

**FOUNDATION INVESTIGATION REPORT  
HIGHWAY 11 AT PAN LAKE, 9.5 km NORTH OF HIGHWAY 64  
EMBANKMENT FROM STATION 14+550 TO 15+210  
TOWNSHIP OF OLIVE, ONTARIO  
G.W.P. 5578-04-00**

**GEOCRES No.: 31L-151**

**Report to**

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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for the existing embankment carrying Highway 11 at Pan Lake, approximately 9.5 km north of Highway 64, in the Township of Olive, Ontario.

The purpose of the investigation was to explore the subsurface conditions beneath an existing embankment, just east of the shoreline of Pan Lake, from Station 14+550 northerly to 15+210 and an existing culvert, Robin Creek Culvert, located approximately at Station 15+040.

Based on the data obtained from this investigation, a borehole location plan, borehole logs, stratigraphic profiles, cross-sections and a written description of the subsurface conditions are provided. A model of the subsurface conditions was developed through considering a combination of the data obtained in the course of the present investigation and the data obtained from a previous investigation<sup>1</sup> at the project site.

Thurber Engineering Ltd. (Thurber) carried out the investigation as a sub-consultant to MMM Group Limited (MMM) under MTO Assignment Number 5009-E-0024.

**2 SITE DESCRIPTION**

The site is located on Highway 11, approximately 9.5 km north of Highway 64. Highway 11 at this location is a two lane road with gravel shoulders. The site location is shown on Drawing 1 in Appendix C. Site photographs are presented in Appendix F of this report.

The highway embankment is located on the east edge of Pan Lake. The areas to the east and northwest consist of a thick vegetation cover of mature trees and brush. Near the north end of the report limit, Robin Creek crosses Highway 11 in an approximate west-east orientation. The east end of the Robin Creek Culvert connects to a swamp. Drainage in the general area is to the northeast and is mainly controlled by Robin Creek.

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<sup>1</sup> Foundation Investigation Report – Highway 11 at Pan Lake, 10.6 km north of Highway 64 – Station 14+750 to 14+950, in Olive Township – 03 September 2008, by AMEC, GEOCRES No. 31L-123.

This site lies within the physiographic region known as Laurentian Highlands, located in the southernmost part of the Canadian Shield (Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 1). The local physiography is characterized by undulating rock outcrops and variable overburden soils, with swamps and lakes covering the low-lying areas. The bedrock at this site consists of Precambrian granite and gneiss.

### 3 SITE INVESTIGATION AND FIELD TESTING

The site investigation for this section of the Highway 11 was carried out in three phases, from April 06, 2011 until May 05, 2011. A total of 19 boreholes were drilled.

All boreholes were advanced to refusal at depths ranging from 1.1 m to 17.3 m. Approximate locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix C. The borehole locations and elevations were surveyed by MMM.

Boreholes BH11-01 to BH11-06 were drilled using a track-mounted CME 75 drill rig supplied and operated by George Downing Estate Drilling Ltd. of Hawkesbury, Ontario. Hollow stem auger drilling techniques were used to advance the boreholes through the overburden. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Undisturbed Shelby tube samples were obtained in Boreholes BH11-04 and 11-06. In-situ vane shear strength tests (MTO-N vane) were conducted in BH11-04.

Boreholes BH11-07 to BH11-10, RCC-01 and RCC-02 were drilled using a portable tripod drill rig on a raft supplied and operated by OGS INC. of Almonte, Ontario. Casing/wash boring drilling techniques were used to advance the boreholes. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with SPT.

Boreholes BH11-11 to BH11-17 were drilled using a truck-mounted drill rig supplied and operated by George Downing Estate Drilling Ltd. Hollow stem drilling techniques were used to advance the boreholes in the overburden. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with SPT. NQ size rock cores were retrieved in Boreholes BH11-11, BH11-12 and BH11-15.

The boreholes considered in the preparation of this report are separated in the following groups according to their location and purpose, as shown in the table below.

| <b>Location</b>  | <b>Boreholes</b>  |
|--|---|
| Pan Lake / West of HWY 11<br>(Sta. 14+600 and Sta. 14+670)           | BH2A, BH4B, BH6B and BH7 (all by AMEC)  |
| Highway 11<br>West shoulder at Pan Lake                              | BH11-11, BH11-12  |
| Highway 11<br>East side (3 to 4 m beyond the<br>existing embankment) | BH11-01, BH11-02, BH11-03, BH11-04, BH11-05, BH11-06,<br>BH11-07, BH11-08, BH11-09, BH11-10 |

| Location                                   | Boreholes                                   |
|--|---|
| Highway 11<br>East Shoulder at Robin Creek | BH11-13, BH11-14, BH11-15, BH11-16, BH11-17 |
| Robin Creek Culvert                        | RCC-1 and RCC-2                             |

The coordinates and elevations of the boreholes are provided on the Borehole Locations and Soil Strata Drawing in Appendix C and on the individual Record of Borehole Sheets in Appendix A.

Standpipe piezometers, consisting of 19 mm and 25 mm PVC pipes with slotted tips, were installed in 6 of the 19 boreholes to monitor the groundwater level. The installation and backfilling details of the piezometers and boreholes are provided below:

| Borehole | Piezometer<br>Tip<br>Depth (m) | Installation Details  |
|----------|--------------------------------|---|
| 11-02    | 8.8                            | 19 mm diameter piezometer with 1.5 m slotted screen installed, sand filter from 8.8 to 4.7 m, bentonite seal from 64.7 m to ground surface.   |
| 11-04    | 7.3                            | 19 mm diameter piezometer with 1.5 m slotted screen installed, sand filter from 7.3 to 4.8 m, bentonite seal from 4.8 m to ground surface.    |
| 11-06    | 8.6                            | 19 mm diameter piezometer with 1.5 m slotted screen installed, sand filter from 8.6 to 5.2 m, bentonite seal from 5.2 m to ground surface.    |
| 11-09    | 4.0                            | 25 mm diameter piezometer with 1.5 m slotted screen installed, sand filter from 4.0 to 1.2 m, bentonite seal 1.2 m to ground surface.         |
| 11-12    | 15.8                           | 19 mm diameter piezometer with 3.0 m slotted screen installed, sand filter from 15.8 to 10.6 m, bentonite seal from 10.6 m to ground surface. |
| 11-13    | 7.0                            | 19 mm diameter piezometer with 1.5 m slotted screen installed, sand filter from 7.0 to 5.2 m, bentonite seal from 5.2 m to ground surface.    |

A member of Thurber's engineering staff supervised the borehole drilling and sampling operations on a full time basis. The inspector logged the boreholes and the recovered soil and rock samples and processed them for transport to Thurber's Oakville office.

#### 4 LABORATORY TESTING

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

Selected samples were subjected to gradation analysis (sieve and hydrometer) and Atterberg Limit tests and the results are shown on the Record of Borehole sheets in Appendix A and on the figures in Appendix B.

All rock cores were logged and core recovery (TCR and SCR) at Rock Quality Designation (RQD) were determined for each core run. This data is presented on the borehole logs.

## **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

### **5.1 General**

Reference is made to the Record of Borehole sheets in Appendix A. Details of the encountered soil stratigraphy are presented in this appendix and on the attached Borehole Locations and Soil Strata Drawing. An overall description of the stratigraphy is provided below. The factual data presented in the borehole logs governs any interpretation of the site conditions.

The general stratigraphy of the area consist of peat, overlying silt and sand, which is underlain by sand and gravel, and then by Precambrian granite and gneiss bedrock.

The subsurface soils encountered below the bed of Pan Lake, at Boreholes BH4B, BH6B and BH7 (drilled by AMEC, shown in Appendix E), consist of peat at the lakebed, underlain by silty clay, silt and sand, which overlies assumed bedrock. Similar conditions were encountered in a fourth borehole (BH2A) drilled by AMEC, located West of HWY 11 at the East edge of Pan Lake.

Along the west shoulder of Highway 11 at Pan Lake, the subsurface soils encountered consist of asphalt, underlain by granular fill and rockfill, then layers of native silt, sand and gravel, cobbles and boulders overlying bedrock.

The general subsurface soils encountered on the east side of Highway 11 (3 to 4 m beyond the existing embankment) consist of native peat/organics, silty clay and clayey silt, silt, sand and gravel, overlying bedrock.

Along the east shoulder of Highway 11 at Robin Creek, the general soil condition encountered was asphalt underlain by granular fill and rockfill, then silt, sand and gravel, overlying bedrock.

Finally, at the location of Robin Creek culvert, the subsurface soils consisted of peat and sand at the creek bed, underlain by layers of clayey silt, silt, gravel, and then bedrock.

More detailed descriptions of the individual strata are presented below.

### **5.2 Pan Lake (Sta. 14+600 and Sta. 14+670: BH2A, 4B, 6B and 7)**

#### **5.2.1 Ice/water**

The ice/water surface within the boreholes drilled in the lake ranged between Elevations 289.8 m and 289.9 m. The depth of ice/water was 1.1 to 2.0 m at the time of drilling.

#### **5.2.2 Peat**

A layer of peat was encountered at the lakebed in Boreholes BH4B, BH6B and BH7. The thickness of the peat ranges between 1.9 m and 2.6 m with the corresponding underside Elevations of 286.2 m to 285.3 m. The thickness of peat and the nature of the underlying soils were not established in BH-6B. A thin layer of 0.3 m of peat was also encountered in

BH2A adjacent to Pan Lake. A single SPT N-value of 1 was recorded below the lakebed. Based on this data this soil layer is described as very soft.

The peat was brown and dark brown in colour.

### 5.2.3 Clay and Silt

Silty clay to silt deposits were encountered in Boreholes BH2A, BH4B and BH7. Underlying the peat in Borehole BH2A was a 0.3 m layer of silt and then a 3.9 m layer of silt to silty clay. In Borehole BH4B underlying the peat, there was about 0.9 m of silty clay, and then about 3.8 m of silt. In Borehole BH7, about 1.7 m of silty clay to silt layer underlay the 1.3 m thick silt and sand deposit. The underside of the clay and silt layer, below the lakebed, ranged between Elevations 282.3 m to 281.5 m. The underside of the silty clay layer adjacent to Pan Lake was 289.3 m.

The field vane test performed in this deposit provided values of undrained shear strength ranging from about 24 to 34 kPa, and sensitivity of 1 and 2. Based on these results, the silt was classified as low sensitivity.

The SPT N-value in the silt deposits ranged from 1 to 21, typically 12, being classified as soft to very stiff, typically stiff.

Atterberg Limit test performed on one sample indicates that the silt has low plasticity and is classified as (ML).

The gradation data for selected silt samples are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 0        |
| Sand           | 1 to 4   |
| Silt           | 83 to 87 |
| Clay           | 9 to 12  |

### 5.2.4 Silt and Sand

Deposits of silt and sand were encountered in Boreholes BH4B and BH7 underlying the peat and clay and silt. The thickness of this soil layer varied between 1.3 m to 2.5 m with underside elevations at 284.0 to 279.1m. Additionally, a layer of silty sand to sandy silt was encountered adjacent to Pan Lake in Borehole BH2A with an undetermined underside elevation.

Based on SPT N-values ranging from 1 to 50 blows for 0.3 m of penetration. These deposits are very loose to very dense, typically very loose.

The results of the grain size distribution analysis of selected samples are summarized below:



| Soil Particles | (%)      |
|----------------|----------|
| Sand           | 10 to 80 |
| Silt           | 16 to 81 |
| Clay           | 3 to 6   |

### 5.2.5 Silt

A layer of silt, some sand, trace clay and gravel was encountered in Borehole BH7 under the silt and sand layer. The thickness of this silt layer is 0.5 m with an underside elevation at 281.8 m.

Based on an SPT value of 50 blows for 0.10 m of penetration, the silt is classified as very dense. Presence of cobbles was observed.

The soil is described as moist to wet.

The grain size distribution test results of a selected sample of this soil are summarized below:

| Soil Particles | (%) |
|----------------|-----|
| Sand           | 11  |
| Silt           | 78  |
| Clay           | 10  |

### 5.2.6 Bedrock

The top of bedrock elevation was inferred from split spoon refusal in Boreholes BH4B and BH7.

Depth to assumed bedrock and top of assumed bedrock elevations from the borehole information are summarized below:

| Borehole | Depth to Inferred Bedrock (m) | Elevation of Top of Inferred Bedrock (m) |
|----------|-------------------------------|--|
| BH4B     | 10.9                          | 279.1                                    |
| BH7      | 8.1                           | 281.8                                    |

### 5.2.7 Water Levels

The water levels in Boreholes BH4B, BH6B and BH7 were at the lake surface, at Elevation at 289.9 m. Borehole BH2A had a recorded water level at approximately 292.7 m.

### 5.3 Highway 11 - West shoulder East of Pan Lake (BH 11-11 and 11-12)

#### 5.3.1 Asphalt

Asphalt was encountered at the ground surface in the two boreholes drilled at the west shoulder of Highway 11 at Pan Lake, BH11-11 and BH11-12. The thickness ranged from 100 mm to 113 mm.

#### 5.3.2 Granular Fill

Sand and gravel fill were encountered below the asphalt in the two boreholes. The granular fill layer extends to a depth of 2.2 m with the underside elevation ranging from 292.0 to 290.5 m. This fill layer is described as compact to very dense with SPT N-values ranging between 19 and 71.

The sand and gravel fill was brown and moist. The moisture content ranges from 5% to 10%.

The grain size distribution of the granular fill can be found in Appendix B as Figure B1. The gradation of the fill is presented below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 16 to 76 |
| Sand           | 22 to 75 |
| Silt and Clay  | 2 to 9   |

#### 5.3.3 Rockfill

Rockfill was encountered below the granular fill, extending to depths ranging from 5.6 m to 6.6 m. The underside of the rockfill ranged from Elevations 288.6 m to 286.1 m.

A 0.4 m thick layer of granular fill was encountered below the rockfill in BH11-12, with the underside at Elevation 285.7 m.

SPT N-values of 10 and 38 were measured in the rockfill, indicating a compact to dense condition.

#### 5.3.4 Silt

The rockfill is underlain by a layer of silt, trace sand to sandy, and trace clay. The thickness of this silt layer varied from 4.1 m to 4.2 m. The underside of the silt layer ranged from Elevations 284.4 m to 281.6 m.

Based on SPT N-values ranging from 4 to 17, this layer is classified as loose to compact. A higher value of 111 blows for 0.30 m of penetration was measured at the base of the silt deposit.

The measured natural moisture contents ranged from 17% to 30%, typically 26% and the soil is described as moist to wet.

The grain size distributions of selected samples of this soil are plotted on the Record of Borehole sheets and shown in Figures B3 and B4 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Sand           | 1 to 18  |
| Silt           | 78 to 89 |
| Clay           | 3 to 10  |

### 5.3.5 Sand

In BH11-11, the silt deposit is underlain by a layer of sand, some silt and some gravel. The thickness of this layer is 0.9 m. The underside of the sand layer is at Elevation 283.5 m.

Based on a SPT N-value of 29 blows, this soil is classified as compact.

The measured natural moisture content was 20%, and the soil is described as wet.

### 5.3.6 Cobbles and Boulders

Underlying the silt and sand described above, the boreholes encountered cobbles and boulders. The inferred thicknesses of these layers are 1.5 m to 2.0 m, with underside varying from Elevations 282.0 to 279.6 m.

SPT N-values of 23 and 33 were measured in this layer in BH11-11, indicating a compact to dense condition. This layer had to be cored in BH11-12

### 5.3.7 Bedrock

Bedrock consisting of granite was encountered underlying the cobbles and boulders in Boreholes BH11-11 and BH11-12. The bedrock is reddish grey and blackish grey in colour, slightly weathered to fresh and strong.

Depth to bedrock and top of bedrock elevations from the borehole information are summarized below:

| Borehole | Depth to Bedrock (m) | Elevation of Top of Bedrock (m) |
|----------|----------------------|---------------------------------|
| BH11-11  | 12.2                 | 282.0                           |
| BH11-12  | 13.1                 | 279.6                           |

### 5.3.8 Water Levels

The groundwater depth and elevation monitored in the piezometer are shown in the following table.

| Borehole | May 04, 2011 |           |
|----------|--------------|-----------|
|          | Depth (m)    | Elev. (m) |
| BH11-12  | 2.4          | 290.3     |

Upon completion of Borehole BH11-11, the water level was at a depth of 2.5 m, equivalent to Elevation 291.7 m.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level will be influenced by the water level in Pan Lake and may fluctuate in elevation after spring snowmelt or after periods of heavy rainfall.

## 5.4 Highway 11 - East Ditch (BH 11-01 to 11-10 located ~4 m east of embankment toe)

### 5.4.1 Ice/Water

Ice and water were encountered at the surface in Boreholes BH11-05, BH11-06, BH11-07, BH11-08 and BH11-09. The ice/water surface ranged from Elevations 291.0 m to 290.5 m, with thicknesses varying from 0.4 m to 0.9 m.

### 5.4.2 Peat/Organics

Layers of peat and organic matter were encountered at the ground surface in Boreholes BH11-01, BH11-02, BH11-03, BH11-04 and BH11-10. In Boreholes BH11-05 and BH11-06 the peat layer was encountered underlying a silty clay layer. In Boreholes BH11-07 and BH11-08 the peat and organic matter were encountered below the ice/water and in Borehole BH11-09 the peat was encountered below a sandy silt layer. The thicknesses of the peat/organics deposits ranged from 50 mm to 2.3 m, typically less than 0.6 m, with underside from Elevations 293.0 m to 287.2 m. These soils are described as very soft to firm based on SPT N-values between 0 and 8.

The peat/organics were dark brown in colour. The moisture content ranges from 22% to 526%, typically higher than 100%.

### 5.4.3 Clayey Silt/Silty Clay

Layers of clayey silt with organics and roots were encountered below the organics in Boreholes BH11-03 and BH11-04, and layers of silty clay were encountered just below the

ice in Boreholes BH11-05 and BH11-06. These layers extended to depths ranging from 0.6 m to 3.6 m. The underside of the clayey silt deposit ranged from Elevations 290.8 m to 289.4 m. The thickness of the clay deposit ranges from 0.4 m to 0.7 m.

The clayey silt layer is generally soft to very stiff in consistency. The soil is dark brown to grey in colour. The SPT N-values ranged from 2 to 18. The moisture content varied from 24% to 36%, with an upper value of 132% which is likely due to organic content.

In Borehole BH11-06 a 2.0 m thick layer of clayey silt, trace sand was encountered at 5.2 m depth between the silt and sand deposits. This cohesive soil is soft in consistency, with an average SPT N-value of 3. Moisture contents of 26% and 27% were measured in this soil layer.

Additionally, a 0.4 m thick layer of clayey silt, some sand and trace gravel was encountered at 2.5 m depth between the upper and lower deposits of sand in Borehole BH11-10. This cohesive layer is hard in consistency, with an SPT N-value of 37. A moisture content of 27% was measured in this layer.

The grain size distributions of selected samples of these cohesive soils are reported on the Record of Borehole sheets and gradation test results (Figures B5) are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 0 to 1   |
| Sand           | 2 to 16  |
| Silt           | 61 to 74 |
| Clay           | 22 to 24 |

#### 5.4.4 Silt

A deposit of silt, trace clay and trace sand was encountered underlying the clayey silt in Borehole BH11-04 and the peat in Borehole BH11-06. The underside of the silty deposits ranged from Elevations 287.7 m to 285.5 m. The thickness of the silt deposit ranges from 1.6 m to 1.9 m.

This silt layer is generally firm to stiff, with undrained shear strength values measured by in-situ vane tests of 41 and 53 kPa. The moisture content varied from 22% to 43%.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and gradation test results (Figures B2 and B3) are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Sand           | 2        |
| Silt           | 90 to 94 |
| Clay           | 4 to 8   |

Atterberg Limit test (Figure B10) performed on one selected sample indicates that the clayey silt has intermediate plasticity..

#### 5.4.5 Sandy Silt

Deposits of silt, trace sand to sandy, and trace to some clay were encountered underlying the peat layer in Boreholes BH11-01, BH11-02, BH11-05, BH11-07, and BH11-08, below the clayey silt in BH11-03, and below the ice in BH11-09. The underside of the sandy silt layer ranged from Elevations 288.9 m to 281.5 m. The thickness of this cohesionless deposit ranges from 0.6 m to at least 8.2 m. Borehole BH11-02 was terminated within this deposit at Elevations 281.5 m.

This silt is very loose to very dense, typically compact. SPT N-values ranged from 1 to 52, typically 10. The moisture content varied from 11% to 54%.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and gradation test results (Figures B2 and B3) are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 0 to 4   |
| Sand           | 3 to 29  |
| Silt           | 61 to 89 |
| Clay           | 4 to 12  |

#### 5.4.6 Sand

Deposits of sand, some silt to silt and sand, trace clay, trace gravel were encountered underlying the silt deposits in Boreholes BH11-01, BH11-04, BH11-05, BH11-06, and BH11-07 and below the peat in Borehole BH11-09. The thickness of this soil layer varied from 0.6 m to 4.7 m. Boreholes BH11-04, BH11-05, BH11-06 and BH11-09 were terminated within this deposit at Elevations ranging from 288.1 m to 280.0 m.

Based on SPT N-values ranging from 8 to 59, this soil is classified as loose to very dense. High blow counts of more than 100 blows for less than 0.30 m penetration was noted at the refusal depths.

The measured natural moisture contents ranged from 11% to 38% and the soil is described as moist to wet.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and shown in Figure B7 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 1 to 9   |
| Sand           | 42 to 86 |
| Silt and Clay  | 10 to 57 |

#### 5.4.7 Sand and Gravel

Deposits of Sand and Gravel, Sandy Gravel and Gravelly Sand were encountered in Boreholes BH11-01, BH11-03, BH11-07, BH11-08 and BH11-10. These boreholes were terminated within these layers at Elevations ranging from 287.2 m to 280 m. The thickness of these layers ranged from at least 0.2 m to 1.7 m.

SPT N-values of 8 to more than 100 blows for less than 0.30 m of penetration were measured, indicating a loose to very dense conditions.

The measured natural moisture contents were between 6 to 15% and the soil is described as wet.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and shown in Figure B9 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 33 to 38 |
| Sand           | 47 to 57 |
| Silt & Clay    | 13 to 16 |

#### 5.4.8 Bedrock

The top of bedrock elevation was inferred from auger refusal. Some of the referred depths may be on a probable boulder. Depth to inferred bedrock and top of bedrock elevations from the borehole information are summarized below:

| <b>Borehole</b> | <b>Depth to Inferred Bedrock (m)</b> | <b>Elevation of Top of Inferred Bedrock (m)</b> |
|-----------------|--------------------------------------|---|
| BH11-01         | 4.3                                  | 285.9   |
| BH11-02         | 8.8                                  | 281.5   |
| BH11-03         | 6.3                                  | 285.0   |
| BH11-04         | 7.3                                  | 285.7   |
| BH11-05         | 2.9                                  | 288.1   |
| BH11-06         | 8.6                                  | 282.0   |
| BH11-07         | 10.5                                 | 280.0   |
| BH11-08         | 3.4                                  | 287.2   |
| BH11-09         | 4.0                                  | 286.9   |
| BH11-10         | 4.1                                  | 287.2   |

#### 5.4.9 Water Levels

The groundwater depths and elevations monitored in the piezometers are shown in the following table.

| <b>Borehole</b> | <b>April 07 and 12, 2011</b> |           | <b>May 04, 2011</b> |           | <b>May 05, 2011</b> |           |
|-----------------|------------------------------|-----------|---------------------|-----------|---------------------|-----------|
|                 | Depth (m)                    | Elev. (m) | Depth (m)           | Elev. (m) | Depth (m)           | Elev. (m) |
| BH11-02         | 0.9                          | 289.4     | 0.6                 | 289.7     | 0.7                 | 289.6     |
| BH11-04         | 1.7                          | 291.3     | 1.7                 | 291.3     | 1.6                 | 291.4     |
| BH11-06         | 0.0                          | 290.7     | 0.1                 | 290.6     | 0.2                 | 290.5     |
| BH11-09         | 0.0                          | 290.9     | -                   | -         | -                   | -         |

The water levels measured in the borehole at the completion of drilling is shown in the following table:

| <b>Borehole</b> | <b>April 06 to 15, 2011</b> |           |
|-----------------|-----------------------------|-----------|
|                 | Depth (m)                   | Elev. (m) |
| BH11-01         | 0.9                         | 289.3     |
| BH11-02         | 1.2                         | 289.1     |
| BH11-03         | 2.0                         | 289.4     |
| BH11-04         | 2.1                         | 290.9     |
| BH11-05         | 0.2                         | 290.8     |



| Borehole | April 06 to 15,<br>2011 |              |
|----------|-------------------------|--------------|
|          | Depth<br>(m)            | Elev.<br>(m) |
| BH11-06  | 0.0                     | 290.7        |
| BH11-07  | 0.0                     | 290.5        |
| BH11-08  | 0.0                     | 290.6        |
| BH11-09  | 0.0                     | 290.9        |
| BH11-10  | 0.1                     | 291.2        |

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level will be influenced by water level in Pan Lake and may fluctuate in elevation after spring snowmelt or after periods of heavy rainfall.

## 5.5 Highway 11 - East Shoulder North of Robin Creek (BH 11-13 to 11-17)

### 5.5.1 Asphalt

Asphalt was encountered at the ground surface in Boreholes BH11-13 to BH11-17. The thickness ranged from 38 mm to 50 mm.

### 5.5.2 Granular Fill

Sand fill with trace gravel to gravelly and trace silt was encountered below the asphalt in Boreholes BH11-13 to BH11-17. The granular fill layer extends to depths varying from 1.1 m to 4.4 m with the underside Elevations ranging from 296.8 m to 291.3 m. Boreholes BH11-16 and BH11-17 were terminated within this fill at Elevations 296.8 m and 295.3 m respectively. This fill layer is described as very loose to very dense with SPT values between 1 blow for 0.30 m of penetration to more than 100 blows for less than 0.30 m of penetration.

This fill was brown in colour. The moisture content ranges from 1% to 12%, being typically described as moist.

The grain size distribution of the granular fill can be found in Appendix B as Figure B1. The gradation of the fill is summarized as follows:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 21 to 31 |
| Sand           | 65 to 72 |
| Silt and Clay  | 4 to 9   |

### 5.5.3 Rockfill

Rockfill was encountered below the granular fill in Borehole BH11-13. The thickness of this fill was 3.1 m, with underside at Elevation 288.3 m.

### 5.5.4 Silt

A deposit of silt, some sand, trace gravel and trace clay, was encountered underlying the rockfill in BH11-13. The thickness of this cohesionless deposit was 2.4 m. Borehole BH11-13 was terminated in this deposit at Elevation 286.0 m.

This silt is loose to compact, becoming very dense at the refusal depth. SPT N-values ranged from 9 to 60. The moisture content varied from 17% to 25%.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and gradation test results (Figures B4) are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 2 to 4   |
| Sand           | 12       |
| Silt           | 80 to 81 |
| Clay           | 4 to 5   |

### 5.5.5 Sand and Silt

Deposits of sand and silt, trace gravel and trace clay were encountered below the gravelly sand deposit in Borehole BH11-14 and underlying the granular fill in Borehole BH11-15. The thickness of this soil layer was 1.1 m and 0.9 m. The underside of this cohesionless layer is at Elevations 289.0 m and 292.7 m.

Based on SPT N-values ranging from 10 to 28, this soil is classified as compact.

The measured natural moisture contents ranged from 18% to 25% and the soil is described as wet to moist.

A 1.1 m thick layer of sand, some gravel and trace silt was encountered at 7.6m depth in BH11-14. This soil was loose to very dense, with SPT N-values of 7 blows and 156 blows for 0.20 m of penetration. The measured moisture contents were 13% and 16%, being described as wet. Borehole BH11-14 was terminated within this deposit at Elevation 284.9 m.

The grain size distributions of selected samples of these soils are reported on the Record of Borehole sheets and shown in Figures B7 and B8 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 0 to 11  |
| Sand           | 44 to 82 |
| Silt           | 7 to 38  |
| Clay           | 9 to 14  |

### 5.5.6 Gravelly Sand/Gravel

A layer of Gravelly Sand was encountered below the granular fill in Borehole BH11-14 and underlying the sand and silt layer in BH11-15. The thickness of these layers was 1.2 m and 0.6 m, with underside at Elevations 290.1 m and 292.2 m. A 3 m thick layer of Gravel with Cobbles, with underside at Elevation 286.0 m, was encountered underlying the sand and silt layer in Borehole BH11-14.

SPT N-values of 3 to 50 blows for 0.15 m of penetration were measured, indicating a loose to very dense condition.

The measured natural moisture content ranged from 6% to 17% and the soil is described as wet.

The grain size distributions of selected samples of this soil are plotted on the Record of Borehole sheets and shown in Figure B9 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%) |
|----------------|-----|
| Gravel         | 31  |
| Sand           | 58  |
| Silt & Clay    | 11  |

### 5.5.7 Bedrock

Bedrock was cored in Borehole BH11-15 and the bedrock is described as granite. The bedrock is blackish grey in colour, slightly weathered to fresh and strong.

In a number of the boreholes, the top of bedrock elevation was inferred from auger refusal.

Depth to bedrock and top of bedrock elevations from the borehole information are summarized below:

| <b>Borehole</b> | <b>Depth to Bedrock<br/>(m)</b> | <b>Elevation of Top of<br/>Bedrock (m)</b> |
|-----------------|---------------------------------|--|
| BH11-13         | 7.4                             | 286.0*                                     |
| BH11-14         | 8.7                             | 284.9*                                     |
| BH11-15         | 3.6                             | 292.2**                                    |
| BH11-16         | 1.1                             | 296.8*                                     |
| BH11-17         | 4.4                             | 295.3*                                     |

\* resual on probable boulder or inferred bedrock

\*\* bedrock cored

### 5.5.8 Water Levels

The groundwater depths and elevations monitored in the piezometers are shown in the following table.

| <b>Borehole</b> | <b>May 05, 2011</b> |                  |
|-----------------|---------------------|------------------|
|                 | <b>Depth (m)</b>    | <b>Elev. (m)</b> |
| BH11-13         | 2.50                | 290.8            |

The water level measured at the completion of boreholes without piezometer installation is showing as following:

| <b>Borehole</b> | <b>May 04 and 05,<br/>2011</b> |                      |
|-----------------|--------------------------------|----------------------|
|                 | <b>Depth<br/>(m)</b>           | <b>Elev.<br/>(m)</b> |
| BH11-14         | 2.6                            | 291.0                |
| BH11-15         | 2.9                            | 292.9                |
| BH11-17         | Dry                            |                      |

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level will be influenced by the water level in Robins Creek and may fluctuate in elevation after spring snowmelt or after periods of heavy rainfall.

## 5.6 Robin Creek Culvert (BH RCC-1 and RCC-2)

### 5.6.1 Water

Standing water was encountered at the surface in Boreholes RCC-1 and RCC-2. The water surface was at Elevation 290.8 m, and the depth of water ranged from 1.4 to 1.5m.

### 5.6.2 Peat

Peat was encountered in Borehole RCC-2 only. The thickness of the peat deposit was 0.6 m, with underside at Elevation 288.7 m. This soil is described as very soft based on one SPT N-value of 1.

The peat/organics was dark brown in colour. The measured moisture content was 129%.

### 5.6.3 Sand

A 0.4 m thick layer of sand, trace gravel and trace silt was encountered in Borehole RCC-1. The underside of this deposit was at Elevation 289.0 m.

Based on one SPT N-value of 7, this soil is classified as loose. The moisture content of this layer is about 52%.

### 5.6.4 Clayey Silt

A 1.3 m thick layer of clayey silt was encountered below the peat deposit in Borehole RCC-2. This soil extends to a depth of 3.4 m, with underside at Elevation 287.4 m.

The clayey silt layer is soft to firm in consistency and it is grey in colour. The SPT N-values were 2 and 8. The measured water contents were 32% and 47%.

The grain size distribution of one sample of this soil is reported on the Record of Borehole sheets and gradation test results (Figures B5) are summarized below:

| Soil Particles | (%) |
|----------------|-----|
| Sand           | 6   |
| Silt           | 67  |
| Clay           | 27  |

### 5.6.5 Sandy Silt

Deposits of silt, trace sand to sandy, and trace to some clay were encountered underlying the sand layer in Borehole RCC-1 and the clayey silt in Borehole RCC-2. The underside of the silt deposits ranged from Elevations 281.6 m to 281.3 m. The thickness of this cohesionless deposit ranges from 7.3 m to 6.0 m. Borehole RCC-1 was terminated within this deposit at Elevation 281.6 m.

This silt is loose to very dense, typically compact. SPT N-values ranged from 4 to 127. The moisture content varied from 10% to 28%.

The grain size distributions of selected samples of this soil are reported on the Record of Borehole sheets and gradation test results (Figures B4 and B8) are summarized below:

| Soil Particles | (%)      |
|----------------|----------|
| Gravel         | 0 to 17  |
| Sand           | 23 to 50 |
| Silt           | 29 to 72 |
| Clay           | 4 to 5   |

#### 5.6.6 Gravel

A deposit of gravel was encountered below the sandy silt in Borehole RCC-2. This borehole was terminated within this layer at Elevation 280.7 m. This layer is 0.7 m thick.

SPT N-values of 78 and 100 blows for 0.025 m of penetration were measured, indicating a very dense layer.

The measured natural moisture content was about 10% and the soil is described as wet.

The grain size distribution of one selected sample of this soil is reported on the Record of Borehole sheets and shown in Figure B9 in Appendix B. The gradation data is summarized below:

| Soil Particles | (%) |
|----------------|-----|
| Gravel         | 44  |
| Sand           | 24  |
| Silt & Clay    | 32  |

#### 5.6.7 Bedrock

The top of bedrock elevation was inferred from auger refusal. Depth to bedrock and top of bedrock elevations from the borehole information are summarized below:

| Borehole | Depth to Inferred Bedrock (m) | Elevation of Top of Inferred Bedrock (m) |
|----------|-------------------------------|--|
| RCC-1    | 9.1                           | 281.6                                    |
| RCC-2    | 10.1                          | 280.7                                    |

#### 5.6.8 Water Levels

The water level at the completion of Boreholes RCC-1 and RCC-2 was at surface, at Elevation 290.8 m.

## 6 MISCELLANEOUS

Surveying of the locations and elevations of the boreholes was provided by MMM.

Full time supervision of field drilling, including obtaining utility clearances was carried out by Ms. Eckie Siu of Thurber.

Overall supervision of the field program, interpretation of the data and preparation of the report were carried out by Ms. Luciana Thomasi, M. Sc., Mr. Stephen Peters, E.I.T., and Mr. Jason Lee, P.Eng..

The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

Stephen Peters, E.I.T., M.A.Sc.

Jason P. Lee, P.Eng., M.Sc.  
Geotechnical Engineer



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



**Appendix A**  
**Record of Borehole Sheets**



# RECORD OF BOREHOLE No 11-01

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 174.603 E 282 212.612 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                                 |                   |  | PLASTIC LIMIT<br>NATURAL MOISTURE CONTENT<br>LIQUID LIMIT |  |  | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|---------------------------------|-------------------|--|---|--|--|--|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20 40 60 80 100                             | W <sub>P</sub> W W <sub>L</sub> | WATER CONTENT (%) |  |   |  |  |  |   |
| 290.2         |  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  |   |
| 0.0           | <b>PEAT:</b> (100mm)<br><br><b>SILT</b> , trace sand, some clay, trace roots and rootlets<br>Loose<br>Brown<br>Moist<br>Occasional grey sand seams   |            | 1       | SS   | 10         |                            | 290             |   |                                 |                   |  |   |  |  |  |   |
| 0.1           |  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  |   |
|               |  |            | 2       | SS   | 8          |                            | 289             |   |                                 |                   |  |   |  |  |  |   |
|               |  |            | 3       | SS   | 10         |                            |                 |   |                                 |                   |  |   |  |  |  |   |
|               |  |            | 4       | SS   | 10         |                            | 288             |   |                                 |                   |  |   |  |  |  |   |
| 287.3         |  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  |   |
| 2.9           | <b>SAND</b> , trace gravel<br>Compact<br>Brown<br>Wet  |            | 5       | SS   | 28         |                            | 287             |   |                                 |                   |  |   |  |  |  | 0 6 83 11   |
| 286.6         |  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  |   |
| 3.6           | <b>SAND</b> and <b>GRAVEL</b> , some silt and clay<br>Compact<br>Brown<br>Wet  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  | 38 47 15<br>(SI+CL)                               |
| 285.9         |  |            |         |      |            |                            |                 |   |                                 |                   |  |   |  |  |  |   |
| 4.3           | END OF BOREHOLE AT 4.3m UPON AUGER REFUSAL ON PROBABLE BOULDER OR BEDROCK.<br>WATER LEVEL AT 0.9m UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH HOLEPLUG TO 2.4m, THEN CUTTINGS TO SURFACE. |            |         |      |            |                            | 286             |   |                                 |                   |  |   |  |  |  |   |


























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

# RECORD OF BOREHOLE No 11-02

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 224.419 E 282 215.261 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

| SOIL PROFILE  |   |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |    |                                      | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR   SA   SI   CL |                 |  |
|---------------|---|---|---------|------|------------|---|-----------------|---|----|----|---|----|--------------------------------------|--|--|-----------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |   |                 | SHEAR STRENGTH kPa                          |    |    |   |    | WATER CONTENT (%)                    |  |  |                 |  |
|               |   |   |         |      |            |   |                 | ○ UNCONFINED      + FIELD VANE              |    |    |   |    | w <sub>P</sub> w      w <sub>L</sub> |  |  |                 |  |
|               |   |   |         |      |            |   |                 | ● QUICK TRIAXIAL      × LAB VANE            |    |    |   |    |                                      |  |  |                 |  |
| 290.3         |   |   |         |      |            |   | 20              | 40  | 60 | 80 | 100   | 20 | 40                                   | 60   |  |                 |  |
| 0.0           | <b>PEAT</b> , wood fibres<br>Soft<br>Dark Brown<br>Wet  |    | 1       | SS   | 3          |    |                 |   |    |    |   |    |                                      |  | 137  |                 |  |
| 289.7         |   |   |         |      |            |   |                 |   |    |    |   |    |                                      |  |  |                 |  |
| 0.6           | <b>SILT</b> , some sand, trace roots and rootlets, mixed with peat<br>Very Loose<br>Grey/Dark Brown<br>Moist  |    | 2       | SS   | 1          |    |                 |   |    |    |   |    |                                      | ○  |  |                 |  |
| 288.8         |   |   |         |      |            |   |                 |   |    |    |   |    |                                      |  |  |                 |  |
| 1.5           | <b>SILT</b> , trace sand, trace to some clay, occasional sand pockets<br>Loose<br>Brown<br>Moist  |    | 3       | SS   | 4          |    |                 |   |    |    |   |    |                                      | ○  |  |                 |  |
|               | Becoming grey   |    | 4       | SS   | 4          |    |                 |   |    |    |   |    |                                      | ○  |  | 0   6   87   7  |  |
|               |   |    | 5       | SS   | 6          |    |                 |   |    |    |   |    |                                      | ○  |  |                 |  |
|               |   |   |         |      |            |   |                 |   |    |    |   |    |                                      |  |  |                 |  |
|               | Sand seams<br>Compact   |  | 6       | SS   | 16         |  |                 |   |    |    |   |    |                                      | ○  |  |                 |  |
|               |   |  |         |      |            |  |                 |   |    |    |   |    |                                      |  |  |                 |  |
|               |   |  | 7       | SS   | 10         |  |                 |   |    |    |   |    |                                      | ○  |  | 0   1   88   10 |  |
|               |   |  |         |      |            |  |                 |   |    |    |   |    |                                      |  |  |                 |  |
|               |   |  |         |      |            |  |                 |   |    |    |   |    |                                      |  |  |                 |  |
|               | Becoming sandy, trace gravel<br>Very Dense<br>Grey<br>Wet<br>Occasional cobbles   |  | 8       | SS   | 52         |  |                 |   |    |    |   |    |                                      | ○  |  | 4   20   73   4 |  |
| 281.5         |   |   |         |      |            |  |                 |   |    |    |   |    |                                      |  |  |                 |  |
| 8.8           | END OF BOREHOLE AT 8.8m UPON AUGER REFUSAL ON PROBABLE BOULDER OR BEDROCK.<br>WATER LEVEL AT 1.2m UPON COMPLETION.<br>Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. |   |         |      |            |   |                 |   |    |    |   |    |                                      |  |  |                 |  |

Continued Next Page

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

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]

# RECORD OF BOREHOLE No 11-03

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 282.596 E 282 219.803 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |  |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |     |  |  |  |
| 291.4         |  |            |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100 |  |  |  |
| 0.0           | ORGANICS: (150mm)  |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
| 0.2           | Clayey SILT, some sand, trace organics   |            | 1       | SS   | 2          |                            | 291             |   |    |    |    |     |  | ○  |  |
| 290.8         | Soft   |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
| 0.6           | Brown  |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
|               | SILT, trace sand, trace to some clay, occasional oxide staining  |            | 2       | SS   | 8          |                            | 290             |   |    |    |    |     |  | ○  |  |
|               | Loose to Compact   |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
|               | Brown  |            | 3       | SS   | 7          |                            | 289             |   |    |    |    |     |  | ○  |  |
|               | Moist to Wet   |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
|               |  |            | 4       | SS   | 12         |                            | 288             |   |    |    |    |     |  | ○  |  |
|               | Occasional sand seams  |            | 5       | SS   | 10         |                            | 287             |   |    |    |    |     |  | ○  |  |
|               |  |            | 6       | SS   | 6          |                            | 286             |   |    |    |    |     |  |  |  |
| 285.3         |  |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
| 6.1           | Sandy GRAVEL   |            | 7       | SS   | 100/       |                            |                 |   |    |    |    |     |  | ○  |  |
| 285.0         | Very Dense   |            |         |      | 0.100      |                            |                 |   |    |    |    |     |  |  |  |
| 6.3           | Brown Wet  |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |
|               | END OF BOREHOLE AT 6.3m UPON REFUSAL ON BEDROCK.<br>WATER LEVEL AT 2.0m UPON COMPLETION.<br>BOREHOLE BACKFILLED WITH HOLEPLUG TO 3.9m, THEN CUTTINGS TO SURFACE. |            |         |      |            |                            |                 |   |    |    |    |     |  |  |  |

# RECORD OF BOREHOLE No 11-04

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 376.732 E 282 227.452 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |  |  |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|---|---|--|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |   |   |  |  |  |  |  |  |
| 293.0         |   |            |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100   |   |  |  |  |  |  |  |
| 0.0           | <b>ORGANICS:</b> (50mm)<br><br>Clayey <b>SILT</b> , trace sand, trace roots<br>and rootlets, occasional oxide staining<br>Firm to Very Stiff<br>Brown/Grey<br>Moist   |            | 1       | SS   | 5          |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            | 2       | SS   | 6          |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               | Occasional sand seams   |            | 3       | SS   | 12         |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            | 4       | SS   | 18         |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            | 5       | SS   | 11         |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 289.4         |   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 3.6           | <b>SILT</b> , trace sand, trace clay<br>Firm<br>Grey<br>Moist   |            | 1       | TW   |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 287.7         |   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 5.2           | <b>SAND</b> , trace gravel, some silt and<br>clay, occasional cobbles<br>Compact<br>Brown<br>Wet  |            | 6       | SS   | 30         |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            | 7       | SS   | 19         |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 285.7         |   |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |
| 7.3           | END OF BOREHOLE AT 7.3m UPON<br>AUGER REFUSAL ON PROBABLE<br>BOULDER OR BEDROCK.<br>WATER LEVEL AT 2.1m UPON<br>COMPLETION.<br>Piezometer installation consists of<br>19mm diameter Schedule 40 PVC pipe<br>with a 1.52m slotted screen.<br><br>WATER LEVEL READINGS:<br>DATE      DEPTH (m)      ELEV. (m)<br>Apr. 07/ 11      1.68      291.32<br>May. 04/ 11      1.71      291.29<br>May. 05/ 11      1.60      291.4 |            |         |      |            |                            |                 |   |    |    |    |   |   |  |  |  |  |  |  |

ONTMT4S 1103.GPJ 7/20/11

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

# RECORD OF BOREHOLE No 11-05

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 432.912 E 282 229.558 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

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

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









20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11-06

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 486.807 E 282 241.686 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
DATUM Geodetic DATE 2011.04.06 - 2011.04.06 CHECKED BY JPL

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE   | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT |  |  | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|---|---------|------|------------|---|---|---|----|----|----|---|--|--|--|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |   |   | SHEAR STRENGTH kPa                          |    |    |    | WATER CONTENT (%)                                       |  |  |  |   |
| 290.7         |  |   |         |      |            |   |   | 20  | 40 | 60 | 80 | 100   |  |  |  |   |
| 0.0           | ICE  |    | 1       | SS   | 2          |  |  |   |    |    |    |   |  |  |  |   |
| 290.1         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 0.6           | Silty <b>CLAY</b> , some peat<br>Very Soft<br>Grey to Dark Brown<br>Wet  |    | 2       | SS   | 2          |   |   |   |    |    |    |   |  |  |  |   |
| 289.3         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 1.3           | <b>PEAT</b> , amorphous, trace roots<br>Very Soft<br>Dark Brown<br>Wet   |    | 3       | SS   | 1          |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   | 4       | SS   | 1          |   |   |   |    |    |    |   |  |  |  |   |
| 287.4         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 3.3           | <b>SILT</b> , trace clay, trace sand<br>Very Soft<br>Grey<br>Moist<br>(MI-OI)  |   | 5       | SS   | 1          |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   | 6       | SS   | 2          |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   | 1       | TW   |            |   |   |   |    |    |    |   |  |  |  |   |
| 285.5         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 5.2           | Clayey <b>SILT</b> , trace sand<br>Soft<br>Grey<br>Wet   |  | 7       | SS   | 3          |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   | 8       | SS   | 3          |   |   |   |    |    |    |   |  |  |  |   |
| 283.5         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 7.2           | <b>SAND</b> , trace gravel<br>Compact<br>Grey<br>Wet   |  | 9       | SS   | 25         |   |   |   |    |    |    |   |  |  |  |   |
|               |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 282.0         |  |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |
| 8.6           | END OF BOREHOLE AT 8.6m UPON<br>AUGER REFUSAL ON PROBABLE<br>BOULDER OR BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br>Piezometer installation consists of<br>19mm diameter Schedule 40 PVC pipe<br>with a 1.52m slotted screen.<br>WATER LEVEL READINGS: |   |         |      |            |   |   |   |    |    |    |   |  |  |  |   |

Continued Next Page

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

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]



## METRIC

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                                 | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |            | UNIT WEIGHT<br>$\gamma$ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|---------------------------------|---|------------|-------------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20 40 60 80 100                             | W <sub>P</sub> W W <sub>L</sub> | WATER CONTENT (%)                                   | GR SA SI C |                         |  |
| 290.5<br>0.0  | <b>WATER</b>  | [Pattern]  |         |      |            |                            |                 |   |                                 |   |            |                         |  |
| 289.6<br>0.9  | <b>ORGANICS</b> , mixed with roots, trace silt<br>Very Soft<br>Dark Brown<br>Wet                        | [Pattern]  | 1       | SS   | 1          |                            |                 |   |                                 |   | 373        |                         |  |
| 288.4<br>2.1  | <b>PEAT</b> , amorphous, trace silt, trace roots and rootlets<br>Very Soft to Soft<br>Dark Brown<br>Wet | [Pattern]  | 2       | SS   | 0          |                            |                 |   |                                 |   | 88         |                         |  |
| 287.2<br>3.2  | <b>SILT</b> , trace to some clay, trace sand<br>Loose to Compact<br>Grey<br>Wet                         | [Pattern]  | 3       | SS   | 1          |                            |                 |   |                                 |   | 102        |                         |  |
| 284.6<br>5.8  | <b>SILT</b> , trace to some clay, trace sand<br>Loose to Compact<br>Grey<br>Wet                         | [Pattern]  | 4       | SS   | 3          |                            |                 |   |                                 |   |            |                         |  |
| 281.7<br>8.8  | <b>SAND</b> , trace gravel, trace clay<br>Compact to Very Dense<br>Grey<br>Wet                          | [Pattern]  | 5       | SS   | 5          |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 6       | SS   | 16         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 7       | SS   | 18         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 8       | SS   | 14         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 9       | SS   | 19         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 10      | SS   | 10         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 11      | SS   | 8          |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 12      | SS   | 14         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 13      | SS   | 29         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 14      | SS   | 17         |                            |                 |   |                                 |   |            |                         |  |
|               |   |            | 15      | SS   | 59         |                            |                 |   |                                 |   |            |                         |  |

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

ONTMT4S 1103.GPJ 7/20/11

RECORD OF BOREHOLE No 11-07

2 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 517.835 E 282 251.139 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
DATUM Geodetic DATE 2011.04.13 - 2011.04.13 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |     |                | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |                |  | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|-----|----------------|---|----------------|--|---|--|
| ELEV<br>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   |            |         |      |            |                            |                 |   |    |    |     |                |   |                |  |   |  |
| 280.2         |  |            | 16      | SS   | 138        |                            |                 |   |    |    |     |                |   |                |  |   |  |
| 280.0         | Gravelly <b>SAND</b><br>Very Dense<br>Brown<br>Wet   |            |         |      |            |                            |                 |   |    |    |     |                |   |                |  |   |  |
| 10.5          | END OF BOREHOLE AT 10.5m<br>UPON REFUSAL ON BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>SAND TO SURFACE. |            |         |      |            |                            | 280             |   |    |    |     |                |   |                |  |   |  |

# RECORD OF BOREHOLE No 11-08

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 563.586 E 282 271.908 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
DATUM Geodetic DATE 2011.04.15 - 2011.04.15 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    |     | PLASTIC<br>LIMIT<br>w <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR  SA  SI  CL |
|---------------|---|------------|---------|------|---------------|----------------------------|-----------------|--|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |    |    |    |     |                                    |                                     |                                   |   |   |
| 290.6         |   |            |         |      |               | ▽                          | 290             | 20   | 40 | 60 | 80 | 100 |                                    |                                     |                                   |   |   |
| 0.0           | ICE   |            |         |      |               |                            |                 | 20   | 40 | 60 | 80 | 100 |                                    |                                     |                                   |   |   |
| 0.2           | WATER   |            |         |      |               |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 290.0         |   |            |         |      |               |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 0.6           | PEAT, roots and rootlets<br>Soft<br>Dark Brown<br>Moist   |            | 1       | SS   | 2             |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 289.5         |   |            |         |      |               | 289                        | 289             |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 1.1           | SILT, some sand<br>Compact<br>Grey<br>Moist   |            | 2       | SS   | 23            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 288.9         |   |            |         |      |               |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 1.7           | Gravelly SAND, some silt and clay<br>Loose to Compact<br>Brown<br>Wet<br><br>Trace bedrock fragments  |            | 3       | SS   | 8             |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
|               |   |            | 4       | SS   | 19            |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
|               |   |            | 5       | SS   | 110/<br>0.250 | 288                        | 288             |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 287.2         |   |            |         |      |               |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |
| 3.4           | END OF BOREHOLE AT 3.4m UPON<br>REFUSAL ON BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>SAND TO SURFACE. |            |         |      |               |                            |                 |  |    |    |    |     |                                    |                                     |                                   |   |   |

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

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11-09

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 622.685 E 282 303.204 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
DATUM Geodetic DATE 2011.04.12 - 2011.04.12 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |     | UNIT<br>WEIGHT<br><br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|--|------------|---------|------|---------------|----------------------------|-----------------|---|--|--|--|-----|---|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |     |   |  |
| 290.9         |  |            |         |      |               |                            |                 | 20 40 60 80 100                             |  |  |  |     |   |  |
| 0.0           | ICE  |            | 1       | SS   | 1             |                            |                 |   |  |  |  |     |   |  |
| 290.4         |  |            |         |      |               |                            |                 |   |  |  |  |     |   |  |
| 0.6           | Sandy <b>SILT</b> , trace to some clay<br>Compact<br>Brown<br>Wet  |            | 2       | SS   | 17            |                            | 290             |   |  |  |  |     |   |  |
|               | occasional burnt wood fibres,<br>occasional organics   |            | 3       | SS   | 20            |                            |                 |   |  |  |  |     |   | 0 29 60 10   |
| 288.9         |  |            |         |      |               |                            |                 |   |  |  |  |     |   |  |
| 2.0           | <b>PEAT</b> , wood fibres<br>Firm<br>Dark Brown<br>Wet   |            | 4       | SS   | 8             |                            | 289             |   |  |  |  | 103 |   |  |
| 288.5         |  |            |         |      |               |                            |                 |   |  |  |  |     |   |  |
| 2.4           | <b>SAND</b> , trace gravel<br>Loose<br>Brown<br>Wet  |            | 5       | SS   | 7             |                            | 288             |   |  |  |  |     |   |  |
|               |  |            | 6       | SS   | 5             |                            |                 |   |  |  |  |     |   |  |
| 286.9         |  |            | 7       | SS   | 158/<br>0.200 |                            | 287             |   |  |  |  |     |   |  |
| 4.0           | END OF BOREHOLE AT 4.0m UPON<br>REFUSAL ON BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br><br>Piezometer installation consists of<br>25mm diameter Schedule 40 PVC pipe<br>with a 1.52m slotted screen.<br><br>WATER LEVEL READINGS:<br>DATE      DEPTH (m)      ELEV. (m)<br>Apr 12/11      0                      290.9 |            |         |      |               |                            |                 |   |  |  |  |     |   |  |







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

# RECORD OF BOREHOLE No 11-10

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 657.784 E 282 331.873 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE 3rd Weight Hammer COMPILED BY AN  
DATUM Geodetic DATE 2011.04.11 - 2011.04.11 CHECKED BY JPL

| SOIL PROFILE  |   |  | SAMPLES |      |              | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |              |                  |            |                   | PLASTIC<br>LIMIT<br>W <sub>P</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|--|---------|------|--------------|---|-----------------|---|--------------|------------------|------------|-------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT   | NUMBER  | TYPE | "N" VALUES   |   |                 | SHEAR STRENGTH kPa                          |              |                  |            |                   |                                    |                                     |                                   |  |  |
|               |   |  |         |      |              |   |                 | ○ UNCONFINED                                | + FIELD VANE | ● QUICK TRIAXIAL | × LAB VANE | WATER CONTENT (%) |                                    |                                     |                                   |  |  |
| 291.3         |   |  |         |      |              |   | 20              | 40  | 60           | 80               | 100        |                   |                                    |                                     |                                   |  |  |
| 0.0           | <b>ORGANICS</b><br>Dark Brown<br>Frozen   |   | 1       | SS   | 6            |  | 291             |   |              |                  |            |                   |                                    |                                     |                                   | 528  |  |
| 290.8         |   |  |         |      |              |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
| 0.5           | <b>SAND</b> , some gravel, some silt, trace<br>clay<br>Compact to Dense<br>Brown<br>Wet   |   | 2       | SS   | 17           |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  | 12 73 14<br>(SI+CL)  |
|               |   |  | 3       | SS   | 31           |   | 290             |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
|               |   |  | 4       | SS   | 39           |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
| 288.8         |   |  |         |      |              |   | 289             |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
| 2.5           | Clayey <b>SILT</b> , some sand, trace<br>gravel, occasional cobble  |   | 5       | SS   | 37           |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  | 1 16 60 22   |
| 288.3         | Hard<br>Brown<br>Wet  |   |         |      |              |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
| 2.9           | Gravelly <b>SAND</b> , some silt, trace clay<br>Compact to Dense<br>Brown<br>Wet  |  | 6       | SS   | 14           |   | 288             |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
|               |   |  | 7       | SS   | 21/<br>0.275 |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  | 26 57 16<br>(SI+CL)  |
| 287.2         |   |  |         |      |              |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  |  |
| 4.1           | END OF BOREHOLE AT 4.1m UPON<br>REFUSAL ON PROBABLE BOULDER<br>OR BEDROCK.<br>WATER LEVEL AT 0.2m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>HOLEPLUG TO SURFACE. |  |         |      |              |   |                 |   |              |                  |            |                   |                                    |                                     |                                   |  |  |

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

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11-11

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 108.414 E 282 188.645 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2011.05.03 - 2011.05.04 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                      |    |    |     | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                                      |    |    |    |    |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|-----|---|---|--------------------------------------|----|----|----|----|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa   |    |    |     |   |   | WATER CONTENT (%)                    |    |    |    |    |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |    |    |     |   |   | w <sub>p</sub> w      w <sub>L</sub> |    |    |    |    |
| 294.2         |   |            |         |      |            |                            | 20              | 40   | 60 | 80 | 100 | 20  | 40  | 60                                   | GR | SA | SI | CL |
| 0.0           | ASPHALT: (100mm)  |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
| 0.1           | SAND, some gravel, trace silt, trace clay<br>Compact to Dense<br>Brown<br>Moist<br>(FILL) |            | 1       | SS   | 32         |                            |                 |  |    |    |     | ○   |   |                                      |    |    |    |    |
|               |   |            | 2       | SS   | 19         |                            |                 |  |    |    |     | ○   |   |                                      |    |    |    |    |
|               | Occasional cobbles  |            | 3       | SS   | 37         |                            |                 |  |    |    |     | ○   |   |                                      |    |    |    |    |
| 292.0         |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
| 2.2           | ROCKFILL:   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |
|               |   |            |         |      |            |                            |                 |  |    |    |     |   |   |                                      |    |    |    |    |

Continued Next Page

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

RECORD OF BOREHOLE No 11-11

2 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 108.414 E 282 188.645 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/NQ Coring COMPILED BY AN  
DATUM Geodetic DATE 2011.05.03 - 2011.05.04 CHECKED BY JPL

| SOIL PROFILE                 |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS                                       | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT              |  |  |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |  |
|------------------------------|--|------------|---------|------|------------|--|-----------------|--|--|--|--|--|--|---|--|--|
| ELEV<br>DEPTH                | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |  |                 | SHEAR STRENGTH kPa                                       |  |  |  |  |  |   |  |  |
|                              |  |            |         |      |            |  |                 | 20 40 60 80 100  |  |  |  |  |  |   |  |  |
|                              |  |            |         |      |            |  |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |  |  |  |   |  |  |
| Continued From Previous Page |  |            |         |      |            | WATER CONTENT (%)  |                 |  |  |  |  |  |  |   |  |  |
|                              |  |            |         |      |            | 20 40 60   |                 |  |  |  |  |  |  |   |  |  |
|                              |  |            |         |      |            | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT<br>W P W W L |                 |  |  |  |  |  |  |   |  |  |
| 283.5                        | Compact Grey Wet   |            | 9       | SS   | 29         |  | 284             |  |  |  |  |  |  |   |  |  |
| 10.7                         | COBBLES:<br>Compact to Dense<br>Blackish Grey<br>Wet   |            | 10      | SS   | 23         |  | 283             |  |  |  |  |  |  |   |  |  |
|                              |  |            | 11      | SS   | 33         |  |                 |  |  |  |  |  |  |   |  |  |
| 282.0                        | GRANITE, bedrock   |            |         |      |            |  | 282             |  |  |  |  |  |  |   |  |  |
| 12.2                         |  |            | 1       | RUN  |            |  | 281             |  |  |  |  |  |  |   |  |  |
|                              |  |            | 2       | RUN  |            |  |                 |  |  |  |  |  |  |   |  |  |
|                              | 400mm cobbles at 13.8m<br>Reddish grey, occasional mechanical<br>breaks, strong<br>Sub-vertical fractures (25mm to 50mm)<br>from 14.2m to 14.7m  |            | 3       | RUN  |            |  | 280             |  |  |  |  |  |  |   |  |  |
|                              |  |            |         |      |            |  |                 |  |  |  |  |  |  |   |  |  |
|                              | 50mm broken zone at 16.1m  |            |         |      |            |  | 279             |  |  |  |  |  |  |   |  |  |
|                              | Sub-vertical fractures (25mm to 50mm)<br>at 15.3m, 15.4m, 15.7m, 16.1m,<br>16.7m, 16.8m, 16.9m<br>50mm sub-vertical fractures at 16.7m<br>and 17.0m<br>350mm vertical fractures at 16.9m |            | 4       | RUN  |            |  | 278             |  |  |  |  |  |  |   |  |  |
|                              | Sub-horizontal fractures at 17.0m and<br>17.1m   |            |         |      |            |  |                 |  |  |  |  |  |  |   |  |  |
| 276.9                        |  |            | 5       | RUN  |            |  | 277             |  |  |  |  |  |  |   |  |  |
| 17.3                         | END OF BOREHOLE AT 17.3m.<br>WATER LEVEL AT 2.5m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>HOLEPLUG TO 0.1m, THEN<br>ASPHALT TO SURFACE.  |            |         |      |            |  |                 |  |  |  |  |  |  |   |  |  |

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

# RECORD OF BOREHOLE No 11-12

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 176.423 E 282 193.536 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2011.04.26 - 2011.04.26 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |  |   | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |    |    |                           |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|--|----|----|----|---|--|---|---|---|----|----|---------------------------|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL      × LAB VANE |    |    |    | WATER CONTENT (%)<br>w <sub>P</sub> w      w <sub>L</sub>     |  |   |   | GR  | SA | SI | CL                        |
| 292.7         |  |            |         |      |            |                            |                 | 20   | 40 | 60 | 80 | 100   |  |   |   |   |    |    |                           |
| 0.0           | ASPHALT: (113mm)   |            |         |      |            |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                           |
| 0.1           | Sandy <b>GRAVEL</b> , trace silt, occasional cobbles<br>Very Dense<br>Brown<br>Moist<br>(FILL) |            | 1       | SS   | 71         |                            | 292             |  |    |    |    |   |  | ○ |   |   |    |    |                           |
|               |  |            | 2       | SS   | 36         |                            | 291             |  |    |    |    |   |  | ○ |   |   |    |    | 76 22 2<br>(SI+CL)        |
| 290.5         |  |            |         |      |            |                            | 290             |  |    |    |    |   |  |   |   |   |    |    |                           |
| 2.2           | <b>ROCKFILL:</b>   |            | 3       | SS   | 10         |                            | 289             |  |    |    |    |   |  |   |   |   |    |    |                           |
|               |  |            |         |      |            |                            | 288             |  |    |    |    |   |  |   |   |   |    |    |                           |
|               |  |            |         |      |            |                            | 287             |  |    |    |    |   |  |   |   |   |    |    |                           |
| 286.1         |  |            | 4       | SS   | 38         |                            | 286             |  |    |    |    |   |  | ○ |   |   |    |    |                           |
| 6.6           | Gravelly <b>SAND</b>   |            |         |      |            |                            | 285             |  |    |    |    |   |  |   |   |   |    |    |                           |
| 285.7         | Dense to Compact   |            | 5       | SS   | 14         |                            | 284             |  |    |    |    |   |  |   |   |   |    |    | No sample for WC testing. |
| 7.0           | Grey<br>Wet<br>(FILL)  |            |         |      |            |                            | 283             |  |    |    |    |   |  |   |   |   |    |    |                           |
|               | <b>SILT</b> , trace sand to sandy, trace clay  |            | 6       | SS   | 14         |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    | 0 1 89 10                 |
|               | Compact  |            |         |      |            |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                           |
|               | Grey   |            | 7       | SS   | 13         |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                           |
|               | Wet to Moist   |            |         |      |            |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                           |
|               |  |            | 8       | SS   | 17         |                            |                 |  |    |    |    |   |  | ○ |   |   |    |    |                           |
|               |  |            |         |      |            |                            |                 |  |    |    |    |   |  |   |   |   |    |    |                           |

Continued Next Page

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

20  
15  
10  
(%) STRAIN AT FAILURE



## METRIC

[illegible]

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

# RECORD OF BOREHOLE No 11-13

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 532.488 E 282 246.147 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Casing/NQ COMPILED BY AN  
 DATUM Geodetic DATE 2011.05.04 - 2011.05.04 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |              | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |     |  | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |                     |  |  |
|---------------|---|------------|---------|------|--------------|----------------------------|-----------------|---|----|----|-----|--|--|--|---------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES   |                            |                 | SHEAR STRENGTH kPa                          |    |    |     |  |  |  | WATER CONTENT (%)   |  |  |
|               |   |            |         |      |              |                            |                 | ○ UNCONFINED      + FIELD VANE              |    |    |     |  |  |  | w P      w      w L |  |  |
|               |   |            |         |      |              |                            |                 | ● QUICK TRIAXIAL      × LAB VANE            |    |    |     |  |  |  |                     |  |  |
| 293.3         |   |            |         |      |              |                            | 20              | 40  | 60 | 80 | 100 |  |  |  |                     |  |  |
| 0.0           | ASPHALT: (50mm)   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               | SAND, some to trace gravel<br>Compact to Very Dense<br>Brown<br>Moist<br>(FILL) |            | 1       | GS   |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            | 1       | SS   | 29           |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
| 291.5         |   |            | 2       | SS   | 73/<br>0.200 |                            |                 |   |    |    |     |  |  |  |                     |  |  |
| 1.9           | ROCKFILL  |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |
|               |   |            |         |      |              |                            |                 |   |    |    |     |  |  |  |                     |  |  |

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

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11-14

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 542.937 E 282 249.374 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Casing/NQ COMPILED BY AN  
 DATUM Geodetic DATE 2011.05.04 - 2011.05.04 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |               | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br>$\gamma$<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|---------------|----------------------------|-----------------|---|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES    |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 | WATER CONTENT (%)                           |  |  |  |   |   |
| 293.6         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 293.6         | ASPHALT: (38mm)   |            |         |      |               |                            |                 |   |  |  |  |   |   |
|               | Gravelly SAND, trace silt, trace clay<br>Loose to Compact<br>Brown<br>Moist<br>(FILL)   |            | 1       | GS   |               |                            |                 |   |  |  |  |   |   |
|               |   |            | 1       | SS   | 24            |                            |                 |   |  |  |  |   |   |
|               |   |            | 2       | SS   | 8             |                            |                 |   |  |  |  |   |   |
| 291.3         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 2.3           | Gravelly SAND, some silt, mixed with<br>peat<br>Compact<br>Dark Brown<br>Wet  |            | 3       | SS   | 20            |                            |                 |   |  |  |  |   |   |
|               |   |            | 4       | SS   | 7             |                            |                 |   |  |  |  |   |   |
| 290.1         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 3.5           | SAND and SILT, trace clay,<br>occasional oxide staining<br>Loose<br>Grey<br>Wet   |            | 5       | SS   | 10            |                            |                 |   |  |  |  |   |   |
|               |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 289.0         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 4.6           | GRAVEL, some sand<br>Very Loose to Compact<br>Grey<br>Wet   |            | 6       | SS   | 6             |                            |                 |   |  |  |  |   |   |
|               | Occasional cobble   |            | 7       | SS   | 17            |                            |                 |   |  |  |  |   |   |
|               |   |            | 8       | SS   | 10            |                            |                 |   |  |  |  |   |   |
|               |   |            | 9       | SS   | 3             |                            |                 |   |  |  |  |   |   |
| 286.0         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 7.6           | SAND, coarse grained, some gravel,<br>trace silt, trace clay<br>Loose to Very Dense<br>Brown<br>Wet   |            | 10      | SS   | 7             |                            |                 |   |  |  |  |   |   |
|               |   |            | 11      | SS   | 156/<br>0.200 |                            |                 |   |  |  |  |   |   |
| 284.9         |   |            |         |      |               |                            |                 |   |  |  |  |   |   |
| 8.7           | END OF BOREHOLE AT 8.7m.<br>WATER LEVEL AT 2.6m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>HOLEPLUG TO 0.4m, CUTTINGS TO<br>0.1m, THEN ASPHALT TO<br>SURFACE. |            |         |      |               |                            |                 |   |  |  |  |   |   |

ONTMT4S 1103.GPJ 7/20/11

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

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11-15

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 595.685 E 282 271.285 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Casing/NQ COMPILED BY AN  
 DATUM Geodetic DATE 2011.05.01 - 2011.05.01 CHECKED BY JPL

| SOIL PROFILE  |  |            | SAMPLES |      |              | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT              |  |  |  |  |  | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup>  | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |   |  |  |  |  |
|---------------|--|------------|---------|------|--------------|----------------------------|-----------------|--|--|--|--|--|--|---|---|---|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES   |                            |                 | SHEAR STRENGTH kPa                                       |  |  |  |  |  |   |   |   |  |  |  |  |
|               |  |            |         |      |              |                            |                 | 20 40 60 80 100  |  |  |  |  |  |   |   |   |  |  |  |  |
| 295.8         |  |            |         |      |              |                            |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |  |  |  | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT<br>w <sub>P</sub> w w <sub>L</sub><br>WATER CONTENT (%) |   |   |  |  |  |  |
| 0.0           | ASPHALT: (50mm)  |            |         |      |              |                            |                 | 20 40 60 80 100  |  |  |  |  |  |   |   |   |  |  |  |  |
|               | SAND, some to trace gravel,<br>occasional cobbles<br>Very Dense<br>Brown<br>Moist<br>(FILL)  |            | 1       | GS   |              |                            | 295             |  |  |  |  |  |  |   |   |   |  |  |  |  |
|               |  |            | 1       | SS   | 50/<br>0.125 |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |
|               |  |            | 2       | SS   | 53           |                            | 294             |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 293.7         |  |            |         |      |              |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 2.1           | SAND and SILT, trace gravel, some<br>clay<br>Compact<br>Brown<br>Moist   |            | 3       | SS   | 28           |                            | 293             |  |  |  |  |  |  |   | 4 43 38 14  |   |  |  |  |  |
| 292.7         |  |            |         |      |              |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 3.0           | Gravelly SAND, some silt, trace clay,<br>trace peat, occasional cobbles<br>Very Dense<br>Brown<br>Damp   |            | 4       | SS   | 50/<br>0.150 |                            |                 |  |  |  |  |  |  |   | 31 58 11<br>(SI+CL)                               |   |  |  |  |  |
| 292.2         |  |            |         |      |              |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 3.6           | GRANITE bedrock, blackish grey,<br>strong  |            | 1       | RUN  |              |                            | 292             |  |  |  |  |  |  |   |   | RUN #1<br>TCR=100%<br>SCR=100%<br>RQD=88% |  |  |  |  |
|               |  |            |         |      |              |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 290.7         | 125mm sub-vertical fracture at 4.8m  |            |         |      |              |                            | 291             |  |  |  |  |  |  |   |   |   |  |  |  |  |
| 5.0           | END OF BOREHOLE AT 5.0m.<br>WATER LEVEL AT 2.9m UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>HOLEPLUG TO 0.1m, THEN<br>ASPHALT TO SURFACE. |            |         |      |              |                            |                 |  |  |  |  |  |  |   |   |   |  |  |  |  |

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

20  
15  
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-16

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 643.922 E 282 297.201 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Hollow Stem Augers/Casing/NQ COMPILED BY AN  
DATUM Geodetic DATE 2011.05.05 - 2011.05.05 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |   |   |
| 298.0         |   |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |  |   |   |
| 0.0           | ASPHALT: (50mm)   |            |         |      |            |                            | 298             |   |  |  |  |   |   |
|               | Gravelly <b>SAND</b> , trace silt, trace clay   |            | 1       | GS   |            |                            |                 |   |  |  |  |   |   |
|               | Brown   |            |         |      |            |                            |                 |   |  |  |  |   |   |
|               | Moist   |            |         |      |            |                            |                 |   |  |  |  |   |   |
|               | (FILL)  |            |         |      |            |                            |                 |   |  |  |  |   |   |
|               | Trace gravel, occasional cobbles  |            | 1       | SS   | 133/       |                            |                 |   |  |  |  |   |   |
| 296.8         | Very Dense  |            |         |      | 0.225      |                            | 297             |   |  |  |  |   | 21 70 9   |
| 1.1           | END OF BOREHOLE AT 1.1m UPON<br>REFUSAL ON PROBABLE<br>BEDROCK.<br>BOREHOLE BACKFILLED WITH<br>CUTTINGS TO 0.04m, THEN<br>ASPHALT TO SURFACE. |            |         |      |            |                            |                 |   |  |  |  |   | (SH+CL)   |

# RECORD OF BOREHOLE No 11-17

1 OF 1

METRIC

W.P. 19-5161-103 LOCATION N 5 189 687.536 E 282 326.447 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Hollow Stem Augers/Casing/NQ COMPILED BY AN  
 DATUM Geodetic DATE 2011.05.05 - 2011.05.05 CHECKED BY JPL

| SOIL PROFILE  |  |                 | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  | PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR   SA   SI   CL |  |                        |  |
|---------------|--|-----------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|---|--|--|---|--|--|------------------------|--|
| ELEV<br>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>          |  |  |   |  |  |                        |  |
| 299.7         |  |                 |         |      |            |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
| 0.0           |  | ASPHALT: (40mm) |         |      |            |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
|               | Gravelly <b>SAND</b> , trace silt<br>Very Loose to Dense<br>Dark Brown to Brown<br>Damp to Moist<br>(FILL)   |                 | 1       | GS   |            |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
|               |  |                 | 1       | SS   | 39         |                            |                 |   |  |  |  |   |  |  |   |  |  | 31   65   4<br>(SI+CL) |  |
|               |  |                 | 2       | SS   | 7          |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
|               |  |                 | 3       | SS   | 3          |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
|               |  |                 | 4       | SS   | 1          |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
|               |  |                 | 5       | SS   | 6          |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
| 295.3         |  |                 |         |      |            |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |
| 4.4           | END OF BOREHOLE AT 4.4m UPON<br>REFUSAL ON PROBABLE BOULDER<br>OR BEDROCK.<br>BOREHOLE DRY UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>CUTTINGS TO 0.04m, THEN<br>ASPHALT TO SURFACE. |                 |         |      |            |                            |                 |   |  |  |  |   |  |  |   |  |  |                        |  |

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

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No RCC-1

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 534.691 E 282 254.844 ORIGINATED BY ES  
 HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
 DATUM Geodetic DATE 2011.04.12 - 2011.04.12 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT              |  |  |  |  | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |  |  |  |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|--|--|--|--|--|--|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                                       |  |  |  |  |  |  | WATER CONTENT (%)  |  |  |  |  |
|               |   |            |         |      |            |                            |                 | 20 40 60 80 100  |  |  |  |  |  |  | 20 40 60   |  |  |  |  |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |  |  |  |  | PLASTIC LIMIT<br>W P      W      W L<br>NATURAL MOISTURE CONTENT<br>LIQUID LIMIT |  |  |  |  |
| 290.8         |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0           | WATER   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 289.4         |   |            |         |      |            |                            | 290             |  |  |  |  |  |  |  |  |  |  |  |  |
| 1.4           | SAND, trace gravel, trace silt  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 289.0         | Loose   |            | 1       | SS   | 7          |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 1.8           | Dark Brown  |            |         |      |            |                            | 289             |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Wet   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | SILT, some clay, trace sand   |            | 2       | SS   | 4          |                            |                 |  |  |  |  |  |  |  | 0 5 80 15  |  |  |  |  |
|               | Loose to Compact  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Grey  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Moist   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Black coarse sand seam at 2.8m  |            | 3       | SS   | 10         |                            | 288             |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 4       | SS   | 13         |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 286.8         |   |            |         |      |            |                            | 287             |  |  |  |  |  |  |  |  |  |  |  |  |
| 4.0           | Sandy SILT, trace clay  |            | 5       | SS   | 9          |                            |                 |  |  |  |  |  |  |  | 0 23 72 5  |  |  |  |  |
|               | Loose to Very Dense   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Grey  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Wet   |            | 6       | SS   | 6          |                            | 286             |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 7       | SS   | 7          |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 8       | SS   | 10         |                            | 285             |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Occasional cobbles  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 9       | SS   | 7          |                            | 284             |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 10      | SS   | 17         |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 11      | SS   | 29         |                            | 283             |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               |   |            | 12      | SS   | 31         |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Becoming silty sand, some gravel,   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | trace clay  |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Granite fragments   |            | 13      | SS   | 127        |                            | 282             |  |  |  |  |  |  |  | 17 50 29 4   |  |  |  |  |
| 281.6         |   |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |
| 9.1           | END OF BOREHOLE AT 9.1m UPON<br>REFUSAL ON BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br>BOREHOLE CAVED TO 5.1m,<br>BACKFILLED WITH SAND TO |            |         |      |            |                            |                 |  |  |  |  |  |  |  |  |  |  |  |  |

Continued Next Page

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

20  
15 10 5  
(%) STRAIN AT FAILURE

## METRIC

[illegible]




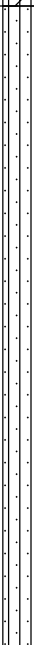



# RECORD OF BOREHOLE No RCC-2

1 OF 2

METRIC

W.P. 19-5161-103 LOCATION N 5 189 536.616 E 282 260.706 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
DATUM Geodetic DATE 2011.04.13 - 2011.04.13 CHECKED BY JPL

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                      |  |  |  | UNIT<br>WEIGHT<br><br><b>γ</b><br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|---|---------|------|------------|----------------------------|-----------------|--|--|--|--|---|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa   |  |  |  |   |   |
| 290.8         |  |   |         |      |            |                            |                 | 20 40 60 80 100  |  |  |  |   |   |
| 0.0           | <b>WATER</b>   |    |         |      |            |                            |                 | ○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |  |  |  |   |   |
| 289.2         |  |   |         |      |            |                            |                 | 20 40 60 80 100  |  |  |  |   |   |
| 1.5           | <b>PEAT</b> , trace roots and rootlets<br>Very Soft<br>Dark Brown<br>Wet       |    | 1       | SS   | 1          |                            |                 |  |  |  |  | 128   |   |
| 288.7         |  |   |         |      |            |                            |                 |  |  |  |  |   |   |
| 2.1           | Clayey <b>SILT</b> , trace sand<br>Soft to Firm<br>Grey<br>Wet                 |    | 2       | SS   | 2          |                            |                 |  |  |  |  |   | 0 6 68 27   |
|               |  |   | 3       | SS   | 8          |                            |                 |  |  |  |  |   |   |
| 287.4         | Black coarse sand  |   |         |      |            |                            |                 |  |  |  |  |   |   |
| 3.4           | Sandy <b>SILT</b> , trace clay<br>Loose to Very Dense<br>Grey<br>Wet           |   | 4       | SS   | 14         |                            |                 |  |  |  |  |   |   |
|               |  |   | 5       | SS   | 10         |                            |                 |  |  |  |  |   | 0 24 71 5   |
|               |  |   | 6       | SS   | 9          |                            |                 |  |  |  |  |   |   |
|               |  |   | 7       | SS   | 6          |                            |                 |  |  |  |  |   |   |
|               |  |   | 8       | SS   | 12         |                            |                 |  |  |  |  |   |   |
|               |  |   | 9       | SS   | 10         |                            |                 |  |  |  |  |   |   |
|               |  |   | 10      | SS   | 15         |                            |                 |  |  |  |  |   | 0 32 63 5   |
|               | Trace to some gravel   |   | 11      | SS   | 24         |                            |                 |  |  |  |  |   |   |
|               |  |   | 12      | SS   | 23         |                            |                 |  |  |  |  |   |   |
|               |  |   | 13      | SS   | 69         |                            |                 |  |  |  |  |   |   |
| 281.3         | Sandy <b>GRAVEL</b> , some silt to silty,<br>trace clay<br>Very Dense<br>Brown |  | 14      | SS   | 78         |                            |                 |  |  |  |  |   | 44 24 32<br>(SI+CL)                               |

Continued Next Page

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

RECORD OF BOREHOLE No RCC-2

2 OF 2

METRIC

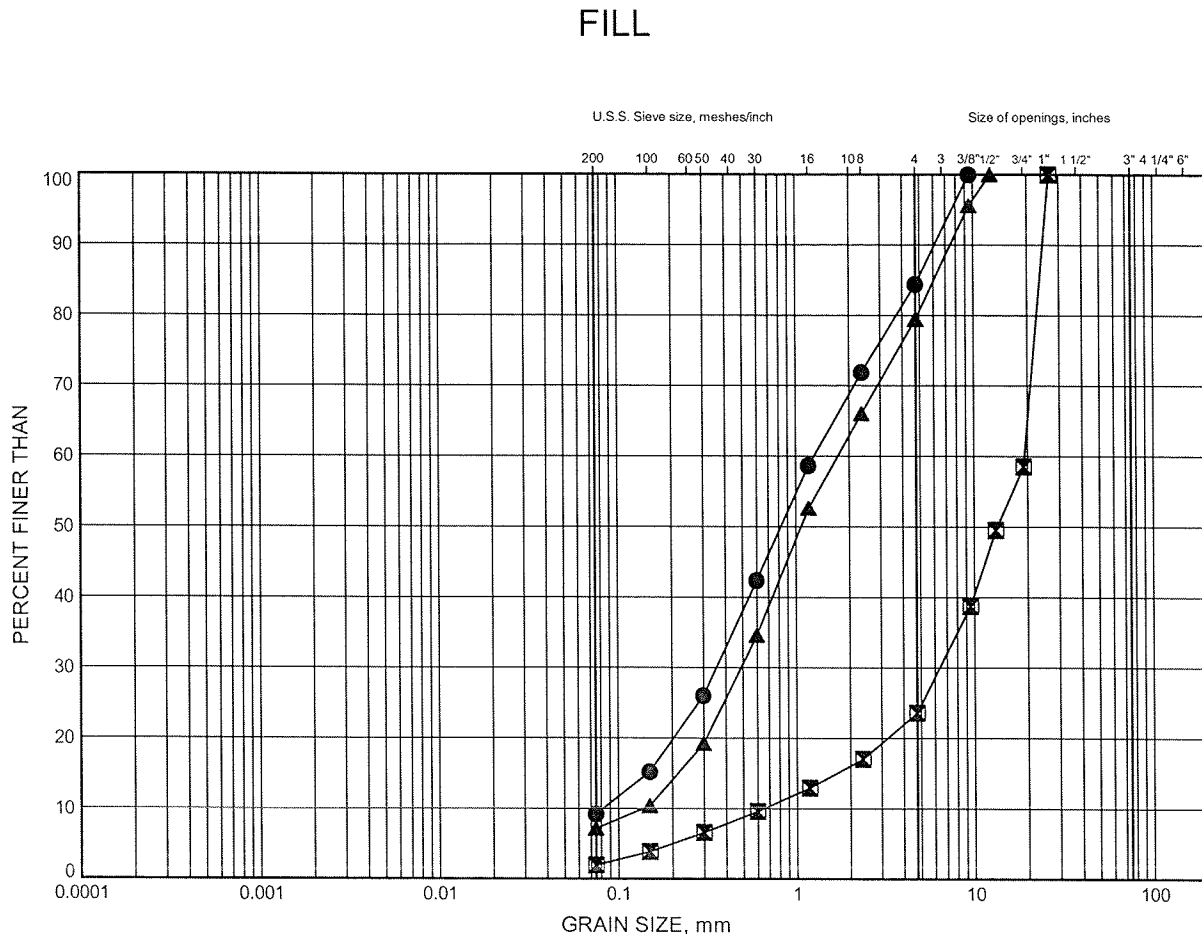
W.P. 19-5161-103 LOCATION N 5 189 536.616 E 282 260.706 ORIGINATED BY ES  
HWY 11 BOREHOLE TYPE Tripod/Casing COMPILED BY AN  
DATUM Geodetic DATE 2011.04.13 - 2011.04.13 CHECKED BY JPL

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |                                    |                                     |                                   |  |  |
| 280.7         | Continued From Previous Page  |            | 15      | SS   | 100        |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 10.1          | Wet<br><br>END OF BOREHOLE AT 10.1m<br>UPON REFUSAL ON BEDROCK.<br>WATER LEVEL AT SURFACE UPON<br>COMPLETION.<br>BOREHOLE BACKFILLED WITH<br>SAND TO SURFACE. |            |         |      | 0.025      |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            | 280             |   |  |                                    |                                     |                                   |  |  |

**Appendix B**  
**Laboratory Test Results**

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B1



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

## LEGEND

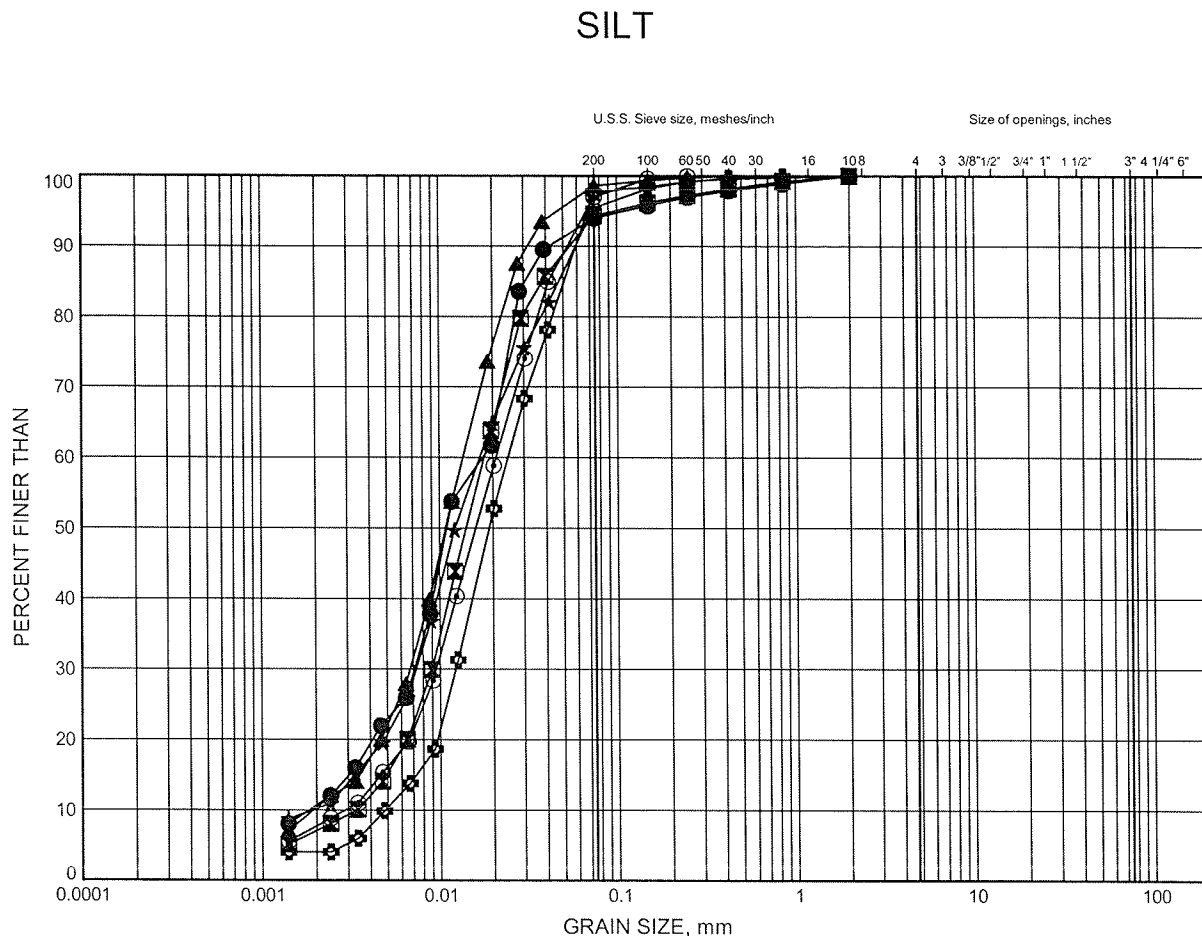
| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-11    | 1.83      | 292.36    |
| ⊠      | 11-12    | 1.83      | 290.88    |
| ▲      | 11-14    | 1.83      | 291.76    |



W.P.# 19-5161-103  
Prepared By AN  
Checked By LT

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B2



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

## LEGEND

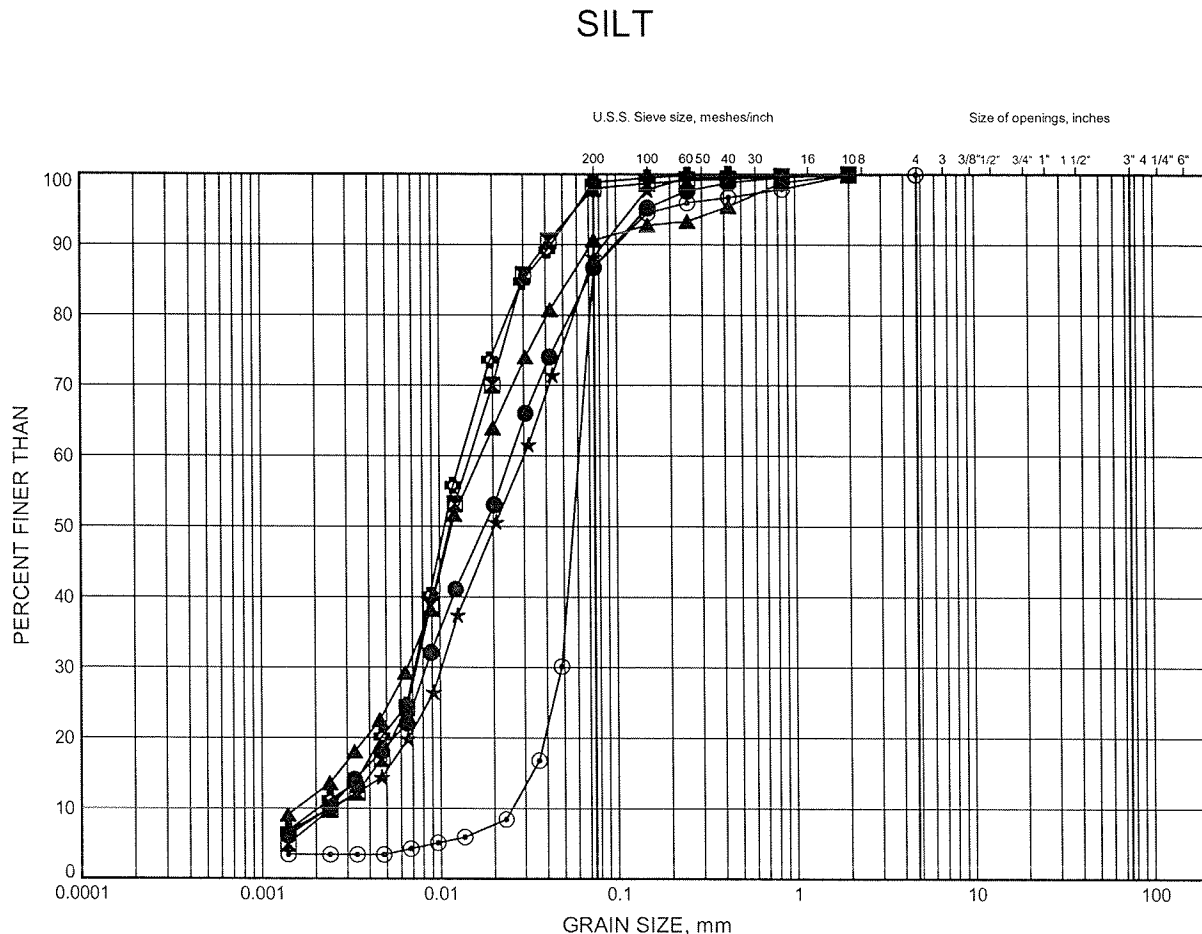
| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-01    | 1.83      | 288.37    |
| ⊠      | 11-02    | 2.59      | 287.76    |
| ▲      | 11-02    | 6.40      | 283.95    |
| ★      | 11-03    | 1.07      | 290.32    |
| ⊙      | 11-03    | 4.88      | 286.51    |
| ⊕      | 11-04    | 4.04      | 288.92    |



W.P.# 19-5161-103.....  
Prepared By AN.....  
Checked By LT.....

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B3



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

## LEGEND

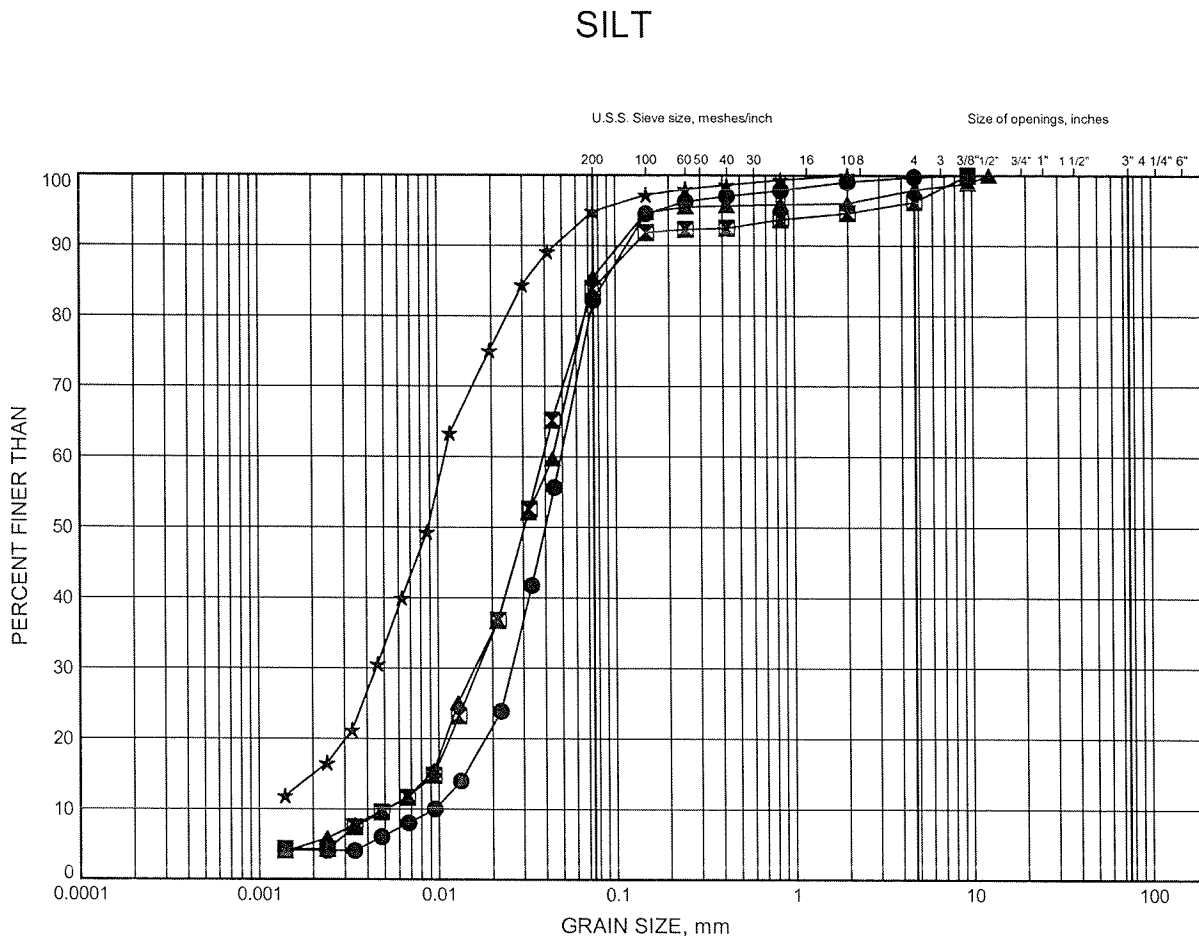
| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-05    | 1.83      | 289.21    |
| ⊠      | 11-06    | 4.11      | 286.54    |
| ▲      | 11-07    | 4.22      | 286.23    |
| ★      | 11-11    | 7.16      | 287.03    |
| ⊙      | 11-11    | 9.45      | 284.74    |
| ⊕      | 11-12    | 7.92      | 284.78    |



W.P.# 19-5161-103.....  
Prepared By AN.....  
Checked By LT.....

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B4



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-12    | 10.90     | 281.81    |
| ■      | 11-13    | 5.64      | 287.69    |
| ▲      | 11-13    | 7.16      | 286.17    |
| ★      | RCC-1    | 2.29      | 288.49    |

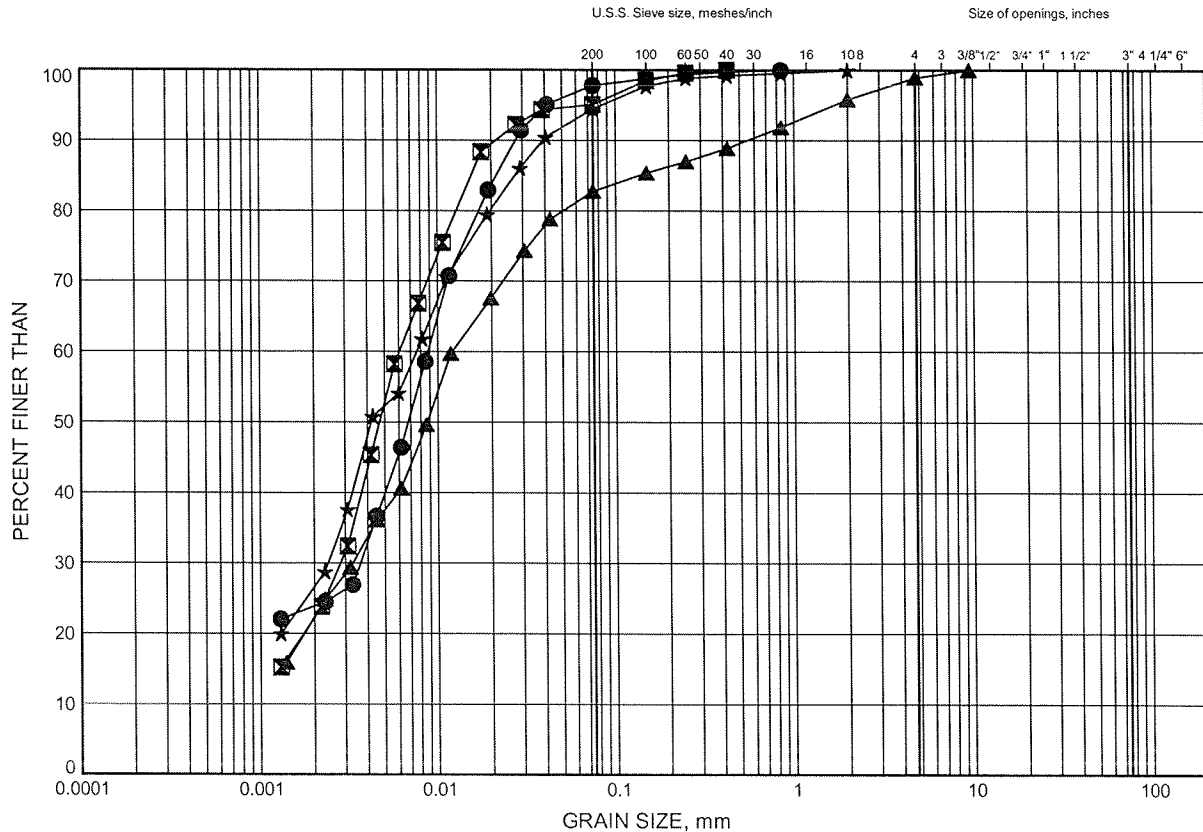


W.P.# 19-5161-103  
Prepared By AN  
Checked By LT

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B5

## SILTY CLAY/CLAYEY SILT



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-04    | 1.07      | 291.89    |
| ⊠      | 11-06    | 6.40      | 284.25    |
| ▲      | 11-10    | 2.69      | 288.60    |
| ★      | RCC-2    | 2.44      | 288.33    |



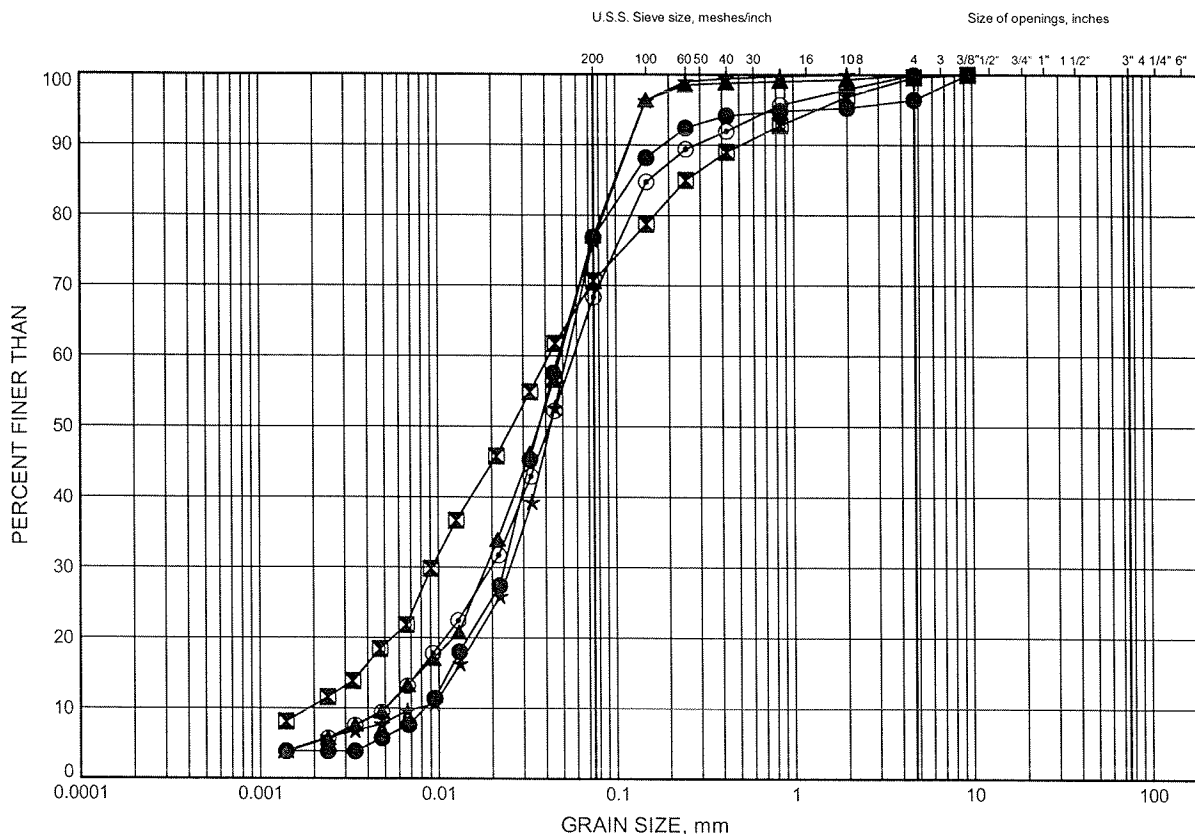
W.P.# 19-5161-103.....  
Prepared By .AN.....  
Checked By .LT.....



# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B6

## SANDY SILT



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-02    | 7.92      | 282.42    |
| ⊠      | 11-09    | 1.52      | 289.39    |
| ▲      | RCC-1    | 4.42      | 286.36    |
| ★      | RCC-2    | 4.27      | 286.50    |
| ⊙      | RCC-2    | 7.32      | 283.45    |

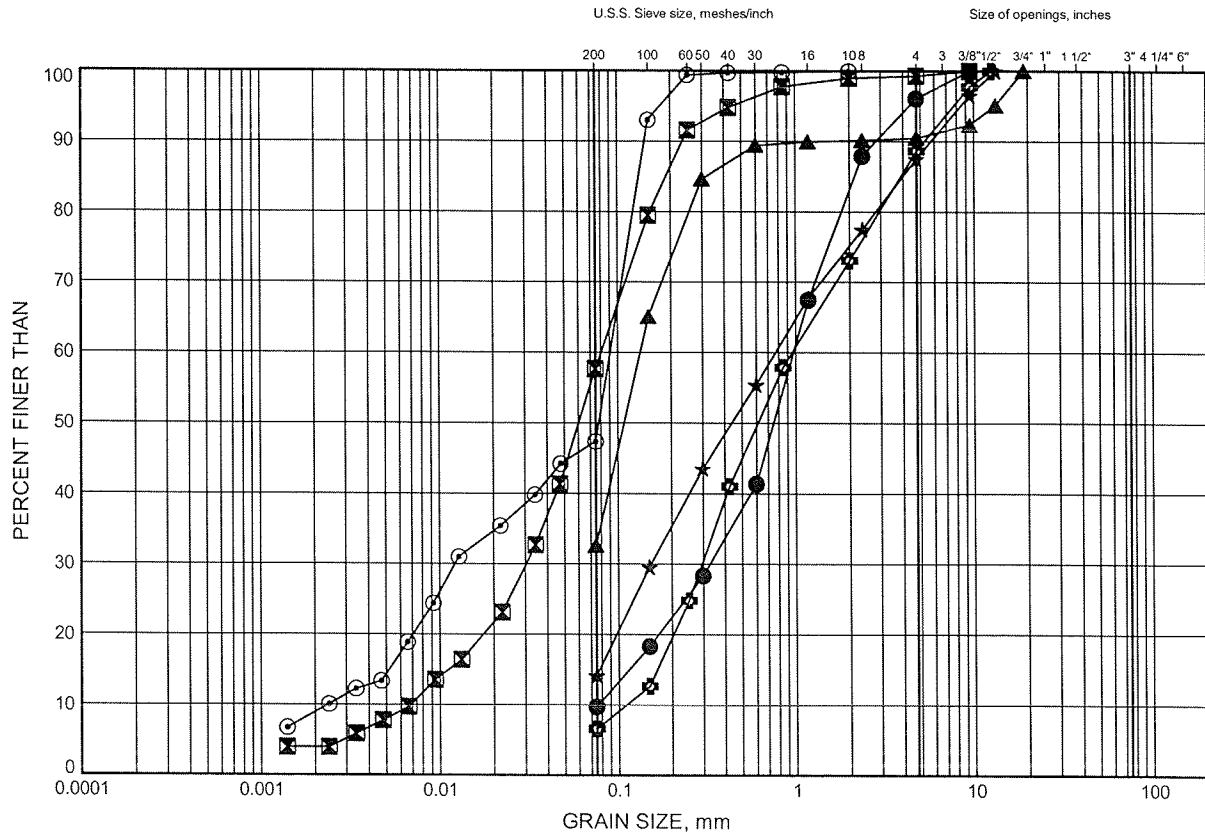


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Checked By LT

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B7

## SILTY SAND/SILT & SAND/SAND



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-04    | 6.40      | 286.56    |
| ⊠      | 11-07    | 7.26      | 283.19    |
| ▲      | 11-07    | 9.70      | 280.75    |
| ★      | 11-10    | 0.91      | 290.38    |
| ⊙      | 11-14    | 4.11      | 289.47    |
| ⊕      | 11-14    | 7.92      | 285.66    |

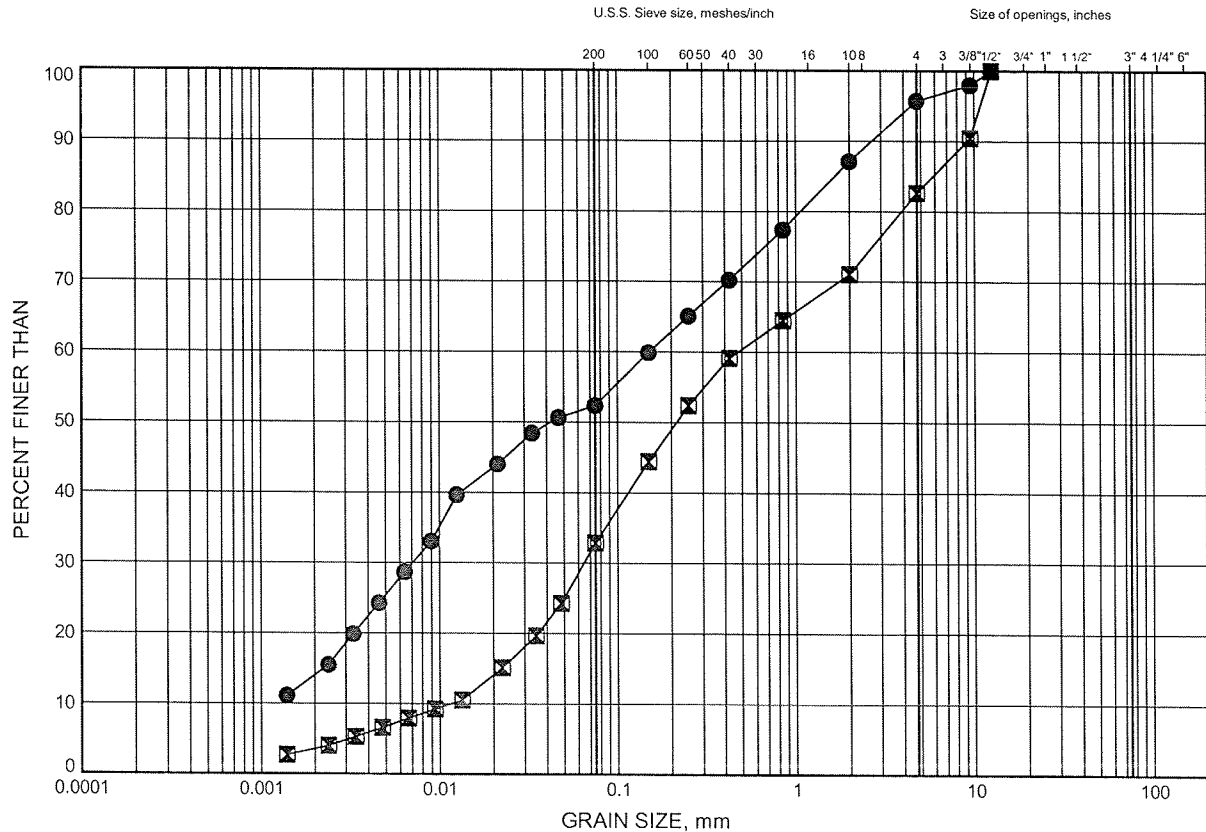


W.P.# 19-5161:103.....  
Prepared By AN.....  
Checked By LT.....

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B8

## SILTY SAND/SILT & SAND/SAND



|               |      |        |        |        |        |                |
|---------------|------|--------|--------|--------|--------|----------------|
| SILT and CLAY | FINE | MEDIUM | COARSE | FINE   | COARSE | COBBLE<br>SIZE |
| FINE GRAINED  | SAND |        |        | GRAVEL |        |                |

### LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-15    | 2.59      | 293.16    |
| ⊠      | RCC-1    | 8.92      | 281.86    |

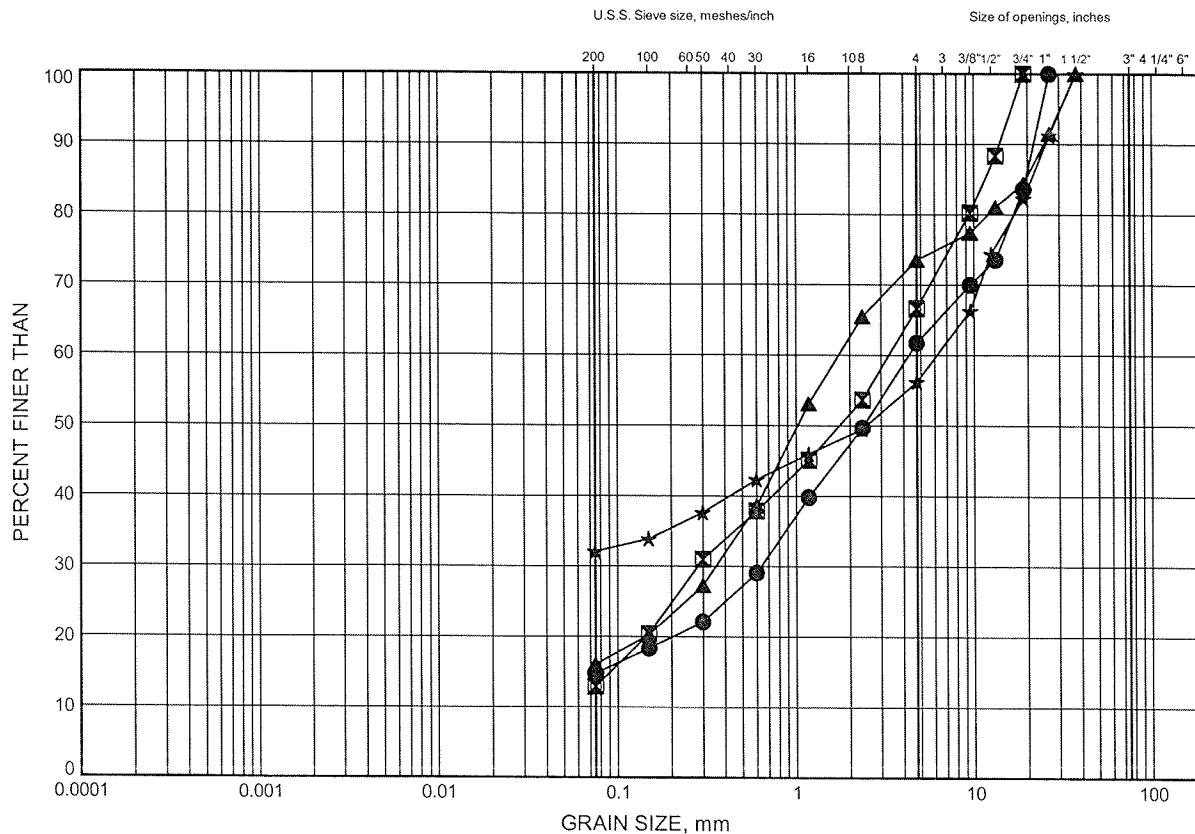


W.P.# 19-5161-103.....  
Prepared By AN.....  
Checked By LT.....

# Hwy 11 Tomiko River GRAIN SIZE DISTRIBUTION

FIGURE B9

## SAND & GRAVEL/GRAVELLY SAND/SANDY GRAVEL



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

### LEGEND

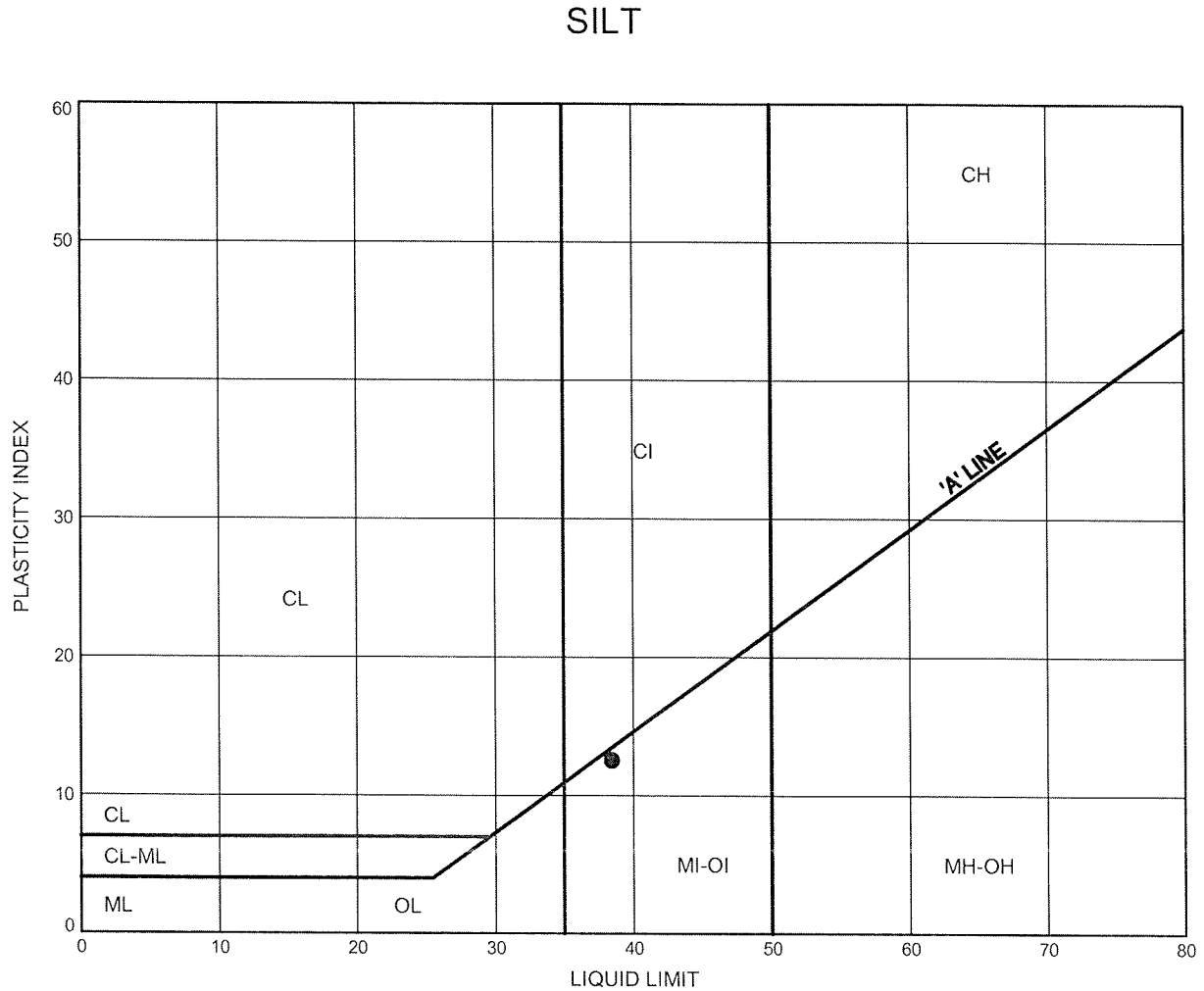
| SYMBOL | BOREHOLE | DEPTH (m) | ELEV. (m) |
|--------|----------|-----------|-----------|
| ●      | 11-01    | 3.61      | 286.60    |
| ⊠      | 11-08    | 2.69      | 287.91    |
| ▲      | 11-10    | 3.89      | 287.41    |
| ★      | RCC-2    | 9.75      | 281.02    |



W.P.# 19-5161-103  
Prepared By AN  
Checked By LT

# Hwy 11 Tomiko River ATTERBERG LIMITS TEST RESULTS

FIGURE B10



| SYMBOL | BH    | DEPTH (m) | ELEV. (m) |
|--------|-------|-----------|-----------|
| ●      | 11-06 | 4.11      | 286.54    |

Date June 2011

Project 19-5161-103



Prep'd AN

Chkd. LT

## **Appendix C**

### **Drawings**

| NO        | ELEVATION | NORTHING    | EASTING   |
|-----------|-----------|-------------|-----------|
| 11-14     | 293.6     | 5 189 542.9 | 282 249.4 |
| 11-15     | 295.8     | 5 189 595.7 | 282 271.3 |
| 11-16     | 298.0     | 5 189 643.9 | 282 297.2 |
| 11-17     | 299.7     | 5 189 687.5 | 282 326.4 |
| RCC-01    | 290.8     | 5 189 534.7 | 282 254.8 |
| RCC-02    | 290.8     | 5 189 536.6 | 282 260.7 |
| 2A (AMEC) | 293.8     | N.A.        | N.A.      |
| 4B (AMEC) | 289.9     | N.A.        | N.A.      |
| 6B (AMEC) | 289.8     | N.A.        | N.A.      |
| 7 (AMEC)  | 289.9     | N.A.        | N.A.      |

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

CONT No 5009-E-0024  
WP No 5578-04-00  
& 5240-06-00

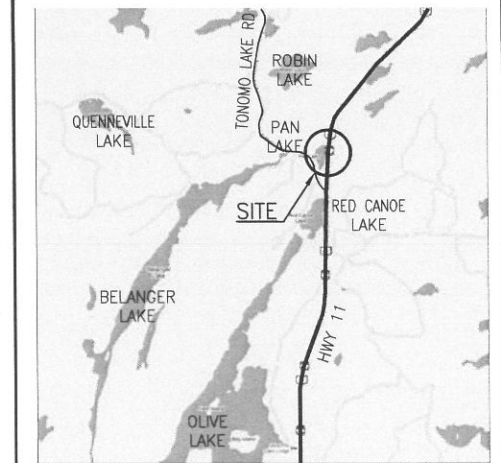


HIGHWAY 11  
AT PAN LAKE  
(9.5km NORTH OF HWY 64)  
BOREHOLE LOCATIONS

SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole (Thurber)
- ⊕ Borehole (Amec)
- 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
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| 11-01 | 290.2     | 5 189 174.6 | 282 212.6 |
| 11-02 | 290.3     | 5 189 224.4 | 282 215.3 |
| 11-03 | 291.4     | 5 189 282.6 | 282 219.8 |
| 11-04 | 293.0     | 5 189 379.7 | 282 227.5 |
| 11-05 | 291.0     | 5 189 432.9 | 282 229.6 |
| 11-06 | 290.7     | 5 189 486.8 | 282 241.7 |
| 11-07 | 290.5     | 5 189 517.8 | 282 251.1 |
| 11-08 | 290.6     | 5 189 563.6 | 282 271.9 |
| 11-09 | 290.9     | 5 189 622.7 | 282 303.2 |
| 11-10 | 291.3     | 5 189 657.8 | 282 331.9 |
| 11-11 | 294.2     | 5 189 108.4 | 282 188.6 |
| 11-12 | 292.7     | 5 189 176.4 | 282 193.5 |
| 11-13 | 293.3     | 5 189 532.5 | 282 246.1 |

-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. 31L-151

| DATE   | BY        | DESCRIPTION |
|--------|-----------|-------------|
| DESIGN | LT        | CHK JPL     |
| DRAWN  | MFA       | CHK LT      |
| DATE   | DEC. 2011 |             |
| DWG    | 1         |             |



PLAN



UNSUBDIVIDED

BC = 14+881.520

R=582.125

BM

BM

BM

Bush

Bush

Bush

Bush

Bush

PAN LAKE

ABANDONED GRAVEL PIT

N 5 189 400

N 5 189 300

N 5 189 200

N 5 189 100

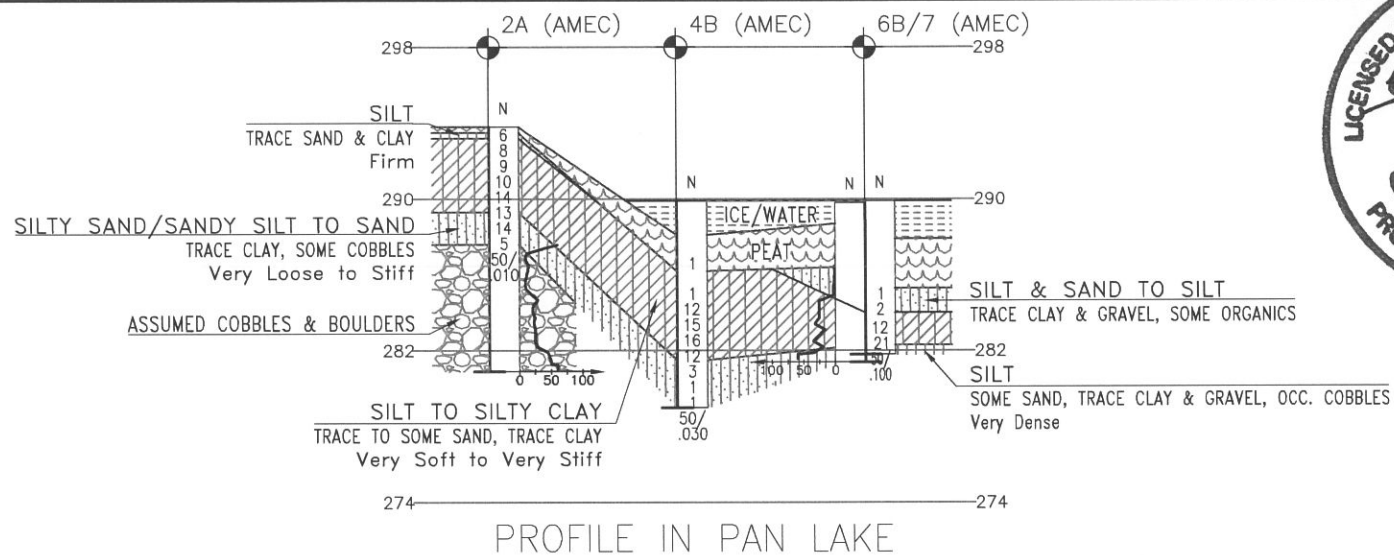
E 282 100

E 282 200

E 282 300

E 282 400

| NO        | ELEVATION | NORTHING    | EASTING   |
|-----------|-----------|-------------|-----------|
| 11-14     | 293.6     | 5 189 542.9 | 282 249.4 |
| 11-15     | 295.8     | 5 189 595.7 | 282 271.3 |
| 11-16     | 298.0     | 5 189 643.9 | 282 297.2 |
| 11-17     | 299.7     | 5 189 687.5 | 282 326.4 |
| RCC-01    | 290.8     | 5 189 534.7 | 282 254.8 |
| RCC-02    | 290.8     | 5 189 536.6 | 282 260.7 |
| 2A (AMEC) | 293.8     | N.A.        | N.A.      |
| 4B (AMEC) | 289.9     | N.A.        | N.A.      |
| 6B (AMEC) | 289.8     | N.A.        | N.A.      |
| 7 (AMEC)  | 289.9     | N.A.        | N.A.      |



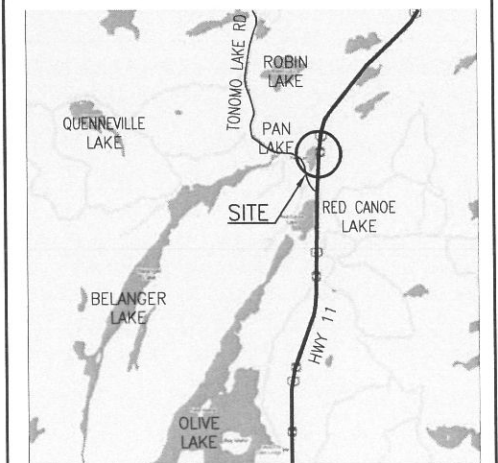
METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No 5009-E-0024  
WP No 5578-04-00  
& 5240-06-00

HIGHWAY 11  
AT PAN LAKE  
(9.5km NORTH OF HWY 64)  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



LEGEND

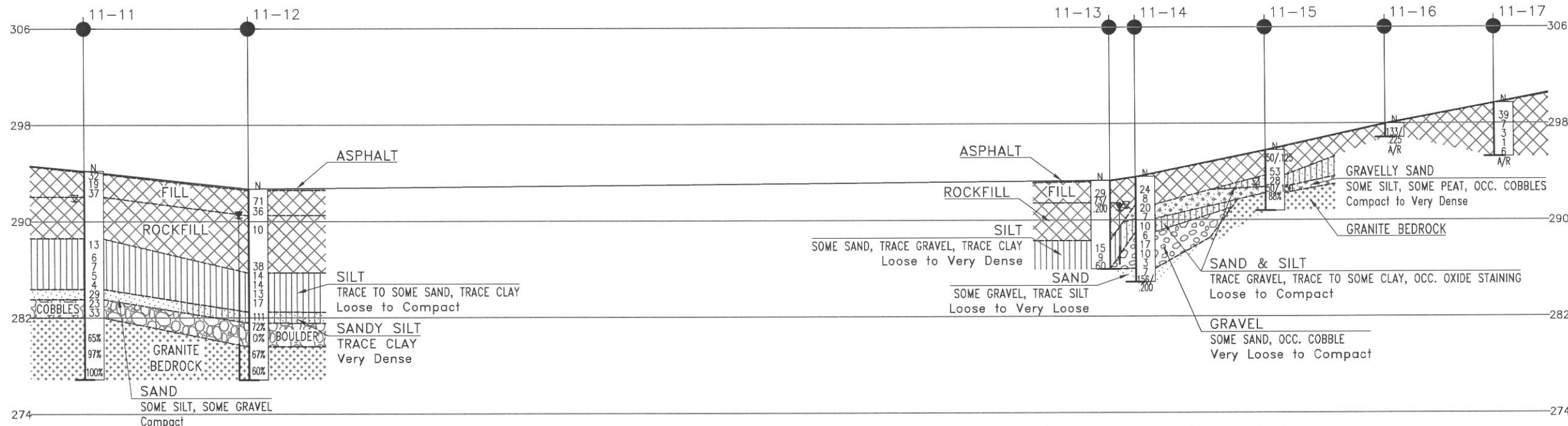
- Borehole (Thurber)
- Borehole (Amec)
- Blows /0.3m (Std Pen Test, 475J/blow)
- Blows /0.3m (60' Cone, 475J/blow)
- CONE
- PH
- Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90%
- Rock Quality Designation (RQD)
- Auger Refusal

| NO    | ELEVATION | NORTHING    | EASTING   |
|-------|-----------|-------------|-----------|
| 11-01 | 290.2     | 5 189 174.6 | 282 212.6 |
| 11-02 | 290.3     | 5 189 224.4 | 282 215.3 |
| 11-03 | 291.4     | 5 189 282.6 | 282 219.8 |
| 11-04 | 293.0     | 5 189 379.7 | 282 227.5 |
| 11-05 | 291.0     | 5 189 432.9 | 282 229.6 |
| 11-06 | 290.7     | 5 189 486.8 | 282 241.7 |
| 11-07 | 290.5     | 5 189 517.8 | 282 251.1 |
| 11-08 | 290.6     | 5 189 563.6 | 282 271.9 |
| 11-09 | 290.9     | 5 189 622.7 | 282 303.2 |
| 11-10 | 291.3     | 5 189 657.8 | 282 331.9 |
| 11-11 | 294.2     | 5 189 108.4 | 282 188.6 |
| 11-12 | 292.7     | 5 189 176.4 | 282 193.5 |
| 11-13 | 293.3     | 5 189 532.5 | 282 246.1 |

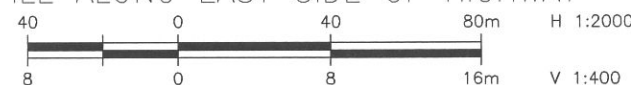
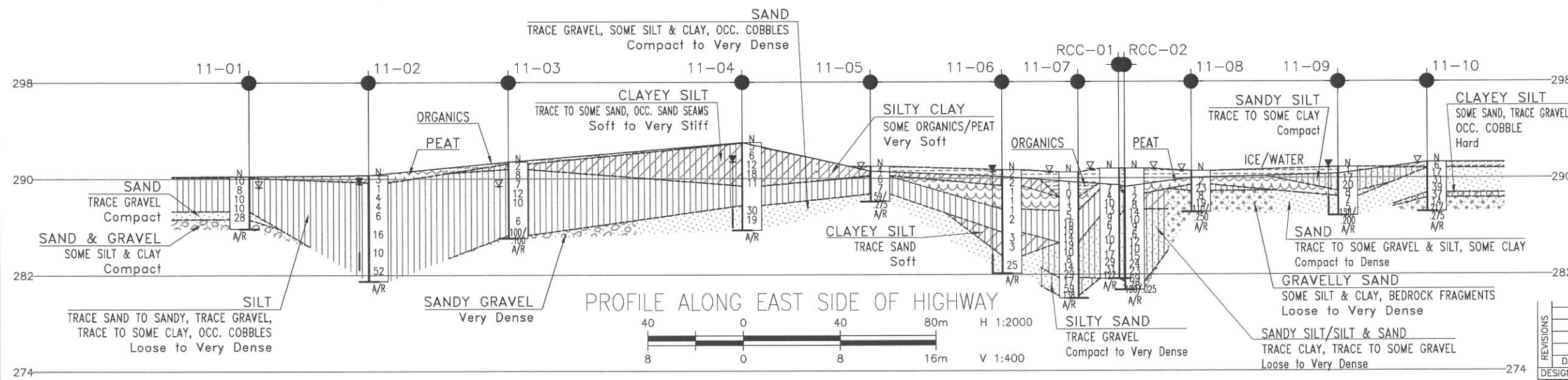
-NOTES-

- 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. 31L-151



PROFILE ALONG NB SHOULDER



| DATE   | BY        | DESCRIPTION |
|--------|-----------|-------------|
| DESIGN | LT        | CHK JPL     |
| DRAWN  | MFA       | CHK LT      |
| CODE   | SITE      | LOAD        |
| STRUCT | STRUCT    | DWG 2       |
| DATE   | DEC. 2011 |             |



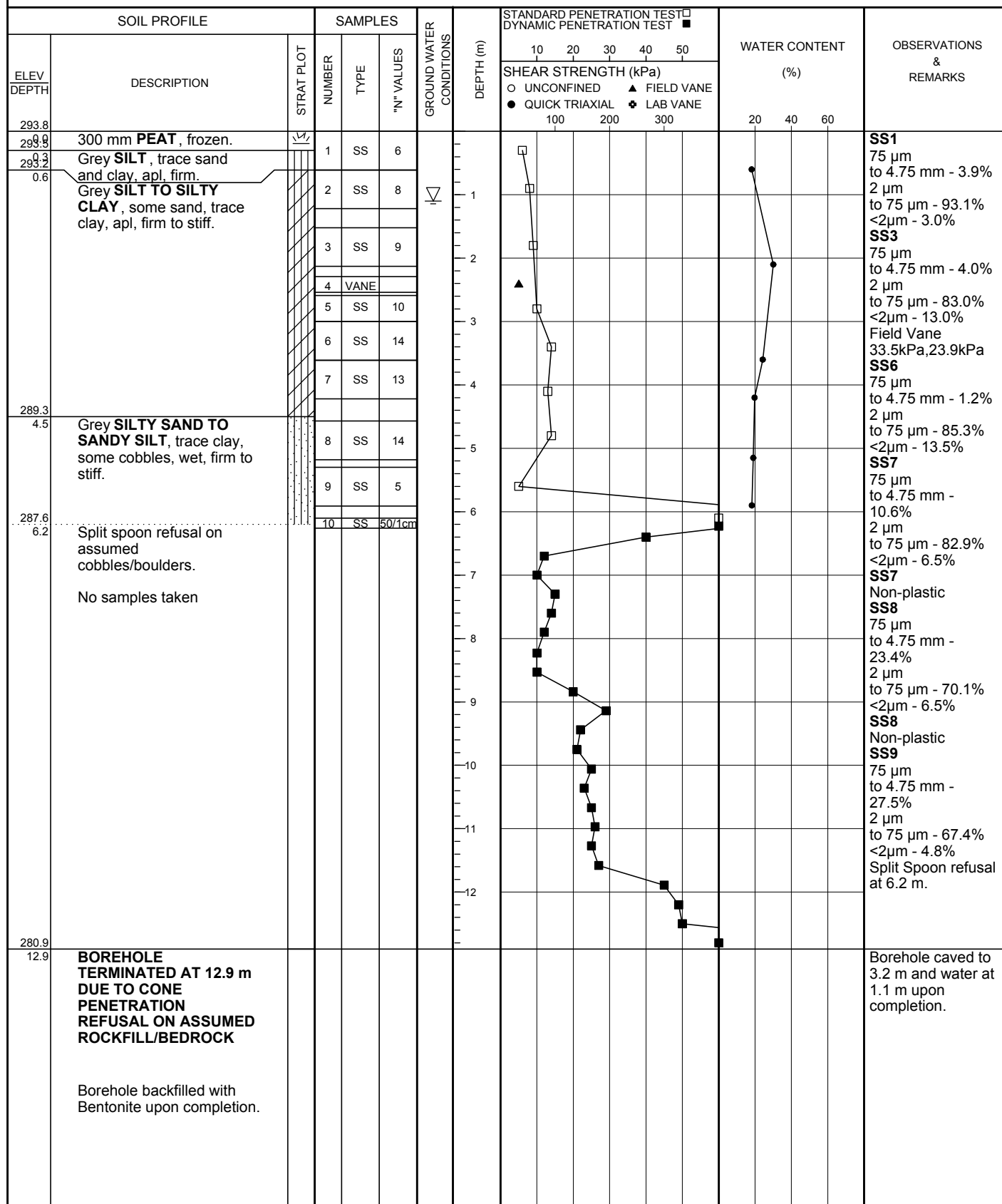
**Appendix D**

Select Record of Borehole Sheets from GEOCREST No. 31L-123

# RECORD OF BOREHOLE No 2A

1 OF 1

PROJECT Foundation Investigation and Design LOCATION As shown on Borehole Location Plan. ORIGINATED BY JF  
 CLIENT MTO NE Region - Cont. #5006-E-0070 Sta(14+750), 17.0m left of center line. COMPILED BY LC  
 JOB NO. TB7206007 DATE 28 March 2008 CHECKED BY HS



# RECORD OF BOREHOLE No 4B

1 OF 1

PROJECT Foundation Investigation and Design LOCATION As shown on Borehole Location Plan. ORIGINATED BY JF  
 CLIENT MTO NE Region - Cont. #5006-E-0070 Sta(14+800), 18.0m left of center line. COMPILED BY LC  
 JOB NO. TB7206007 DATE 2 April 2008 CHECKED BY HS

| SOIL PROFILE  |   |            | SAMPLES |       |            | GROUND WATER<br>CONDITIONS | DEPTH (m) | STANDARD PENETRATION TEST <input type="checkbox"/><br>DYNAMIC PENETRATION TEST <input checked="" type="checkbox"/> |                  |              |            |    | WATER CONTENT |    |    | OBSERVATIONS<br>&<br>REMARKS |
|---------------|---|------------|---------|-------|------------|----------------------------|-----------|--|------------------|--------------|------------|----|---------------|----|----|------------------------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE  | "N" VALUES |                            |           | SHEAR STRENGTH (kPa)   |                  |              |            |    | (%)           |    |    |                              |
|               |   |            |         |       |            |                            |           | ○ UNCONFINED   | ● QUICK TRIAXIAL | ▲ FIELD VANE | ✚ LAB VANE | 10 | 20            | 30 | 40 |                              |
| 289.9<br>0.0  | ICE   |            |         |       |            |                            |           |  |                  |              |            |    |               |    |    |                              |
| 289.3<br>0.6  | WATER   |            |         |       |            |                            | 1         |  |                  |              |            |    |               |    |    |                              |
| 288.1<br>1.8  | Brown PEAT , some silt.   |            | 1       | AUGER |            |                            | 2         |  |                  |              |            |    |               |    |    |                              |
| 286.2<br>3.7  | Grey SILTY CLAY TO SILT , trace sand, apl, very soft to very stiff.   |            | 2       | SS    | 1          |                            | 3         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 3       | VANE  |            |                            | 4         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 4       | VANE  |            |                            | 5         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 5       | SS    | 1          |                            | 6         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 6       | SS    | 12         |                            | 7         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 7       | SS    | 15         |                            | 8         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 8       | SS    | 16         |                            | 9         |  |                  |              |            |    |               |    |    |                              |
| 281.5<br>8.4  | SANDY SILT/SILTY SAND to SAND, trace clay, wet, very loose.   |            | 10      | SS    | 3          |                            | 9         |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 11      | SS    | 1          |                            | 10        |  |                  |              |            |    |               |    |    |                              |
|               |   |            | 12      | SS    | 1          |                            |           |  |                  |              |            |    |               |    |    |                              |
| 279.1<br>10.9 | BOREHOLE TERMINATED DUE TO SPLIT SPOON REFUSAL ON ASSUMED ROCKFILL/BEDROCK<br>Borehole backfilled with Bentonite upon completion. |            | 13      | SS    | 50/3cm     |                            |           |  |                  |              |            |    |               |    |    |                              |

Field Vane  
23.9kPa,19.2kPa

Field Vane  
23.9kPa,19.2kPa

SS5  
75 µm  
to 4.75 mm - 1.1%  
2 µm  
to 75 µm - 86.9%  
<2µm - 12.0%

SS5  
LL-20%,PL-18%,PI-2%

SS7  
75 µm  
to 4.75 mm - 3.6%  
2 µm  
to 75 µm - 87.4%  
<2µm - 9.0%

SS7  
Non-plastic

SS8  
75 µm  
to 4.75 mm - 4.0%  
2 µm  
to 75 µm - 86.5%  
<2µm - 9.5%

Borehole caved to  
4.7 m and water at  
surface upon  
completion.

SS10  
75 µm  
to 4.75 mm -  
30.3%  
2 µm  
to 75 µm - 64.76%  
<2µm - 5.0%

SS11  
75 µm  
to 4.75 mm -  
64.5%  
2 µm  
to 75 µm - 32.0%  
<2µm - 3.5%

SS13  
75 µm to 4.75 mm  
- 80.4%  
2 µm to 75 µm -  
16.1%  
<2µm - 3.5%

Field Vane  
23.9kPa, 19.2kPa

Field Vane  
23.9kPa, 19.2kPa

SS5  
75 µm  
to 4.75 mm - 1.1%  
2 µm  
to 75 µm - 86.9%  
<2µm - 12.0%

SS5  
LL-20%, PL-18%, PI-2%

SS7  
75 µm  
to 4.75 mm - 3.6%  
2 µm  
to 75 µm - 87.4%  
<2µm - 9.0%

SS7  
Non-plastic

SS8  
75 µm  
to 4.75 mm - 4.0%  
2 µm  
to 75 µm - 86.5%  
<2µm - 9.5%

Borehole caved to 4.7 m and water at surface upon completion.

SS10  
75 µm  
to 4.75 mm - 30.3%  
2 µm  
to 75 µm - 64.76%  
<2µm - 5.0%

SS11  
75 µm  
to 4.75 mm - 64.5%  
2 µm  
to 75 µm - 32.0%  
<2µm - 3.5%

SS13  
75 µm to 4.75 mm - 80.4%  
2 µm to 75 µm - 16.1%  
<2µm - 3.5%



# RECORD OF BOREHOLE No 7

1 OF 1

PROJECT Foundation Investigation and Design LOCATION As shown on Borehole Location Plan. ORIGINATED BY JF  
 CLIENT MTO NE Region - Cont. #5006-E-0070 Sta(14+850), 20.0m left of center line. COMPILED BY LC  
 JOB NO. TB7206007 DATE 31 March 2008 CHECKED BY HS

| SOIL PROFILE  |   |            | SAMPLES |       |            | GROUND WATER<br>CONDITIONS | DEPTH (m) | STANDARD PENETRATION TEST <input type="checkbox"/><br>DYNAMIC PENETRATION TEST <input checked="" type="checkbox"/> |    |    |    |    | WATER CONTENT |    |    |  | OBSERVATIONS<br>&<br>REMARKS |
|---------------|---|------------|---------|-------|------------|----------------------------|-----------|--|----|----|----|----|---------------|----|----|--|------------------------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE  | "N" VALUES |                            |           | SHEAR STRENGTH (kPa)   |    |    |    |    | (%)           |    |    |  |                              |
|               |   |            |         |       |            |                            |           | 10   | 20 | 30 | 40 | 50 | 20            | 40 | 60 |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
| 289.9<br>0.0  | ICE   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
| 289.3<br>0.6  | WATER   |            |         |       |            |                            | 1         |  |    |    |    |    |               |    |    |  |                              |
| 287.9<br>2.0  | Dark Brown <b>PEAT</b> , trace rootlets and wood chips.   |            | 1       | AUGER |            |                            | 2         |  |    |    |    |    |               |    |    |  |                              |
|               |   |            | 2       | AUGER |            |                            | 3         |  |    |    |    |    |               |    |    |  |                              |
|               |   |            | 3       | AUGER |            |                            | 4         |  |    |    |    |    |               |    |    |  |                              |
| 285.3<br>4.6  | Brown <b>SILT AND SAND to SILT</b> , some sand and silt, trace clay and gravel, some organics.                                      |            | 4       | SS    | 1          |                            | 5         |  |    |    |    |    |               |    |    |  |                              |
| 284.0<br>5.9  | Grey <b>SILTY CLAY TO SILT</b> , trace sand, apl, stiff to very stiff.  |            | 5       | SS    | 2          |                            | 6         |  |    |    |    |    |               |    |    |  |                              |
|               |   |            | 6       | VANE  |            |                            | 7         |  |    |    |    |    |               |    |    |  |                              |
|               |   |            | 7       | SS    | 12         |                            |           |  |    |    |    |    |               |    |    |  |                              |
| 282.3<br>7.6  |   |            | 8       | SS    | 21         |                            |           |  |    |    |    |    |               |    |    |  |                              |
| 281.8<br>8.1  | Grey <b>SILT</b> , some sand, trace clay and gravel, occasional cobbles, moist to wet, very dense.                                  |            | 9       | SS    | 50/10cm    |                            | 8         |  |    |    |    |    |               |    |    |  |                              |
|               | <b>BOREHOLE TERMINATED DUE TO SPLIT SPOON REFUSAL ON ASSUMED BEDROCK</b><br>Borehole was backfilled with Bentonite upon completion. |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |
|               |   |            |         |       |            |                            |           |  |    |    |    |    |               |    |    |  |                              |

**Appendix E**  
**Site Photos**



Photo 1: Highway 11 East Ditch (looking south)



Photo 2: Highway 11 West Embankment Slope, Pan Lake (looking north)





Photo 3: Drilling at Robin Creek Culvert (looking south)



Photo 4: Highway 11 East Embankment Slope north of Robin Creek Culvert (looking northeast at Swamp)