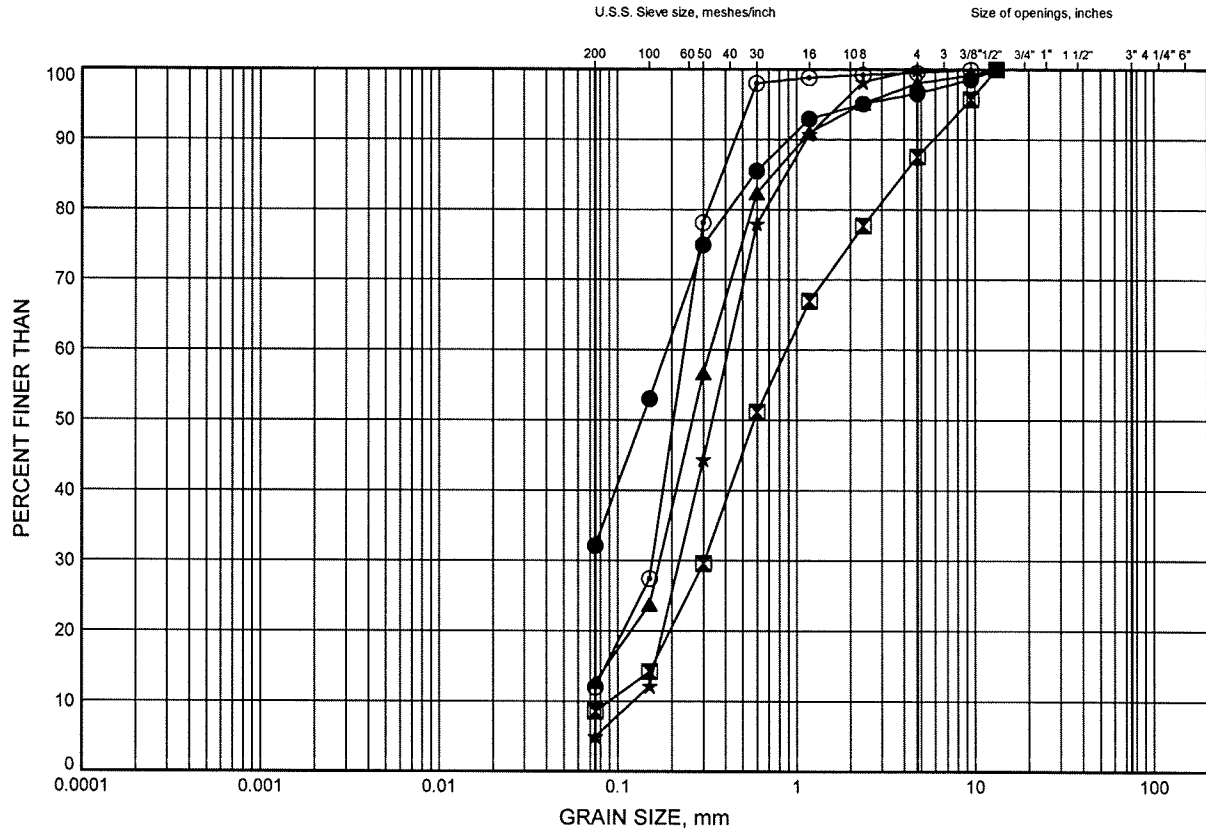


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE C2

SAND to SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-115	4.88	
⊠	10-116	2.59	
▲	10-117	2.59	
★	10-120	2.59	
⊙	10-122	6.40	

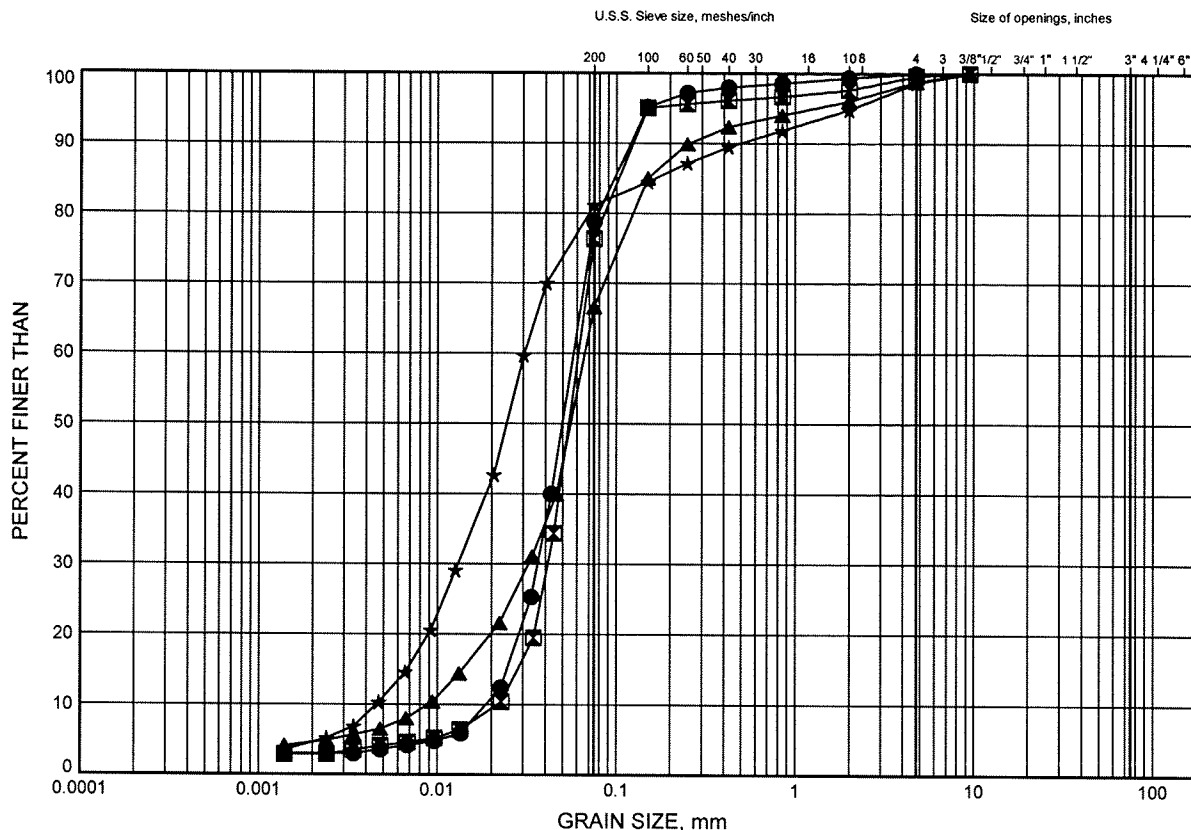


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE C3

## SILT to SANDY SILT



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-115	9.45	
⊠	10-116	4.88	
▲	10-119	2.59	
★	10-120	4.82	

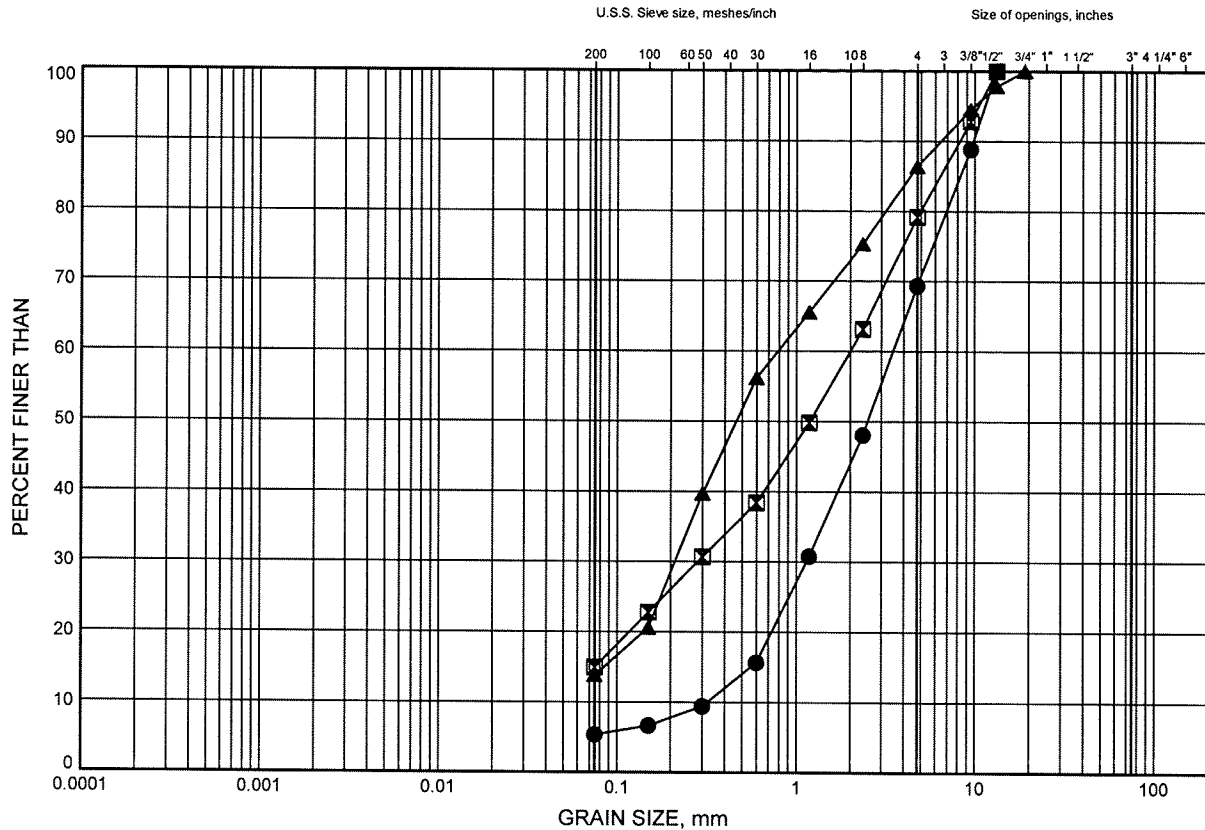


W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE C4

GRAVELLY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-118	6.30	
⊠	10-121	4.88	
▲	10-121	7.92	



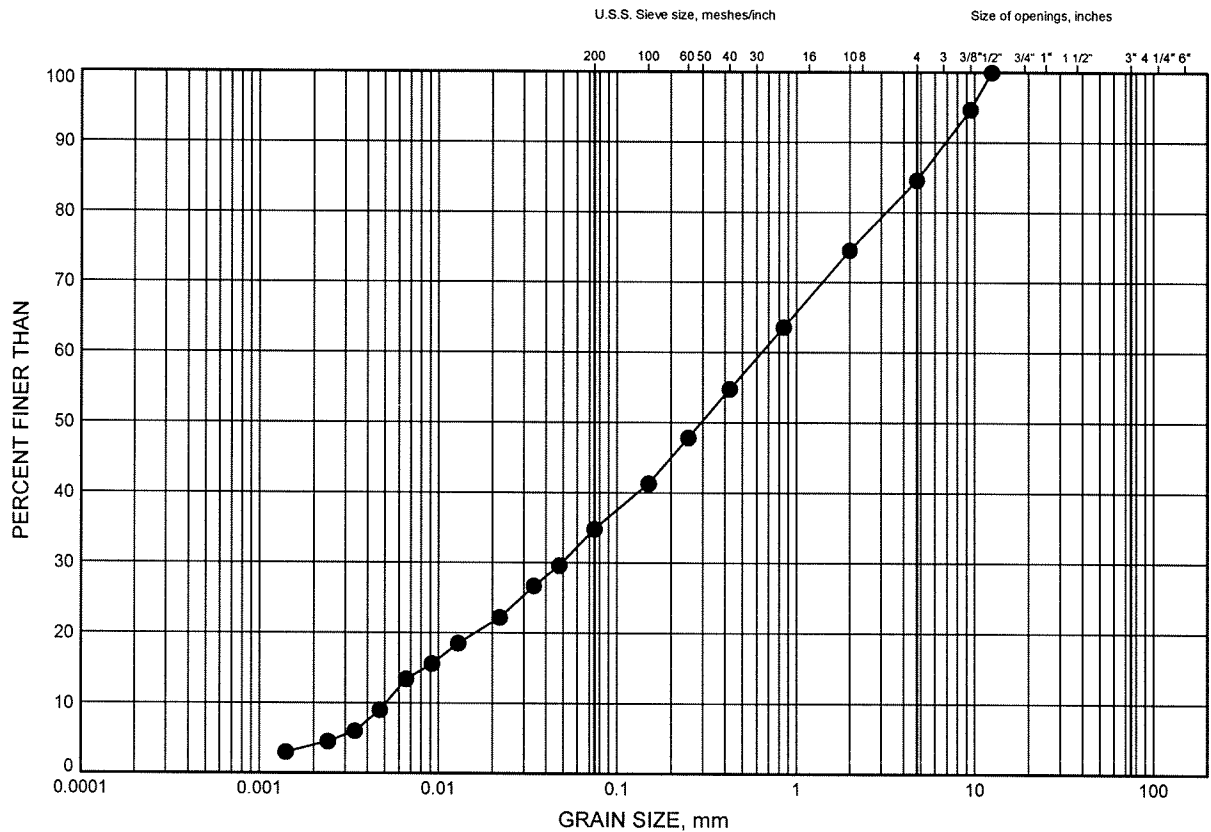
W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE C5

SILTY SAND TILL



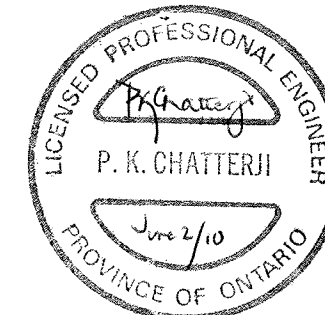
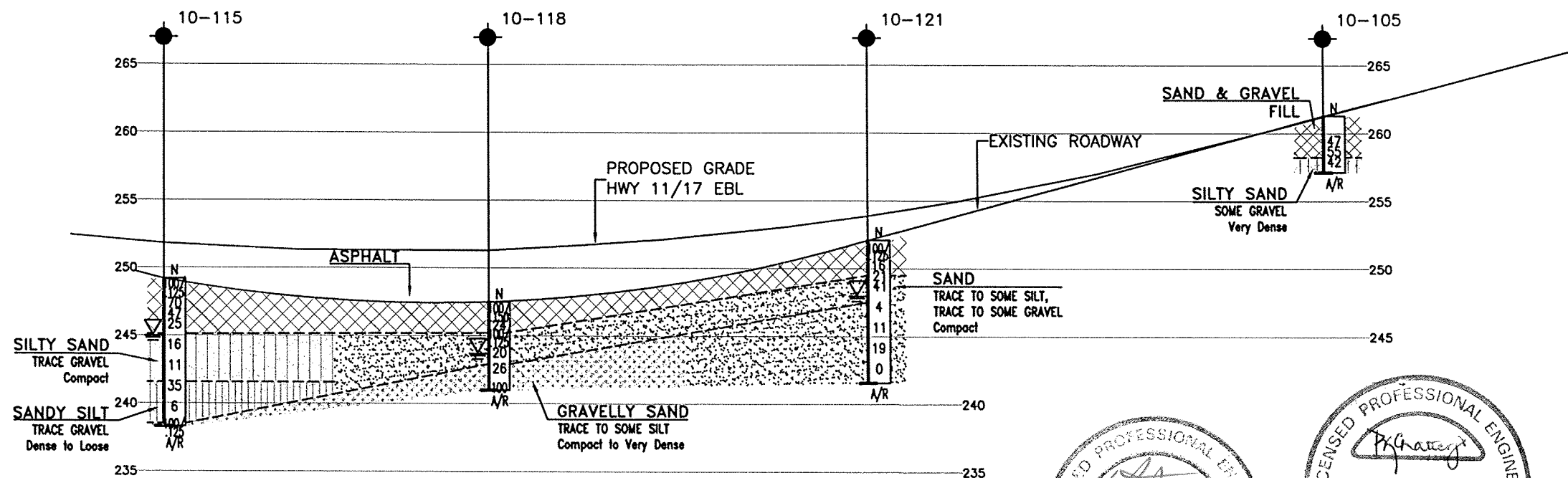
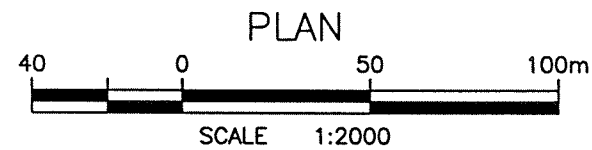
SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-122	9.32	



W.P.# 334-94-00  
Prepared By AN  
Checked By MRA



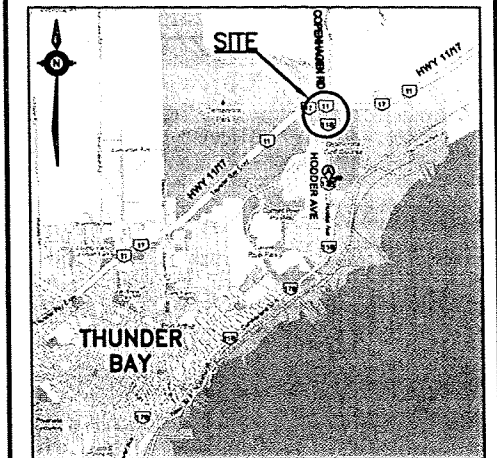
CONT No  
WP No 334-94-00

HIGHWAY 11/17  
EASTBOUND LANES  
TOP OF SLOPE  
BOREHOLE LOCATIONS AND SOIL STRATA






**MRC** **McCORMICK RANKIN**  
**CORPORATION**



**THURBER ENGINEERING LTD.**  
**GEOTECHNICAL • ENVIRONMENTAL • MATERIALS**



KEYPLAN  
LEGEND

	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

[illegible]

**-NOTES-**

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**

REVISIONS									
DATE		BY		DESCRIPTION					
DESIGN	MRA	CHK	AEG	CODE	LOAD	DATE	JUN. 2010		
DRAWN	AN	CHK	PKC	SITE	STRUCT	DWG	C1		



**Appendix D**

**Highway 11/17 WBL**

**Station 29+450 to 30+000**

**Boreholes 10-106 to 10-114**


**Cone C-01**

RECORD OF BOREHOLE No 10-106

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 374 013.8 E 369 231.2 ORIGINATED BY JM  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2010.01.22 - 2010.01.22 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
255.8																	
0.0	CRUSHED ROCK, some organics Dark Brown (FILL)		1	SS	52												
255.1																	
0.7	END OF BOREHOLE AT 0.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.						255										

RECORD OF BOREHOLE No 10-107

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 374 060.7 E 369 235.9 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hand Shovel COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.23 - 2010.01.23 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
263.6 0.0	BEDROCK AT SURFACE.																

ONTMT4S 1156.GPJ 4/15/10

# RECORD OF BOREHOLE No 10-107A

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 374 044.2 E 369 228.7 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.23 - 2010.01.23 CHECKED BY TH

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 <sup>3</sup>	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 <sub>p</sub> w w <sub>L</sub>				
260.5	Silty SAND, some gravel, occasional roots Compact Brown Frozen (FILL)		1	SS	17												
259.8																	
0.8	END OF BOREHOLE AT 0.8m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 10-108

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+485 20m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.08 - 2010.01.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL MOISTURE      LIQUID CONTENT      LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	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	ICE and WATER		1	SS	8												
	PEAT, some roots Dark Brown Frozen to Wet		2	SS	5												
			3	SS	18												
1.9	SAND and SILT Compact Brown Wet		4	SS	23												
			5	SS	6												
2.7	SILT, trace sand, trace clay Loose Grey Moist to Wet																
4.6	SAND and GRAVEL, trace silt Very Dense Grey Wet		6	SS	100/												
4.9	END OF BOREHOLE AT 4.9m UPON AUGER REFUSAL. BOREHOLE OPEN TO 1.1m AND WATER LEVEL AT 0.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
10 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 10-109

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+510 45m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.08 - 2010.01.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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 (%) PLASTIC LIMIT    NATURAL MOISTURE CONTENT    LIQUID LIMIT w <sub>p</sub> w    w <sub>L</sub>		
0.0	PEAT, some roots Dark Brown Frozen		1	SS	6												
0.8	SAND, some silt, some gravel Compact to Dense Dark Brown to Grey Moist		2	SS	16												
			3	SS	36												22 54 21 3
2.2	END OF BOREHOLE AT 2.2m UPON AUGER REFUSAL. BOREHOLE OPEN TO 2.1m AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.91m slotted screen.  WATER LEVEL READINGS: DATE      DEPTH (m)    ELEV. (m) 2010.01.31    1.0      - 2010.03.01    1.1      -																



# RECORD OF BOREHOLE No 10-111

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+600 42m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.07 - 2010.01.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	Sandy SILT, trace gravel, some roots Compact to Loose Dark Brown to Brown Frozen to Moist		1	SS	25									○				
			2	SS	9									○				
			3	SS	20									○			0 24 70 6	
2.3	SILT, some sand Compact to Loose Brown Moist to Wet		4	SS	14									○				
			5	SS	7									○			0 2 93 6	
4.6	SAND, trace silt Compact Brown Moist to Wet		6	SS	16									○				
6.1	SILT, some clay, trace sand Loose to Compact Brown Moist  Occasional cobble		7	SS	10									○			0 7 82 11	
7.6	SAND, some silt, trace gravel, occasional cobbles Compact to Very Dense Grey Moist		8	SS	27									○				
			9	SS	35									○				

Continued Next Page

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10-111

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+600 42m LT ORIGINATED BY JM  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2010.01.07 - 2010.01.07 CHECKED BY TH

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 <sup>3</sup>	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 <sub>P</sub>	W	W <sub>L</sub>			
	Continued From Previous Page																
	SAND, some silt, trace gravel, some rock fragments Very Dense Grey Moist		10	SS	53												
12.0	END OF BOREHOLE AT 12.0m UPON AUGER REFUSAL. BOREHOLE OPEN TO 11.4m AND WATER LEVEL AT 6.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																

+<sup>3</sup> ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-112

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+670 48m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.09 - 2010.01.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	TOPSOIL, some roots Dark Brown Frozen		1	SS	3									
0.8	SAND, some silt to silty Loose to Compact Brown Moist		2	SS	4									
			3	SS	11									
			4	SS	20									
			5	SS	18									
			6	SS	20									
			7	SS	20									
			8	SS	24									
9.1	Sandy SILT, trace clay Loose to Compact Brown Wet		9	SS	5									

Continued Next Page

+ 3, X 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-112

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+670.48m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.09 - 2010.01.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	w <sub>p</sub>	w	w <sub>L</sub>		
Continued From Previous Page																	
	Sandy SILT, some clay Compact Brown Wet		10	SS	12											0 34 60 6	
			11	SS	23												
			12	SS	25												
14.2	SAND, some gravel, trace silt Compact to Very Dense Grey Wet		13	SS	100/ 0.125											15 75 10 (SI+CL)	
15.9	END OF BOREHOLE AT 15.9m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2010.01.31 1.5 -																

# RECORD OF BOREHOLE No 10-113

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+740 17m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.06 - 2010.01.06 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	20	40	60										
0.0	<b>SAND</b> , some silt to silty, trace gravel Compact to Very Dense Brown Moist		1	AS																
	Occasional cobble		1	SS	13															
			2	SS	21															
			3	SS	31															
			4	SS	72															
			5	SS	32															
6.1	<b>SAND</b> , trace silt, trace gravel Dense Brown to Dark Brown Moist		6	SS	36															
7.6	<b>SILT</b> , some sand, trace clay Dense Brown Moist to Wet		7	SS	41															
			8	SS	22															

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-113

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+740 17m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.06 - 2010.01.06 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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
	Continued From Previous Page																			
	SILT, some sand, trace clay Dense Brown Moist		9	SS	14											0 20 73 7				
12.2	SAND, some silt Compact Brown to Grey Wet		10	SS	25															
13.7	Sandy SILT, trace gravel Compact Brown to Grey Wet		11	SS	16											2 30 62 6				
14.5	END OF BOREHOLE AT 14.5m UPON AUGER REFUSAL. BOREHOLE OPEN TO 10.4m AND WATER LEVEL AT 7.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																			

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

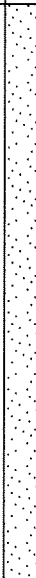


# RECORD OF BOREHOLE No 10-114

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+870 45m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.09 - 2010.01.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	SAND, some silt, trace gravel, roots Loose to Compact Brown Moist		1	SS	59												7 73 20 (SI+CL)			
			2	SS	18															
			3	SS	12															
			4	SS	5															
			5	SS	20												3 73 19 5			
3.8	END OF BOREHOLE AT 3.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																			

+<sup>3</sup> . X<sup>3</sup> : Numbers refer to  
Sensitivity

20  
15  
10


(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No C-001

1 OF 1

METRIC

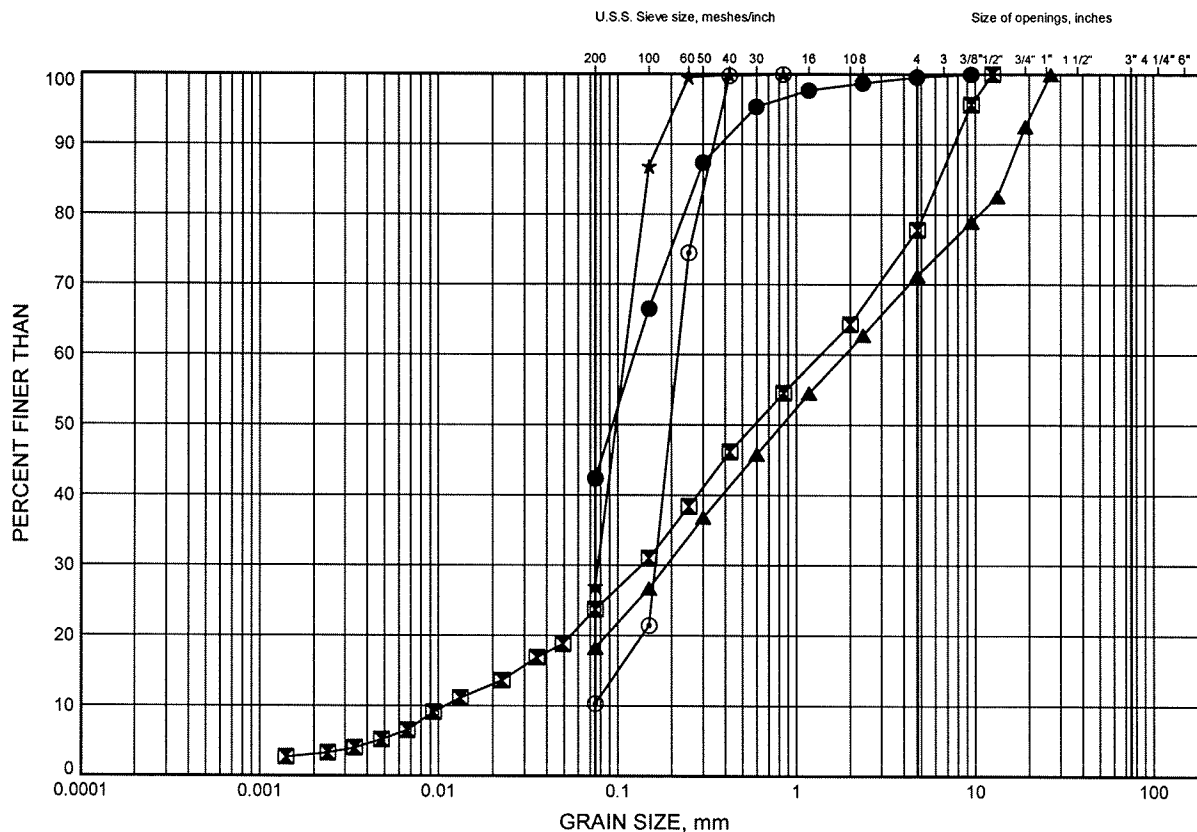
G.W.P. 334-94-00 LOCATION HWY 11/17, Sta. 29+510, 1m LT ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.08 - 2010.01.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT	WATER CONTENT (%)	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
0.0	ICE											
0.3	DCPT from surface											
0.9	END OF DCPT AT 0.9m.											

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE D1

SAND to SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-108	2.51	
⊠	10-109	1.83	
▲	10-110	2.59	
★	10-112	3.35	
⊙	10-112	6.40	

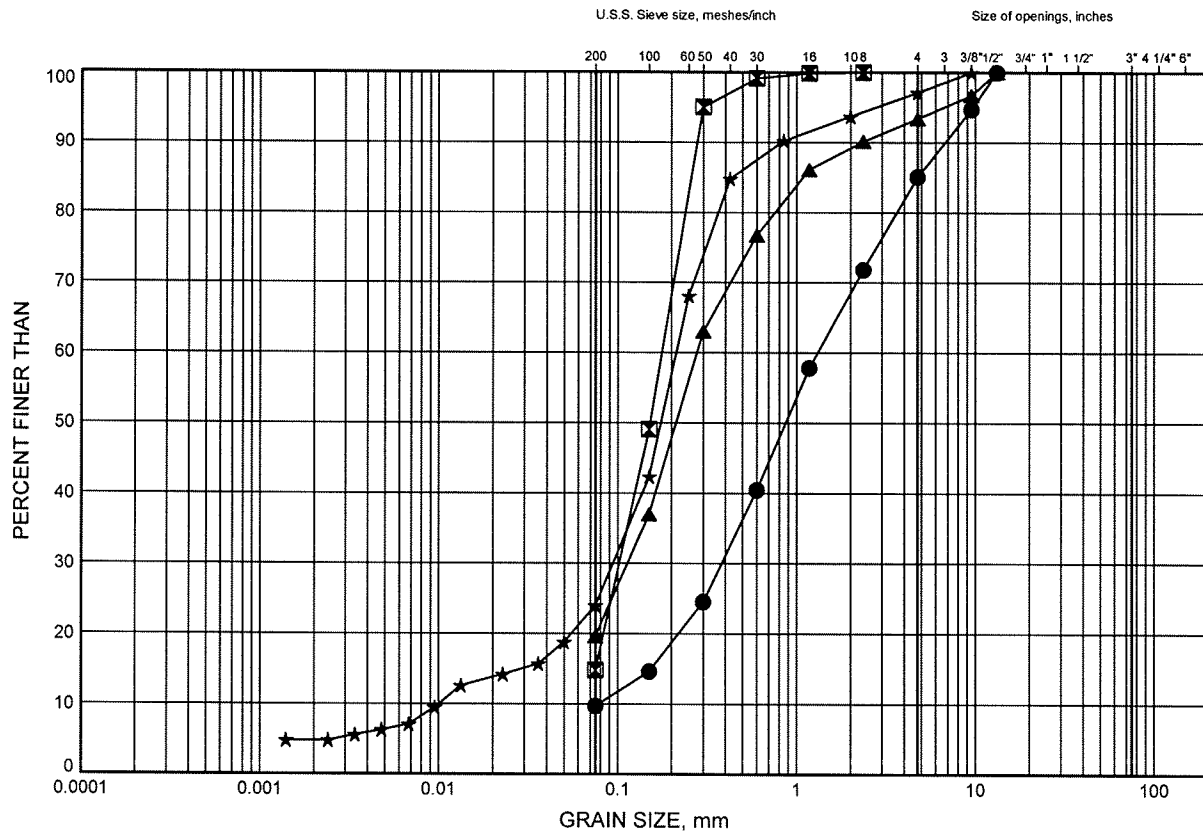


W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....

Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE D2

**SAND to SILTY SAND**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-112	15.47	
⊠	10-113	2.59	
▲	10-114	1.83	
★	10-114	3.35	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

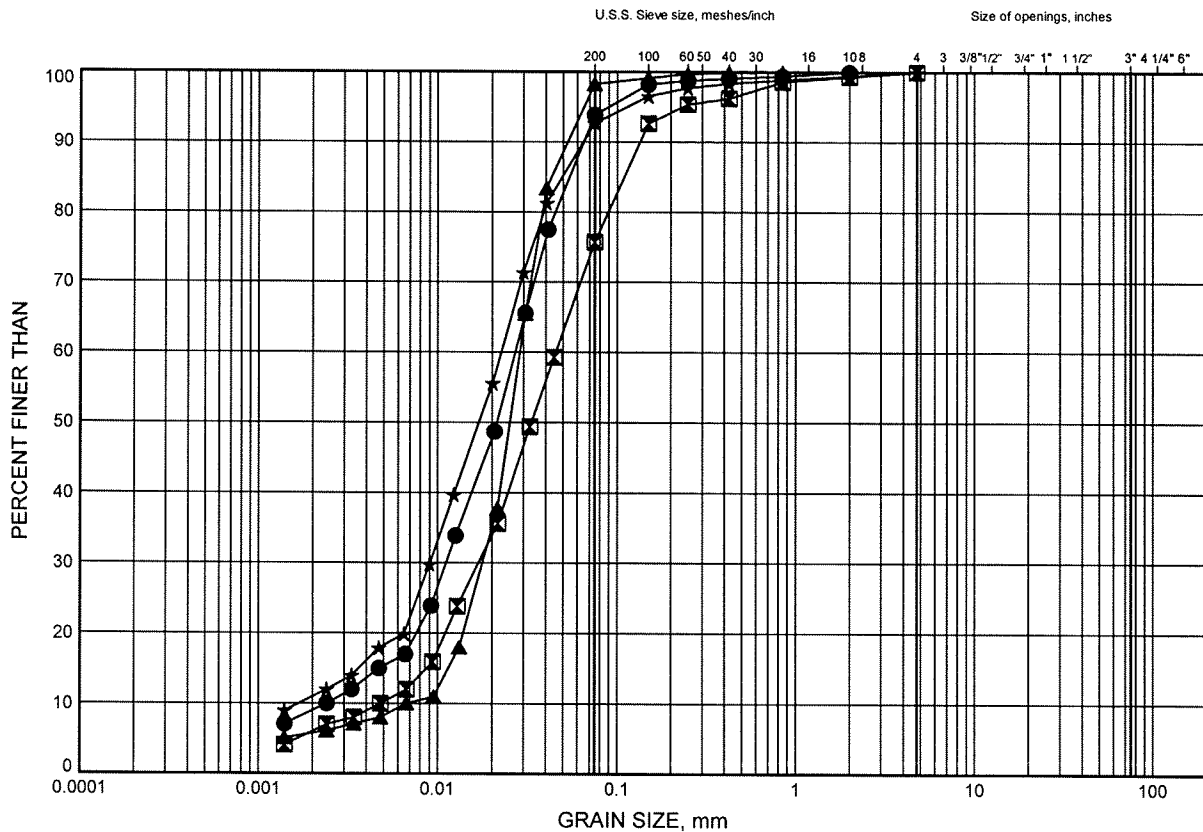
W.P.# 334-94-00  
 Prepared By AN  
 Checked By MRA



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE D3

SILT to SANDY SILT



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

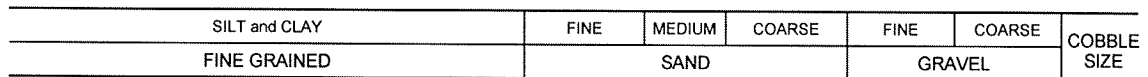
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-108	2.82	
⊠	10-111	1.83	
▲	10-111	3.35	
★	10-111	6.40	

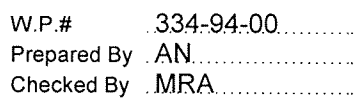


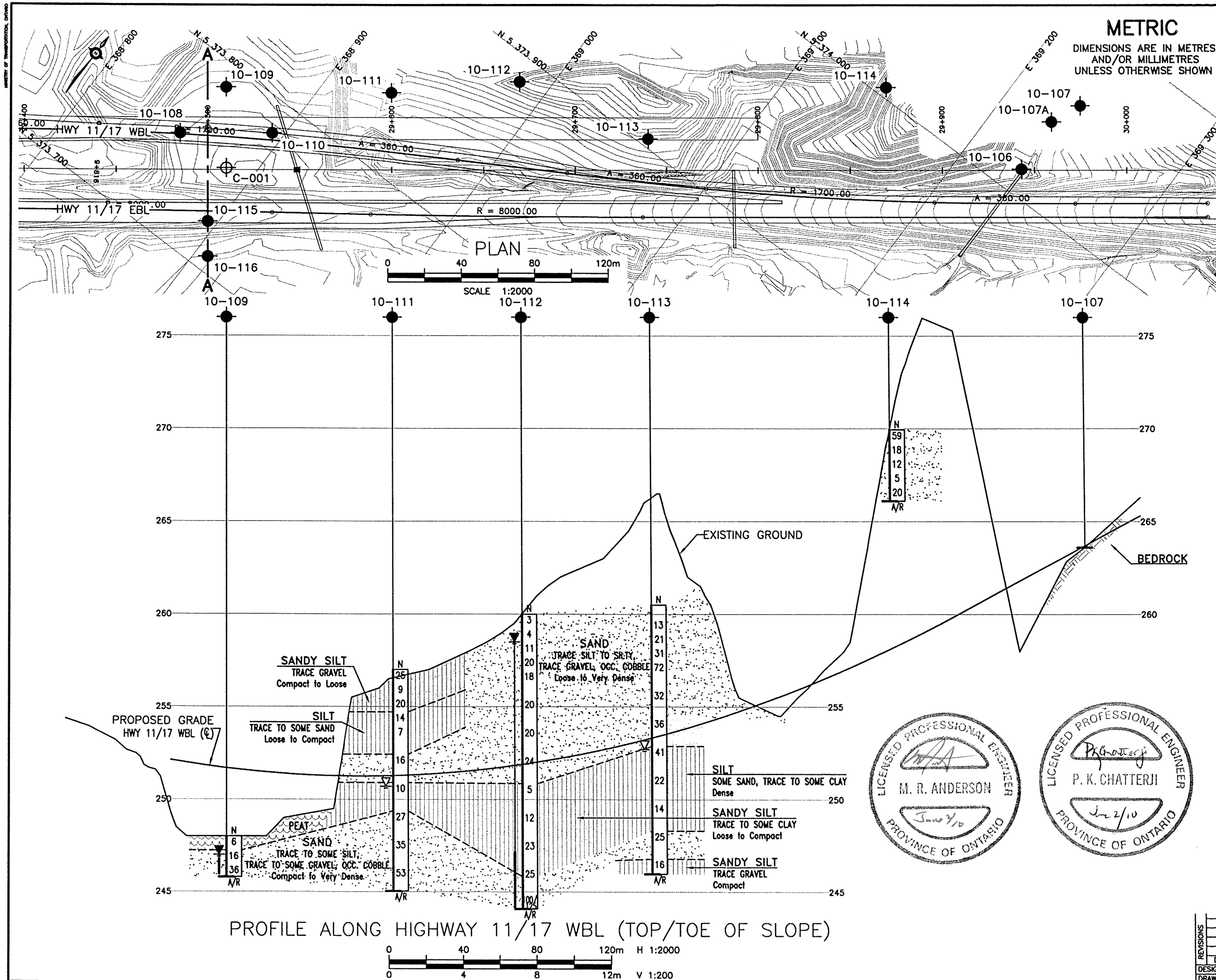
W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....

## FIGURE D4



SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-112	10.97	
⊠	10-113	7.92	
▲	10-113	10.97	
★	10-113	14.00	





CONT No  
WP No 334-94-00

HIGHWAY 11/17  
WESTBOUND LANES  
29+450 TO 30+000  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** MCCORMICK RANKIN CORPORATION

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

**KEYPLAN**  
LEGEND

◆ Borehole  
⊕ Cone  
N Blows /0.3m (Std Pen Test, 475J/blow)  
CONE Blows /0.3m (60° Cone, 475J/blow)  
PH Pressure, Hydraulic  
W Water Level  
H Head Artesian Water  
P Piezometer  
90% Rock Quality Designation (RQD)  
A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
10-106	255.8	5 374 013.8	369 231.2
10-107	263.6	5 374 060.7	369 235.9
10-107A	260.5	5 374 044.2	369 228.7

NO	STATION	OFFSET
10-108	29+485	20m LT.
10-109	29+510	45m LT.
10-110	29+535	20m LT.
10-111	29+600	42m LT.
10-112	29+670	48m LT.
10-113	29+740	17m LT.
10-114	29+870	45m LT.
10-115	29+500	28m RT.
10-116	29+500	47m RT.
C-001	29+510	1.0m LT.

**-NOTES-**

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**

**REVISIONS**

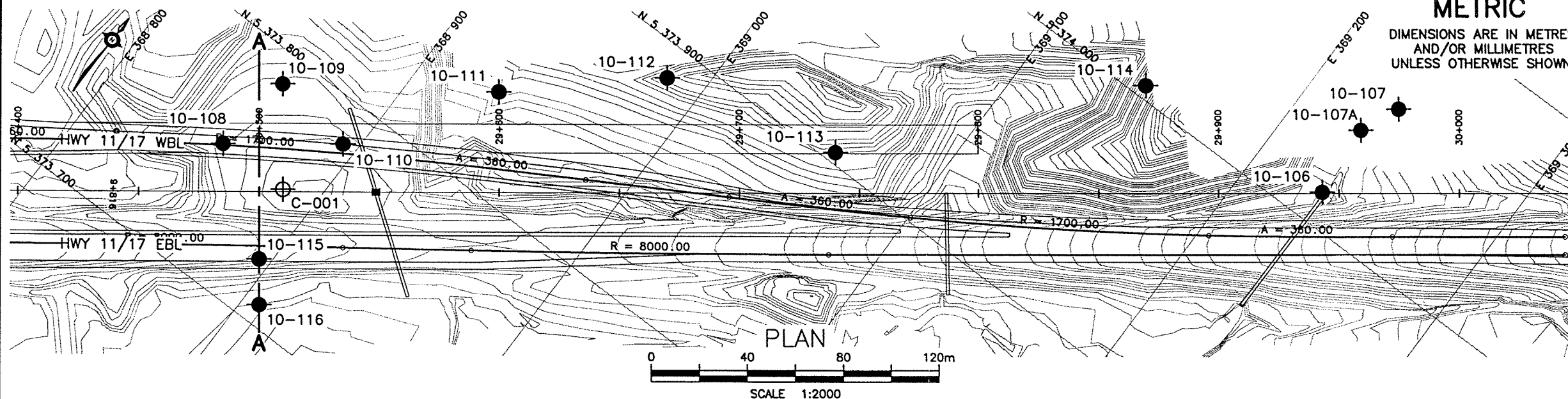
DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG
DRAWN	MFA	CHK PKC

DATE JUN. 2010  
DWG D1

**PROFESSIONAL ENGINEER**  
M. R. ANDERSON  
PROVINCE OF ONTARIO

**PROFESSIONAL ENGINEER**  
P. K. CHATTERJI  
PROVINCE OF ONTARIO

REVISION: 01/01/2010  
PLOT DATE: Jun 01, 2010



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

CONT No  
WP No 334-94-00

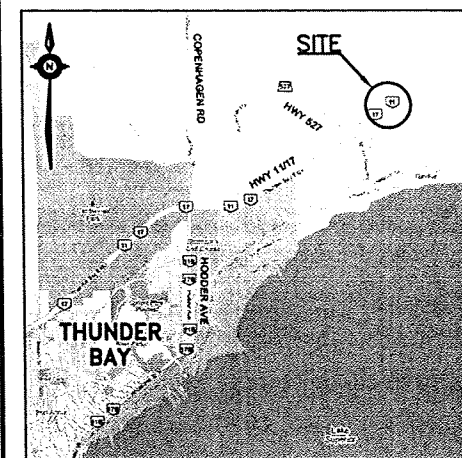
HIGHWAY 11/17  
WESTBOUND LANES  
29+450 TO 30+000  
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

**MRC** MCCORMICK RANKIN  
CORPORATION

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



**KEYPLAN**

**LEGEND**

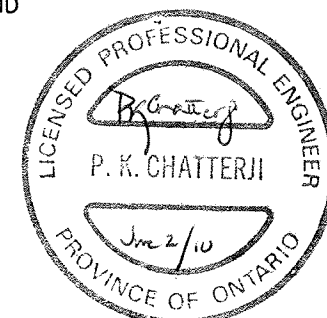
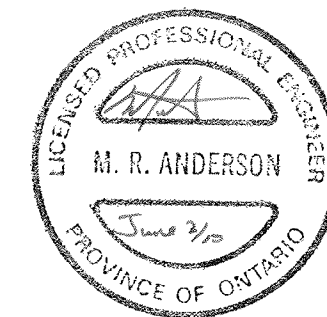
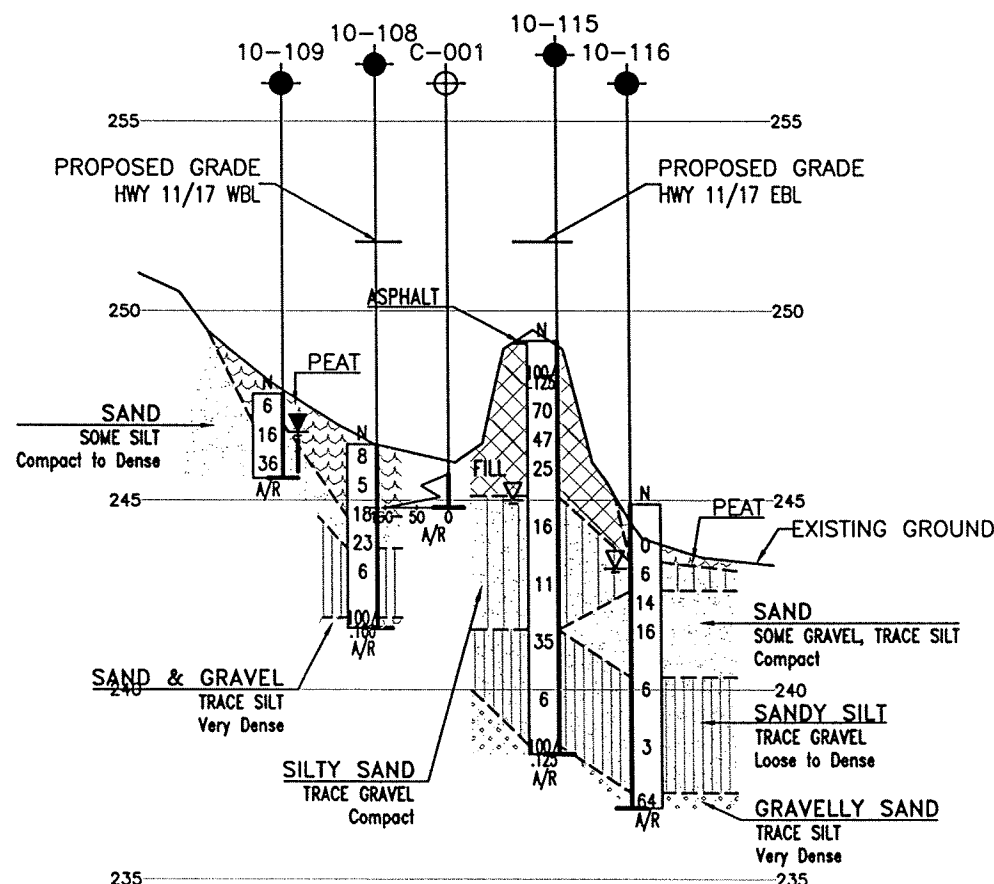
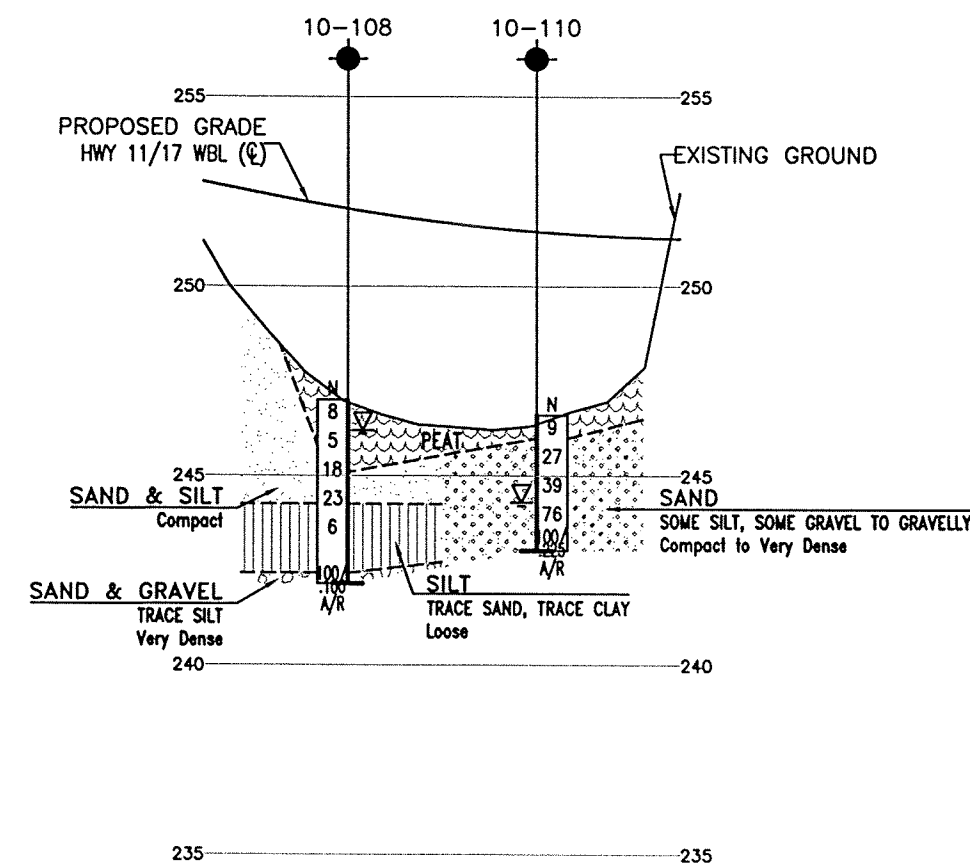
- ◆ Borehole
- ⊕ Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- HA Head Artesian Water
- PZ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
10-106	255.8	5 374 013.8	369 231.2
10-107	263.6	5 374 060.7	369 235.9
10-107A	260.5	5 374 044.2	369 228.7
NO	STATION	C OFFSET	
10-108	29+485	20m LT.	
10-109	29+510	45m LT.	
10-110	29+535	20m LT.	
10-111	29+600	42m LT.	
10-112	29+670	48m LT.	
10-113	29+740	17m LT.	
10-114	29+870	45m LT.	
10-115	29+500	28m RT.	
10-116	29+500	47m RT.	
C-001	29+510	1.0m LT.	

**-NOTES-**

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
			STRUCT
			DWG D2



**Appendix E**

**Copenhagen Road**

**Station 9+550 to 9+950**

**Boreholes 09-47 to 09-64**

**Cones C-12 to C-19**

# RECORD OF BOREHOLE No 09-047

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 030.9 E 365 262.0 ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.14 - 2009.07.14 CHECKED BY TH

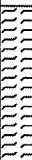


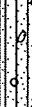
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
260.4														
0.0	ORGANICS, peat, with roots and rootlets Brown						260							
259.5														
0.9	Clayey SILT, topsoil stained, trace roots and rootlets Firm Dark Brown		1	SS	8		259							
258.9														
1.5	Clayey SILT and SAND, trace gravel Hard Brown (TILL)		2	SS	61									4 34 48 14
257.8							258							
2.6	END OF BOREHOLE AT 2.6m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		3	SS	50/126									

# RECORD OF BOREHOLE No 09-048

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+925, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.14 - 2009.07.14 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	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	ORGANICS, peat, with roots and rootlets Black																			
1.1	Clayey SILT, topsoil stained, with roots and rootlets Soft		1	SS	2									○						
1.5	Dark Brown																			
	SAND and SILT, trace clay, trace gravel Dense Brown Moist (TILL)		2	SS	33									○			8 47 37 8			
			3	SS	50/															
2.5	END OF BOREHOLE AT 2.5m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.125															

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-049

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+900 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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						
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT						
								w <sub>p</sub> w w <sub>L</sub>						
								WATER CONTENT (%)						
								20 40 60						
0.0	ORGANICS, peat Black												31.4	
			1	AS										
			1	SS	2									
1.2	Clayey SILT, trace sand Soft Brown to Grey													
			2	SS	3									
2.2	Silty SAND, trace clay, trace gravel Very Dense Brown to Grey Moist to Wet (TILL)													
			3	SS	65									9 56 30 6
			4	SS	50/									
3.3	END OF BOREHOLE AT 3.3m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.76m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.11.23 0.6 -				.050									

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-050

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+875, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

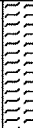

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
20 40 60 80 100														
					</									

RECORD OF BOREHOLE No 09-051

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+850 CL ORIGINATED BY SLL  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	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		x	LAB VANE						
								20	40	60	80	100					
0.0	ORGANICS, peat Black		1	AS												253	
0.9	Clayey SILT, trace sand Soft Grey		2	SS	3												
1.4	END OF BOREHOLE AT 1.4m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup> x<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-052

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+825, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE					W <sub>P</sub> W W <sub>L</sub> 20 40 60						
0.0	TOPSOIL, with roots: (50mm)																
	Silty SAND, with shale fragments																
	Brown																
	Moist																
	(TILL)		1	SS	100/												
0.8	END OF BOREHOLE AT 0.8m UPON AUGER REFUSAL ON PROBABLE BEDROCK. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.025												

RECORD OF BOREHOLE No 09-053

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta 9+800 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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					WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>				
							20	40	60	80	100	20	40	60			
0.0	TOPSOIL, with roots and rootlets (150mm)																
0.2	Silty SAND, with shale fragments Brown Moist (TILL)		1	SS	100/.125												
0.7	END OF BOREHOLE AT 0.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

ONTMT4S 1156.GPJ 3/17/10



**METRIC**[illegible][illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

## METRIC

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

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 09-056

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+725, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
0.0	ORGANICS, peat Black		1	AS										
0.4	Silty SAND, trace clay, trace gravel Loose Brown (TILL)		1	SS	7									3 59 31 6
1.5	END OF BOREHOLE AT 1.5m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.													

RECORD OF BOREHOLE No 09-057

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+700 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	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					WATER CONTENT (%)							
0.0	ORGANICS, peat, with roots and rootlets Black Wet		1	AS											175	GR SA SI CL	
0.8	Clayey SILT, trace sand Very Soft Grey		1	SS	1												
1.4	SILT, some clay to clayey, trace sand Stiff Grey  with thin sand seams		2	SS	9											0 3 86 11	
			3	SS	11										0 6 72 22		
			4	SS	9												
3.8	Silty SAND, some gravel Compact Grey Wet (TILL)		2	AS													
			5	SS	100/												
4.8	END OF BOREHOLE AT 4.8m. ARTESIAN PRESSURE AT APPROX. 0.9m ABOVE GROUND SURFACE. BOREHOLE SEALED WITH BENTONITE TO SURFACE.				.050												

+<sup>3</sup> ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-058

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+675, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	ORGANICS, peat Black		1	AS										GR SA SI CL
0.7	Clayey SILT, trace gravel, trace rootlets Firm Brown		1	SS	5									
1.4	Silty SAND, some gravel, trace clay, occasional cobbles Dense to Compact Brown Wet (TILL)		2	SS	40									
			3	SS	13									
			4	SS	14									
3.8	END OF THE BOREHOLE AT 3.8m UPON AUGER REFUSAL. BOREHOLE OPEN TO 1.9m AND WATER LEVEL AT 0.6m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE TO 1.2m THEN CUTTINGS TO SURFACE.													13 55 25 7

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-059

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+650 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

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 <sup>3</sup>	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			WATER CONTENT (%) w <sub>P</sub> w w <sub>L</sub>				
0.0	ORGANICS, peat Black		1	AS											
0.7	Clayey SILT, some sand seams Soft to Very Soft Brown		1	SS	3										
			2	SS	1										0 10 72 18
2.2	Silty SAND, some gravel, trace clay Loose to Very Dense Brown Moist to Wet (TILL)		3	SS	6										
	Sand and Gravel Lense		4	SS	26										39 43 18 (SI+CL)
	becoming grey		5	SS	66										
			6	SS	100/ .150										
5.6	END OF BOREHOLE AT 5.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.61m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.11.23 1.4 - 2010.03.01 1.2 -														

+<sup>3</sup> . X<sup>3</sup> : Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-060

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+625, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH




SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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					WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>				
0.0	ORGANICS, peat Black																
0.5	Silty SAND, some gravel, trace clay, occasional cobbles Loose to Dense Dark Brown Moist (TILL)		1	SS	6											11 50 33 6	
			2	SS	50/												
1.8	END OF BOREHOLE AT 1.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 09-061

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+600 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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					
0.0	ORGANICS, with roots and rootlets					▽											
0.3	Clayey SILT, some sand, trace gravel, trace rootlets Soft Dark Brown		1	SS	3												
1.8	Silty SAND, trace clay, trace gravel, occasional cobbles Dense Dark Brown to Brown Moist (TILL)		2	SS	46												
			3	SS	44												
			4	SS	507												
3.2	END OF BOREHOLE AT 3.2m UPON AUGER REFUSAL. BOREHOLE OPEN AND WATER LEVEL AT 2.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE TO 2.1m, THEN CUTTINGS TO SURFACE.				.075												

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 09-062A

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 403.2 E 365 250.9 ORIGINATED BY SLL  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
256.2														
0.0	TOPSOIL, with roots and rootlets													
0.2	Silty SAND, some gravel, trace clay Loose Brown Wet (TILL)		1	SS	4									12 57 23 9
254.6														
1.5	END OF BOREHOLE AT 1.5m UPON AUGER REFUSAL. BOREHOLE OPEN TO 1.1m AND WATER LEVEL AT 0.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.													

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity




20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-062B

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 421.6 E 365 255.9 ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.14 - 2009.07.14 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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									
256.8								20	40	60	80	100					
0.0	ORGANICS, with roots and rootlets Black																
256.5																	
0.3	Silty CLAY, topsoil stained, trace roots and rootlets Soft to Firm Dark Brown		1	SS	4		256										
255.4																	
1.4	Silty SAND		2	SS	507												
255.1	Very Dense Brown																
1.7	(TILL)				.075												
END OF BOREHOLE AT 1.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																	

# RECORD OF BOREHOLE No 10-062C

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 404.5 E 365 240.7 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.31 - 2010.01.31 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB VANE					PLASTIC LIMIT w <sub>p</sub> NATURAL MOISTURE CONTENT w    LIQUID LIMIT w <sub>L</sub>	
256.0							20 40 60 80 100							
0.0	PEAT, trace roots Dark Brown Frozen		1	AS		▽	256					155	10 48 38 4	
			1	SS	3		255							152
254.4														
1.5	SAND and SILT, some gravel Compact Grey Moist (TILL)		2	SS	15		254							
253.6			3	SS	100/									
2.4	END OF BOREHOLE AT 2.4m UPON AUGER REFUSAL. BOREHOLE OPEN TO 1.7m, AND WATER LEVEL AT 1.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 1.2m, THEN BENTONITE TO SURFACE.				0.100									

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-063

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 405.5 E 365 261.0 ORIGINATED BY SLL  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
256.3														
0.0	ORGANICS, peat		1	AS										
256.0	Black													
0.3	SAND and SILT, some clay, trace gravel Compact Grey Wet (TILL)		1	SS	17		256							
254.7							255							4 48 38 10
1.5	END OF BOREHOLE AT 1.5m UPON AUGER REFUSAL. BOREHOLE OPEN AND WATER LEVEL AT 1.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.													

+<sup>3</sup> . X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-063B

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 372 428.0 E 365 280.1 ORIGINATED BY JM  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.31 - 2010.01.31 CHECKED BY TH

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 <sup>3</sup>	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							
256.5							20   40   60   80   100				20   40   60				
0.0	PEAT, trace roots Dark Brown Frozen to Moist		1	AS											
	Occasional silt Very Loose		1	SS	0										
		2	SS	0											
254.5															
2.0	SILT, some clay, trace sand Loose to Compact Grey Moist														
			3	SS	16										
			4	SS	8										
252.3															
4.3	Silty CLAY, some sand, trace gravel Firm Grey Moist														
251.7			5	SS	8										
4.9	Silty SAND, trace gravel Loose to Compact Grey Moist														
251.1															
5.4	END OF BOREHOLE AT 5.4m UPON AUGER REFUSAL. BOREHOLE OPEN TO 3.7m, AND WATER LEVEL AT 0.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO 2.1m, THEN BENTONITE TO SURFACE.														

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-064

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+550 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.14 - 2009.07.14 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	Gravelly SAND, some silt Brown Moist (FILL)		1	AS										
1.1	Clayey SILT, topsoil stained Firm Brown (FILL)		1	SS	7									22 61 17 (SI+CL)
1.6	ORGANICS, peat, with roots Firm to Soft Black		2	SS	5									
2.2	SAND													
2.4	Loose Grey Wet  Silty CLAY, trace sand Firm Grey		3	SS	4									
3.1	END OF BOREHOLE AT 3.1m UPON AUGER REFUSAL. BOREHOLE BACKFILLED WITH BENTONITE TO 2.3m, THEN CUTTINGS TO SURFACE.		4	SS	50/ .100									

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No C-012

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+925, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
0.0	DCPT from surface.													
2.7	END OF DCPT AT 2.7m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													

ONTMT4S 1156.GPJ 3/17/10

# RECORD OF BOREHOLE No C-013

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+875, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W <sub>P</sub>	W	W <sub>L</sub>			
0.0	DCPT from surface.						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE 20 40 60 80 100							
3.0	END OF DCPT AT 3.0m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													

ONTMT4S 1156.GPJ 3/17/10



RECORD OF BOREHOLE No C-014

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+825, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
0.0	DCPT from surface.													
0.5	END OF DCPT AT 0.5m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													

# RECORD OF BOREHOLE No C-015

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta 9+775, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
0.0	DCPT from surface.													
1.2	END OF DCPT AT 1.2m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													

RECORD OF BOREHOLE No C-016

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+725, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

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 <sup>3</sup>	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 <sub>P</sub>	W	W <sub>L</sub>		
0.0	DCPT from surface.							20	40	60	80	100	20	40	60		
2.3	END OF DCPT AT 2.3m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.																

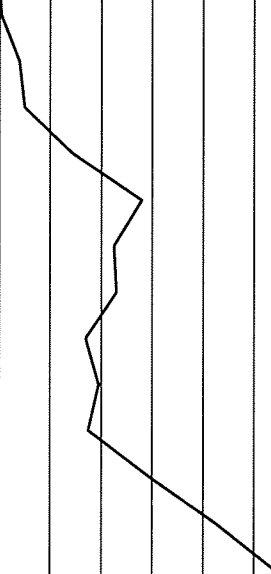
ONTMT4S 1156.GPJ 3/17/10

# RECORD OF BOREHOLE No C-017

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+675, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT      NATURAL LIMIT      MOISTURE      LIQUID CONTENT      LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	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							
								○ UNCONFINED      + FIELD VANE							
								● QUICK TRIAXIAL      × LAB VANE							
								20   40   60   80   100							
0.0	DCPT from surface.														
4.8	END OF DCPT AT 4.8m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.														

ONTMT4S 1156.GPJ 3/17/10

RECORD OF BOREHOLE No C-018

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+625, 10m RT ORIGINATED BY SLL  
HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	DCPT from surface.																
3.6	END OF DCPT AT 3.6m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.																

ONTMT4S 1156.GPJ 3/17/10

RECORD OF BOREHOLE No C-019

1 OF 1

METRIC

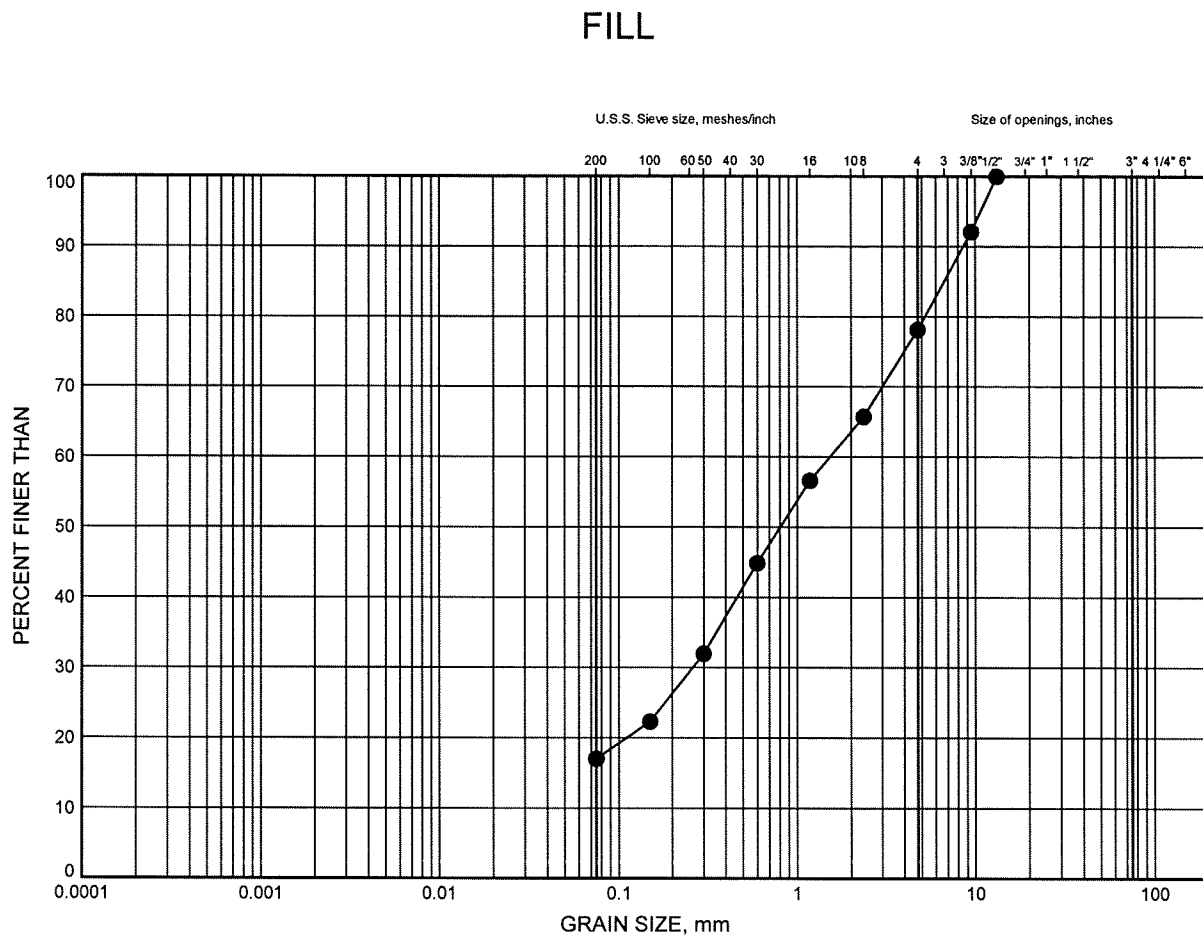
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 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.13 - 2009.07.13 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
0.0	DCPT from surface.																
2.0	END OF DCPT AT 2.0m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.																

ONTWT4S 1156.GPJ 3/17/10

# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE E1



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

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-064	0.91	

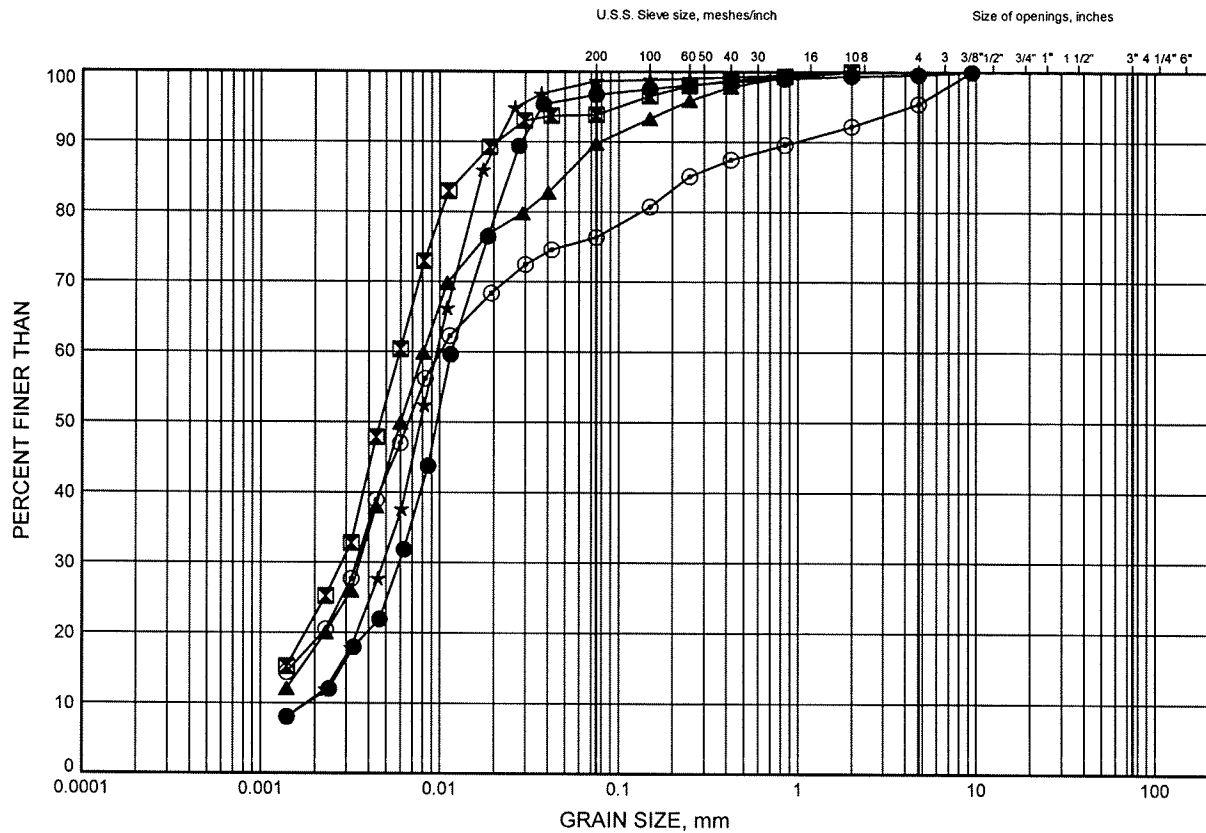


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE E2

CLAYEY SILT to SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-057	1.83	
⊠	09-057	2.59	
▲	09-059	1.83	
★	10-063B	2.59	253.94
⊙	10-063B	4.80	251.73



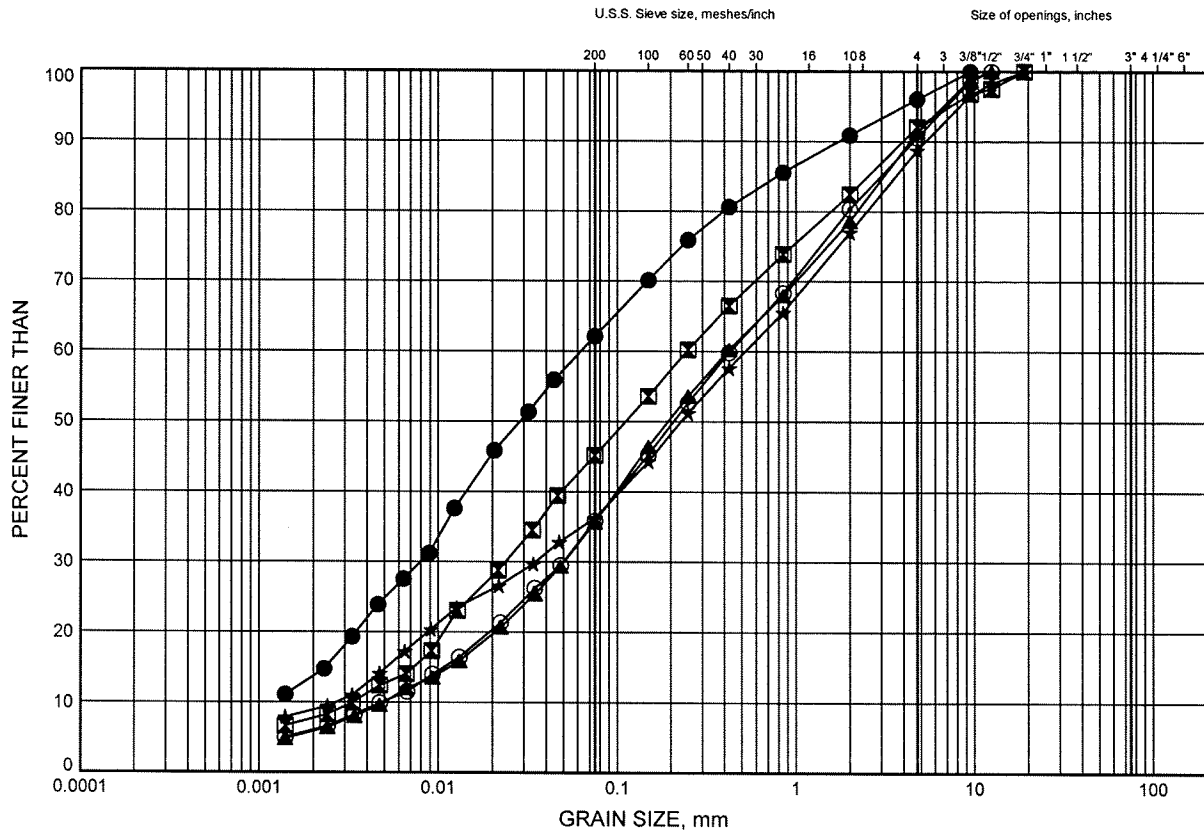
W.P.# 334-94-00  
Prepared By AN  
Checked By MRA



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE E3

SILTY SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-047	1.83	258.57
⊠	09-048	1.83	
▲	09-049	2.59	
★	09-050	2.48	
⊙	09-054	1.76	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

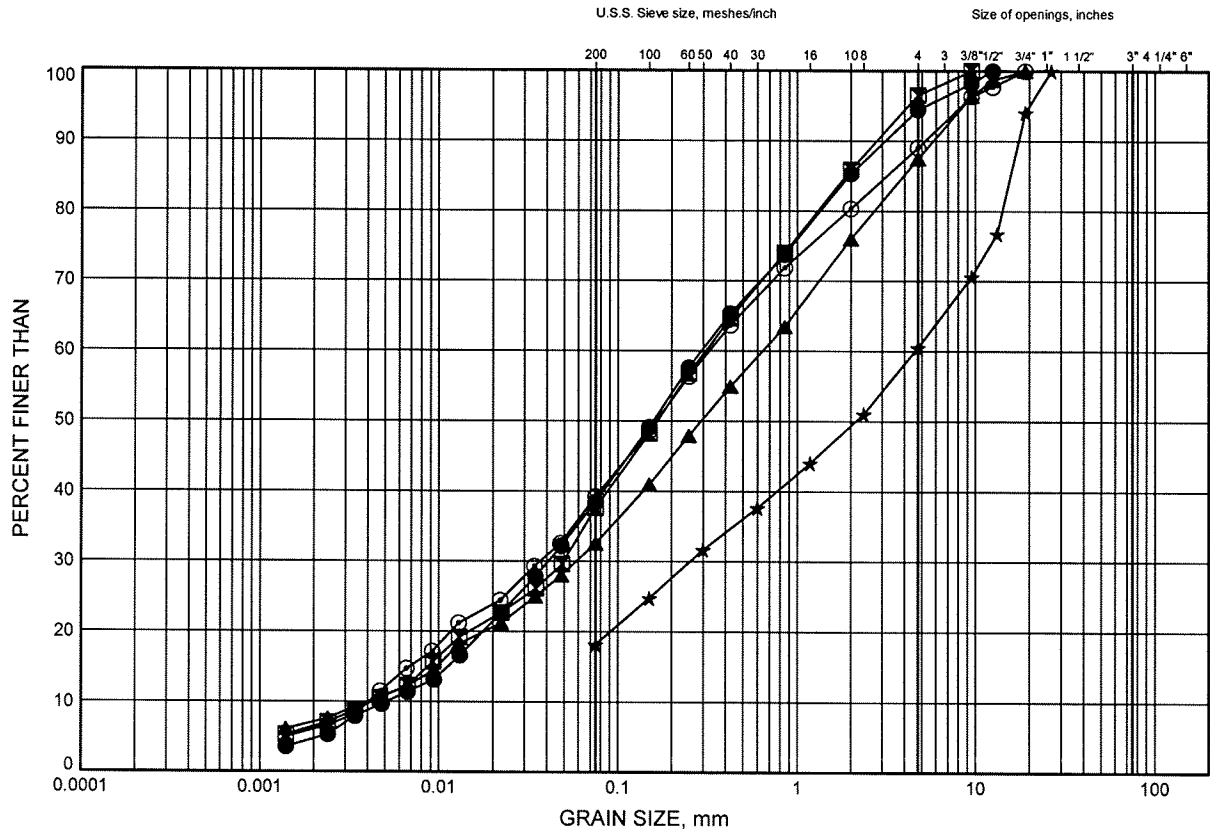
W.P.# 334-94-00  
Prepared By AN  
Checked By MRA



Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

**FIGURE E4**

**SILTY SAND TILL**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-055	1.07	
⊠	09-056	1.07	
▲	09-058	3.35	
★	09-059	3.35	
⊙	09-060	1.07	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

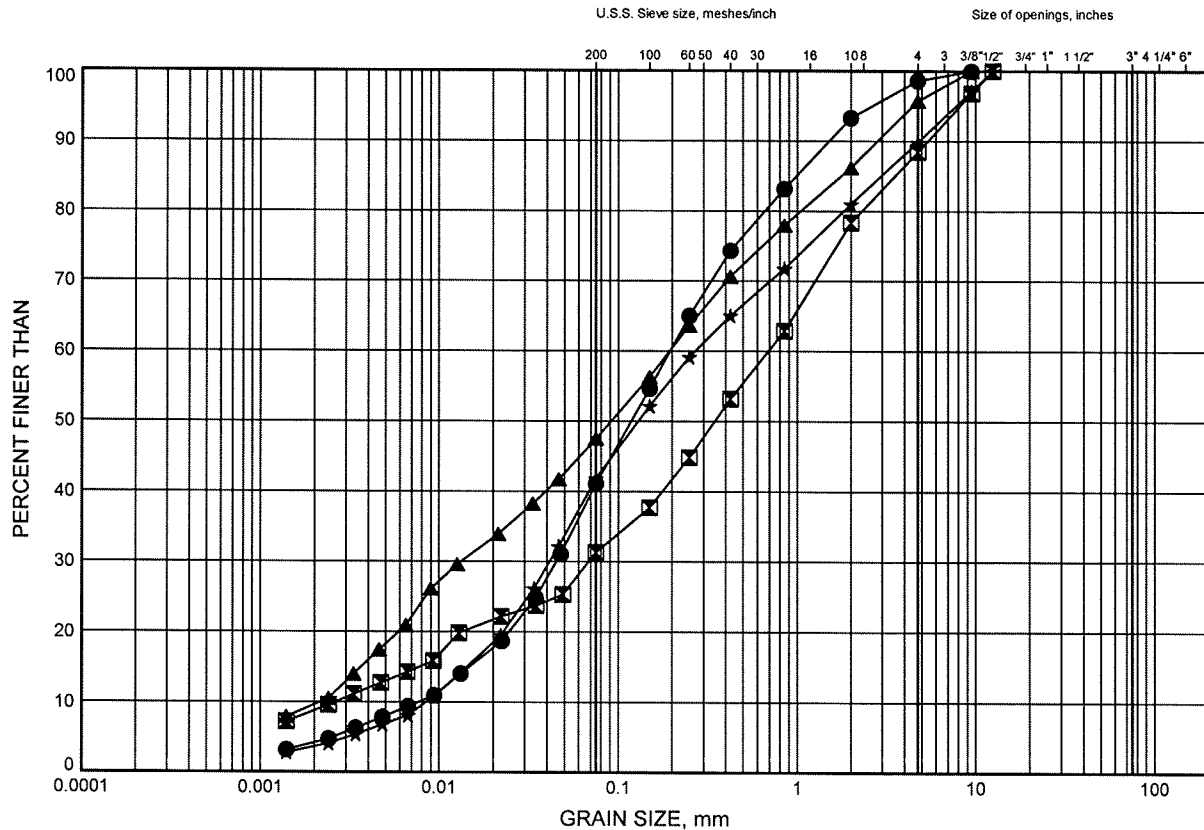
W.P.# 334-94-00  
 Prepared By AN  
 Checked By MRA



Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE E5

**SILTY SAND TILL**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-061	2.57	
⊠	09-062A	1.07	255.11
▲	09-063	1.07	255.21
★	10-062C	1.83	254.14

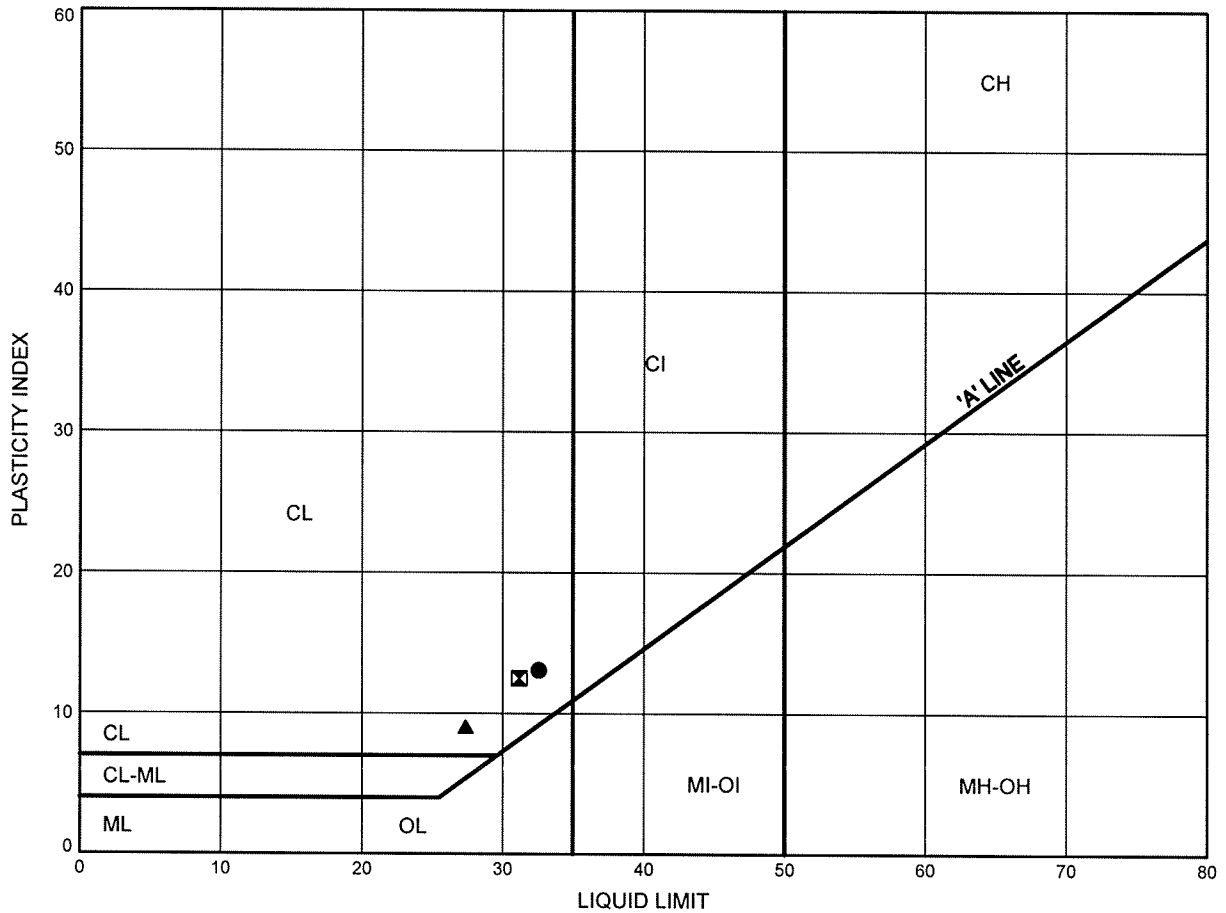


W.P.# 334-94-00  
 Prepared By AN  
 Checked By MRA

Hwy 11/17 Hodder Avenue  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE E6

**CLAYEY SILT to SILTY CLAY**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-057	2.59	
⊠	09-059	1.83	
▲	10-063B	4.80	251.73

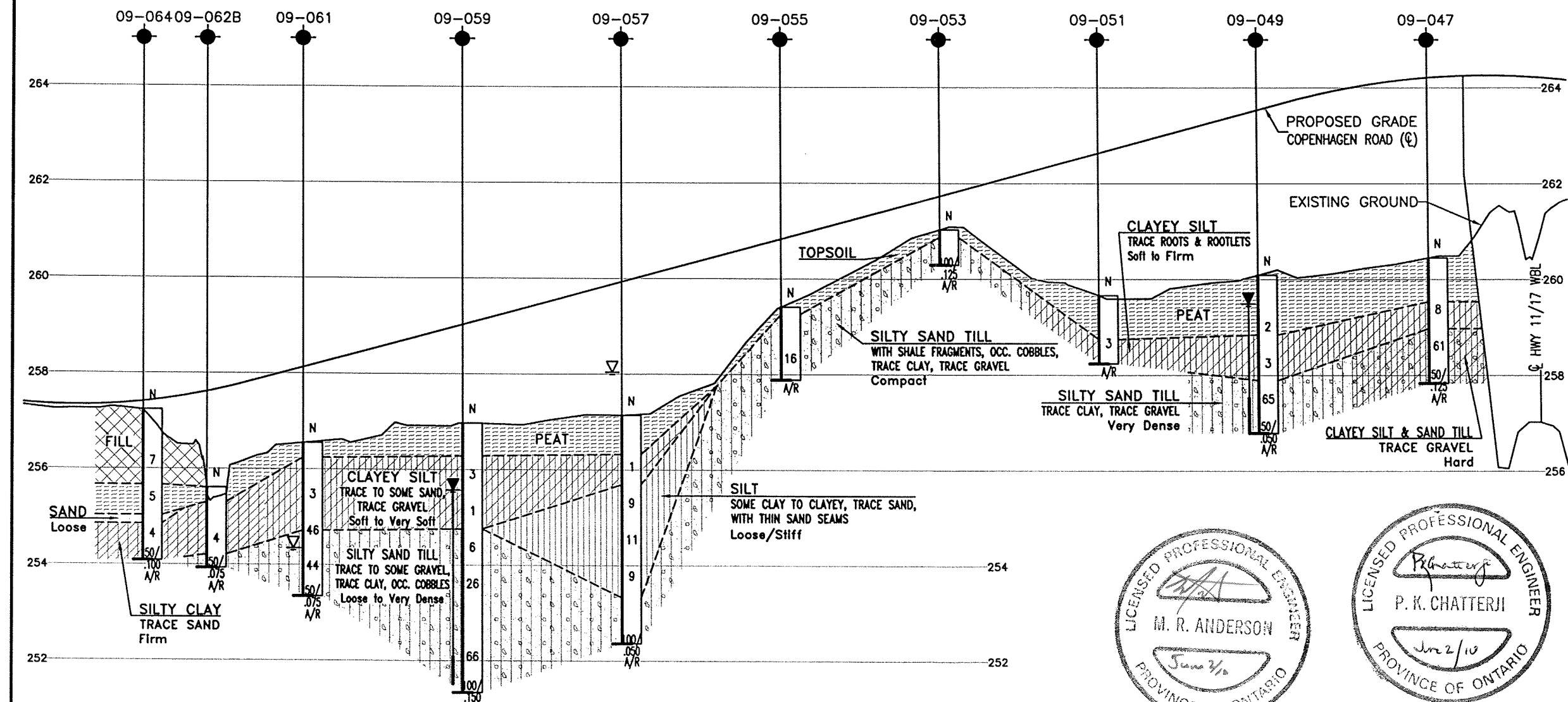
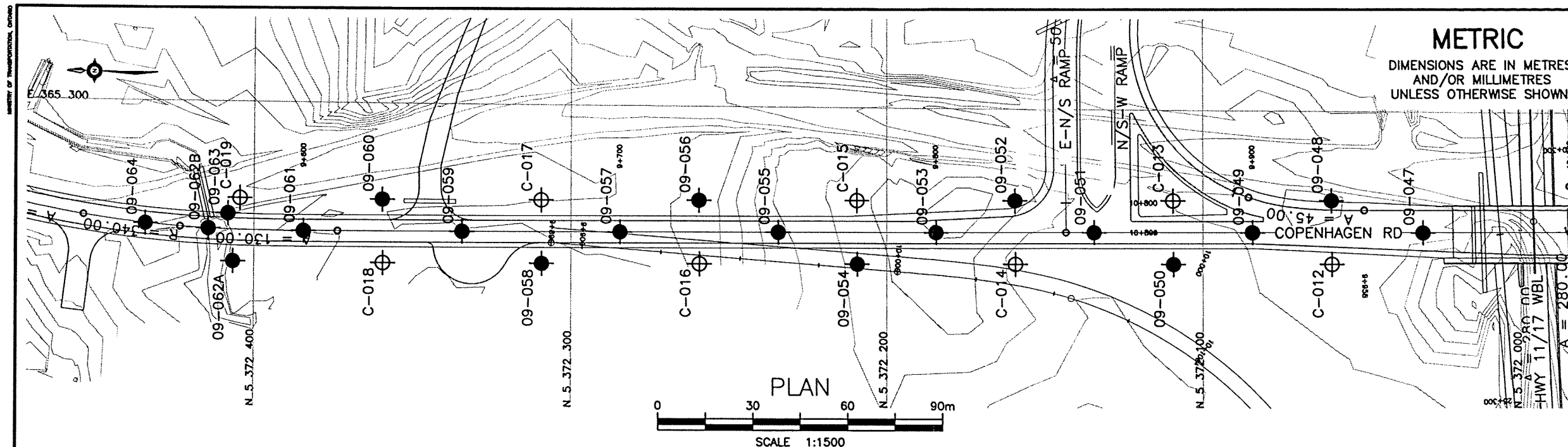
Date April 2010

Project 334-94-00



Prep'd AN

Chkd. MRA

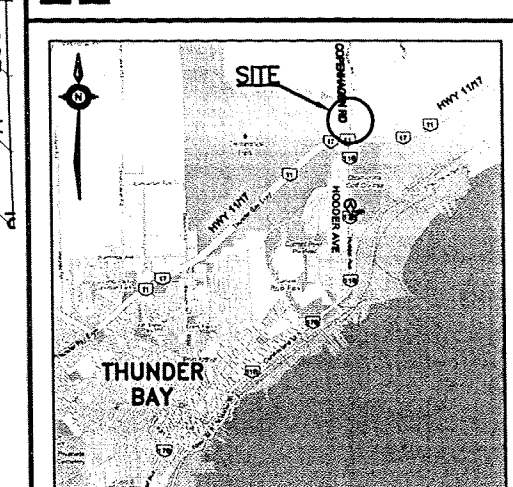


CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
COPENHAGEN ROAD (C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** **MCCORMICK RANKIN CORPORATION**

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



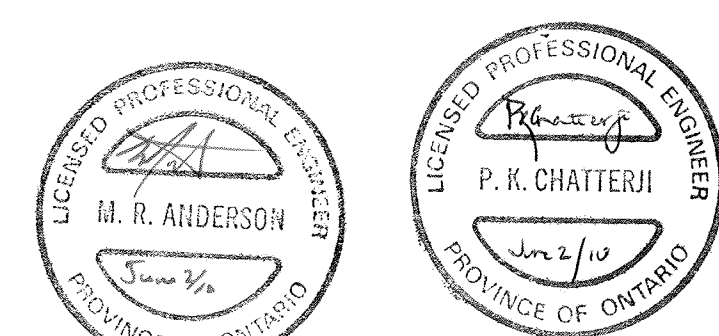
**LEGEND**

- Borehole
- Cone
- Borehole and Cone
- N  
Blows /0.3m (Std Pen Test, 475J/blow)
- CONE  
Blows /0.3m (60° Cone, 475J/blow)
- PH  
Pressure, Hydraulic
- W  
Water Level in Open Borehole
- H  
Head Artesian Water
- P  
Piezometer
- 90%  
Rock Quality Designation (RQD)
- A/R  
Auger Refusal

NO	STATION	C OFFSET
09-047	9+953.5	0m
09-049	9+900	0m
09-051	9+850	0m
09-053	9+800	0m
09-055	9+750	0m
09-057	9+700	0m
09-059	9+650	0m
09-061	9+600	0m
09-062B	9+570	0m
09-064	9+550	0m

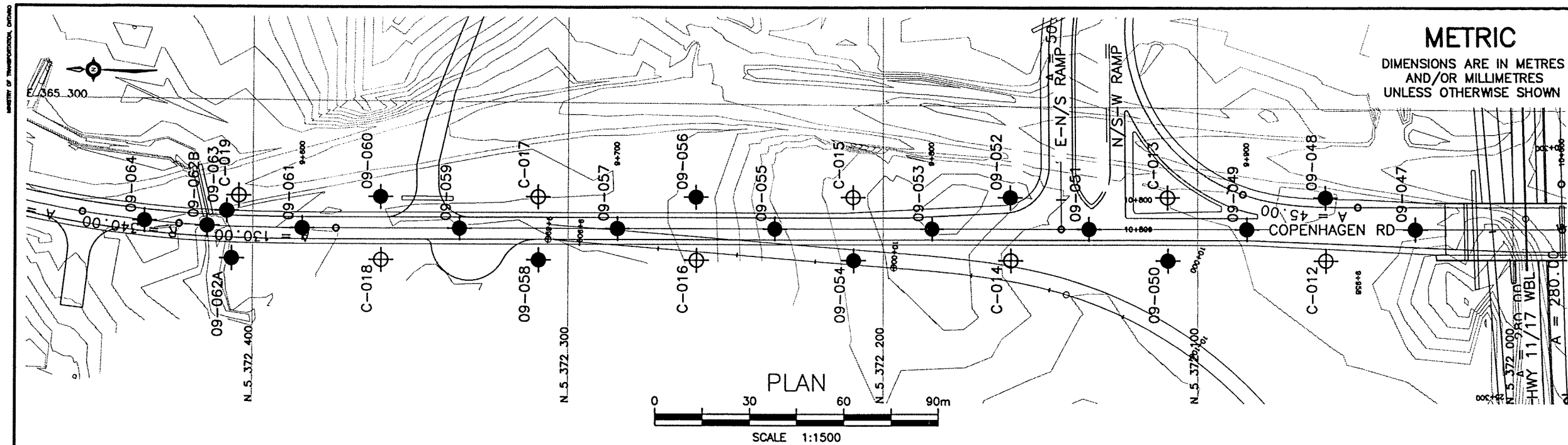
- NOTES**
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
  - This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
LOAD			
STRUCT			
DWG			

FILENAME: G:\Drawing\191\351\156\156\1156-Copenhagen Road (Plan&Profile).dwg  
PLOTDATE: Jun 01, 2010 - 2:34pm



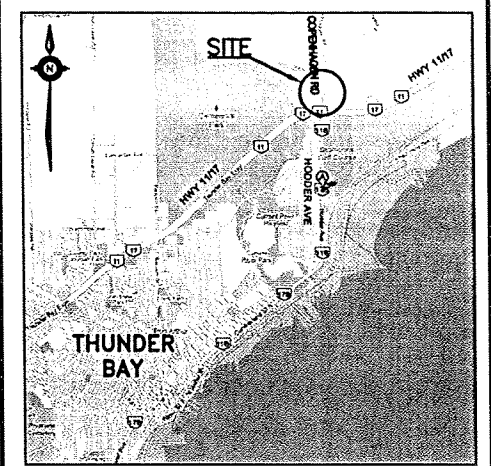
CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
COPENHAGEN ROAD (10m LT. OF C)  
BOREHOLE LOCATIONS AND SOIL STRATA

MRC McCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

SHEET



KEYPLAN  
LEGEND

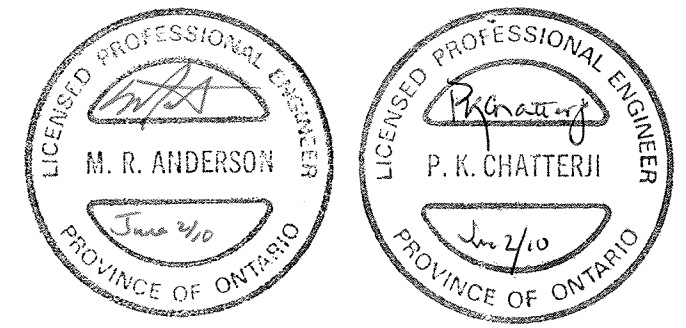
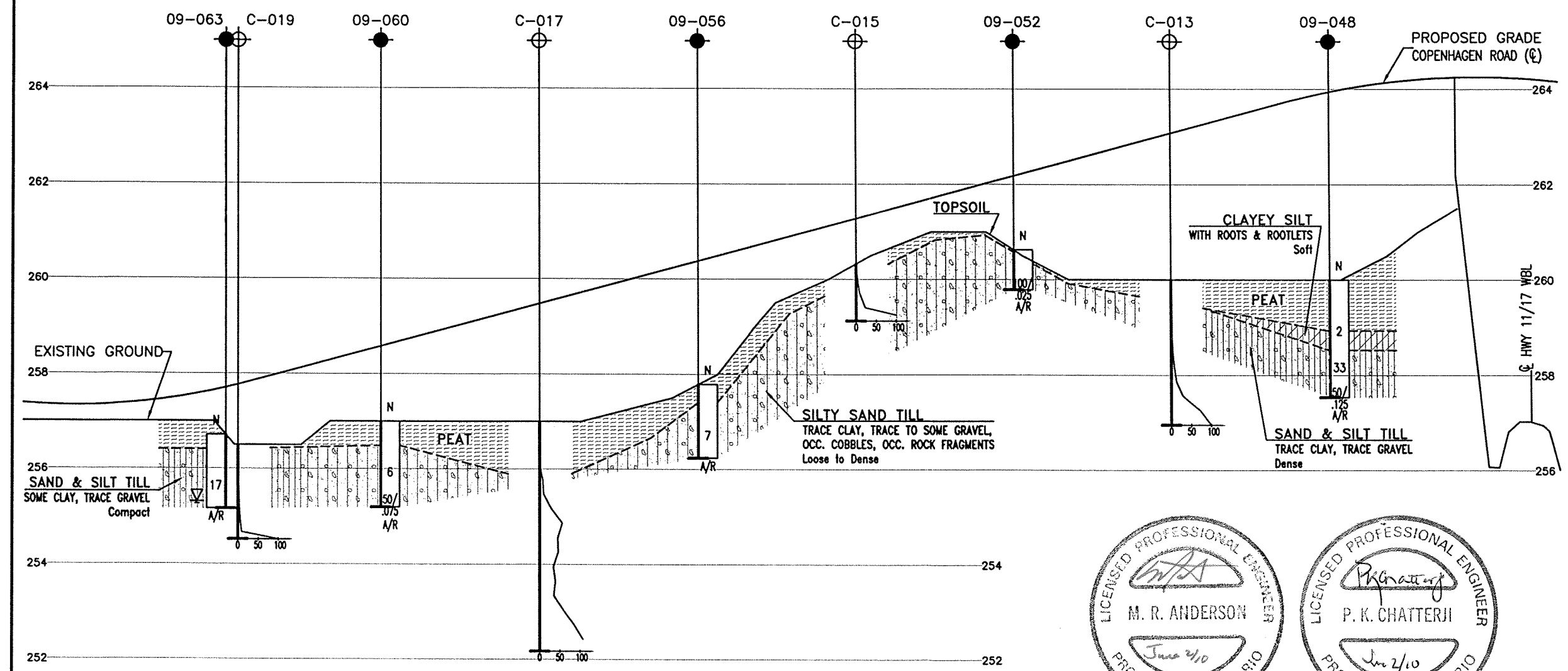
- Borehole
- Cone
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level in Open Borehole
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	C OFFSET
09-048	9+925	10m LT.
09-052	9+825	10m LT.
09-056	9+725	10m LT.
09-060	9+625	10m LT.
09-063	9+576	5m LT.
C-013	9+875	10m LT.
C-015	9+775	10m LT.
C-017	9+675	10m LT.
C-019	9+580	10m LT.

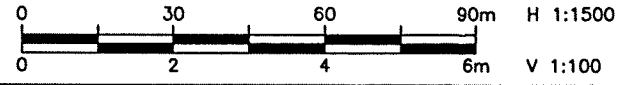
-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEORES No. 52A-146

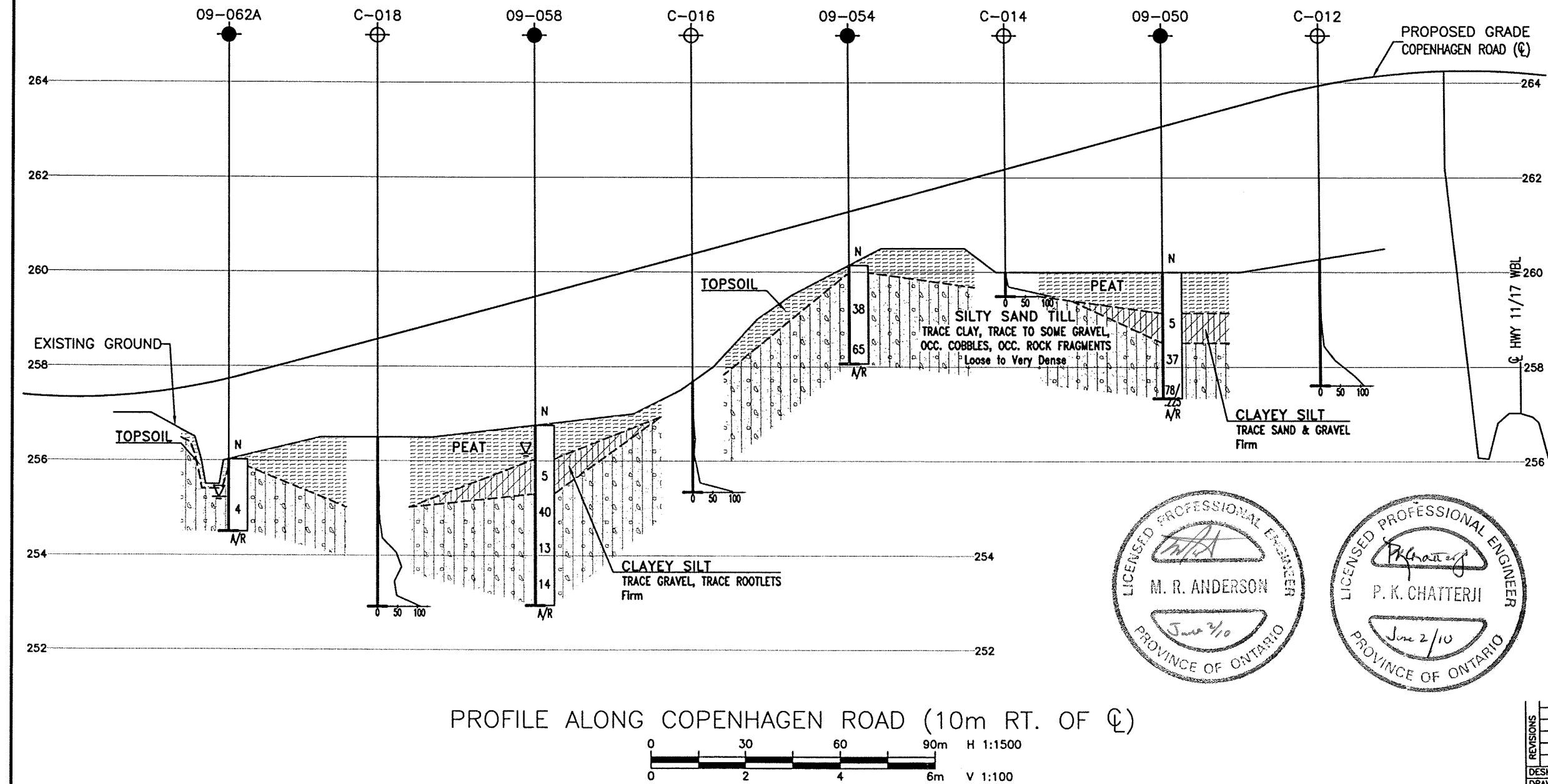
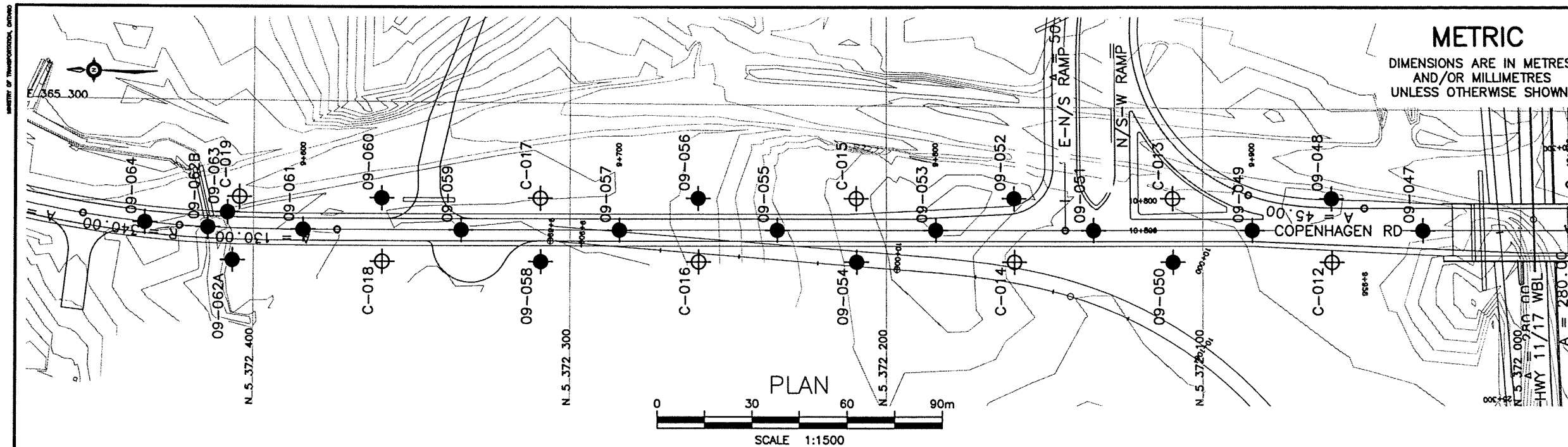


PROFILE ALONG COPENHAGEN ROAD (10m LT. OF C)



DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG
DRAWN	MFA	CHK PKC
DATE	JUN, 2010	

FILENAME: c:\working\19\1351\1361\1361155-Copenhagen Road (Plan&Profile).dwg  
PLOTDATE: Jun 01, 2010 - 2:34pm



CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
COPENHAGEN ROAD (10m RT. OF CL)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** **MCCORMICK RANKIN CORPORATION**

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

**KEYPLAN**  
**LEGEND**

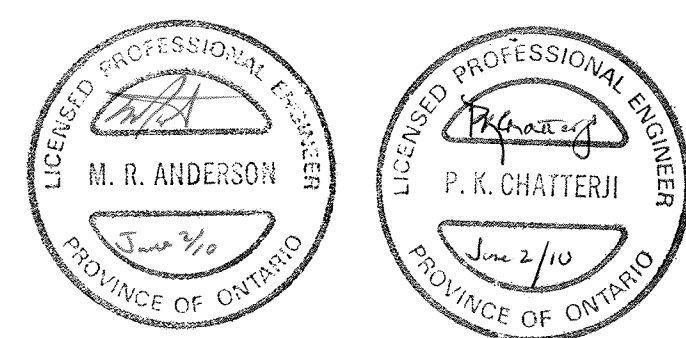
- Borehole
- Cone
- Borehole and Cone
- N  
Blows /0.3m (Std Pen Test, 475J/blow)
- CONE  
Blows /0.3m (60° Cone, 475J/blow)
- PH  
Pressure, Hydraulic
- W  
Water Level in Open Borehole
- HA  
Head Artesian Water
- P  
Piezometer
- 90%  
Rock Quality Designation (RQD)
- A/R  
Auger Refusal

NO	STATION	CL OFFSET
09-050	9+875	10m RT.
09-054	9+775	10m RT.
09-058	9+675	10m RT.
09-062A	9+578	10m RT.
C-012	9+925	10m RT.
C-014	9+825	10m RT.
C-016	9+725	10m RT.
C-018	9+625	10m RT.

**-NOTES-**

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



FILENAME: D:\Working\19\1351\1351.dwg  
PLOTDATE: Jun 01, 2010 - 2:34pm

**Appendix F**

**Hodder Avenue Interchange E-N/S Ramp**

**Station 10+543 to 10+809**

**Boreholes 09-27 to 09-46, 09-51 and 09-52**

**Cones C-02 to C-11**



# RECORD OF BOREHOLE No 09-027

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+543 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
0.0	TOPSOIL, with roots and rootlets (200mm)																
0.2	Silty SAND, trace gravel, trace clay Loose Brown (TILL)		1	SS	9												9 58 27 6
1.6	END OF BOREHOLE AT 1.6m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity



20  
15 5  
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-028

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+555, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

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 <sup>3</sup>	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 <sub>P</sub> W      W <sub>L</sub>												
0.0	TOPSOIL, with roots and rootlets (125mm)													8   43   40   9								
0.1	SAND and SILT, trace clay, trace gravel Loose to Very Dense Brown Moist to Wet (TILL)		1	SS	4																	
			2	SS	72																	
2.2	END OF BOREHOLE AT 2.2m UPON AUGER REFUSAL. BOREHOLE OPEN AND WATER LEVEL AT 0.7m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																					

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-029

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+568 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH





SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	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						
								WATER CONTENT (%)						
								20	40	60	80	100		
								PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT				
								W <sub>P</sub>	W	W <sub>L</sub>				
0.0	ORGANICS, peaty, fibrous Black Wet		1	AS										
0.8	Silty SAND, trace clay and gravel Loose to Dense Brown Moist to wet (TILL)  Becoming grey		1	SS	8									
			2	SS	38									
			3	SS	100/									
2.4	END OF BOREHOLE AT 2.4m UPON AUGER REFUSAL. BOREHOLE OPEN AND WATER LEVEL AT 0.4m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.150									

# RECORD OF BOREHOLE No 09-030

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+580, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.09 - 2009.07.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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 (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
0.0	<b>ORGANICS</b> , with roots and rootlets: (75mm) <b>ASPHALT</b> : (150mm) <b>SAND</b> : (150mm) (FILL)  <b>ORGANICS</b> , peaty, fibrous Soft to Very Soft Black Wet																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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+<sup>3</sup> X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-031

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+593 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT										UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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+<sup>3</sup> ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 (% STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-032

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+605, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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 0.1	TOPSOIL, with roots (100mm)																
0.6	SAND, some gravel Dark Brown Moist (FILL)																
1.4	SAND and SILT, with organics, trace gravel Loose Dark Brown (FILL)		1	SS	6												
1.5	ORGANICS, fibrous		2	SS	7											3 42 45 10	
	SAND and SILT, trace clay and gravel Loose to Compact Brown Moist (TILL)		3	SS	22												
3.0	END OF BOREHOLE AT 3.0m UPON AUGER REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.91m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.11.23 Could not find																

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 09-034

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+630, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
0.0	TOPSOIL, with roots and rootlets (125mm)  Clayey SILT, some sand, trace gravel, trace roots and rootlets Stiff Brown Moist																
0.1			1	SS	9												
			2	SS	50/												
1.7	END OF BOREHOLE AT 1.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				150												

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

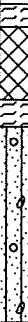


# RECORD OF BOREHOLE No 09-035

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+643 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
0.0	TOPSOIL, with roots and rootlets (150mm)		1	SS	6													
0.2	SAND, some silt, trace gravel, topsoil stained Loose																	
0.6	Brown Moist (FILL)																	
0.8	ORGANICS, with roots and rootlets																	
	Silty SAND, some clay, trace gravel Loose to Compact Brown Moist (TILL)		3	SS	13												4 58 28 10	
2.1	END OF BOREHOLE AT 2.1m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																	

+<sup>3</sup> X<sup>3</sup> : Numbers refer to  
Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-036

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+655, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stern Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					
0.0	TOPSOIL, with roots and rootlets (100m)																
0.1	Silty CLAY, trace sand Brown (FILL)																
0.5	ORGANICS, peaty, fibrous Very Soft Black Moist		1	SS	2											314	
1.7	Silty CLAY, topsoil stained Very Soft Dark Brown		2	SS	2												
2.2	Silty SAND, some gravel, trace clay Very Dense Brown Wet (TILL)		3	SS	100/ 250												21 52 22 5
2.8	END OF BOREHOLE AT 2.8m UPON AUGER REFUSAL. BOREHOLE OPEN TO 2.1m AND WATER LEVEL AT 0.9m. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 09-037

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+668 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>	kN/m <sup>3</sup>	GR SA SI CL
0.0	TOPSOIL, mixed with sand, with roots and rootlets																
0.3	SAND Brown Moist (FILL)																
0.8	ORGANICS		1	SS	2												
1.3	Silty SAND, trace gravel and clay Loose to Very Dense Brown		2	SS	100/												
1.7	Moist (TILL)				.125												
	END OF BOREHOLE AT 1.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

RECORD OF BOREHOLE No 09-038

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+680, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

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

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

RECORD OF BOREHOLE No 09-039

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+693 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
0.0	SAND, some gravel, occasional cobbles Brown Moist (FILL)													
0.7	Clayey SILT, some sand, trace gravel, occasional boulder Very Stiff Dark Brown Moist (FILL)		1	SS	70									
1.4	END OF BOREHOLE AT 1.3m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.													

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-040

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+705, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

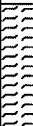


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								20 40 60 80 100				
								○ UNCONFINED + FIELD VANE				
								● QUICK TRIAXIAL × LAB VANE				
									W <sub>P</sub> W W <sub>L</sub>			
									WATER CONTENT (%)			
								20 40 60 80 100				
0.0 0.1	TOPSOIL, trace roots and rootlets (75mm)											
0.6	SAND, some gravel, occasional cobble Brown Moist (FILL)		1	SS	66							
1.4	Sandy SILT, some gravel, occasional cobble and boulders Compact Brown (FILL)		2	SS	6							
1.7	ORGANICS, peaty, fibrous Black											
2.1	Clayey SILT, sandy Firm Brown		3	SS	18							
	Sandy SILT, some clay, trace gravel Compact to Very Dense Brown Moist to Wet (TILL)		4	SS	100/ 275							
3.5	END OF BOREHOLE AT 3.5m UPON AUGER REFUSAL ON PROBABLE BEDROCK.  Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.91m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.11.23 1.8 - 2010.03.01 1.9 -											

RECORD OF BOREHOLE No 09-041

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+718 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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					
0.0	ORGANICS, peaty, fibrous Black																
0.9	Clayey SILT, trace gravel Firm Brown		1	SS	103/ 250												
1.2	END OF BOREHOLE AT 1.2m UPON AUGER REFUSAL. BOREHOLE OPEN TO 0.6m AND WATER LEVEL AT 0.3m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 09-042

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+730, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

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 <sup>3</sup>	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 <sub>p</sub> W W <sub>L</sub>				
0.0	TOPSOIL, with roots and rootlets (200mm)																
0.2	Clayey SILT, topsoil stained, with some bedrock fragments Firm Brown		1	SS	100/												
1.0	END OF BOREHOLE AT 1.0m UPON AUGER REFUSAL. BOREHOLE OPEN TO 0.8m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.075												



RECORD OF BOREHOLE No 09-043

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+743 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

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 <sup>3</sup>	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 0.1	TOPSOIL, with roots and rootlets (100mm)  SAND, some gravel and silt Dense Brown Moist (FILL)		1	SS	100/ .050												
1.0	END OF BOREHOLE AT 1.0m UPON AUGER REFUSAL. BOREHOLE OPEN TO 0.8m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

RECORD OF BOREHOLE No 09-044

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+755, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	TOPSOIL, with roots and rootlets (75mm)																
0.1																	
0.3	ROCKFILL																
	SAND, some gravel Very Dense Brown Moist (FILL)		1	SS	100/												
1.1	END OF BOREHOLE AT 1.0m UPON AUGER REFUSAL. BOREHOLE OPEN TO 0.6m AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-045

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+768 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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 20 40 60 80 100					W <sub>p</sub>	W	W <sub>L</sub>		
0.0	TOPSOIL, with roots and rootlets (200mm)																
0.2	END OF BOREHOLE AT 0.2m UPON AUGER REFUSAL.																





RECORD OF BOREHOLE No 09-052

1 OF 1

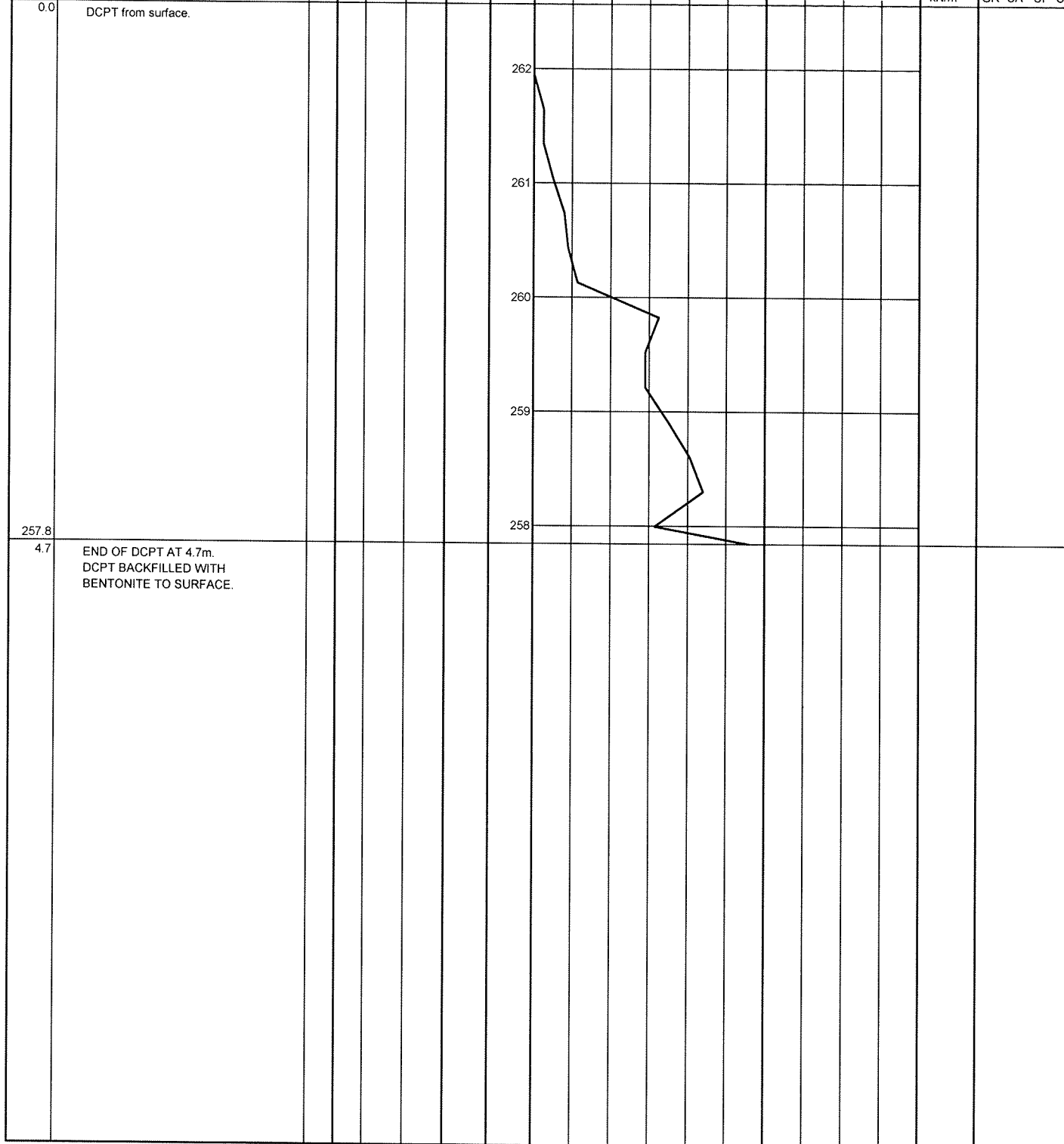
METRIC

G.W.P. 334-94-00 LOCATION Copenhagen Road, Sta. 9+825, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.11 - 2009.07.11 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					20 40 60 W <sub>P</sub> W W <sub>L</sub>						
0.0	TOPSOIL, with roots: (50mm)																
0.0	Silty SAND, with shale fragments Brown Moist (TILL)		1	SS	100/												
0.8	END OF BOREHOLE AT 0.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.025												

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W <sub>P</sub> W      W <sub>L</sub>	WATER CONTENT (%) 20    40    60	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR   SA   SI   CL   ML   PL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					
262.5							20    40    60    80    100 20    40    60    80    100						



ONTMT4S 1156.GPJ 3/17/10

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No C-003

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+580, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.09 - 2009.07.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
262.5								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
0.0	DCPT from surface.							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w <sub>p</sub> w w <sub>L</sub> WATER CONTENT (%)						GR SA SI CL
260.1														
2.4	END OF DCPT AT 2.4m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													



# RECORD OF BOREHOLE No C-004

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+605, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

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 <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W <sub>p</sub> W W <sub>L</sub>	20 40 60			
263.0 0.0	DCPT from surface.						263							GR SA SI CL
259.6 3.4	END OF DCPT AT 3.4m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.						260							

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-005

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+630, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.08 - 2009.07.08 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
262.5 0.0	DCPT from surface.												GR SA SI CL
259.4 3.1	END OF DCPT AT 3.1m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.												

ONTMT4S 1156.GPJ 3/17/10

RECORD OF BOREHOLE No C-006

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+655, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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 (%)	
262.5								20	40	60	80	100	20	40	60		
0.0	DCPT from surface.																
261.1																	
1.4	END OF DCPT AT 1.4m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.																

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-007

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+680, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
262.5													
0.0	DCPT from surface.												
260.5													
2.0	END OF DCPT AT 2.0m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.												

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No C-008

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+705, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
262.0								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					PLASTIC LIMIT W <sub>P</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	
0.0	DCPT from surface.						262							GR SA SI CL
257.2							261							
							260							
							259							
							258							
4.8	END OF DCPT AT 4.8m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.													

ONTMT4S 1156.GPJ 3/17/10

# RECORD OF BOREHOLE No C-009

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+730, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	w <sub>p</sub>	w	w <sub>L</sub>		
261.0							261										
0.0	DCPT from surface.																
260.0																	
1.0	END OF DCPT AT 1.0m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.																

ONTMT4S 1156.GPJ 3/17/10

RECORD OF BOREHOLE No C-010

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+755, 10m LT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES								
260.5													
0.0	DCPT from surface.												
259.2													
1.3	END OF DCPT AT 1.3m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.												

RECORD OF BOREHOLE No C-011

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave E-N/S Ramp, Sta. 10+785, 10m RT ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.09 - 2009.07.09 CHECKED BY TH

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 <sup>3</sup>	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		
0.0	DCPT from surface.												
0.5	END OF DCPT AT 0.5m. DCPT BACKFILLED WITH BENTONITE TO SURFACE.												

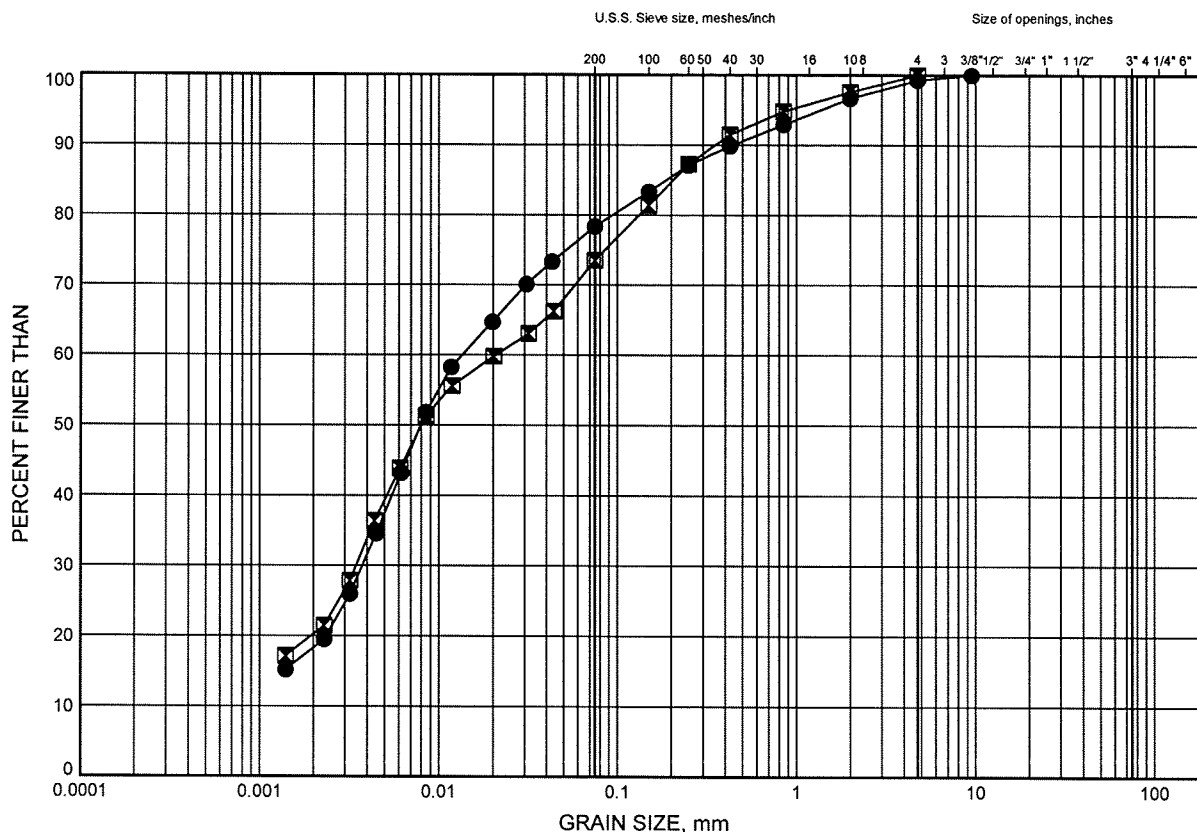
ONTMT4S 1156.GPJ 4/15/10



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE F1

CLAYEY SILT to SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-033	2.59	
■	09-040	1.94	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

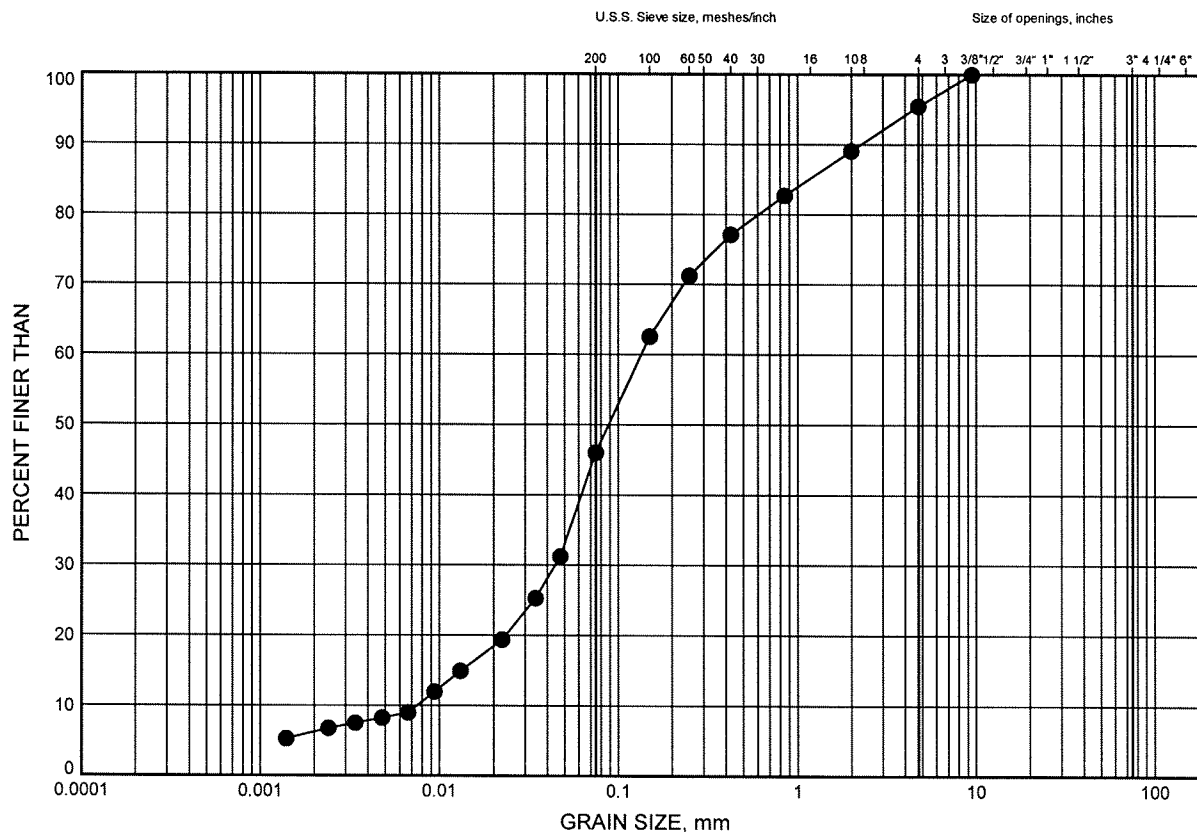
W.P.# 334-94-00  
Prepared By AN  
Checked By MRA



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE F2

SAND & SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-046	1.07	

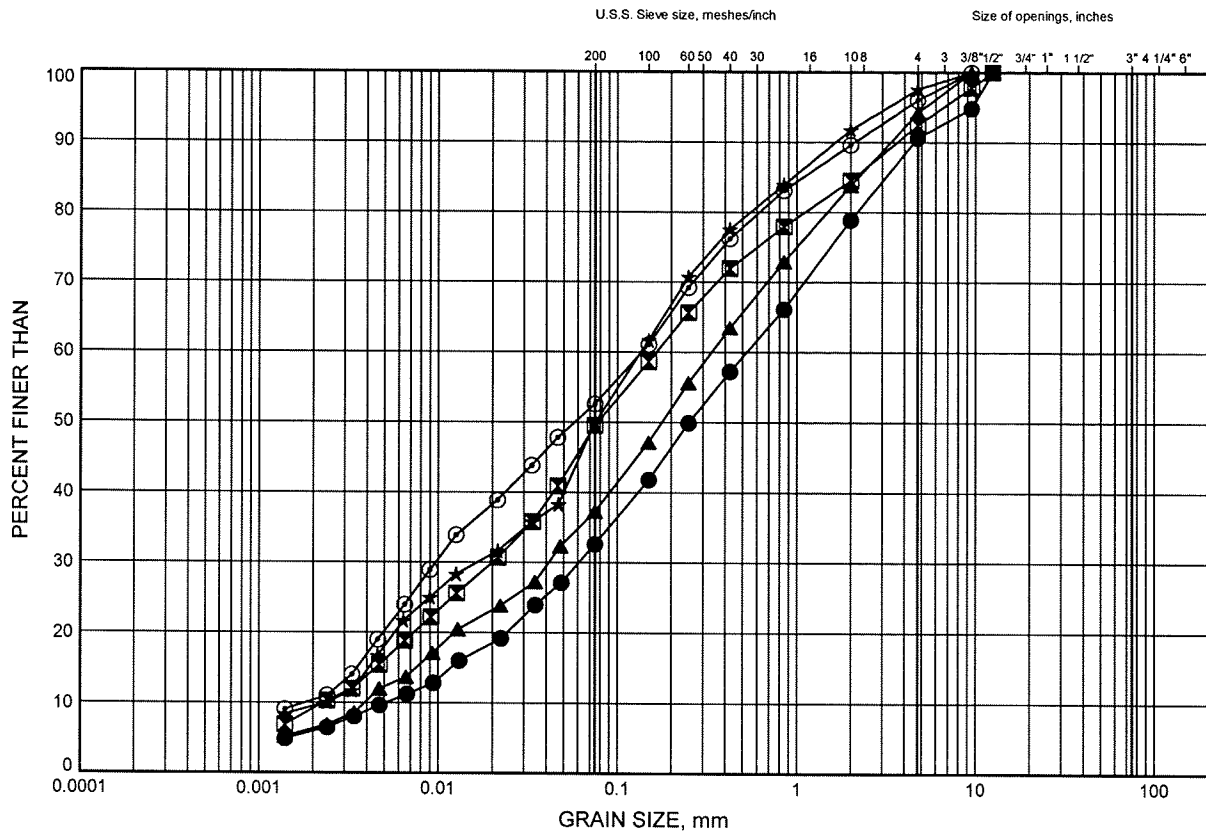


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE F3

SILTY SAND to SANDY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-027	1.07	
⊠	09-028	1.07	
▲	09-029	1.83	
★	09-030	3.35	
⊙	09-031	1.83	

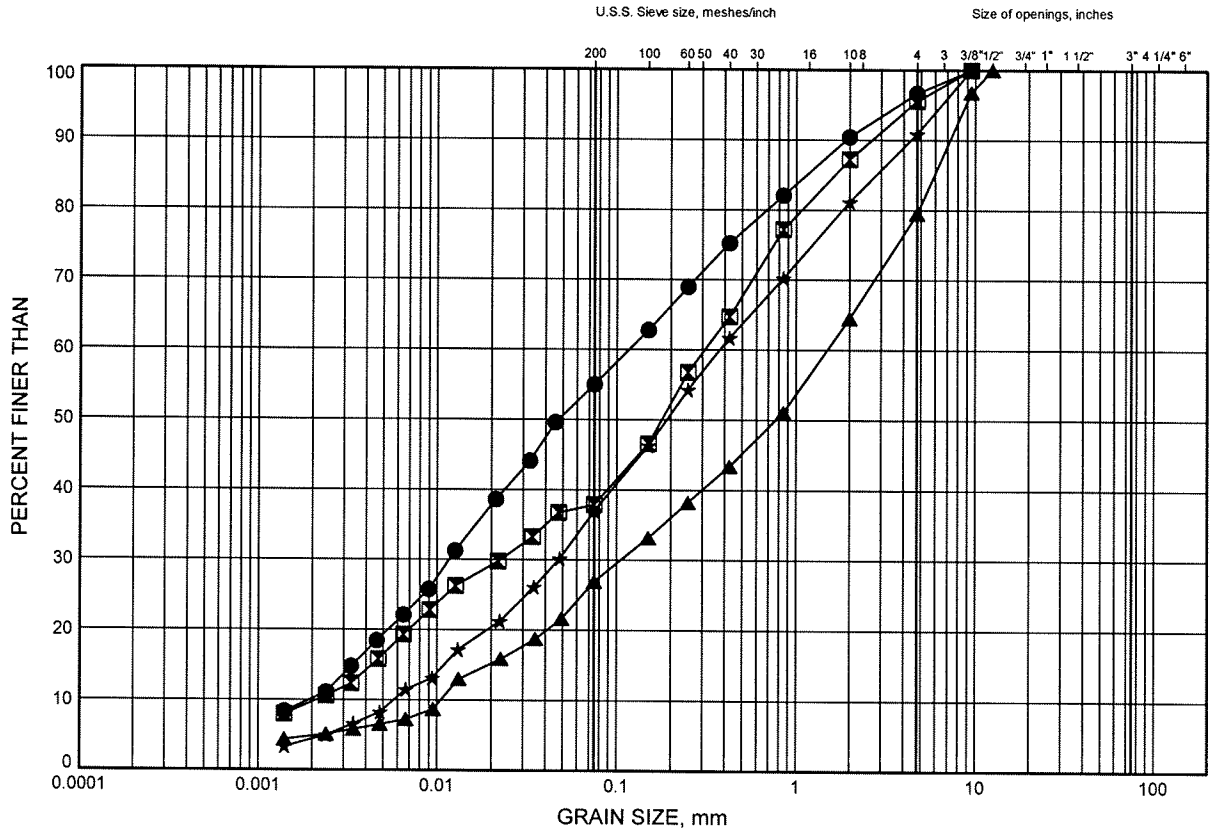


W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....

Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE F4

**SILTY SAND to SANDY SILT TILL**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-032	1.83	
⊠	09-035	1.78	
▲	09-036	2.49	
★	09-038	2.59	



W.P.# .334-94-00.....  
 Prepared By .AN.....  
 Checked By .MRA.....

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

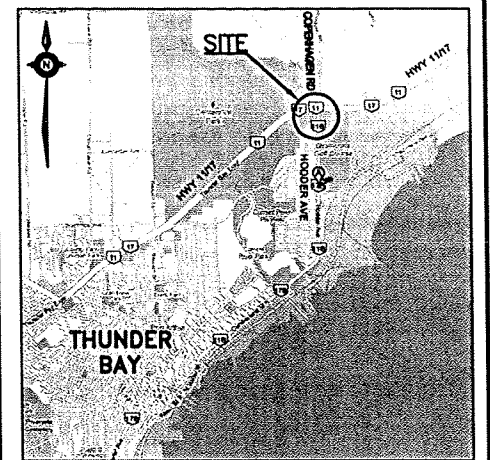
CONT No  
WP No 334-94-00







HIGHWAY 11/17  
AT HODDER AVENUE  
E-N/S RAMP (C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** **McCORMICK RANKIN**  
**CORPORATION**



**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



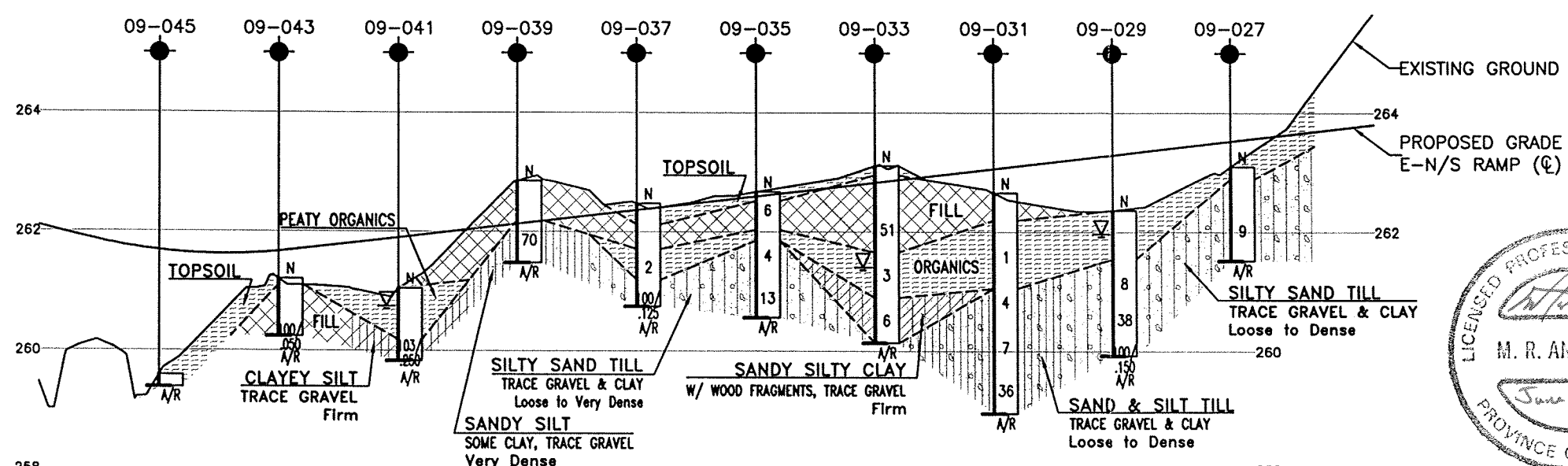
	Borehole
	Cone
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	STATION	℄ OFFSET
09-027	10+543	0m
09-029	10+568	0m
09-031	10+593	0m
09-033	10+618	0m
09-035	10+643	0m
09-037	10+668	0m
09-039	10+693	0m
09-041	10+718	0m
09-043	10+743	0m
09-045	10+768	0m

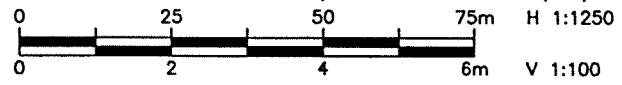
**-NOTES-**

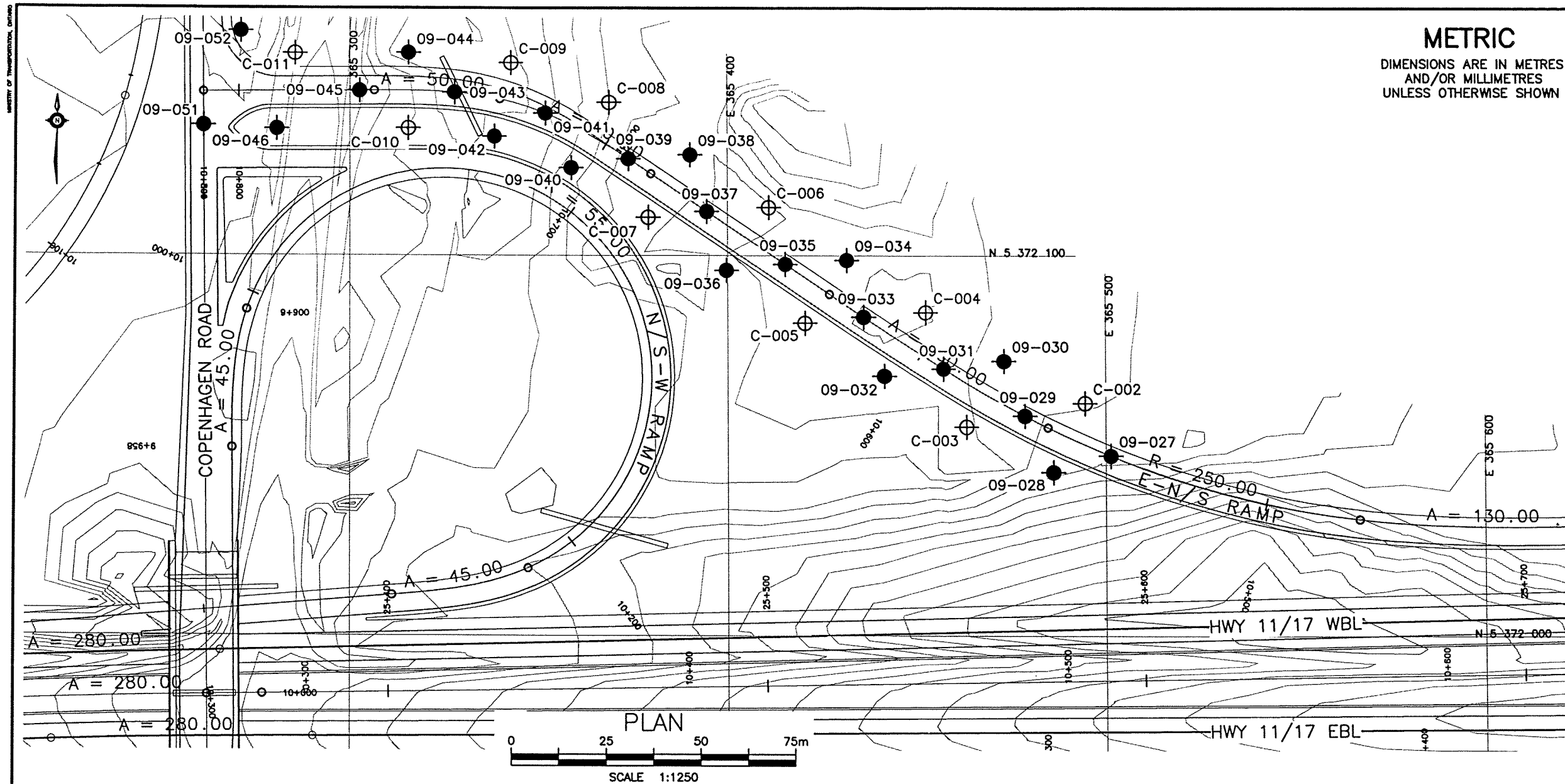
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



PROFILE ALONG E-N/S RAMP (C)

[illegible]



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

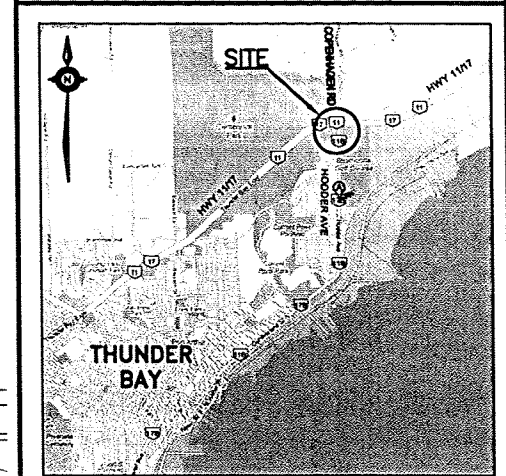
CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
E-N/S RAMP (10m LT. OF C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MCCORMICK RANKIN CORPORATION**

SHEET

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

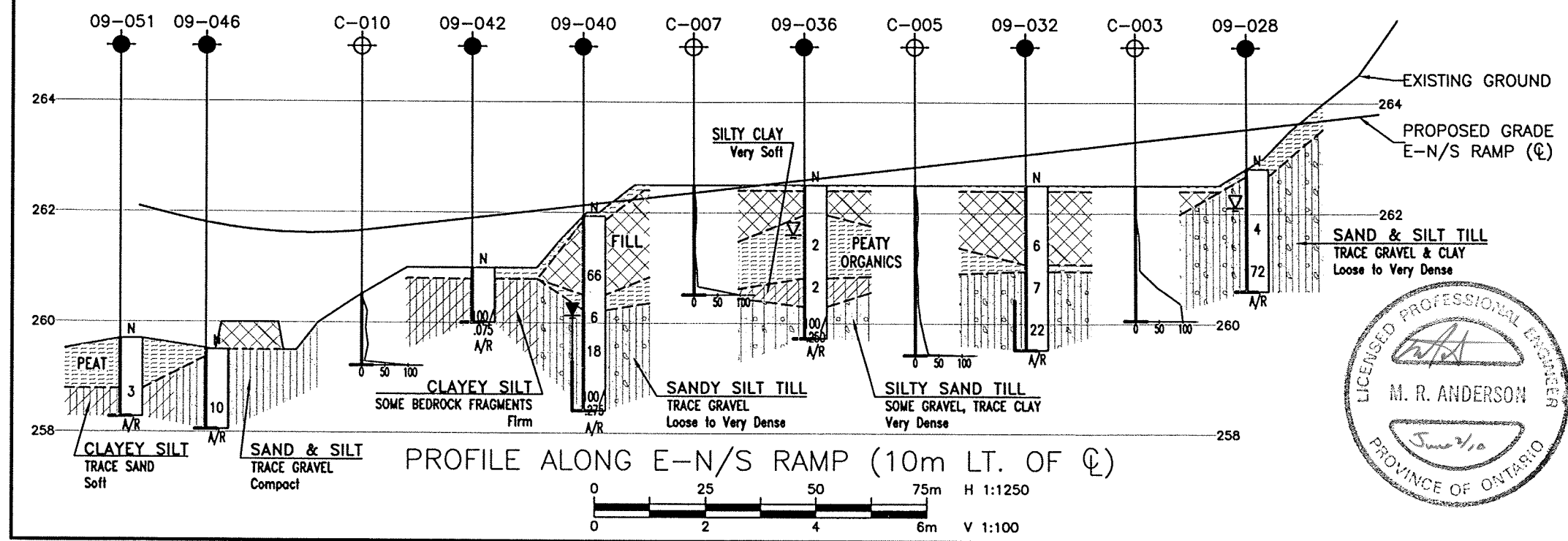


**KEYPLAN  
LEGEND**

- ◆ Borehole
- ⊕ Cone
- ⊕ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- W Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	CL OFFSET
09-028	10+555	10m LT.
09-032	10+605	10m LT.
09-036	10+655	10m LT.
09-040	10+705	10m LT.
09-042	10+730	10m LT.
09-046	10+790	10m LT.
09-051	10+809.3	8.9m LT.
C-003	10+580	10m LT.
C-005	10+630	10m LT.
C-007	10+680	10m LT.
C-010	10+755	10m LT.

- NOTES-**
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
  - This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- GEOCRETS No. 52A-146**

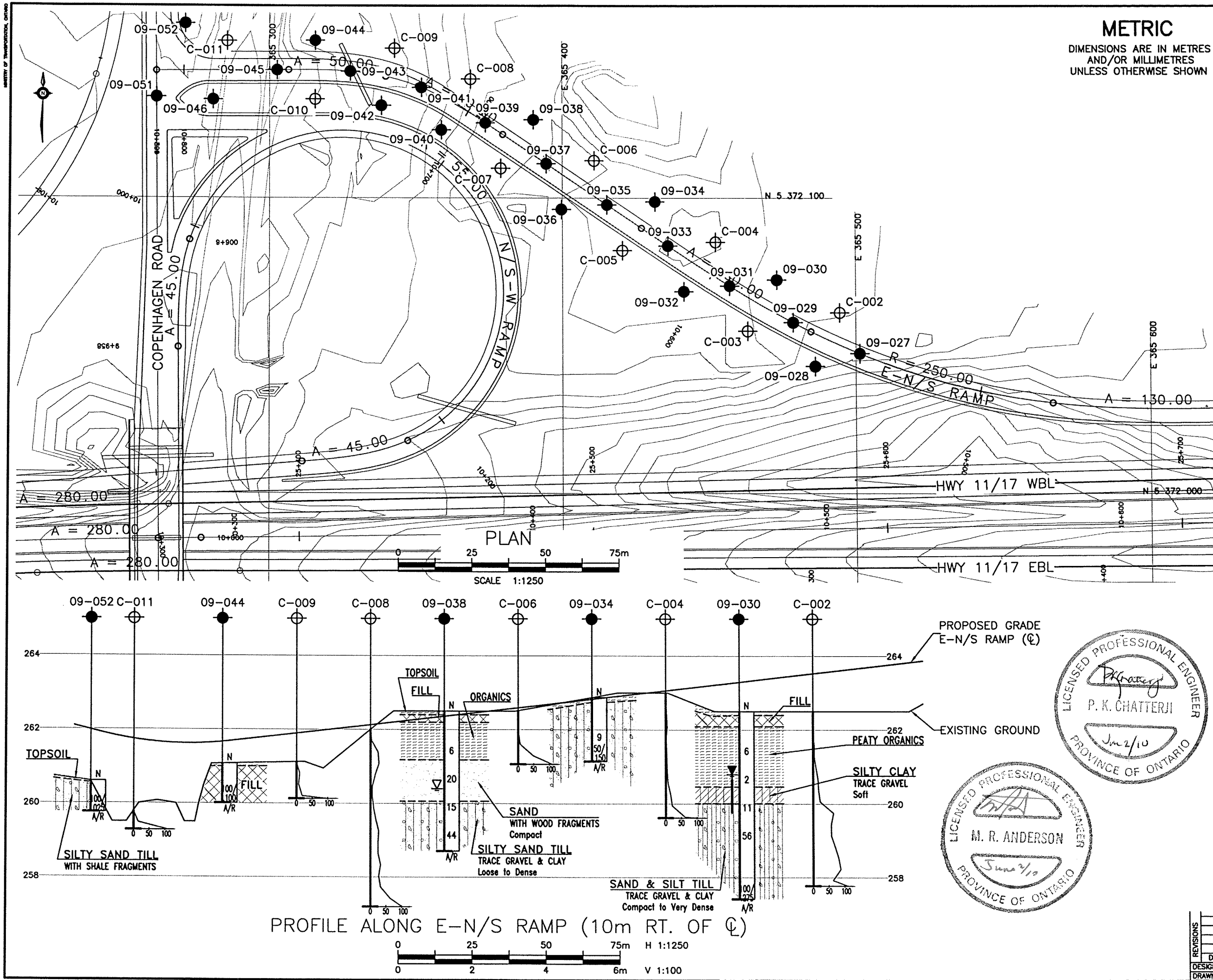


**P. K. CHATTERJI**  
PROVINCE OF ONTARIO

**M. R. ANDERSON**  
PROVINCE OF ONTARIO

DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG
DRAWN	MFA	CHK PKC
DATE	JUN. 2010	
PLUTATE	JUN 01, 2010	2:14pm

FILENAME: D:\Drawing\19\1351\1351\1351-Hodder Ave E-N/S Ramp (Plan&Profile).dwg  
PLUTATE: JUN 01, 2010 - 2:14pm



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

CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
E-N/S RAMP (10m RT. OF C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**McCORMICK RANKIN CORPORATION**

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

**KEYPLAN**  
**LEGEND**

Borehole

Cone

Borehole and Cone

Blows /0.3m (Std Pen Test, 475J/blow)

Blows /0.3m (60' Cone, 475J/blow)

Pressure, Hydraulic

Water Level

Head Artesian Water

Piezometer

Rock Quality Designation (RQD)

Auger Refusal

NO	STATION	C OFFSET
09-030	10+580	10m RT.
09-034	10+630	10m RT.
09-038	10+680	10m RT.
09-044	10+755	10m RT.
09-052	10+794.4	16.1m RT.
C-002	10+555	10m RT.
C-004	10+605	10m RT.
C-006	10+655	10m RT.
C-008	10+705	10m RT.
C-009	10+730	10m RT.
C-011	10+785	10m RT.

**NOTES:**  
1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.  
2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	MRA	CHK	AEG	CODE	LOAD	DATE	JUN. 2010
DRAWN	MFA	CHK	PKC	SITE	STRUCT	DWG	F3

FILENAME: d:\working\191\351\356\101156-Hodder Ave E-N/S Ramp (Plan&Profile).dwg  
PLOTDATE: Jun 01, 2010 - 2:14pm

**Appendix G**

**Hodder Avenue Interchange S-E Ramp**

**Station 10+120 to 10+650**

**Boreholes 09-06 to 09-16, 10-68, 10-70 to 10-73**



# RECORD OF BOREHOLE No 09-006

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+010 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.09 - 2009.07.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	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					

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-007

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+125 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.07 - 2009.07.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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										WATER CONTENT (%)
								20	40	60	80	100						
0.0	TOPSOIL, with roots and rootlets (130mm)  Silty SAND, some gravel, trace clay, occasional cobbles Compact to Very Dense Brown (TILL)																	
0.1			1	SS	21													
			2	SS	48													12 55 27 6
			3	SS	73													
			4	SS	100/													
3.3	END OF BOREHOLE AT 3.3m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE TO 2.4m, THEN CUTTINGS TO SURFACE.				125													

+<sup>3</sup>, x<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 09-008

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+250 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	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					WATER CONTENT (%) W <sub>P</sub> W W <sub>L</sub>				
0.0	TOPSOIL, with root and rootlets (150mm)																
0.2	Silty SAND, some gravel, trace clay Dense to Very Dense Brown (TILL)		1	SS	32												
			2	SS	100												
1.7	END OF BOREHOLE AT 1.7m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.				.050												

ONTMT4S 1156.GPJ 3/17/10

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-009

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+300 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

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 <sup>3</sup>	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					WATER CONTENT (%) W <sub>P</sub> W W <sub>L</sub>				
						20	40	60	80	100	20	40	60				
0.0	TOPSOIL, with roots and rootlets (200mm)																
0.2	Silty SAND, some gravel, trace clay Compact to Very Dense Brown (TILL)		1	SS	23												
			2	SS	31												
			3	SS	100/ 250												
2.8	END OF BOREHOLE AT 2.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

# RECORD OF BOREHOLE No 09-010

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+350 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
0.0	TOPSOIL, with roots and rootlets (125mm)							20	40	60	80	100					
0.2	Silty SAND, some clay, trace gravel Compact Brown Moist (TILL)		1	SS	14			○ UNCONFINED	+	FIELD VANE							
								● QUICK TRIAXIAL	x	LAB VANE							
1.4	END OF BOREHOLE AT 1.4m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup> x<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-011

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+400 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
								20	40	60	80	100						
0.0	TOPSOIL, with roots and rootlets (150mm)																	
0.2	Clayey SILT, sandy, trace gravel Stiff to Very Stiff Brown (TILL)		1	SS	9													1 26 57 16
			2	SS	25													
2.2	END OF BOREHOLE AT 2.2m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																	



# RECORD OF BOREHOLE No 09-013

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+500 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

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

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE



RECORD OF BOREHOLE No 09-014

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+550 CL ORIGINATED BY SLL  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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							
0.0	TOPSOIL, with roots and rootlets (100mm)  Silty SAND, trace clay, trace gravel, occasional cobbles Compact to Very Dense Brown (TILL)																		
0.1			1	SS	73														
			2	SS	22														7 52 32 8

+<sup>3</sup> . x<sup>3</sup> : Numbers refer to  
Sensitivity

20  
15 5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-015

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+600 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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									
0.0	TOPSOIL, with roots and rootlets (150mm)																
0.2	Silty SAND, trace clay, trace gravel, occasional cobbles Compact to Very Dense Brown (TILL)		1	SS	10												
			2	SS	44											5 51 36 8	
			3	SS	100/ 150												
2.6	END OF BOREHOLE AT 2.6m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-016

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave S-E Ramp, Sta. 10+650 CL ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.10 - 2009.07.10 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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		PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
								WATER CONTENT (%)									
0.0	TOPSOIL, with roots and rootlets (200mm)																
0.2	Silty SAND, some gravel, trace clay, occasional cobbles Compact to Very Dense Brown (TILL)		1	SS	13									○			13 50 33 4
														○			
			2	SS	47									○			
														○			
			3	SS	75									○			
														○			
			4	SS	100/ 250												
3.6	END OF BOREHOLE AT 3.6m UPON AUGER. BOREHOLE OPEN AND DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.76m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.11.23 Dry -																

ONTMT4S 1156.GPJ 3/17/10

# RECORD OF BOREHOLE No 10-068

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave., S-E Ramp, Sta. 10+160 15m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.15 - 2010.01.15 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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						
0.0	<b>SAND</b> and <b>SILT</b> , trace to some gravel, trace clay, occasional sand seams, occasional cobbles Compact to Very Dense Brown Moist (TILL)  													

+<sup>3</sup>. X<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-070

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave., S-E Ramp, Sta. 10+200 17m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.15 - 2010.01.15 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	X LAB VANE								
								20	40	60	80	100					
0.0	Silty <b>SAND</b> , some gravel, trace clay Compact to Very Dense Brown Moist (TILL)  Occasional cobbles		1	SS	21												
			2	SS	18												16 54 25 5
			3	SS	62/ 0.275												
	Auger refusal at 2.9m. Began coring.																
2.9	Silty <b>SAND</b> and <b>GRAVEL</b> , cobbles and boulders Very Dense Brown		1	RUN													RUN 1# TCR=0%, SCR=0%, RQD=0%
			2	RUN													RUN 2# TCR=13%, SCR=3%, RQD=0%
5.8	<b>GUNFLINT FORMATION</b> , very strong (grainstone), slightly weathered  250mm vertical fracture at 6.7m 75mm vertical fracture at 7.9m		3	RUN												FI >3 >3 1	RUN 3# TCR=72%, SCR=32%, RQD=32% UCS=109MPa
			4	RUN												>2 0 0 2 1	RUN 4# TCR=100%, SCR=92%, RQD=92% UCS=185MPa
8.5	END OF BOREHOLE AT 8.5m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2010.03.01 4.3 -																

ONTMT4S 1156.GPJ 4/15/10

# RECORD OF BOREHOLE No 10-071

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave., S-E Ramp, Sta. 10+240 18m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.18 - 2010.01.18 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
0.0	Silty SAND, some gravel, trace clay Loose to Very Dense Brown Moist (TILL)  Occasional cobbles		1	SS	9												
			2	SS	31												
			3	SS	74/ 275												13 53 27 7
			4	SS	97												
3.8	END OF BOREHOLE AT 3.8m UPON AUGER REFUSAL. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.																

+ 3, X 3; Numbers refer to  
Sensitivity


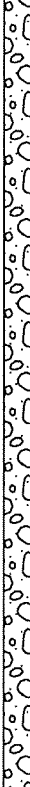

20  
15 10 5  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-072

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave., S-E Ramp, Sta. 10+280 18m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.16 - 2010.01.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	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	x	LAB VANE							
								20	40	60	80	100					
0.0	Silty <b>SAND</b> , trace gravel, trace clay Compact to Very Dense Brown Moist (TILL)		1	SS	22												
			2	SS	50/ .050												
			3	SS	89/ .200												
	Auger refusal at 3.3m. Began coring.		4	SS	70/ .225												
3.3	Silty <b>SAND</b> and <b>GRAVEL</b> , occasional cobbles Very Dense Brown		1	RUN													RUN 1# TCR=22%, SCR=0%, RQD=0%
			2	RUN													RUN 2# TCR=37%, SCR=18%, RQD=0%
			3	RUN													RUN 3# TCR=58%, SCR=17%, RQD=0%
			4	RUN													RUN 4# TCR=20%, SCR=20%, RQD=0%
8.5	<b>GUNFLINT FORMATION</b> , strong to very strong (calcareous grainstone), slightly weathered		5	RUN													RUN 5# TCR=100%, SCR=100%, RQD=100% UCS=175MPa

Continued Next Page

+ 3, X 3 : Numbers refer to 20 15 10 5 0 (%) STRAIN AT FAILURE  
 Sensitivity

# RECORD OF BOREHOLE No 10-072

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave., S-E Ramp, Sta. 10+280 18m RT ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.16 - 2010.01.16 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W P	W	W L		
	Continued From Previous Page							20 40 60 80 100									
			6	RUN				○ UNCONFINED + FIELD VANE									GR SA SI CL
								● QUICK TRIAXIAL X LAB VANE									
								20 40 60 80 100					20 40 60			kN/m <sup>3</sup>	
11.6	END OF BOREHOLE AT 11.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2010.03.01 6.3 -																

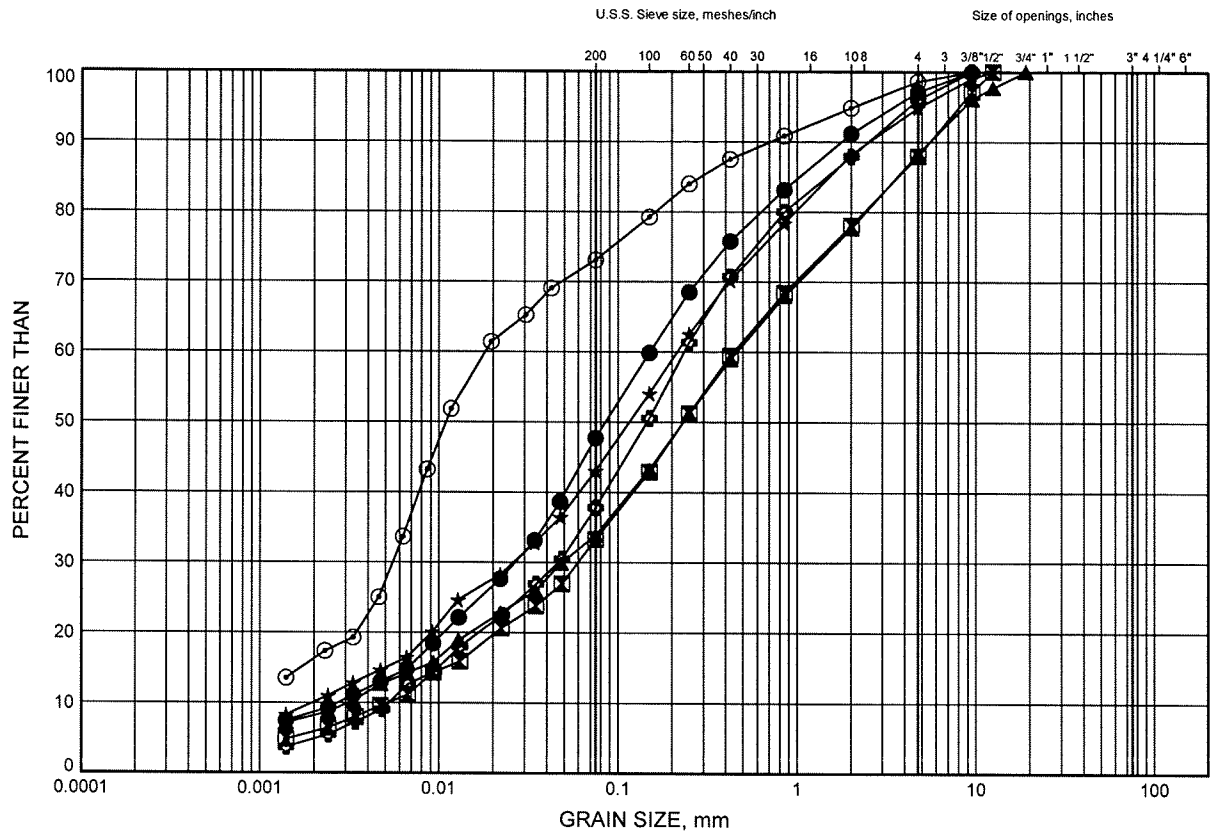




# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE G1

## SILTY SAND TILL



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

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-006	1.07	
⊠	09-007	1.83	
▲	09-009	1.83	
★	09-010	0.99	
⊙	09-011	1.07	
⊗	09-012	1.83	

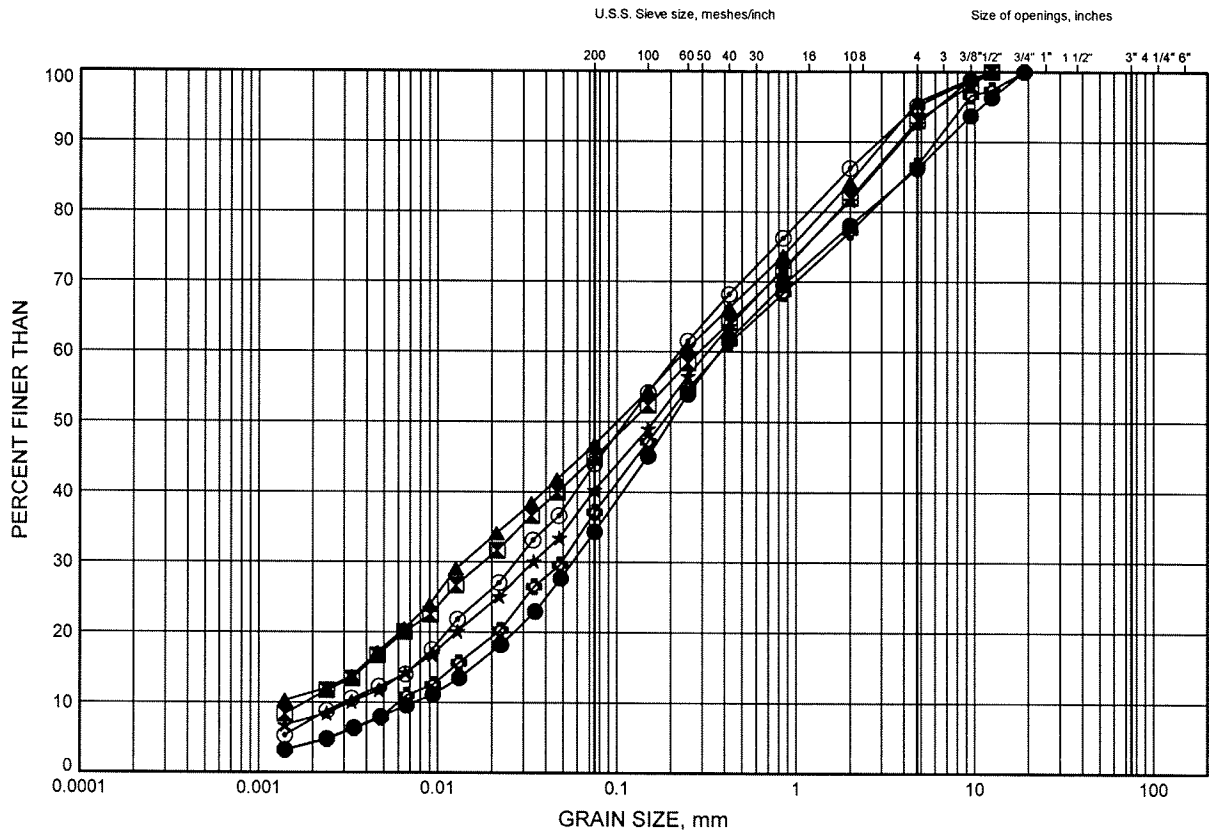


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE G2

SILTY SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-012	3.35	
⊠	09-013	1.83	
▲	09-013	3.35	
★	09-014	1.83	
⊙	09-015	1.83	
⊕	09-016	1.83	

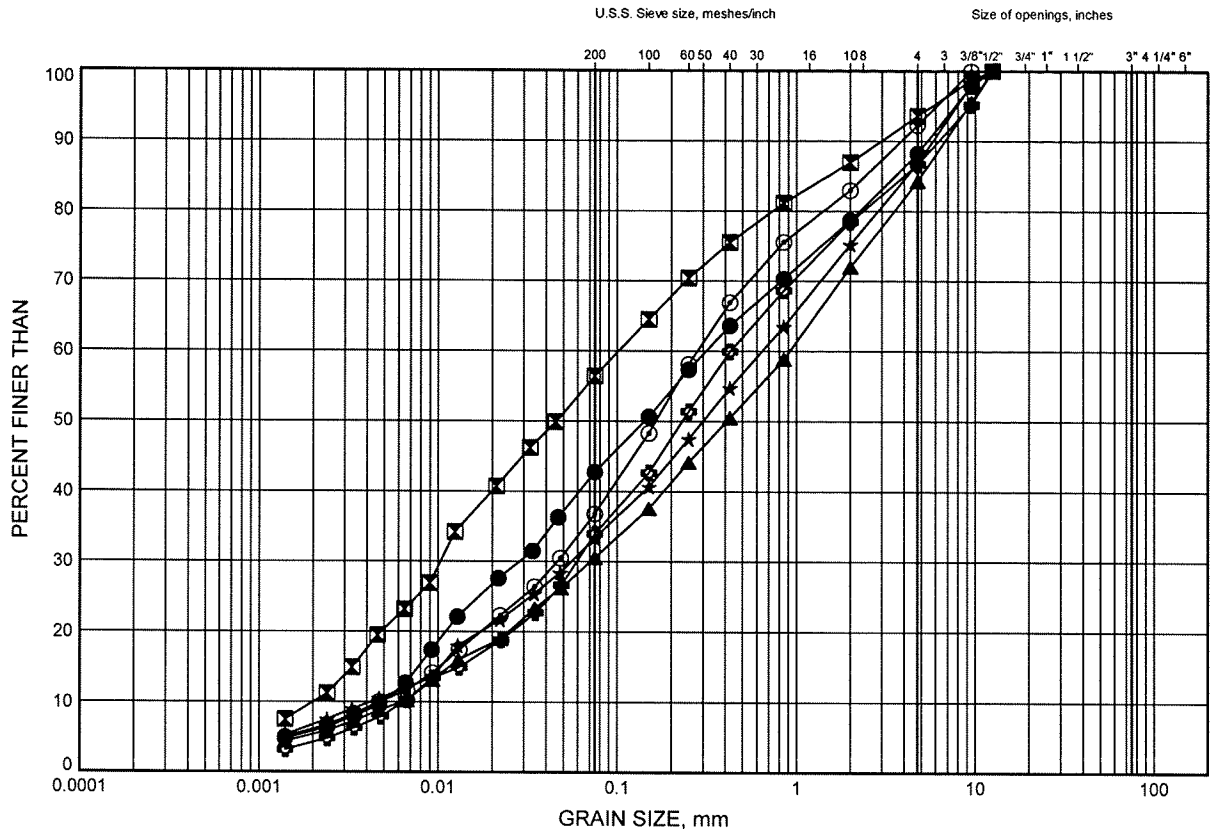


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE G3

SILTY SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10-068	2.44	
⊠	10-068	4.65	
▲	10-070	1.83	
★	10-071	2.51	
⊙	10-072	2.47	
⊕	10-073	1.83	

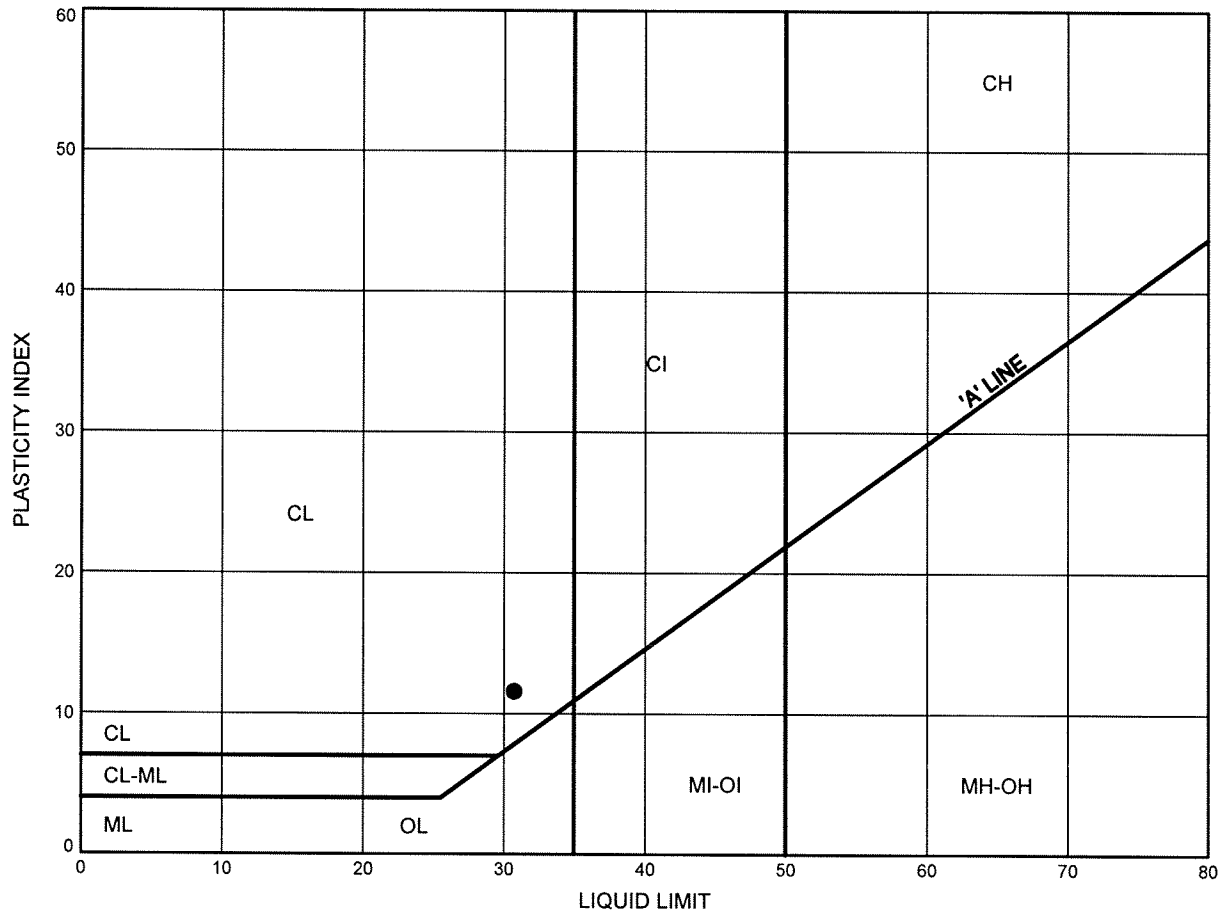


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE G4

**SILTY SAND TILL**



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-011	1.04	

Date April 2010  
 Project 334-94-00



Prep'd AN  
 Chkd. MRA

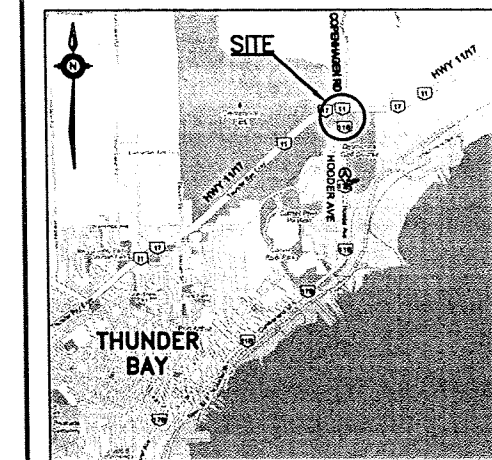
**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
S-E RAMP (C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** **McCORMICK RANKIN**  
CORPORATION

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**KEYPLAN**  
**LEGEND**

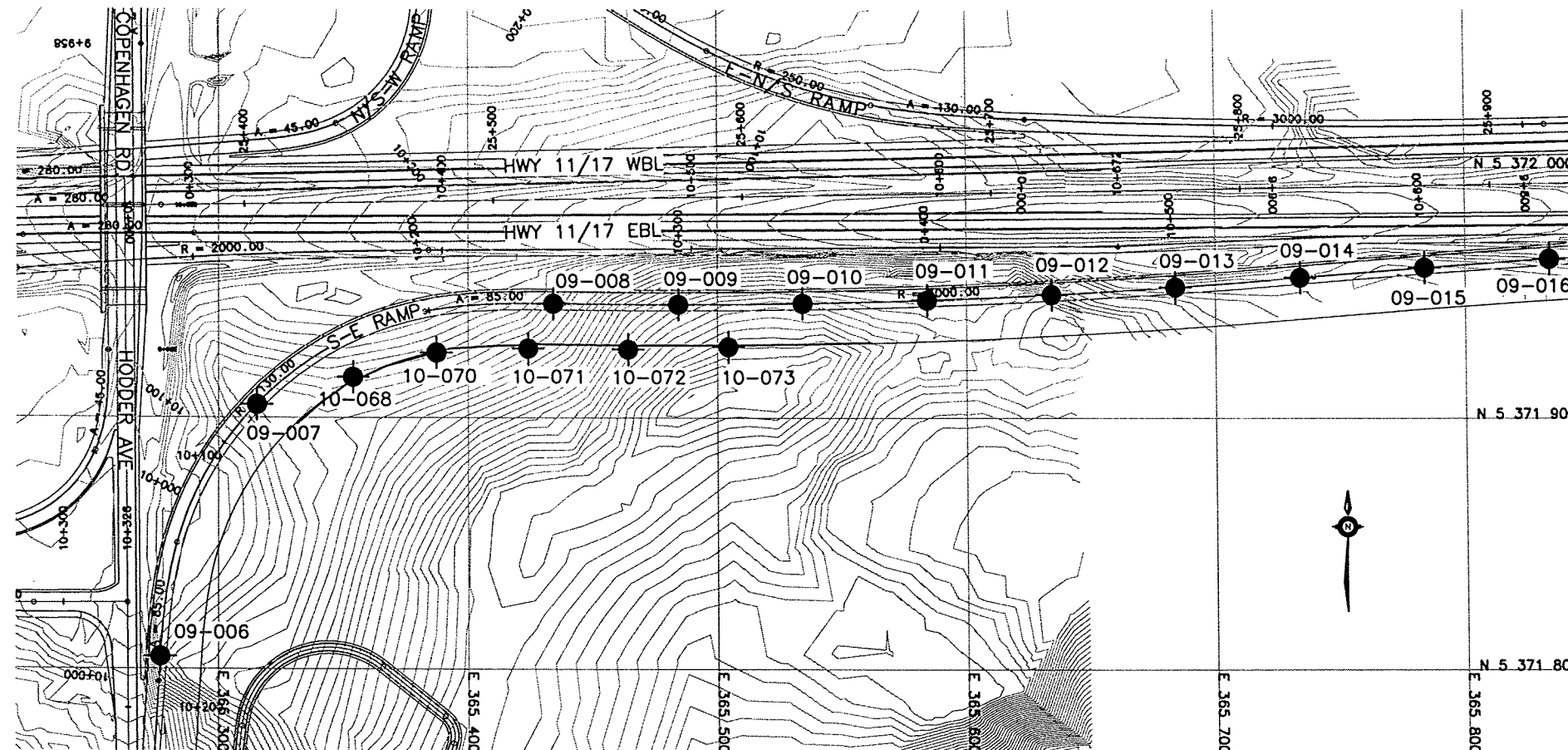
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- ↑ Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	C OFFSET
09-006	10+010	0.0m
09-007	10+125	0.0m
09-008	10+250	0.0m
09-009	10+300	0.0m
09-010	10+350	0.0m
09-011	10+400	0.0m
09-012	10+450	0.0m
09-013	10+500	0.0m
09-014	10+550	0.0m
09-015	10+600	0.0m
09-016	10+650	0.0m

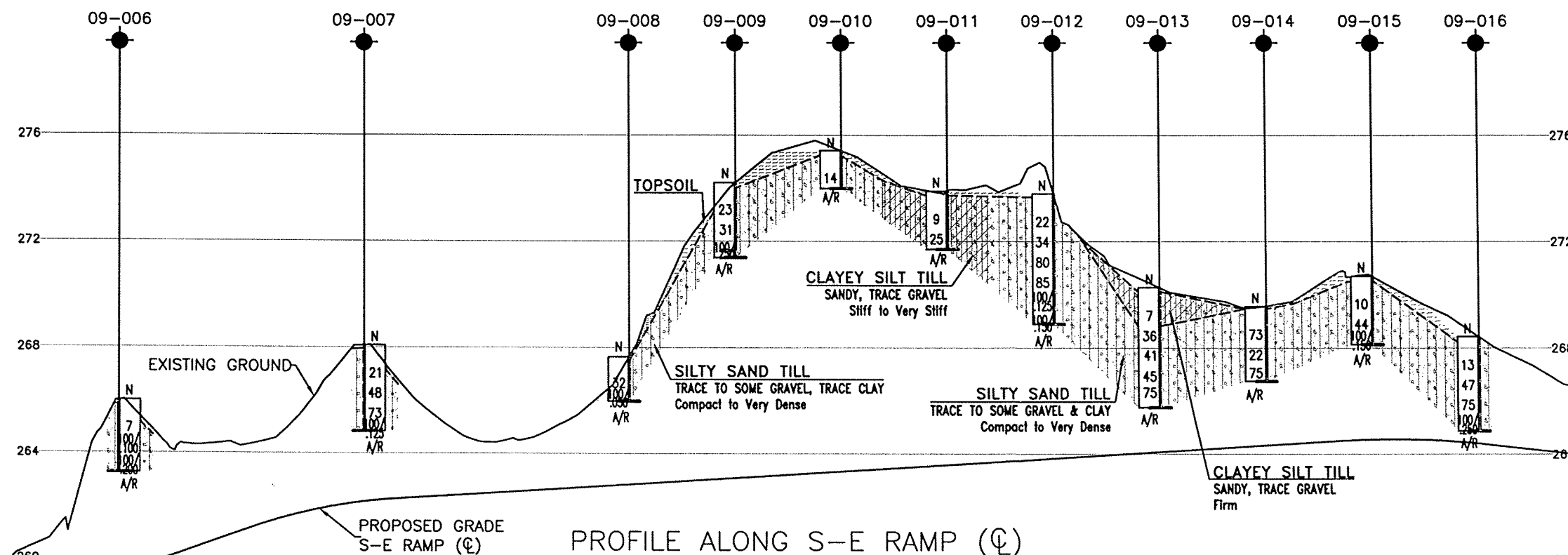
**NOTES**

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



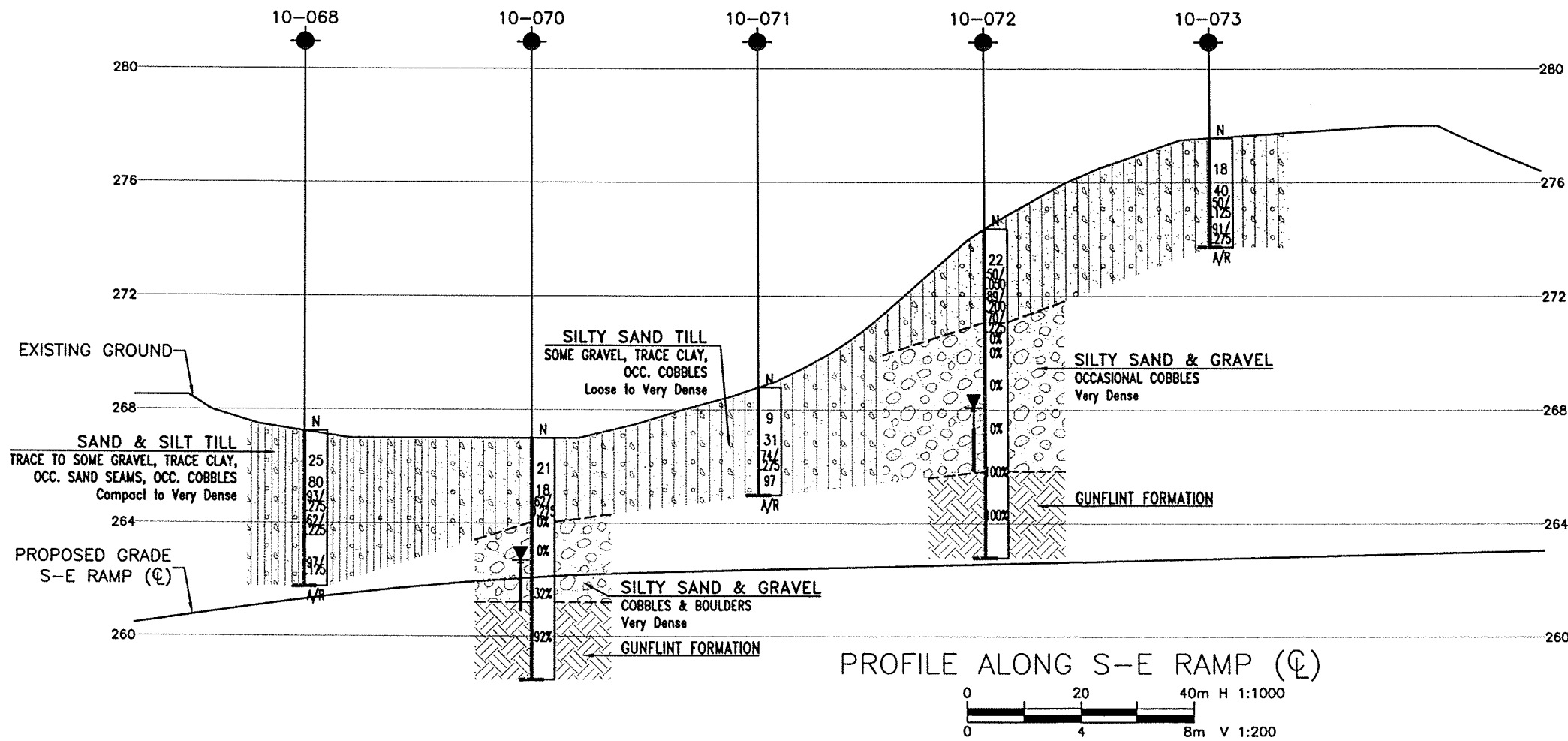
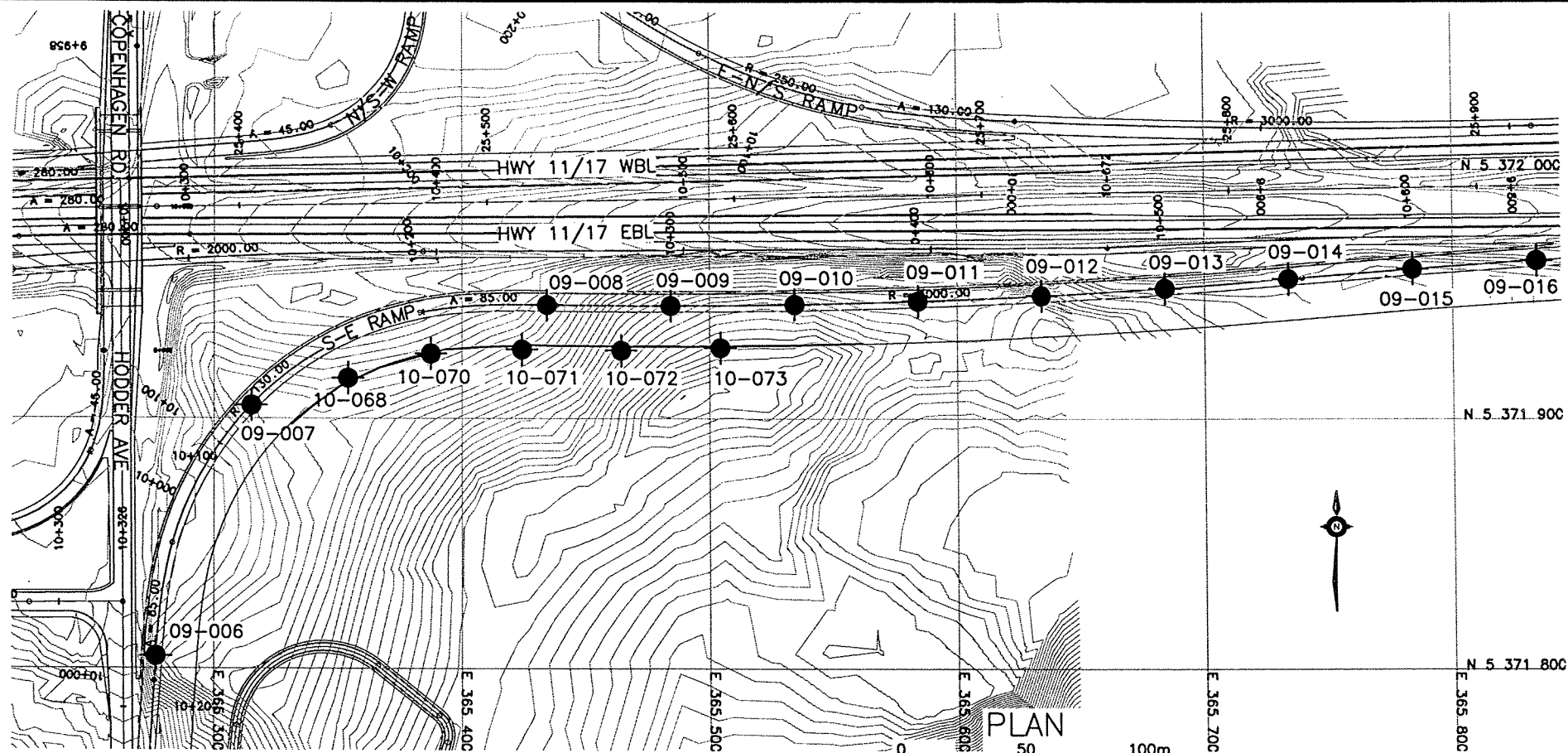
**PLAN**  
0 50 100m  
SCALE 1:2500



**PROFILE ALONG S-E RAMP (C)**

0 50 100m H 1:2500  
0 4 8m V 1:200

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	AN	CHK PKC	SITE
			STRUCT
			DWG G1



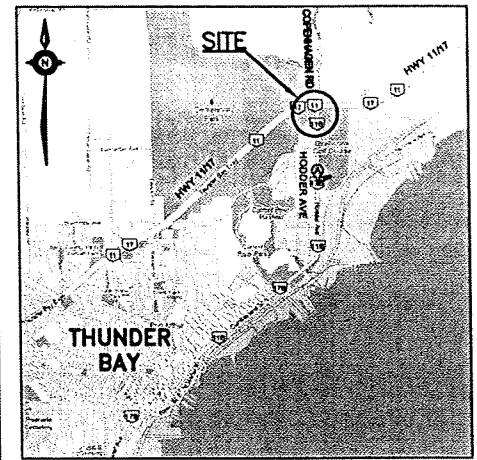
**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
S-E RAMP (RT. OF C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** MCCORMICK RANKIN  
CORPORATION

**THURBER ENGINEERING LTD.**  
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**KEYPLAN  
LEGEND**

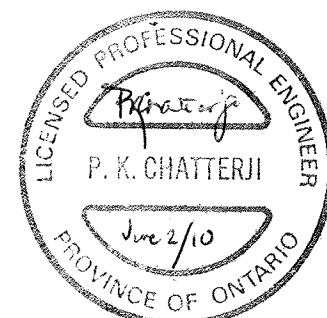
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- ↑ Head Artesian Water
- ↑ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	CL OFFSET
10-068	10+160	15m RT.
10-070	10+200	17m RT.
10-071	10+240	18m RT.
10-072	10+280	18m RT.
10-073	10+320	17m RT.

**-NOTES-**

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	MFA	CHK PKC	SITE
		STRUCT	DWG G2

## **Appendix H**

### **Hodder Avenue Interchange N-E Ramp**

**Station 10+100 to 10+300**

**Boreholes 09-17 to 09-20**






# RECORD OF BOREHOLE No 09-017

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave N-E Ramp, Sta. 10+050 CL ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.01 - 2009.07.01 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	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									
0.0	Silty <b>CLAY</b> , sandy, trace gravel Brown (TILL)		1	AS													4 38 38 20
0.6	<b>SAND</b> , trace silt, some gravel Very Dense Brown		1	SS	100/ 050												
1.1	<b>GUNFLINT FORMATION</b> , very strong (chert carbonate), slightly weathered, charcoal grey		1	RUN													RUN 1# TCR=67%, SCR=63%, RQD=10% UCS=182MPa
2.6	END OF BOREHOLE AT 2.6m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																

# RECORD OF BOREHOLE No 09-018

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave N-E Ramp, Sta. 10+100 CL ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.01 - 2009.07.01 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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									
0.0	Silty SAND, some clay, trace gravel Compact Brown Moist (TILL)		1	AS																
			1	SS	17											4 53 33 10				
1.5	GUNFLINT FORMATION, very strong (chert carbonate), slightly to moderately weathered, thinly banded, calcite veining		1	RUN											FI 1 0 >3	RUN 1# TCR=89%, SCR=78%, RQD=67% UCS=211MPa				
2.9	END OF BOREHOLE AT 2.9m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																			

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 09-020

1 OF 1

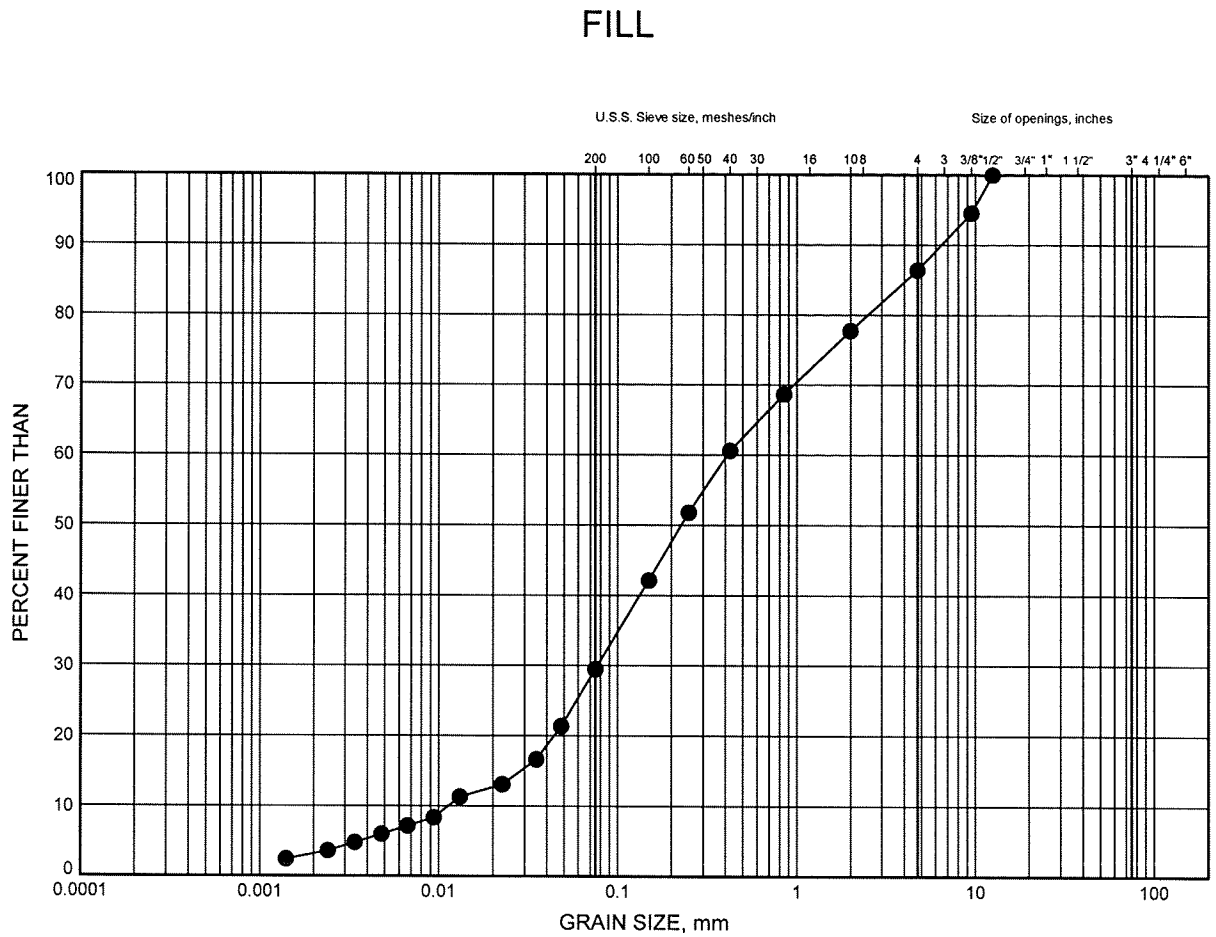
METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave N-E Ramp, Sta. 10+240 CL ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.07.02 - 2009.07.02 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	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	x	LAB VANE							
								20	40	60	80	100					

# Hwy 11/17 Hodder Avenue GRAIN SIZE DISTRIBUTION

FIGURE H1



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

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-020	1.07	

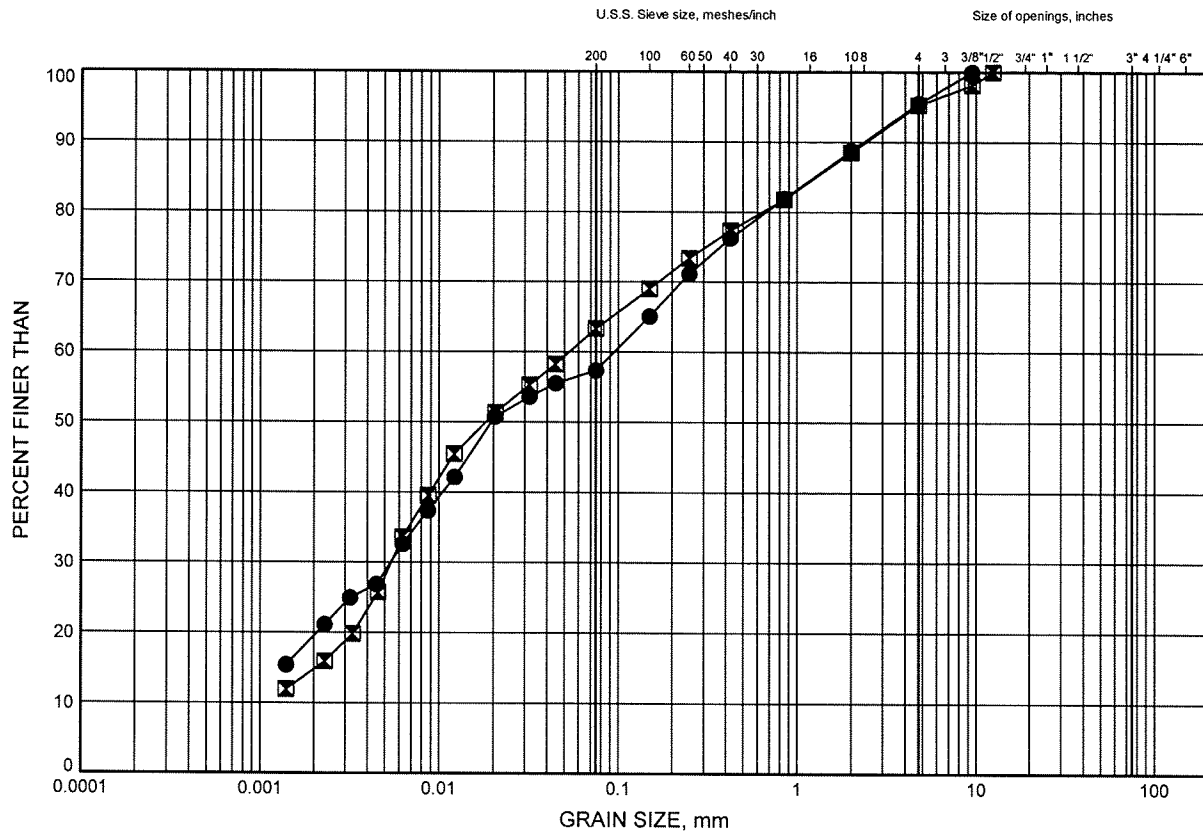


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE H2

CLAYEY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-017	0.38	
⊠	09-019	1.07	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

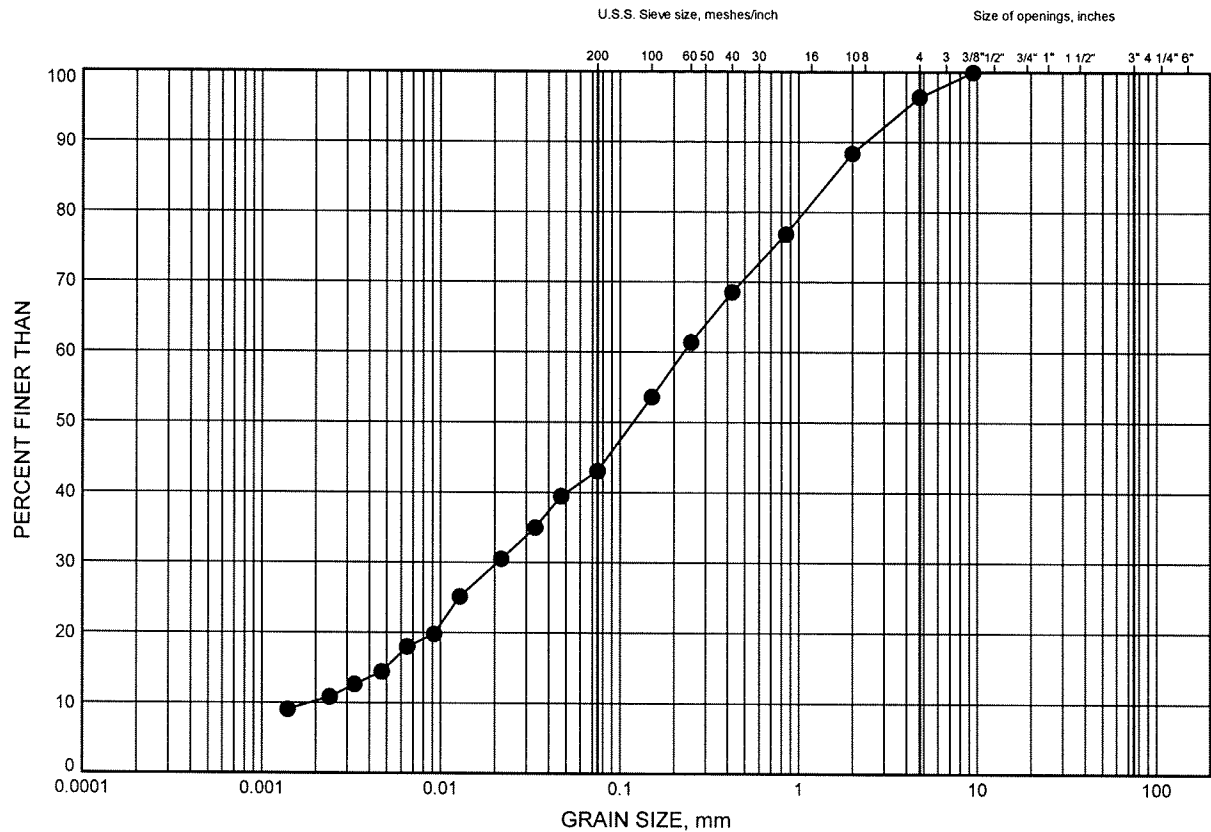
W.P.# 334-94-00  
Prepared By AN  
Checked By MRA



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE H3

SILTY SAND TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-018	1.07	

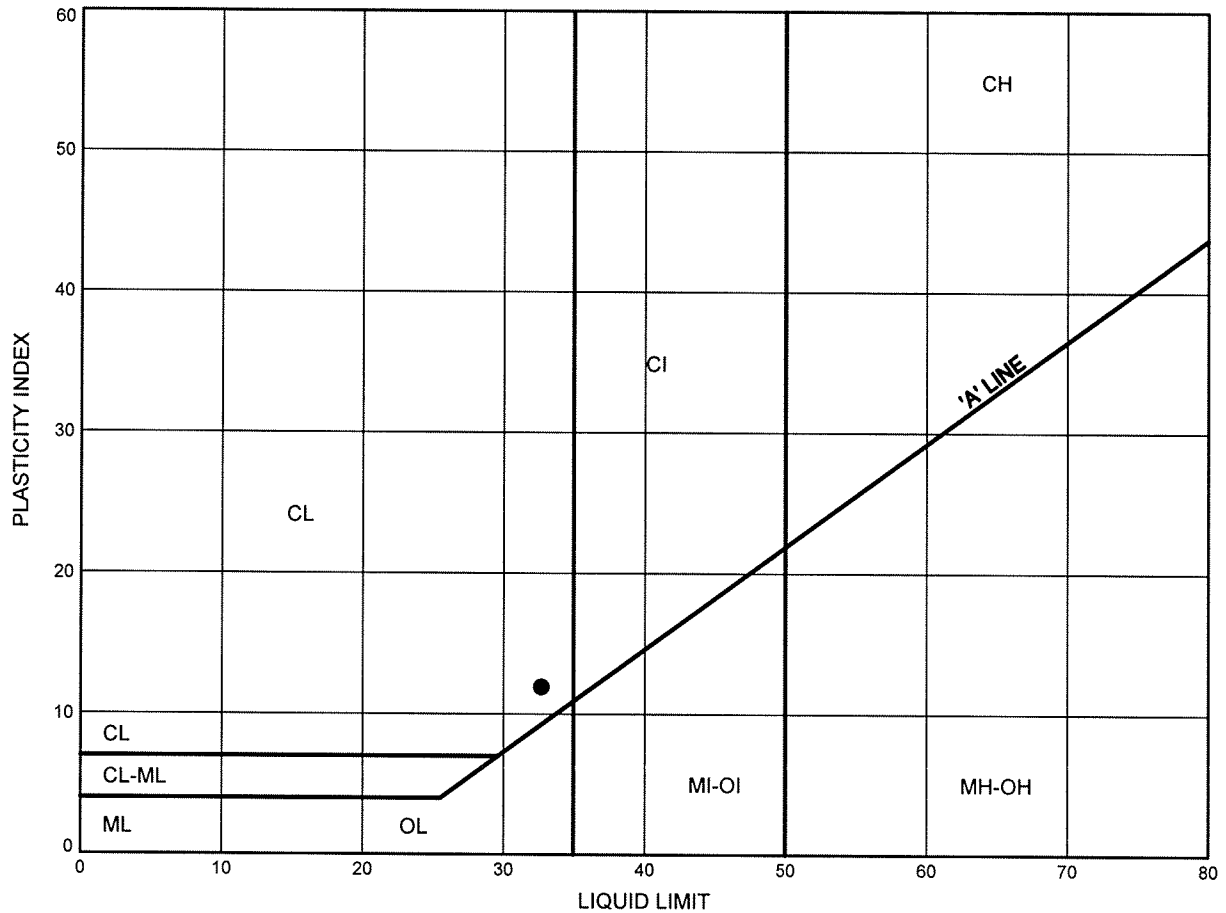


W.P.# 334-94-00  
Prepared By AN  
Checked By MRA

Hwy 11/17 Hodder Avenue  
**ATTERBERG LIMITS TEST RESULTS**

FIGURE H4

**SILTY CLAY TILL**



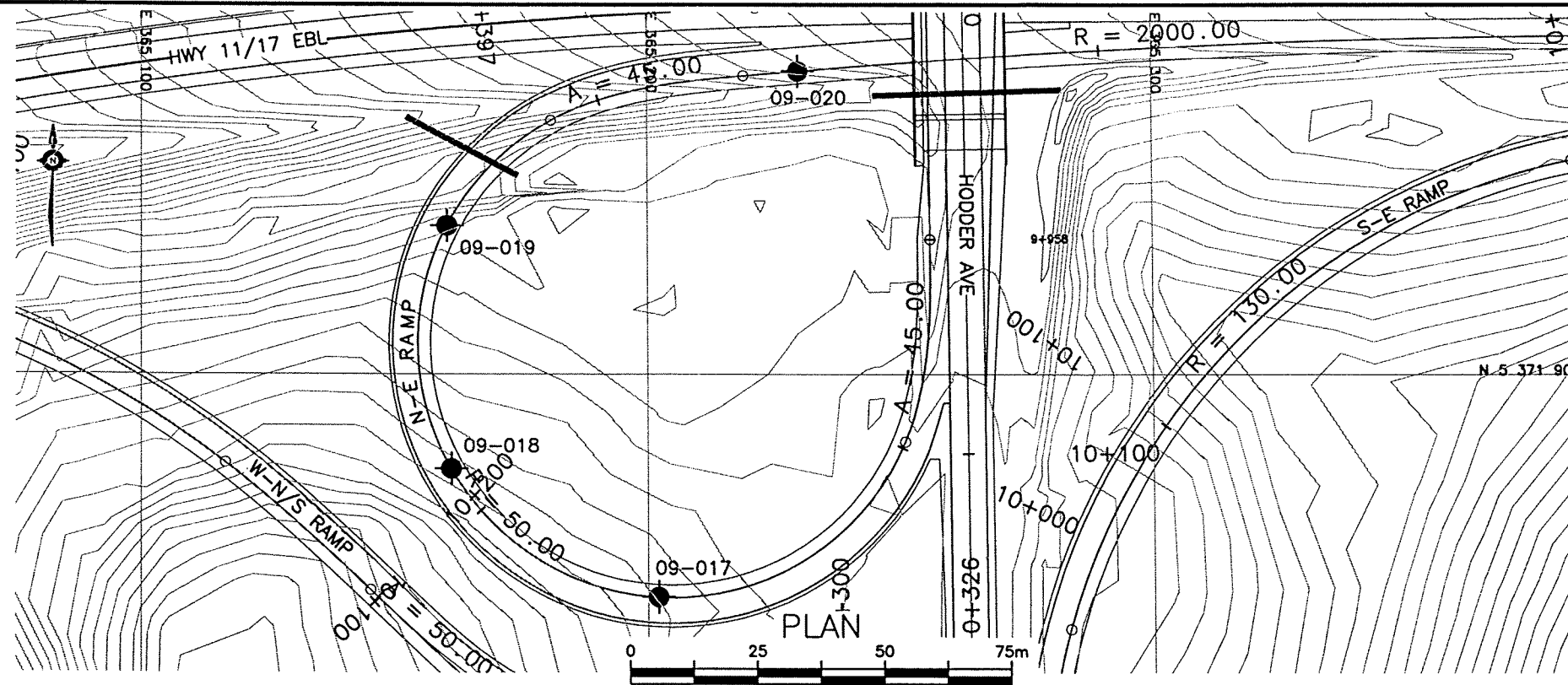
SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	09-017	0.38	

Date April 2010  
 Project 334-94-00



Prep'd AN  
 Chkd. MRA





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

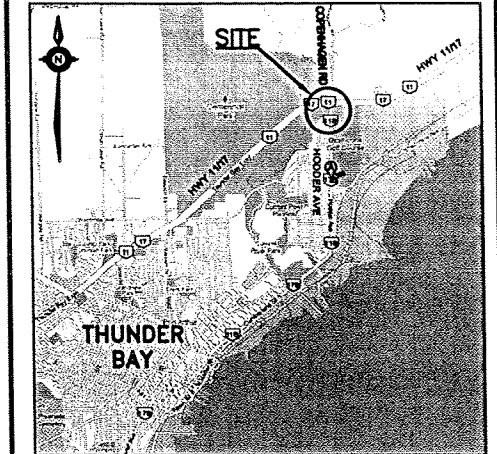


CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
N-E RAMP (C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** McCORMICK RANKIN  
CORPORATION

**THURBER ENGINEERING LTD.**  
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### KEYPLAN LEGEND

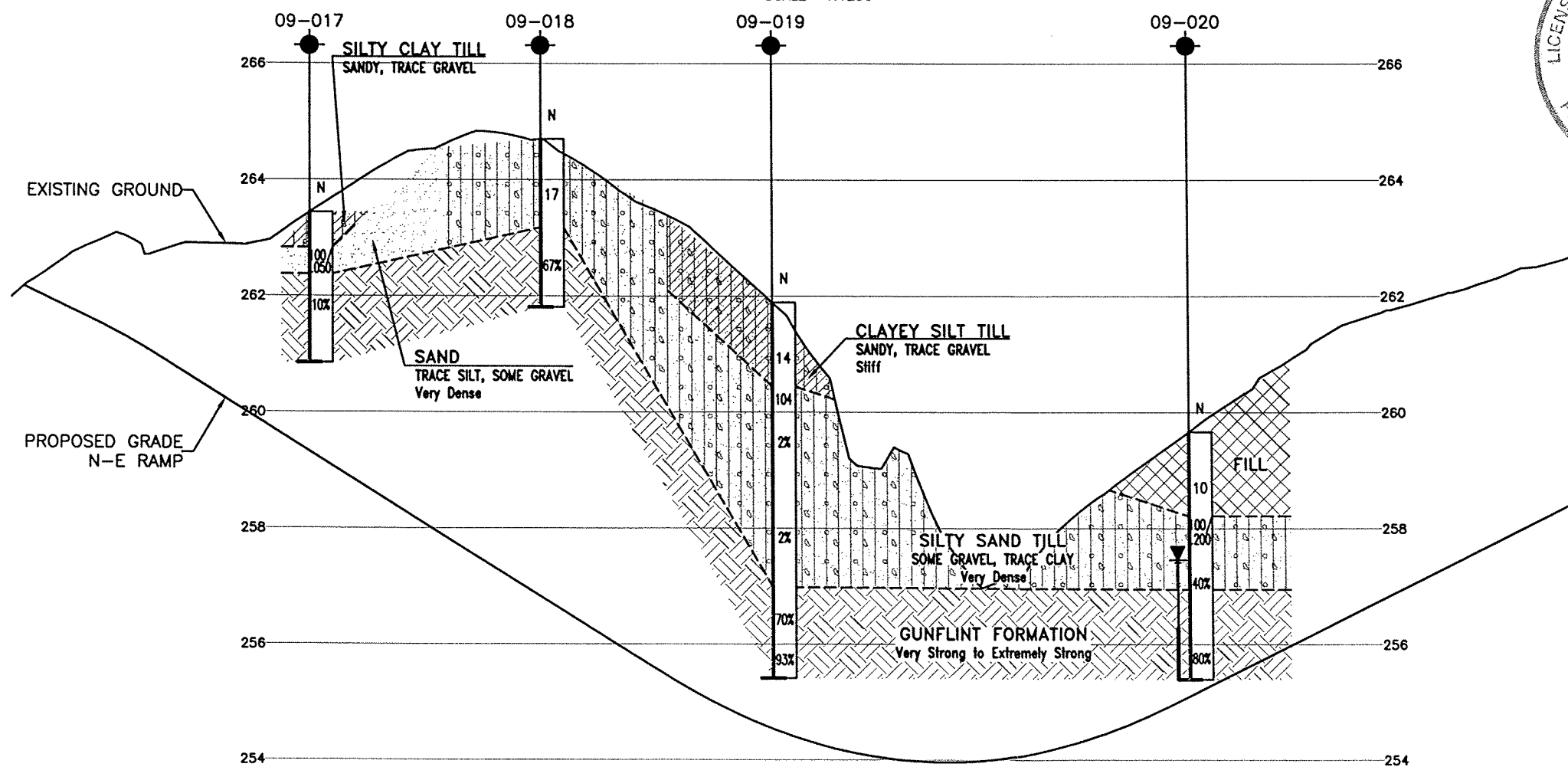
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- ↑ Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	STATION	CL OFFSET
09-17	10+050	0.0m
09-18	10+100	0.0m
09-19	10+150	0.0m
09-20	10+240	0.0m

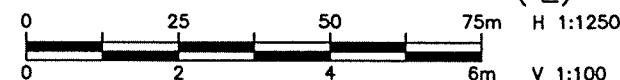
### NOTES

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 52A-146



### PROFILE ALONG N-E RAMP (C)



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MRA	CHK AEG	CODE
DRAWN	AN	CHK PKC	SITE
LOAD			
STRUCT			
DWG	H1		
DATE	JUN. 2010		

**Appendix I**

**Hodder Avenue Interchange W-N/S Ramp**

**Station 10+100 to 10+235**

**Boreholes 09-01 to 09-05, and 10-85 to 10-90**

# RECORD OF BOREHOLE No 09-001

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 905.0 E 365 060.4 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.29 - 2009.06.29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE							WATER CONTENT (%) w <sub>p</sub> w    w <sub>L</sub>			
260.4							20	40	60	80	100	20	40	60	GR	SA	SI	CL
0.0	TOPSOIL, roots, organics																	
259.3			1	SS	21													
1.1	SAND, trace silt, trace gravel, trace organics																	
258.9	Compact Dark brown Moist		2	SS	29													
1.4	SAND and SILT, trace clay, trace to some gravel		3	SS	42													
	Compact to Very Dense Brown Moist (TILL)		4	SS	66													

ONTMT4S 1156.GPJ 3/17/10

+<sup>3</sup> ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (% STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-002

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 893.6 E 365 096.5 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.26 - 2009.06.26 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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		PLASTIC      NATURAL      LIQUID LIMIT      MOISTURE      LIMIT CONTENT				
								● QUICK TRIAXIAL      × LAB VANE		WATER CONTENT (%)				
263.7							20 40 60 80 100							
0.0	Sandy SILT, trace clay, rootlets Loose Brown Moist		1	SS	8									
263.0														
0.7	SAND and SILT, trace to some clay, trace gravel Compact to Very Dense Brown Moist (TILL)		2	SS	22		263							
			3	SS	79		262							7 50 35 8
			4	SS	52		261							
	with cobbles and boulders													
			5	SS	59		260							
			6	SS	78		259							8 49 36 7
			7	SS	101		258							
	Auger refusal on boulder at 4.9m. Began coring. Frequent cobbles and boulders													
			1	RUN			257							RUN 1# TCR=45%, SCR=45%, RQD=38%
257.2														
6.5	GUNFLINT FORMATION, very strong to extremely strong (chert carbonate), slightly weathered, charcoal grey, sub-horizontal fractures, calcite veining		2	RUN			256							RUN 2# TCR=83%, SCR=50%, RQD=50%
	iron staining		3	RUN			255							RUN 3# TCR=100%, SCR=87%, RQD=80%
							254							RUN 4# TCR=100%, SCR=100%, RQD=100%

Continued Next Page

+<sup>3</sup> X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-002

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 893.6 E 365 096.5 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.26 - 2009.06.26 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page		4	RUN				20	40	60	80	100					
252.8							253									0	
10.8	END OF BOREHOLE AT 10.8m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE      DEPTH (m)      ELEV. (m) 2009.11.23      9.2      254.5 2010.03.01      9.4      254.3																

# RECORD OF BOREHOLE No 09-003

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 893.1 E 365 081.2 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.29 - 2009.06.29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m <sup>3</sup>	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 <sub>p</sub> NATURAL MOISTURE CONTENT w LIQUID LIMIT w <sub>L</sub>				
263.1							20	40	60	80	100	20	40	60	GR	SA	SI	CL
0.0	<b>SILT</b> and <b>SAND</b> , trace to some clay, trace gravel Loose to Very Dense Brown Moist (TILL)		1	SS	5													
			2	SS	8										2	30	52	15
			3	SS	28													
	with cobbles and boulders		4	SS	63													
			5	SS	67										9	48	35	8
			6	SS	100/ 0.150													
	Auger refusal on boulder at 4.4m. Began coring. Frequent cobbles and boulders		1	RUN											FI			
			2	RUN														
			3	RUN														
255.4																		
7.6	<b>GUNFLINT FORMATION</b> , strong (chert carbonate), thinly banded, slightly weathered, charcoal grey, sub-horizontal fractures, calcite veining		4	RUN											0			
															3			
															1			
															0			
															1			
															2			
															0			
			5	RUN											0			
		</																

RECORD OF BOREHOLE No 09-003

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 893.1 E 365 081.2 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.29 - 2009.06.29 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60					
	Continued From Previous Page														
252.4							253							2	
10.7	END OF BOREHOLE AT 10.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE        DEPTH (m)    ELEV. (m) 2009.11.23    10.4        252.7													1	

# RECORD OF BOREHOLE No 09-004

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 871.1 E 365 127.8 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2009.06.30 - 2009.06.30 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
267.4								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE	20 40 60 80 100	20 40 60	20 40 60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
0.0	SAND and SILT, trace clay, trace gravel, occasional cobble Compact to Very Dense Brown Moist (TILL)		1	SS	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</

+<sup>3</sup> ×<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (% STRAIN AT FAILURE



RECORD OF BOREHOLE No 09-005

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION Hodder Ave W-N/S Ramp, Sta. 10+235 CL ORIGINATED BY LG  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/BQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2009.06.30 - 2009.06.30 CHECKED BY TH

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100					W <sub>p</sub>	W	W <sub>L</sub>		
0.0	SAND and SILT, trace clay, trace to some gravel Dense to Very Dense Brown Moist (TILL)		1	SS	39												10 57 28 5
			2	SS	59												
			3	SS	62												
2.9	GUNFLINT FORMATION, very strong to extremely strong (chert carbonate), slightly weathered, thinly banded, iron stained fractures, calcite veining		1	RUN													RUN 1# TCR=92%, SCR=85%, RQD=50% UCS=169MPa RUN 2# TCR=93%, SCR=90%, RQD=83% UCS=194MPa RUN 3# TCR=100%, SCR=100%, RQD=92% UCS=267MPa
			2	RUN													
			3	RUN													
6.7	END OF BOREHOLE AT 6.6m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.																

# RECORD OF BOREHOLE No 10-085

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 889.1 E 365 032.3 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.08 - 2010.01.09 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  γ  kN/m <sup>3</sup>	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					PLASTIC      NATURAL      LIQUID LIMIT      MOISTURE      LIMIT 				

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
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			UNIT WEIGHT  $\gamma$  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			"N" VALUES	20      40      60      80      100		W <sub>p</sub>	W			W <sub>L</sub>
								SHEAR STRENGTH kPa						
							○ UNCONFINED	+ FIELD VANE						
							● QUICK TRIAXIAL	x LAB VANE						
							20      40      60      80      100							
									WATER CONTENT (%)					
									20      40      60					

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity



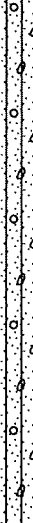
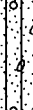
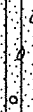

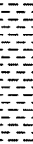
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# RECORD OF BOREHOLE No 10-086

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 898.8 E 365 071.6 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.06 - 2010.01.06 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  γ  kN/m <sup>3</sup>	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 (%)			
261.8							20	40	60	80	100	PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>			
0.0	Clayey <b>SILT</b> , some sand, trace gravel, trace organics Firm Brown Moist (FILL)		1	AS									○				
260.4			1	SS	7								○				
1.4	<b>SILT</b> , some sand, trace gravel, trace organics Very Loose Brown Moist (FILL)		2	SS	3								○				
259.7																	
2.1	Silty <b>SAND</b> , some gravel, trace clay, occasional cobbles Very Dense Brown Moist (TILL)		3	SS	62/ .250								○				
			4	SS	83/ .250								○				14 47 33 6
			5	SS	76/ .225								○				
	Auger refusal at 5.9m. Began coring.		1	RUN													RUN 1# TCR=100%, SCR=0%, RQD=0%
	Numerous cobbles		2	RUN													RUN 2# TCR=67%, SCR=11%, RQD=0%
254.5																	
7.3	<b>GUNFLINT FORMATION</b> , medium strong to very strong (interbedded fine grained wackestone and siltstone), dark grey, sub-horizontal fractures		3	RUN													RUN 3# TCR=100%, SCR=100%, RQD=100% UCS=146MPa
			4	RUN													RUN 4# TCR=100%, SCR=100%, RQD=100% UCS=64MPa
	675mm vertical fracture at 9.7m																

Continued Next Page

+ 3, X 3: Numbers refer to 20 15 10 5 0 (%) STRAIN AT FAILURE  
 Sensitivity

RECORD OF BOREHOLE No 10-086

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 898.8 E 365 071.6 ORIGINATED BY LG  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2010.01.06 - 2010.01.06 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
	Continued From Previous Page																GR SA SI CL
250.9			5	RUN			251									0	RUN 5# TCR=100%, SCR=100%, RQD=100% UCS=31MPa
10.9	END OF BOREHOLE AT 10.9m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.															0	

ONTMT4S 1156.GPJ 4/15/10

+<sup>3</sup>.X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 10 5  
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10-087

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 883.3 E 365 102.6 ORIGINATED BY LG  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2010.01.14 - 2010.01.14 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	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
264.4							264									GR SA SI CL				
0.0	Sandy SILT, trace gravel Loose Brown Moist		1	SS	8															
263.0							263													
1.4	Silty SAND, some gravel, trace clay, occasional cobbles Compact to Very Dense Brown Moist (TILL)		2	SS	34											12 56 26 6				
	Auger refusal at 2.7m. Began coring.		3	SS	50/ 0.075		262													
261.7																				
2.7	Silty SAND and GRAVEL, frequent cobbles Very Dense Brown		1	RUN			261									RUN 1# TCR=29%, SCR=10%, RQD=0%				
							260									RUN 2# TCR=25%, SCR=0%, RQD=0%				
			2	RUN			259													
							258									RUN 3# TCR=77%, SCR=73%, RQD=73% UCS=302MPa				
257.5			3	RUN																
6.9	GUNFLINT FORMATION, very strong to extremely strong (interbedded calcareous siltstone and fine grained wackestone), dark grey, sub-horizontal fractures						257									RUN 4# TCR=83%, SCR=52%, RQD=52% UCS=255MPa				
			4	RUN			256													
							255									RUN 5# TCR=100%, SCR=60%, RQD=60% UCS=243MPa				
			5	RUN																

Continued Next Page

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10-087

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 883.3 E 365 102.6 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.14 - 2010.01.14 CHECKED BY TH

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 <sup>3</sup>	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		
	Continued From Previous Page																
254.0																	
10.4	END OF BOREHOLE AT 10.4m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.						254										

ONTMT4S 1156.GPJ 4/15/10

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15 0.5  
10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 09-088

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 905.7 E 365 080.6 ORIGINATED BY SLL  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NW Casing/BQ Core COMPILED BY AN  
 DATUM Geodetic DATE 2009.12.14 - 2009.12.17 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	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				
262.1								20 40 60 80 100	20 40 60			
0.0	TOPSOIL, with roots and rootlets (200mm)						262					
0.2	Sandy SILT, with roots and rootlets Compact Brown Moist		1	SS	16		261					
260.7												
1.4	SAND and SILT, trace clay, trace gravel Dense to Very Dense Brown Moist (TILL)		2	SS	34		260				6 43 42 9	
			3	SS	85/ 250							
	Occasional cobbles Auger refusal at 3.0m Advanced using NW casing and BQ coring		4	SS	50/ .125		259					
							258					
			5	SS	50/ .125		257					
							256					
			6	SS	50/ .150							
255.1							255					
7.0	SAND and GRAVEL, some silt, occasional cobble Very Dense Grey Moist to Wet		7	SS	100/ .100		254					
							253					
			8	SS	100/ .100							

Continued Next Page

+<sup>3</sup> . X<sup>3</sup> : Numbers refer to  
Sensitivity

20  
15 10 5  
10 (%) STRAIN AT FAILURE





# RECORD OF BOREHOLE No 10-089

1 OF 1

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 911.1 E 365 095.9 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.08 - 2010.01.08 CHECKED BY TH

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 <sup>3</sup>	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 <sub>p</sub> w   w <sub>L</sub>				
								20	40	60	80	100	20	40		
262.2																
0.0	Silty <b>SAND</b> , trace gravel, occasional shale fragments Compact Reddish Brown Moist		1	SS	19											
260.8																
1.4	<b>SAND</b> and <b>SILT</b> , trace to some gravel, trace clay, occasional cobbles Compact to Very Dense Brown Moist (TILL)		2	SS	27											
			3	SS	55											
			4	SS	61											
257.6																
4.6	<b>GUNFLINT FORMATION</b> , very strong to extremely strong (interbedded calcareous siltstone and fine grained wackestone), slightly weathered to fresh, dark to light grey, sub-horizontal fractures		1	RUN												
			2	RUN												
			3	RUN												
253.2	175mm vertical fracture at 7.2m															
9.0	END OF BOREHOLE AT 9.0m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.															

ONTMT4S 1156.GPJ 4/15/10

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 10-090

1 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 914.7 E 365 074.9 ORIGINATED BY LG  
 HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
 DATUM Geodetic DATE 2010.01.07 - 2010.01.07 CHECKED BY TH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								WATER CONTENT (%)					
260.6							20 40 60 80 100						
0.0	Sandy SILT, some gravel, trace organics and wood, occasional cobbles Compact Brown/Black Moist (FILL)												
258.8			1	SS	11								
			2	SS	50/ .125								
1.8	Silty SAND, some gravel, trace silt, occasional cobbles Very Dense Brown Moist (TILL)												
			3	SS	79								
			4	SS	100/ .175								
			5	SS	100/ .125								
255.3	Auger refusal at 5.3m. Began coring.												
5.3	SAND and GRAVEL, numerous cobbles Very Dense Brown		1	RUN									
			2	RUN									
			3	RUN									
			4	RUN									
			5	RUN									

Continued Next Page

+<sup>3</sup> . X<sup>3</sup> : Numbers refer to 20 15 10  
Sensitivity (% STRAIN AT FAILURE)

RECORD OF BOREHOLE No 10-090

2 OF 2

METRIC

G.W.P. 334-94-00 LOCATION N 5 371 914.7 E 365 074.9 ORIGINATED BY LG  
HWY 11/17 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2010.01.07 - 2010.01.07 CHECKED BY TH

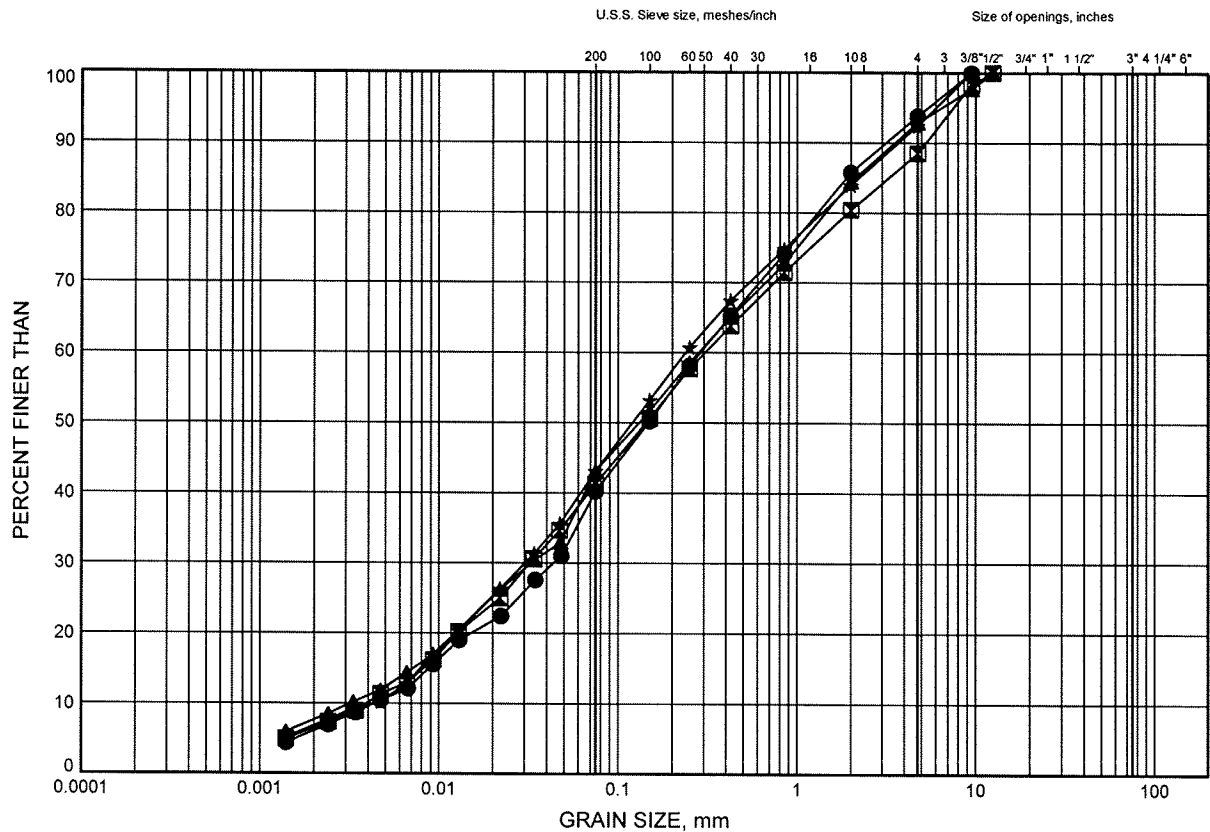
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								20 40 60 80 100								
Continued From Previous Page							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    × LAB VANE				WATER CONTENT (%)					
	SAND and GRAVEL, numerous cobbles		6	RUN			250									RUN 6# TCR=12%, SCR=3%, RQD=0%
			7	RUN			249									RUN 7# TCR=12%, SCR=3%, RQD=0%
			8	RUN			247									RUN 8# TCR=70%, SCR=28%, RQD=0%
246.5	GUNFLINT FORMATION, strong to very strong (interbedded calcareous siltstone to calcareous fine grained wackestone), light to dark grey, sub-horizontal fractures		9	RUN			246								FI	RUN 9# TCR=100%, SCR=100%, RQD=100%
14.1			10	RUN			245								5	RUN 10# TCR=100%, SCR=97%, RQD=57% UCS=131MPa
			11	RUN			244								2	RUN 11# TCR=100%, SCR=97%, RQD=97% UCS=53MPa
242.9	END OF BOREHOLE AT 17.7m. BOREHOLE BACKFILLED WITH BENTONITE TO SURFACE.						243									
17.7																

ONTMT4S 1156.GPJ 4/15/10

Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE 11

**SILTY SAND to SAND & SILT TILL**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-001	2.53	257.84
⊠	09-001	4.75	255.62
▲	09-002	1.83	261.83
★	09-002	4.11	259.54

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

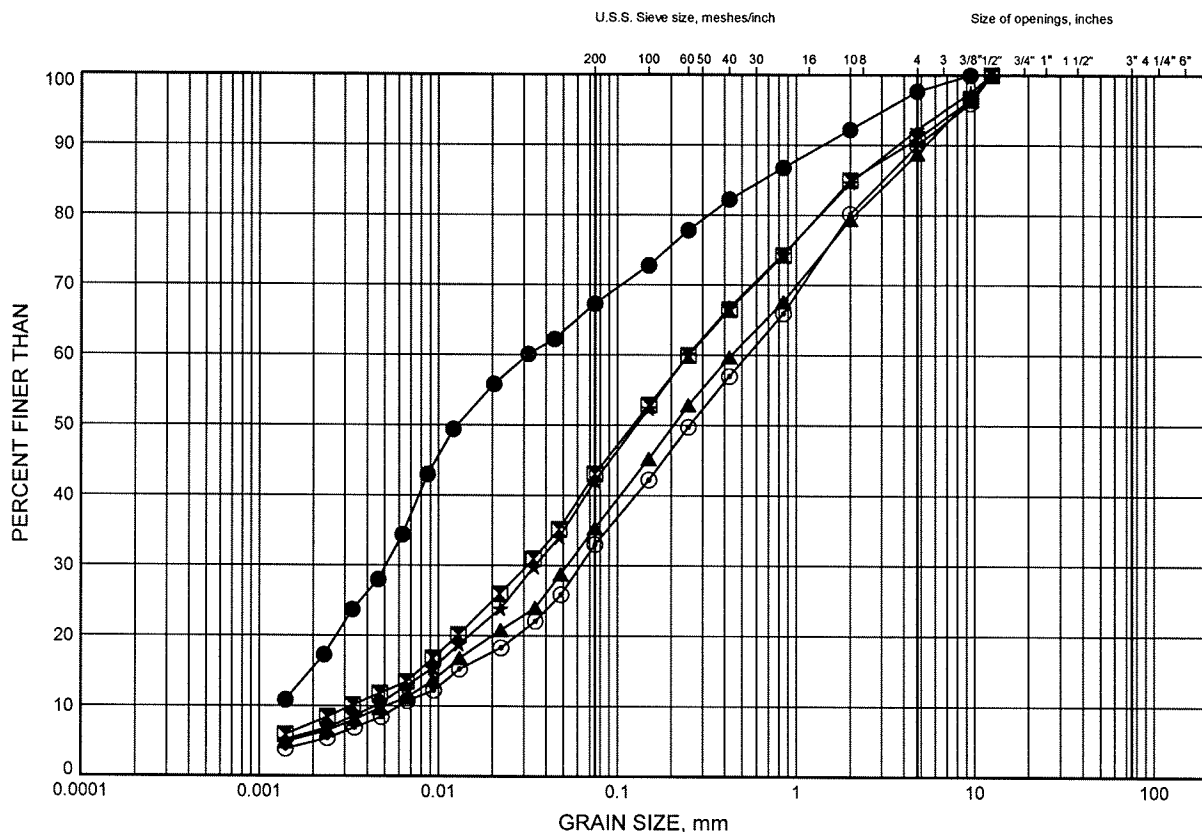
W.P.# 334-94-00  
 Prepared By AN  
 Checked By MRA



Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE 12

**SILTY SAND to SAND & SILT TILL**



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

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-003	1.07	262.00
⊠	09-003	3.35	259.72
▲	09-004	1.07	266.31
★	09-004	2.59	264.78
⊙	09-005	1.83	

GRAIN SIZE DISTRIBUTION - THURBER 1156.GPJ 4/15/10

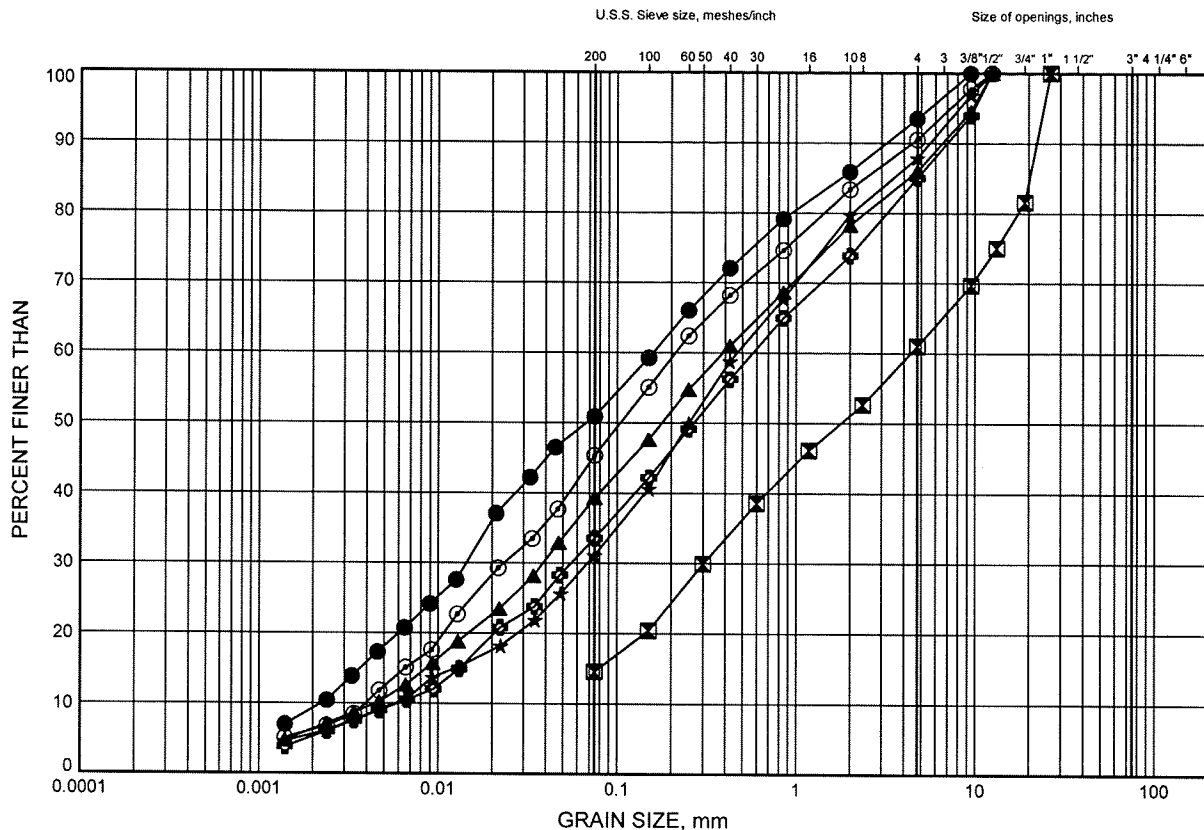
W.P.# 334-94-00  
 Prepared By AN  
 Checked By MRA



Hwy 11/17 Hodder Avenue  
GRAIN SIZE DISTRIBUTION

FIGURE I3

SILTY SAND to SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-088	1.83	260.27
⊠	10-085	3.24	252.11
▲	10-086	3.25	258.57
★	10-087	1.83	262.57
⊙	10-089	2.59	259.61
⊕	10-090	2.59	258.01

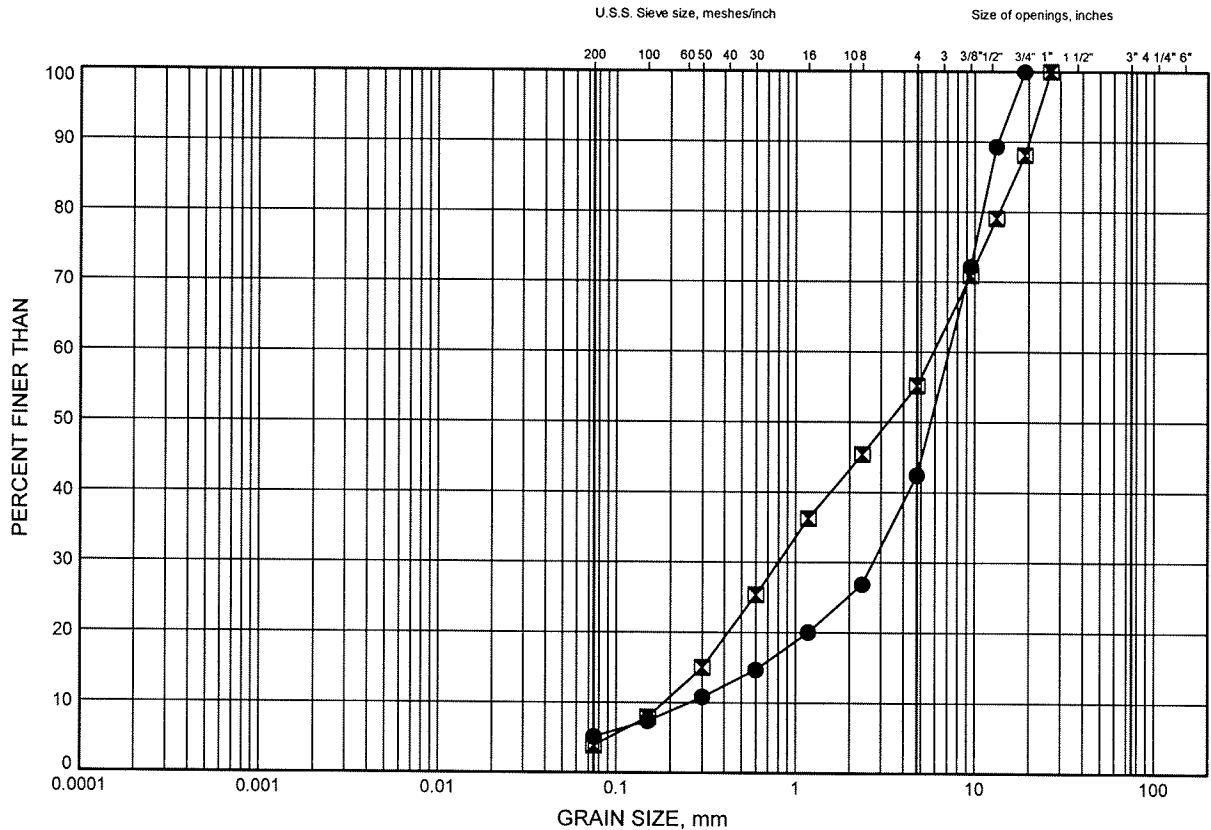


W.P.# .334-94-00.....  
Prepared By .AN.....  
Checked By .MRA.....

Hwy 11/17 Hodder Avenue  
**GRAIN SIZE DISTRIBUTION**

FIGURE I4

**SAND & GRAVEL**



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

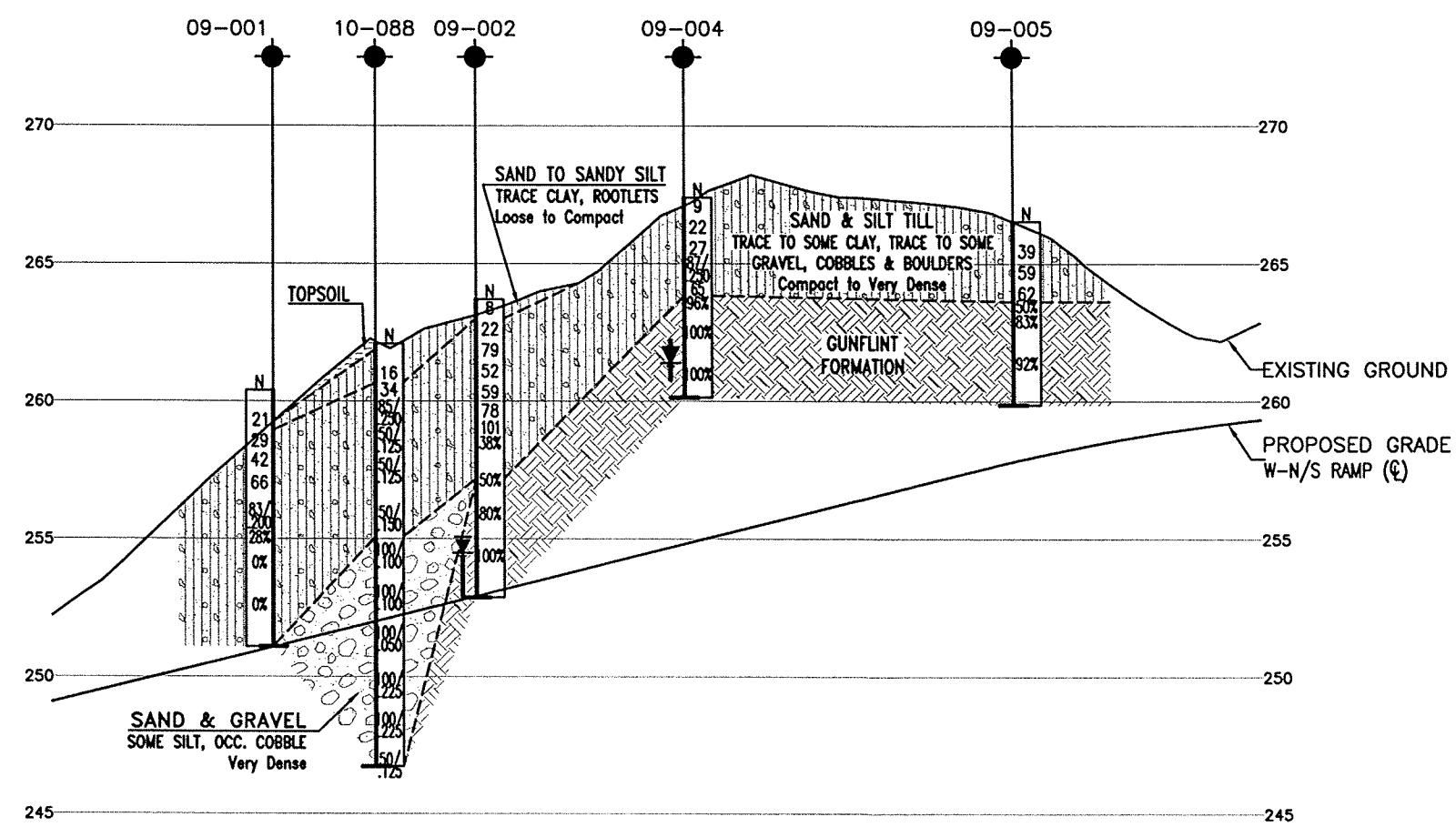
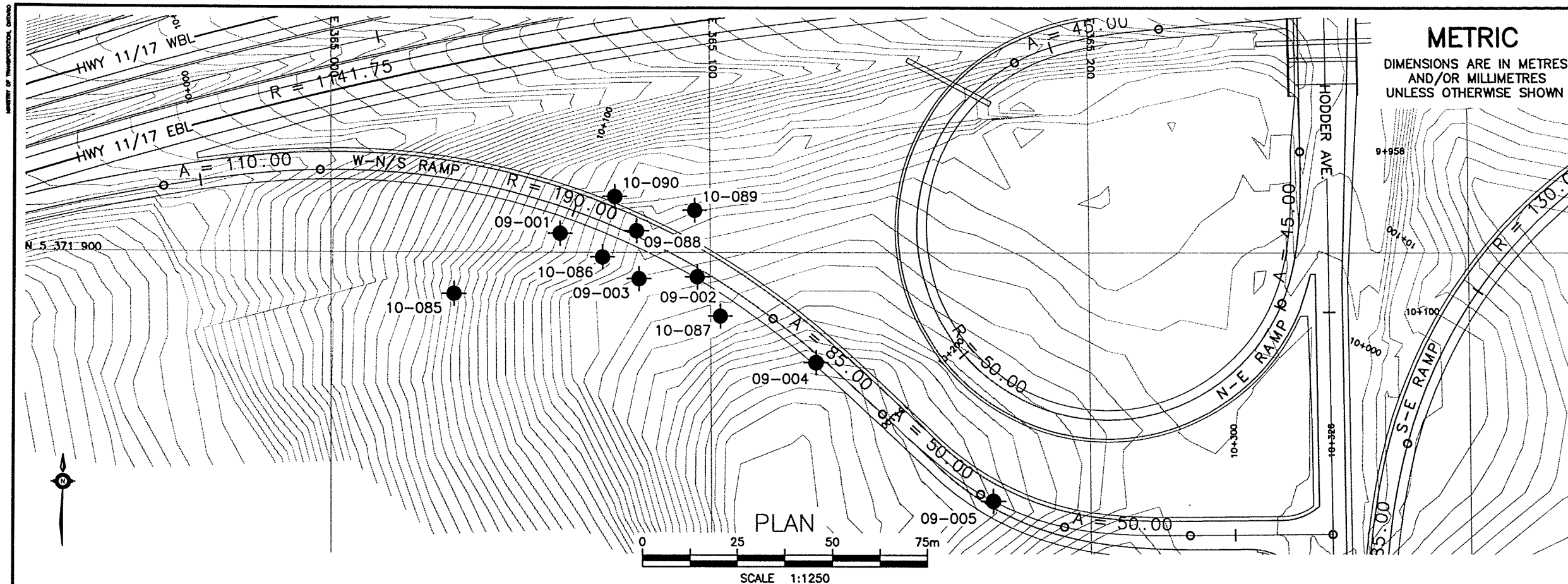
**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	09-088	12.36	249.74
■	09-088	15.26	246.84



W.P.# .334-94-00.....  
 Prepared By .AN.....  
 Checked By .MRA.....





CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
W-N/S RAMP (CL)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** McCORMICK RANKIN CORPORATION

**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

SHEET

**KEYPLAN**

**LEGEND**

- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ▽ Water Level
- ▽ Head Artesian Water
- ▽ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
09-001	260.4	5 371 905.0	365 060.4
09-002	263.7	5 371 893.6	365 096.5
09-004	267.4	5 371 871.1	365 127.8
09-088	262.1	5 371 905.7	365 080.6

NO	STATION	CL OFFSET
09-005	10+235	0m

**NOTES-**

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

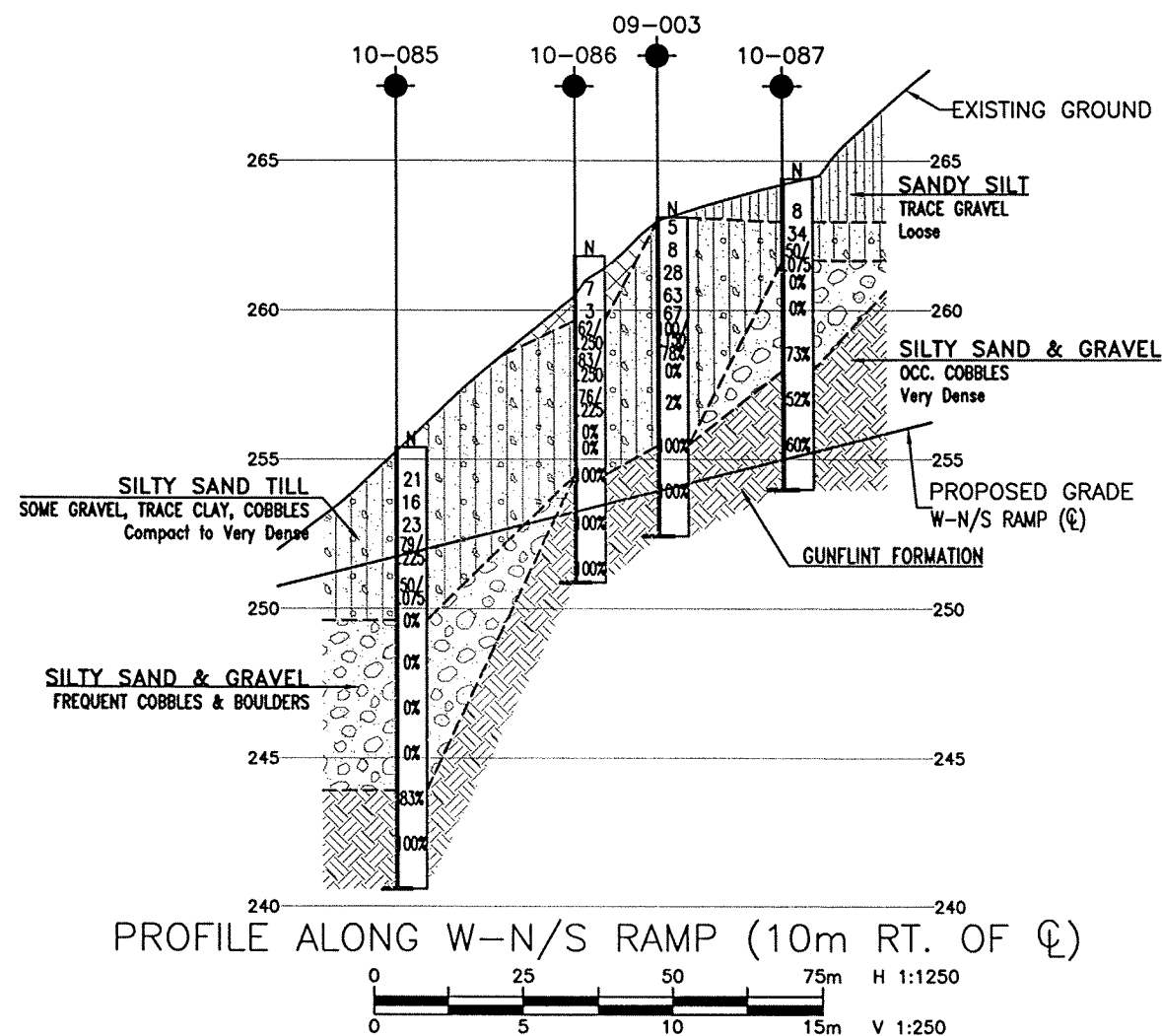
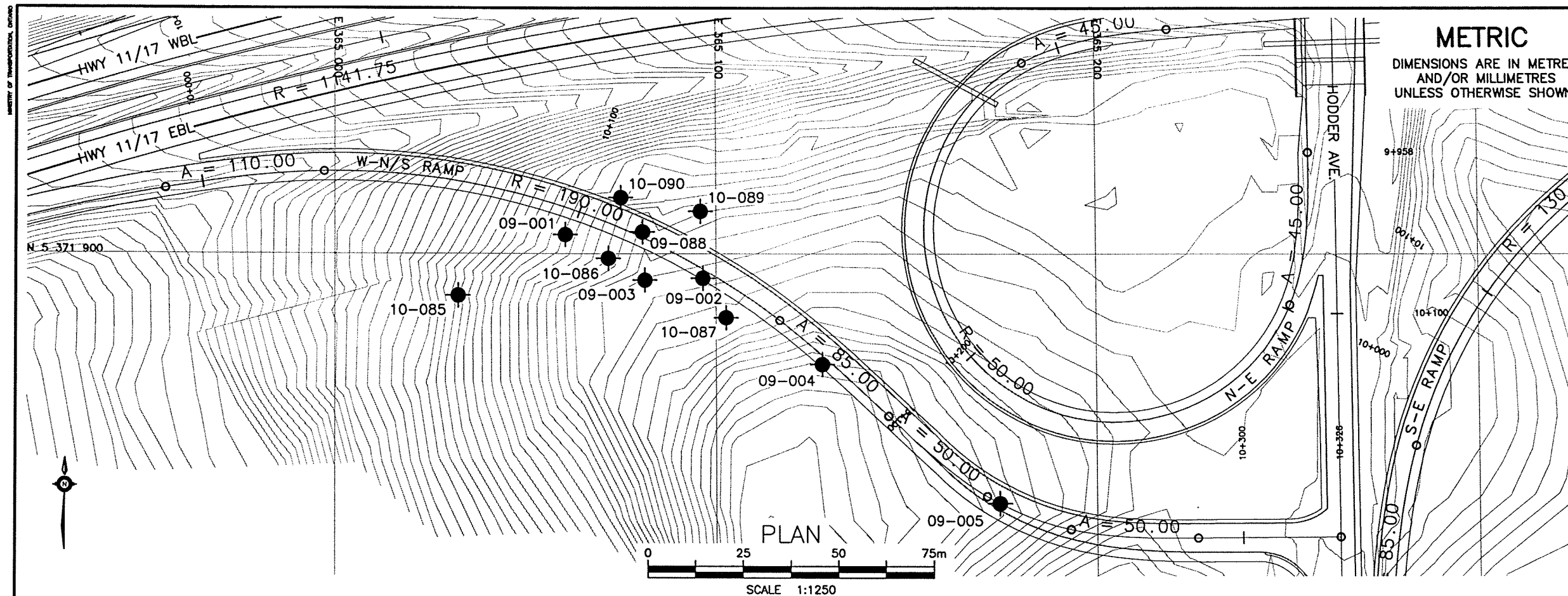
2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**

REVISIONS		DATE	BY	DESCRIPTION
DESIGN	MRA	CHK	AEG	CODE
DRAWN	MFA	CHK	PKC	SITE
LOAD		DATE	JUN. 2010	
STRUCT		DATE	JUN. 2010	

FILENAME: G:\Projects\1115\115-Hodder Ave W-N/S Ramp (Plan&Profile).dwg  
 PLANTING: Jan 01, 2010 1:53pm





METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

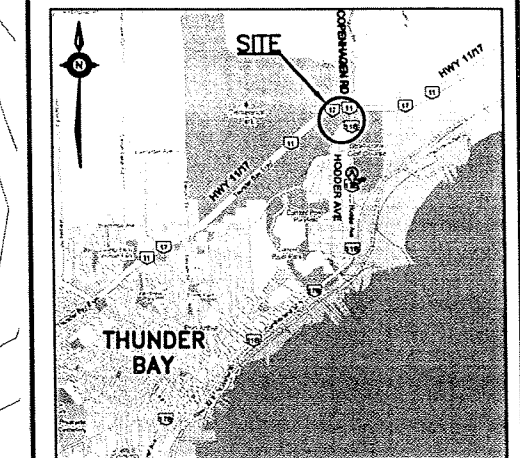
CONT No  
WP No 334-94-00

HIGHWAY 11/17  
AT HODDER AVENUE  
W-N/S RAMP (10m RT. OF C)  
BOREHOLE LOCATIONS AND SOIL STRATA

**MRC** **McCORMICK RANKIN**  
**CORPORATION**








**THURBER ENGINEERING LTD.**  
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



## KEYPLAN

LEGEND

- |   |                                       |
|---|---------------------------------------|
|  | Borehole                              |
|  | Borehole and Cone                     |
| N   | Blows /0.3m (Std Pen Test, 475J/blow) |
| CONE  | Blows /0.3m (60° Cone, 475J/blow)     |
| PH  | Pressure, Hydraulic                   |
|  | Water Level                           |
|  | Head Artesian Water                   |
|  | Piezometer                            |
| 90%   | Rock Quality Designation (RQD)        |
| A/R   | Auger Refusal                         |

[illegible]

**-NOTES-**

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

**GEOCRES No. 52A-146**

REVISIONS									
	DATE	BY	DESCRIPTION						
DESIGN	MRA	CHK	AEG	CODE	LOAD		DATE	JUN. 2010	
DRAWN	MFA	CHK	PKC	SITE	STRUCT		DWG	13	

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BY: CMMATE: LUCY 01/2010 1:42pm